Management for Professionals

Chihiro Suematsu

Transaction Cost Management

Strategies and Practices for a Global Open Economy

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Preface

Over the course of human history, businesses and societies have desperately sought to reduce two types of costs: production costs and transaction costs. The recent proliferation of Internet-based innovations (e.g., online marketplaces) and the numerous ways in which IT can be applied have caused transaction costs to come under more critical consideration. To illustrate, consider that the development of nearly all IT applications features an exclusive emphasis on minimizing transaction costs.

For example, the costs and efforts expended by the author and publisher to deliver this book to you (including those related to translation, advertisement, presentation, travel, delivery, and problem solving) were roughly 0.01 % relative to what doing so would have cost a century ago. These cost savings extend to the readers as well; the costs all the individuals incurred to procure this book are roughly 1 % of what they would have been a century ago. Clearly, transaction costs have dropped substantially in the last hundred years. In contrast, the gross domestic products of developed countries have increased only five to ten times during the same time period. It seems obvious that the rapid proliferation of the Internet and reductions in transaction costs are interconnected.

Despite their continuous decline, transaction costs have never been acknowledged as a type of expense per se. Instead, transaction costs have traditionally been dismissed as a component of production costs. Financial accounting is useful for tracking the costs associated with physical goods, but not for human activities, which comprise the majority of transaction costs. Transaction costs are believed to account for at least 50 % of the gross domestic products of developed countries. Our research similarly shows that 98 % of all costs incurred by a distribution company are transaction costs. Even a software development subcontractor (and therefore, should have low transaction costs) is characterized by substantial transaction costs; up to 60 % of all costs incurred by this company are transaction costs.

Although production varies by industrial sector, business type, company, department, and individual, transaction structures tend to be invariable. Therefore, it is possible to identify a universal procedure for measuring, analyzing, and streamlining transaction costs in a variety of contexts. By identifying such a procedure, we can enable routinization, systemization, and IT utilization. These outcomes can result in a significant increase in productivity for the company that implements them.

Given the above, in this book, the universal structure of transactions is analyzed and new methodologies for management derived from a focus on transaction costs are proposed. The management of transaction costs is the key for promoting value-added activities and innovation in particular, which have played significant roles in the intensified competition around the globe. Our research has demonstrated the utility of the proposed methodologies for those companies that implement them. It is the author's hope that the readers of this volume will adopt a new perspective to understand the simple structure of transactions, which have affected (and continues to affect) the open global economy, thereby allowing them to enjoy the same advantages.

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Kyoto, Japan Chihiro Suematsu
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Introduction

Understanding Globalization and the Internet from the Viewpoint of Transaction Costs

Globalization is clearly interconnected with the spread of the Internet. Its influence is getting more intensive as well as extensive. Its advance is bringing about drastic structural changes around the world. This book aims to provide a unified account on these structural changes and a mechanism to cope in this environment using the viewpoint of transaction costs. The book also aims to show that what we normally see as drastic changes actually proceed according to a simple logic. To see this as such, it is necessary that we overcome old paradigms and adopt a new perspective. Japan is a typical example of the failure to adapt due to her successful experiences in the past.

The Internet has encouraged numerous innovations. Almost all of these innovations have targeted producing creative ways in reducing transaction costs. In fact, we can understand globalization as the outcome of the continuous effort to reduce transaction costs. Before the advent of the Internet, many transactions were impossible to execute because of obstacles such as physical distance and institutional differences. Because of continuous reduction of transaction costs, however, many transactions have become possible. Companies and other organizations can access more sources with much lower prices for innovative parts and products, raw materials, and even workers, engineers, and professionals.

As the transactions between new partners increase rapidly, new transaction costs are generated. New business opportunities also become available to make these transactions more efficient. Reducing transaction costs has become more important than before and its relevance continues to increase.

As drastic reduction of the cost of transacting with the rest of the world has resulted in making business transactions around the world more convenient, division of business processes among different companies is even being advanced. The ease of transactions with many partners has enabled the shift toward modularity in product architecture. All emerging countries have pursued the development model of outsourcing pioneered by Taiwan, India, and China, which is considered to be a type of modularity.

As transactions are considered as the blood of the economy, it is not vitalized in case of stagnation and vice versa. Activation of transactions makes impacts on economy unfathomably.

Reduced transaction costs lower the cost and widen the breadth of transmitted information. This in turn accelerates the creation of de facto standards. Network externality effects, bandwagon effects, and economies of scale effects have further promoted standardization and therefore "winner-takes-all"—that is, market monopoly. Profit accrues to a single company that captures the standard. On the other hand, it becomes difficult for companies even to survive if they find themselves in the second or third position.

Companies therefore aspire to dominate standards creations. As such, they have to join a severe and endless competition in the capturing of standards. In this competition, it is a must for them to continue improving the quality of their product and their service without letup. The range of free offers (in terms of functions, usage periods, and number of users) continues to expand and it is quite common for product prices to become free today. Actually almost all services provided on the Internet and most application software products for mobile smartphones are being offered at no cost. Open source software products such as the Android (an OS for smartphones) are also increasing rapidly. Furthermore, more and more digital contents are becoming free. Theoretically it is even possible that prices are offered below variable cost. Hatsune Miku from Japan heralded this digital content revolution. The trend toward free product offers is even affecting real businesses outside the Internet.

Reduced transaction costs among the general populace are bringing about a revolution in human communication such as what is being seen in the Facebook revolution. There are even numerous number of Internet services that provide a platform to share and exchange idle resources in storage at home without cost to the consumers. The platform matches the needs and availability of idle resources in the form of old clothes, automobiles, guest rooms, vacation houses, fallow farmland, and construction equipment. This type of services has become more popular especially after the Lehman shock in 2008 as many people have become more inclined to conserve. Since many of these services are run by NPOs, we can expect that they may become more popular around the world as a new lifestyle.

The transaction cost is a hindrance in the transmission of information. Hence, its proper management is closely related to the promotion of creativity and innovation. Innovation does not happen when the necessary information is not transmitted as an outcome of high costs of transactions among involved parties. Hindrances to innovation such as "Valleys of Death" (between product development and business development), "Devils River" (between research and product development), and "Darwinian Seas" (between business development and business success) can be overcome by reducing some of the transaction costs involved. In this book, a number of frameworks that stimulate innovation will be introduced by showing illustrative cases that have drastically reduced transaction costs such as open innovation and open source.

An analogy of the concept of a transaction cost is how an individual processes thought. Information transmission within the brain does not exist as frictionless (i.e., transaction costs $= 0$). If past information can be used freely, we can expect that the brain's capacity for data processing and creativity will increase immensely.

In other words, what is important is to reduce the transaction costs between the past and future versions of ourselves. The technique in handling transaction costs in knowledge management within organizations may be applied as well. As creativity is defined as "the combination of information," the technique in managing modularity can be applied as to improve managing personal creativity.

The issue of *transaction "costs"* is not simply an issue of reducing costs as is often misunderstood.

Transactions involve the following constituents: searching for a partner, gathering information, negotiation and agreement, exchange, and ex post exchange. Transactions become more effective when more resources are spent in each constituent ("effectiveness" can be understood as the capability of companies to fulfill their objectives such as increase in sales, development of better products, stronger brand awareness, increase in market share, and human resources and organizational development). Because resources are not infinite, transaction cost management is an issue of resources allocation and not simply an issue of reducing costs. Since business activities can be determined as effective only in the future, it is therefore impossible to judge their effectiveness objectively unless one can predict the future. Businesses make and execute plans that the upper management assumes as effective based on their past experiences. However, businesses can improve their effectiveness by making use of acquired resources after eliminating wastage such as redundant activities and functions. Many examples of wastage and redundancy in transactions that are easily observed in companies will be cited in this book.

The principle of a transaction cost can be applied both extensively and intensively. Transaction costs should actually be used as a new index in tracking value-adding activities for businesses. At the same time, its management is relatively simple. Since all human activities can be considered as different forms of transaction, they can be analyzed within this unified framework encompassing the macro and the micro such as industries, companies, sections within companies, and individuals.

Managing Transaction Costs from the Concept of Transaction Interface

In managing transaction costs, we need to know where and how they accrue. It is therefore vital how transaction costs can be visualized and be understood as a structure.

Accounting is almost perfect in tracking mainly the costs of (physical) goods. In this institution, however, transaction costs are not tracked and their mechanism remains unclear. What is not measurable cannot be managed. Human activities, effectively transactions, are the bases of adding value and we can expect that they will continue to be the most important resource. But the reality is that their management is only based on past experience and intuition.

Transaction cost economics has produced two Nobel Prize winners in economics: Ronald H. Coase and Oliver E. Williamson. Many researches have been

produced using transaction cost approach, so the fundamental principle of a transaction cost has been analyzed albeit fragmentary. In this book, building up on the previous researches, a methodology that can structuralize and manage transaction costs will be proposed by using the concept of *a transaction interface*.

Transactions are executed when transacting parties are successful in adjusting their differences to arrive in agreement. A transaction interface involves the conditions in which transacting parties should agree, such as the specification, the price, the date and method of delivery, and the payment. A disagreement in any one of these prevents the transaction from being consummated. In determining these conditions, the parties involved in a transaction must also be in agreement on the interface with regard to searching for a partner (meeting each other), gathering and providing information, negotiation and agreement, exchange, and ex post exchange. Transaction costs come about the moments transaction interfaces have been agreed upon (or enforced). These factors were originally difficult to see. But when we grasp and manage them in a systematic manner, the methodology in reducing transaction costs can therefore be established. It becomes also possible therefore to plan a scheme that encourages all kinds of transactions including communications and interactions.

The only way to reduce transaction costs is fixing transaction interfaces. When transaction interfaces are fixed by prior agreement and shared by many entities, many practices can be advanced such as the usage of information technology (IT) in transactions, learning curve effects, and lowering worker wages.

There are many ways in fixing interfaces. One way is through customs, trust, and tacit knowledge. Japanese companies are good in these types of interface. But these types of interface have a weakness in the sense that they cannot be managed quickly enough since these are products of natural occurrences. Recently, the technology in fixing interfaces as a means to reduce transaction costs has advanced dramatically around the world. This advancement has surpassed and overwhelmed the Japanese interfaces. For Japanese companies, the source of their competitiveness in the 1970s to the 1980s and their decline since the 1990s can be explained by both the innovation and transformation in the technology of fixing interfaces.

Japanese newspapers have been writing almost every day about instances in which companies adopt modular structure especially for product development in the electronics and automotive industries. Although modularity is strategically important, a satisfactory theory to explain it systematically has not been established mainly because its structure is extremely complicated. Therefore, within the industries, its understanding and application have not been deepened enough. But if we consider that modularity is determined by fixing the interfaces, then we can understand modularity in a simple and straightforward manner.

A modular structure increases the drive that is based on autonomy and motivation from ownership. It also realizes economies of scale through functional divisions and reduction of transaction costs, resulting in increases in the efficient use of resources. But in case the interfaces (from the context of modularization, they are called “architecture”) are not properly designed, this becomes investment with very poor ROI. In Japan, being sensitive and averse to this problem, the people

and organizations emotionally rejected modularity initially. But the advantages gained by modularity are too compelling especially if the technology to manage it is established. Right now, companies around the world compete intensely in developing their capability and the expertise for its management. We do not have to look as far as Taiwan to see its importance not just as a business strategy but as well as a national strategy.

Incidentally, the "standard," which is becoming more and more strategically important in all business fields, can be understood as the interface shared by critical mass in the market (or within organizations). The issue of standardization—that is, the acquisition of de facto standards in the market and the designing of procedures, protocols, processes, and systems within organizations—can be analyzed using the identical approach of the interfaces.

When we have a methodology to understand communications and interactions within organizations as patterns of transactions, then all organizational and institutional measures (policies, rules, systems, processes, regulations, manuals, setups, routines, and so forth) are recognized as means to encourage transaction activities by reducing transaction costs between individuals and between departments through fixing interfaces. By applying the structure of a transaction interface, management of organizations can be systematically and universally clarified.

The original understanding in economics is that organizations and markets are concepts that are distinct. But if we understand them as devices that reduce transaction costs, then it is only logical to think that we can analyze them using the same approach. Since they have the same structure, they influence each other, evolve in synchronization, and eventually become fused to each other. We can see the phenomena in everyday life of businesses, such as the advance of modular division of business processes among companies and market transactions within a company.

Requisites to Satisfy in Fixing Interfaces

Fixed interfaces have substantial contributions in making social or organizational activities more efficient and effective. But if fixing is not properly designed, the disadvantages can also be enormous. Japanese companies have been ineffective in globalization and modularization, but this ineffectiveness is only a superficial manifestation of a more fundamental failure on their part. This failure has been their incapability to manage transaction costs incurred by interfaces. There are many cases in which interfaces such as systems, processes, modules, and plans have been rejected even before consideration. What is important is to analyze their advantages, disadvantages, key success factors, and solutions for disadvantages in an integral manner and evaluate the applicability for each case individually. This book does not espouse that fixed interfaces must be applied to all transactions. What it is saying is that it is significant to be able to determine whether to adopt a fixed interface or not, and that if one decides to adopt, the technology and capability to make a proper design for the interface are necessary. Through illustrating various

cases with implications that can point out problems particularly those faced by Japanese companies, the concept and methodology will be explained as simply as possible throughout this book.

By fixing and standardizing interfaces, many parties to transactions can jointly share an interface. As a result, substitutability of partners increases, and competition becomes fierce. Competition is necessary for growth, improvement, and innovation. But there are always groups that reject and deny the introduction of competition. Reforms along with innovation accompany the risks and the injury against vested interests. The injury against vested interest within the company is simply a problem of adjusting interests. But for some such as Japanese companies, the problem is difficult to resolve since decision making involves unanimous consent without appropriate leadership. In a recent environment wherein competition is getting more and more intense, leadership to take risks and adjust diversified interests has become indispensable. We can see this in Silicon Valley-type companies and high-tech companies such as Apple and Samsung, and even in Japanese SMEs that have exhibited recently very high growth. Fixing of suitable interfaces and standardization requires leadership and is the most indispensable capability required for modern leaders.

Welcome to the World of Transaction Costs!

Ever since the beginning of human history, reducing transaction costs has always been pursued. Since the dawning of the Internet, the attempts and accomplishments are becoming more conspicuous. As long as organizations and societies exist, transaction costs are always present. The reduction of transaction costs makes it possible to transact with another party at the other end of the world. But this also generates new transaction costs. As such, the process is following a limitless repetition of reduction and generation of new transaction costs. Transactions are expected to increase tremendously in this age of globalization. We can therefore expect that the importance of the methodology in managing transaction costs will continue to increase.

To survive in this world of dramatic changes, it is important not to be trapped by common sense and the limited scope that had been developed in the past. The concept of a transaction cost is indispensable among managers, who have been seeking for the next direction. The book will provide and explain the new perspectives as easily as possible.

Contents

Transaction Cost

1

All communications and interactions within companies are also transactions, which incur enormous costs.

1.1 What Is Transaction Cost?

A transaction cost is the cost related to exchanges of goods and information.

The notion of a transaction cost has been receiving attention, and studies in the field have produced two Nobel Prize winners in economics.

A transaction is the smallest unit of economic activity—that is, the smallest exchange as a profit-seeking activity of individuals. Transactions, besides buying and selling activities between and inside companies, include all communications and interactions within companies. Although payment of money is not likely to occur between a manager and a subordinate in companies, all business activities in companies, are also deemed as exchanges of outcomes and rewards such as compensation and promotion. In other words, these are all transactions, one kind of economic activity, and actually take the same processes that accompany transfers of money in commercial transactions. Every activity between and inside companies can be analyzed by the notion of a transaction cost. The purpose of this book is to explain the structure of a deceptively complicated transaction cost as simple as possible, which is embedded in every activity of day-to-day operations and to propose theories, strategies, and practices to improve its efficiency and effectiveness.

The drastic growth in the complexity and significance of information processing in the current business environment has increased the value of analyzing transaction costs enormously. Measurement and evaluation of business activity currently depend upon accounting that is based on the double-entry bookkeeping system developed in northern Italy in the thirteenth century, far before the time of the Merchant of Venice when goods were crucially valuable. In other words, accounting was created for the purpose of measurement and evaluation of goods.

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Cumbersome and bulky products, such as steel and heavy machines, played a central role in the economy until recently. Costs meant *production costs* then, most of which were composed of material, parts, equipment, and factory labor. The way of thinking that resulted in software and services being bundled at no cost with a purchase of hardware is a typical example showing the mindset in that era. In the recent business areas of software and intellectual property, however, the ratio of hardware cost is extremely small, and the reproduction costs are nearly zero.

In contrast, activities of human communication continue increasing both in quantity and quality (diversity). In industries and companies operating in leading-edge areas, this change is conspicuous. Even in the heavy industries, software to operate machines and systems with complicated functions has increased in significance. More than ever, software controls hardware, determines product competitiveness, and supports business management. Software and intellectual property have begun to take more significant roles in every industry and company. However, analysis of human activity, especially the communications and interactions that are indispensable for creating value added, has hardly evolved.

In the past, even the cumbersome and bulky products were homogeneously simple, which were produced in a single company, distributed by the same company, and purchased in the same country. However, the situation has been changing rapidly. Various parts are produced all over the world and delivered to and purchased in various countries where market needs are wide-ranging. Strategic information regarding various diversified customers is transmitted to and shared by many operations in the world. Technical innovation advances rapidly, and the complexity and diversity of the communication have been increasing. Highly detailed information regarding markets and technologies is transmitted and utilized to develop new products continuously. Information of inventories is analyzed concurrently with customer information to shape the most efficient production and logistics plan. All stocks of end products and parts in the world are controlled at the smallest level. The same discussion applies to consumer goods, including perishables. The IT systems, which process the information, have been innovated drastically.

When business activities expand globally, the number of competitors increases, the result of which is fierce competition. Efficiency improvements are pursued comprehensively to reduce prices and delivery time, and all wastes are tracked and eliminated. Information regarding markets and technologies is processed and utilized to increase value added in product development.

At the same time, the value of customer services also becomes emphasized. Companies are required not only to deliver products but also to process information regarding the issues and needs of their customers, execute various customizations for each customer, and provide information and solutions to each customer to ensure proper use of their products. In order to complete those activities, a large amount of data regarding the activities of their customers must be collected and analyzed.

Customer needs have diversified and transactions have become more complicated. All the value added in product development, production, sales, service, and

so forth is created by human activity where exchanges of a huge amount of information are required. The amount of information processing corresponds to the complexity of the transactions, and the transaction costs should be deemed as a key for the analysis of transactions.

When transaction costs are reduced, people regularly execute transactions that were practically impossible in the past, such as transactions in the middle of the night, transactions with unknown transactors living on the opposite side of the globe, and transactions of extremely rare products. Actually, the reduction of transaction costs has been significant since human societies emerged; however, its magnitude was hardly recognized because transaction costs were buried in the huge cost of hardware. Phenomena in which reduction of transaction costs and augmentation of new transactions repeat reciprocally like a piston have been seen increasingly all over the world in the age of the Internet. And eventually analyses of transaction costs, or human activity cost, will become more significant than analyses of hardware cost.

The following sections in this chapter examine a large number of instances in which transaction costs were reduced, in order to illustrate this significance.

1.2 A Huge Number of Instances of Transaction Cost Reduction

Instances of transaction cost reduction have been seen increasingly with the spread of the Internet.

1.2.1 Instances Continuously Increase and Evolve

The Internet has provided opportunities for reducing transaction costs.

As a matter of course, responding to the increase in the number of transactions, various actions and trials have been executed to reduce the huge cost. The Internet has dramatically reduced global transaction costs in a short time. In fact, the postal mail system, telephones, and fax machines have achieved the same effect. Communication with remote locations and other countries had depended on faxes until just recently, and the postal mail system had been crucial for approximately 100 years prior to the introduction of fax technology. The postal media limited transactions to several times per day, but telephones reduced transaction costs and increased it dozens of times. Faxes, e-mails, and mobile phones increased them dozens of times further. It is indisputable that the increase in the number of transactions will continue due to the appearances of new infrastructures such as blogs, Twitter, and other social network sites (SNSs).

After information became digital, the contents of communication have been accumulated in databases and the Web. Today, past transactions are searched readily and the past digital contents are reused flexibly. Given the fact that

transactions can occur between a past provider and a present user through databases, transactions thus can be conceived of as having transcended time differences. These infrastructures also reduce transaction costs and increase the opportunity for transactions.

Ordering data from customers are readily reused as internal ordering data if tools developed for conducting Internet-based business such as electronic data interchange (EDI) are used. After the transaction costs of digital data decreased drastically with the growth of the Internet, the standardization of the data became a critical issue for further cost reduction. Standardization of data is extremely effective for reducing transaction costs, as the data can be reused without editing or modification. Examples include standardization for sharing information of statuses of inventory, production, and sales. When the biggest group of transaction costs at the time decreases, another reduction of the next biggest group becomes a target. And the next. And the next. This has been and will be repeated endlessly.

Both networks and databases, the most popular applications of IT, are technologies developed for the purpose of reducing transaction costs. It may be argued that almost all ITs have been developed for the purpose of reducing transaction costs.[1]

This hard evidence illustrates the magnitude of total transaction costs and efforts that have been and will continue to be expended for the reduction. The following is just a partial list of cases in which enormous efforts have been expended for the reduction of transaction costs.

1.2.2 Partial List of Cases

There are a countless cases.

1.2.2.1 Marketplaces and Online Marketplaces

In the era of the net bubble around the year 2000, although the expectation for the Internet exceeded its actual value, huge substantial changes occurred in the society. Formation of online marketplaces on the Internet in particular greatly contributed to reductions of transaction costs.

In the first place, the purpose of establishing markets has historically been to reduce the transaction costs of traveling and searching by adjusting venue and time. It would have been inconvenient for buyers and merchants to move around to several locations to seek goods or customers. Since place and time were standardized, it became much more efficient for everyone to execute transactions. Market sizes expanded necessarily to improve the efficiency. This was one of the largest and oldest attempts at transaction cost reduction in human history.

[1] Computer simulation calculations in fields such as fluid dynamics, astronomy, and genetic engineering are also important applications.

The same thing is happening in the online marketplaces. That is, searching for merchants and products, communication regarding product information, accreditation (assurance of quality of goods and payment, and the transaction entities), ordering and accepting, and after-sales service are performed in compliance with common standardized procedures. Thus, transaction costs incurred in the course of communication, negotiations, and adjustments are largely reduced. As a result, convenience and efficiency improve for both the merchants and the consumers. When transaction costs are reduced, transactions that were impossible before due to a huge amount of transaction costs become executable.

The old pricing mechanism of the conventional auction was applied to the e-auction to reduce transaction costs. However, the effect is not limited to the price negotiation cost. The presentation procedure of product information and the terms/conditions of exchange (e.g., payment and delivery) are fixed a priori, and respective credit information according to the reputation and the past records is shared by the participants. Therefore, the risk of engaging in a transaction became very small. The escrow service (a service to guarantee that delivery of products and payment of purchase are executed as contracted) was indispensable but expensive in the past. Including the escrow service, an e-auction functions as a platform of exchange and avoids troubles such as wrong product deliveries, nonpayment, and unsolved problems. On the other hand, in some developing countries where credit guarantee systems or robust business customs have not been established, the escrow service remains very valuable. Since the Alibaba of China and the post office of India have guaranteed payment and delivery, e-commerce in the two countries has expanded explosively.

Similarly, in e-commerce sites such as Amazon, Taobao of China, and Rakuten of Japan, innumerable sellers and buyers execute transactions in compliance with their standardized transaction procedures. As prices and transaction conditions are fixed, no negotiation cost is incurred. A key success factor for such online marketplaces is to provide means to reduce transaction costs as much and as appropriately as possible. When transaction costs decrease, transactions are promoted and reactivated, which increases popularity of the site—resulting in further increases of users. The consequent surplus resources are reinvested into the enhancement of the functions to reduce transaction costs, and transactions increase again. Thus, a virtuous circle is created.

E-commerce has become ubiquitous among consumers as a platform that offers means to reduce transaction costs even when consumers need information. It continuously expands product lines from PCs and household appliances to restaurants, apartments, and funeral services. It contributes to the reduction of total transaction costs in the society as an upper-layered platform established on the Internet.

All the above mentioned was regarding business-to-consumer (B2C) transactions. In fact, however, in the era of the net bubble, the growth of business-to-business (B2B) marketplaces was much more expected because businesses are deemed to be more sensitive to transaction cost reduction than are consumers and their motivation for the deployment appeared stronger. Since Wal-Mart, the world's

largest company in the distribution industry, completed its own online marketplace, resulting in drastic reduction of procurement cost, it had been a crucial strategic goal for all other distribution companies to compete against it. Consequently, global B2B marketplaces such as GlobalNetXchange (GNX) and WorldWide Retail Exchange (WWRE) launched operations with huge expectation.

Covisint, which unified part procurements of the automotive industry, is also one of the online marketplaces that attracted huge attention. Those B2B marketplaces were expected to reduce transaction costs and grow quickly. At present, however, many of those have already gone out of business or converted the business model, against expectations. This happened because the suppliers disliked price decreases as a result of encouraging competition. Online marketplaces are able to enhance functionality only when both buyers and suppliers participate actively. If suppliers reject cooperation to increase the number of goods or the participation per se, it would be difficult to provoke the virtuous cycle or even to stabilize the business. So far, only successful B2B marketplaces are driven by one supplier such as Cisco, or by one buyer such as Wal-Mart. Although those are private distribution systems or private procurement systems that are not generally defined as marketplaces, those are frequently cited as unique success cases. In contrast to B2C marketplaces, it seems difficult to destroy the existing orders of industries. This is going to be a central subject throughout this book.

One of the very few examples of successful B2B marketplaces is Alibaba. The reason for its success is that it targeted transactions with small Chinese companies that were growing rapidly. All the companies in the world had interest in conducting transactions with them; however, the cost to originate the transaction per se was too large. In the emerging market, there was no behemoth to dominate the industry order, and all the suppliers appreciated the innovation by the marketplace.

If the Internet sites with standardized procedures to execute transactions for sellers and buyers are defined as online marketplaces, then Web portals, YouTube, SNSs, and social games can be included. For example, SNSs provide functions to assist exchanges of personal information among the users and have been growing so rapidly that they have even become platforms that triggered national revolutions in some developing countries. These are online marketplaces of information that collect a huge number of people by providing various services for nearly free. Q&A Web sites, help forum Web sites, and social search engines such as Answers.com, Ask.com, and Quora have become indispensable for our everyday life. People can get free illustrations and photos on All-free-download.com. Personal blogs gathering many people are also marketplaces in which to exchange opinions and knowledge. Those Web sites earn revenue from advertisements by providing all those transaction assistance functions free and attracting "eyeballs."

As the examples of SNSs exhibit, transactions in online marketplaces are not only for commercial purposes. There exist all the transaction elements except payment, and the technologies to streamline all those transaction elements are crucially significant to activate the Web sites, in order to gather more people and to increase the revenues.

This online marketplace innovation has accelerated even after the Internet revolution seemed over. A subsequent movement, "WEB 2.0," has encouraged the creation of values by interactions among consumers and citizens. Transaction costs incurred by those micro-transactions among consumers were relatively too large for them without the online marketplaces including SNSs.

In this manner, the decrease of transaction costs and the increase in the number of transactions will continue reciprocally. Revolutions after the WEB 2.0 revolution after the Internet revolution after whatever—revolutions of transaction cost reduction will continue endlessly.

1.2.2.2 Mobile Marketplaces for Smartphones

One of the key factors for Apple's amazing successes of the iPhone and iPad is that the iTunes Store (and the App Store) has dominated music online marketplaces, download markets of digital contents. Utilizing the dominant platform, the contents and application software of the iPhone and iPad had competitiveness in both quantity and quality from the very first launch. Since Apple also altered the application development, providing a simpler computer language, an enormous number of developers and artists entered into the market, resulting in the price decrease. The marketplace is now the main revenue source for Apple. Currently, competition for the online market share has been intensifying with the entries of most of the world's telecommunication companies, smartphone manufacturers, PC hardware manufacturers, Intel, Microsoft, and so forth, all of which are in quest of the standard position. Nexus of Google, Kindle Fire of Amazon, and Kobo of Rakuten are reportedly all distributed below cost to acquire the standard position of a window to the online market.

1.2.2.3 Logistics Management by Supply Chain Management

A huge cost of inventory management in whole supply chains was incurred before the introduction of supply chain management (SCM). Examples include inventory cost, disposal cost of wasted inventory, opportunity loss, and document handling cost (e.g., informing customers of changes in delivery) due to the improper inventories in each process of sales, distribution, and production. An enormous amount of time was wasted due to the mutually tangled information of inventories, order statuses, changes of schedules, and so forth. UCCnet, a US-based standards body for product master data, estimated the loss of sales as more than 40 billion US dollars in 2003. All those costs had been perceived as a significant issue intuitively; however, those had been left unsolved due to the difficulty of innovating processes.

A methodology called SCM that integrated all those conflicting data into one database through networks was proposed at that time. It was no more than an electronic ledger, the function and effect of which everyone understood. However, the impact of the software package, which allows the maximal use of databases and networks, was so huge to encourage many companies to challenge the innovations of supply chain processes, resulting in drastic improvements in efficiency. Dell attracted the world's attention when it presented its advanced use of SCM, which is known as the Dell model. A new industry of electronic manufacturing services

(EMS) emerged and has grown rapidly due to their great utilization of SCM. The business model had started on the US soil and enjoyed its competitiveness for some time, but moved to Singapore and Taiwan, and recently to China, all of which provide much lower labor costs. It is not an exaggeration to argue that China's remarkable economic growth fully depends on business models enabled by SCM. It also changed the whole pictures of some industries, such as the apparel industry, which has been innovated totally by specialty retailers of private label apparel (SPAs) such as ZARA of Spain, H&M of Sweden, and UNIQLO of Japan.

Although SCM brought significant cost savings, many large companies still do not utilize SCM well. Despite the fact that SCM systems and valuable data have been provided, it has been difficult for many companies to prioritize total optimization before self-optimization and to overcome mutual distrust between departments. Achieving this large-scale innovation depends on a huge number of transactions among change originators, change agents, and employees in charge of local operations (e.g., sales, logistics, and production). Consensus making for the introduction of the innovation incurs transaction costs as well. Because these transaction costs are too large to execute the transactions, all the wastes have been left ignored. Even though an innovation is deemed reasonable, many companies cannot overcome the barriers of transactions to obtain consensus for the new business processes and to implement the changes. In many cases of SCM deployments, suppliers and customers need to be involved in projects, which increase transaction costs further. Innovation requires a huge amount of transaction costs anyway.

1.2.2.4 Economic Growth of China, India, and Taiwan Due to Reduction of Transaction Costs

The countries that gained the biggest benefit from reduction of transaction costs due to the Internet were China and India. It was quite uncommon to outsource manufacturing to those companies before the 1990s. The first barrier was to find where the potential companies were. Even if they could be accessed, the credibility of their quality, delivery, and other management operations and their trustworthiness had to be investigated. How problems could be solved and controlled had to be determined because they might have different business customs. There existed many risks for Chinese and Indian companies as well, such that customers did not make payments. Therefore, the transaction costs were perceived as too large to start such promising businesses. However, the cost decreased drastically with the worldwide spread of the Internet, and smoother communication became possible with the lower cost. Finally, China became a manufacturing hub and India became a global IT operations hub. Many Chinese Americans and Indian Americans must have contributed to the successes by reducing transaction costs due to differences in languages and business cultures.

Taiwan has been focusing on outsourcing businesses as a national strategy. In particular, the success of its foundry[2] business, and the outsourcing of

[2] Manufacturers who specialize IC manufacturing.

semiconductors as typified by TSMC, pioneered the national innovation. Hon Hai Precision Industry and its subsidiary, Foxconn, which deal with most of the manufacturing of Apple, Nintendo, and Sony and earn more revenue than any of the Japanese large-sized electric manufacturers, are most well known among the companies in the country at present.

Some of the companies started OEM businesses with their own brands. HTC used to assemble Palm devices, which once dominated the personal data assistant (PDA) market, and now is one of the main suppliers of Android-based smartphones. ASUS, a Taiwan-based PC manufacturer, used to focus on the supply of PC motherboards and now manufactures its own branded netbook PCs and ultrabook PCs.

MediaTek grew expansively with semiconductors for the mobile phones, and it dominated the market of the central IC modules that play the most significant functions. It is said that its market share of the IC modules for the Shanzhai mobile phones, the Chinese imitation mobile phones with pirated brands, reached 90 %. The company uses TSMC for manufacturing, without having its own production facility.

Yue Yuen Industrial, a Taiwan-based Hong Kong-listed company, supplies shoes to most of the major brand sports shoes companies in the world such as Nike, Adidas, Reebok, and Asics, earning the largest revenues in the world. In addition, Pou Chen and Feng Tai, its competitors, are also growing rapidly. Other illustrative examples of the contract manufacturing services (CMS) in Taiwan include Giant and Merida for bicycles and Yulong for automobiles.

1.2.2.5 Demise of the Vertical Integration Model

The iPad from Apple triggered the emergence of the tablet PC market. The Kindle Fire from Amazon, the Nexus 7 from Google, and the Surface from Microsoft were brought to the market afterward. Google also has already launched products such as the Nexus Q (a media player), Google TV (a smart TV), and Google Glass (a wearable computer). It is astonishing that none of those companies is classified in the manufacturing sector. Google and Microsoft acquired the mobile device business division from Motorola for $12.5 billion and Nokia for EUR 5.44 billion (mainly for the purpose of acquiring their technologies and patents). That is, conventional PC hardware sales and manufacturing companies are considered to decrease their competitiveness, and the companies in other sectors invaded their market as great powers. This can be attributed to the spread of readily procured manufacturing and sales functions that were definitely enabled by the reduction of transaction costs with the contract manufacturers and consumers of the world. The location of key success factors shifted from sales and manufacturing to innovative product development, brand power, and risk acceptance capability. In terms of profitability, the development capabilities of application software and contents are of increasing significance. These imply the obsolescence of the silo model or the vertical integration model, which adheres to possession of all functions including manufacturing and sales, a result of which is the dispersion of resources.

1.2.2.6 Integrated Transaction Processing Provider

Amazon has been expanding its B2B transaction processing provider service, which has processed all of its clients' transactions, including SCM, logistics, and marketing, since 2012. Its clients can concentrate their scarce resources on product developments, relegating the processing of all those transactions to Amazon's system. This service offers great opportunities to start-up companies because the young companies can launch new businesses readily. This business model is also called "third-party logistics" and appears to be an efficient means of reducing transaction costs on the whole.

As widely known, Amazon started business with the online sale of books, CDs, and DVDs and became a general retailer dealing with all kinds of consumer goods, taking approximately 25 % share of the fast-growing online market in the USA. Its revenue has been growing by more than 30 % yearly, on average, and has reached $50 billion. The key success factors of such a fast growth are twofold:

- Universal procedures of transactions across all products (presentation, order and acceptance, delivery, ex post processing such as returning)
- A highly efficient logistics system that carries inventory in-house and delivers products for free on the same day (those are actualized by as many as hundreds of thousands of servers and its management system. Amazon is opening up all those resources and technologies to clients for profit as described above)

The following transaction processing functions are provided to the clients of the service:

- Merchandising of their products on the WEB
- Orders and acceptances
- Charging and payments
- Inventory control
- Shipment
- Sales data analysis (information provisions of the best- and worst-selling products)
- Recommendation of products for promotion to visiting consumers
- Call center

As all the services can obtain the full benefit of economies of scale (advantages of scale) structurally, the transaction costs decrease greatly, providing the company stable competitive advantage.

1.2.2.7 Global Economy Revitalized by Establishments and Enhancements of the Transaction Infrastructures

Besides the Internet, another new great means of reducing transaction costs is the expansion of low-cost carriers (LCCs). This business model totally depends on the Internet by which the air tickets are distributed with much lower costs. In addition, various costs are reduced throughout the operation by all means in order to realize that amazingly low price, which is similar to the shop floors of Japanese manufacturing companies. Passengers, including students and low-income people, use them just like buses on streets, revitalizing not only the industry but also a wide range of transactions in societies. Accessing the infrastructure on land was also

established at the same time. Shuttle buses to airports depart regularly and punctually, and passenger traffic runs very smoothly at the dedicated airports.

Although most face-to-face meetings have been substituted by the Internet video phones, people still need to meet each other in person. Reduction of the traveling costs is indispensable for expansion and activation of transactions. LCCs generated an enormous number of new transactions, which used to incur prohibitively large transaction costs in the past.

Although LCCs facilitated travel beyond borders, it remains still troublesome to travel in unfamiliar cities. Mobile phones, especially smartphones, assist travelers in finding locations, directions, and train and bus schedules. In many countries at present, travelers can purchase SIM cards from a vending machine, insert them into their smartphones, and make voice calls and gain Internet access instantly. They can refill them easily by purchasing a secret number at kiosks or through the Web. In contrast, mobile phones are bundled with the telecommunication carriers in countries such as Japan, incurring huge transaction costs to replace carriers. Even in the EU, the international roaming services using the same SIM card charge largely to travelers, and the EU government has been recommending that telecommunication companies decrease the prices. Reduction of transaction costs in the EU area is definitely the government's biggest mission.

In the past, people used to expend time and cost for monetary exchange, the transaction costs of which obstructed transactions in the EU. The monetary unification, however, reduced the transaction costs. Furthermore, various infrastructures, including clearance and settlement, transportation, and business customs, have decreased transaction costs further and revitalized the economy of the area. Expectations for its future have swelled to bursting; however, the fundamentals of the economy are strong. The appropriate investment on infrastructures like the EU is another key success factor for most of the developing countries.

The globalization of companies and consumers contradicts the concept of nation in origin. Nations impose transaction costs by a means of regulations such as tariffs to construct barriers mutually. Regulation benefits a group of vested right holders inside and outside governments such as China and other developing countries, and the regulation is especially likely to be imposed intentionally. As nations can easily become anti-globalism, a stance that coincides with nationalism, those are likely to win public supports. However, all those transaction costs incurred by regulations are imposed on consumers and citizens eventually. The EU selected the present policy to overcome those issues and to reduce transaction costs for their economic, social, political, and cultural growth in the future. Following the EU, EPAs (Economic Partnership Agreements) and FTAs (Free Trade Agreements) such as NAFTA (North American Free Trade Agreement) and TPP (Trans-Pacific Partnership) have been established worldwide. Governments that can make citizens understand the benefits of the decrease of transaction costs, including Korea, are strategically positive to these treatments.

1.2.2.8 Open Source

In the IT-related industries (including the household appliance industry and the automotive industry, which utilize IT heavily) these days, the proportion of open source software has been increasing. Linux, an operating system (OS) that took the central role in open source software's growth, is examined here as a typical success instance of transaction cost reduction.

As is generally known, for many years Microsoft, the strongest monopolistic company in history, ruled over the market with its Windows OS, and every CEO of every industry, including distribution, finance, and automotive, was frightened at the menace of the company. The combination sales using the standard OS were extremely powerful, and nobody could expect that the power would ever weaken. However, it is open source software, Linux in particular, that brought a stir there and changed the momentum greatly.

The open source activity leveraged two approaches to the cost reduction.

First, open source software adopted a special licensing methodology, the GNU General Public License (GPL). The GPL was developed on the basis of an idealistic philosophy that asserts all software should be used freely by anybody in order to encourage cooperation among people. Under this type of license, software is used, duplicated, modified, and redistributed by other programmers freely.[3] There is no rule that enforces free distribution, as is often misunderstood; however, any person may and some persons certainly will redistribute acquired software for free under this license, and, as a result, the price of software will become zero, eventually. From a perspective of transaction costs here, it is important to note that the conventional licensing, especially negotiation of pricing, incurs considerable cost, but the cost of negotiation under the GPL disappears since the price is agreed as zero a priori. This has facilitated the utilization of others' outcomes and has accelerated the pace of open source software development, including Android OS.

Another breakthrough of reducing transaction costs accomplished by open source was attributed to its methodologies for development project management. The number of users and programmers expanded rapidly due to the advantage of the licensing, and thousands of programmers from all over the world participated in each project. Systems to assist the collaboration were introduced so as to increase efficiencies of development projects, thus saving time and energy. For example, the "Current Versioning System" properly numbers and organizes all programs developed, one after another. The "Bug Tracking System" tracks all the bugs and assists the assignments of responsibilities for fixing them—that is, the bug fixing processes of finding bugs, extracting solutions, assigning programmers, corrections, confirmations, distribution, notification, and standardization are controlled securely and efficiently. GitHub, an information and data sharing system with SNS

[3] Someone who obtained a software program under the GPL is obliged to adopt the GPL continuously when he or she seeks to redistribute the program after modification. That makes a philosophical difference from open source, which does not necessarily require the continuity.

functions, has been introduced recently and started supporting the community more strongly to further improve its efficiency.

Through open source, these two innovative approaches have collected and utilized powers scattered all over the world and facilitated more than equal competitiveness over the historic monopoly.

The international, high-impact success of open source has attracted attention and generated various derivatives. For example, OpenCourseware, an initiative used for sharing university courseware for education driven by Massachusetts Institute of Technology, was triggered by the success of open source and opened their faculty members' courseware materials to the public on the Web. Many countries such as China, which prioritizes the establishment of university education, have been quite active with this initiative. Courseware materials are provided by faculty and searched and used by students in their standardized formats, and only a very low transaction costs are incurred between them. Sebastian Thrun, Google VP and fellow and a former Stanford professor, started free online classes, Udacity. The courses are so well prepared that they provide better learning outcomes than do regular offline classes. It is now possible to take various high-level lectures for free from anywhere in the world. Khan Academy was founded in 2006 with grants of $2 million from Google and $1.5 million from the Bill and Melinda Gates Foundation to provide more than 3,000 free classes, mainly to poor children in developing countries.

Wikipedia is a free encyclopedia with more than 4.3 million articles covering keywords in almost all areas. It is also based on the philosophy of open source as well as Wiki, which is a software platform of Wikipedia. Creative Commons was also provoked by the philosophy and has been trying to expand its cover from only software to all areas of intellectual properties generally. Since an intellectual property of Miku Hatsune, the first humanoid character platform born in Japan, was opened to the public, many musicians and artists started collaborating on the platform to create numerous contents in music, animation, and various fields, which is now expanding worldwide.

Book reviews and product reputation comments are provided by many voluntary users, which assist others in their purchase decisions. The sharing of such information has become popular, and the function is served by all online marketplaces these days.

Waze of Israel, which was merged by Google in 2013 for the price of more than $1 billion, provides a map service with a traffic information sharing function. Users add and modify routes on the map and report traffic jams and accidents, just like playing a game. As the number of users increases, the accuracy improves due to the increase of the volume of data. In addition, the collected big data will be analyzed in various manners such as average travel time, and useful navigation information is provided to drivers for free.

The concept of open source has finally expanded into hardware production. Design diagrams of hardware are being shared by the open source license called *open source hardware* (e.g., Thingiverse). As low-price 3D printers for individual use have spread, people began to manufacture hardware readily by themselves at

home. When they acquire design diagrams for free, they can produce hardware with little additional cost.

While open source is a success case of reducing transaction costs by setting the price at zero, some trams in the EU are interesting cases that eliminate payment per se (the price is not zero) to reduce transaction costs. In some public transportation systems in the EU, passengers are supposed to purchase tickets before rides, not to make payment in cars. People who are caught attempting to ride for free must pay large penalties. This system has various advantages. As tram-drivers concentrate on only their driving without troublesome tasks of payment, exchange, and inspection, which requires knowledge of the complicated time-dependent discount fare system, their operation becomes much simpler, reducing initial training cost and enabling utilization of lower-cost laborers. The management cost of cash (e.g., cash handling, security management, risks of loss, and payment equipment) also drastically decreases. Furthermore, because all exit doors can open at the same time, many passengers can get in and out of cars without creating jams at the doors. It diminishes travel time, enhances punctuality, and eventually increases competitiveness against other transportation systems. Although there is a small problem in that first-time tourists may get confused,[4] total transaction costs are reduced enormously.

As this example shows, huge transaction costs are submerged everywhere in businesses and life without being recognized consciously. They amount to an incredible volume and obstruct many valuable transactions that might otherwise arise.

1.2.2.9 Zero-Price Business Model

After the brave business model of zero-price was originated by Google, it has been attracting attention widely and growing rapidly. This was also enabled by reduction of the transaction costs.

Examples of the zero-price model include:

(1) Zero-price cloud computing businesses of Google
   - Google search engine: This is a typical advertisement revenue model by which a free search engine collects consumers.
   - Gmail: Microsoft, Yahoo, and some other companies offered free mail services, but Google increased the volume of free data storage, triggering competition among those competitors, all of which provide quite enough volume for regular individual use. This is accessible across locations and PC machines, the same as all other Google services.
   - Google Calendar: Users can share their schedules with families, friends, and colleagues.
   - Memo
   - To-Do List
   - Google Maps: Detailed maps and satellite photos are available for free. In addition, the free functions of route searching and automatic navigation

[4] Basel, Switzerland, day tickets, which are included in the hotel accommodation charge, are provided to all tourists when they check into hotels in order to avoid this confusion.

are nearly equivalent to the car-mounted navigation systems, which cost a few thousands in US dollars. Street views and provision of information about restaurants and shops have been increasing.
- Google Documents: Although Google's online functions for creating office documents are not as rich as those of Microsoft Office, they are sufficient to meet regular users' needs. Functions of sharing data are also well supported.
- Google News
- YouTube
- Picasa: Photos are edited, organized, archived, and shared with communities.
- Phone directory assistance: An automated operator assists in searching phone numbers. It is said that the service is provided free to collect user voice data samples.
- Android OS
- Google Books: Books and magazines, the pages of which Google has scanned, are open to the public and easily searched and read for free.

Although a part of those services are provided for advertisement revenue, most of them are just for the purpose of increasing Internet users, which will eventually increase their revenue of advertisements in the long term.

(2) Zero-price businesses by others

The following is a partial list of zero-price businesses called *freemiums*, which are continuing to grow on the Internet:

- Media Players: RealPlayer, Windows Player, Quicktime, and Flash Player have been distributed for free.
- Adobe Acrobat: The viewer of PDF files is distributed for free to obtain a standard position.
- Wikipedia: Its contents are equivalent to encyclopedias, which were priced at a few thousands of US dollars in the past. The site is operated by user donations.
- Q&A Web sites: Users exchange knowledge and know-how basically for free.
- SNSs: Communication and online community assistance services of Facebook, Twitter, and Google+ are provided for free.
- Social games: Various games are provided for free except the purchases of additional items for enthusiasts.
- Internet phones/TV phones: Skype, Google Hangouts, and Line provide free communication services, which include chatting, file sharing, and conference calling.
- Free WiFi: Many restaurants, hotels, and shops provide free WiFi connections to their guests all over the world. Fon provides free connections to its members, who open their WiFi connections to Fon members in return.
- Microsoft BizSpark Program: All software needed for business operation is provided free of charge for 3 years to startup companies that develop software and are less than 5 years old and earn $1 million annual revenue.

It should be noticed that even a company such as Microsoft, which has been setting the extremely high prices, has started using a zero-price model.
- Groupon: Discount tickets for restaurants, hotels, and shops are distributed online for sales promotion. It is not completely free, but the prices are set lower than the costs. It is called online to offline (O2O), and it has attracted a lot of attention as it explores the freemium model in the offline real world.

The reason why these free products and services have arisen on the market depends on the reduction of distribution cost, one of the transaction costs, of sales promotion offers. The significance of standardization as a strategic objective as a purpose of the free distribution will be discussed in Chap. 3.

1.2.2.10 Accelerated Growth of Exchanges/Sharing of Idle Home Resources

Not-for-profit online marketplaces for exchange/sharing of resources that are excessive, idle, or dead at home are rapidly growing.[5] After Lehman's fall, as the citizens became more conscious about conservation and ecology, they obtained great popularity. The following is a partial list of those marketplaces:

- Online marketplaces for sharing personal cars: Different from regular car sharing systems that use the system operators' cars, they provide services to share personal cars while these are not used. Examples include WhipCar, RentMyCar, and Drive My Car Rentals. Resource efficiency of the society is improved, and the members are able to earn extra incomes as well. Many similar sites arose in many countries after 2010.
- Online marketplaces for sharing personal houses/rooms: Individuals register open houses/rooms for a short-term rental with reasonable prices to accommodate and make friends with world travelers and, at the same time, to earn some extra income. Examples are AirBnB, CouchSurfing, Roomorama, and SabbaticalHomes. Although some argue that the services are not compliant with hotel laws and tax laws, they are growing rapidly.
- Online recycling sites: Disused goods are exchanged in hundreds of recycling sites basically for nonprofit all over the world. Examples include swap.com and my.freecycle, in which a million members swap 2 million goods. The number is increasing.
- Online rental listing sites: They match demands and supplies of rental of almost any kind of personal items, such as cars, power tools, camping equipment, event spaces/goods, and party goods. Examples are Zilok, HotPads, Oodle, and Trulia.
- Online peer-to-peer exchange of fallow farmland: The marketplaces, such as SharedEarth.com and LandShare.net, match idle land owners and seekers such as personal vegetable gardeners and agricultural venture start-up companies. US-based SharedEarth.com and UK-based LandShare.net have affiliated their services to expand worldwide for nonprofit.

[5] Please refer to Botsman, R. and R. Rogers (2010), *What's Mine Is Yours: The Rise of Collaborative Consumption*, HarperCollins.

– Social lending: Transactions of lending money between individuals are supported online by Prosper, Zopa, and the like. The interest rates are determined by the reverse auction model. Many similar sites are proliferating all over the world.

All those sites, both for profit and nonprofit, are growing rapidly and it is becoming a worldwide trend. If all dead, idle, or excess resources are searched and utilized further due to the further reduction of transaction costs, the world economy may alter drastically.

1.2.2.11 Open Innovation

Transfer of information incurs transaction costs. It obstructs innovation for which various kinds of irregular communication are indispensable. Either in-house innovation or open innovation by unknown individuals in discrete organizations incurs much more transaction costs than day-to-day communication does. It has been too large to execute the transaction to achieve innovation.

Consider computer programs exchanged in open source projects, for example. Computer programs are collections of information in which ideas are described in a certain language, a computer language. In open source projects, a tremendous number of ideas are transferred, distributed, and integrated. For creation of new ideas, it is much easier to integrate other ideas than to produce them from scratch. Therefore, innovation corresponds to integration of other outcomes, and it is critical to establish such environments that promote the integration.

Even in the process of innovation, the number of kinds of information transferred and shared is usually very limited. The more specialized a field becomes, the more specific the information transferred becomes. Although information can be exchanged quite readily within a community, it becomes costly to do that outside the group. When individuals with high processing capabilities pursue new and unfamiliar information, ideas, and concepts in different fields, there had existed huge transaction costs.

In Fig. 1.1, a road to achieve innovation is illustrated. A certain individual distributes information or an idea to others. Among the many individuals who receive that, one individual adds information or an idea and redistributes it. Among the many individuals who receive that, one individual integrates it with his own idea and accomplishes a breakthrough. The greater the number of transactions of information that are executed, the higher the probability that innovations will fail. Transaction costs have obstructed innovations severely in this process.

Innovators need information to solve their problems. It is very seldom that they can acquire what they need in any given moment. The location of the information is unknown, and the search is very costly. Although they may encounter seemingly useful information, determining whether it is advantageously valuable or not incurs considerable transaction costs. When it is judged as valuable, developing more profound understanding for utilization requires time and effort, especially in the case of information acquired from an unknown source.

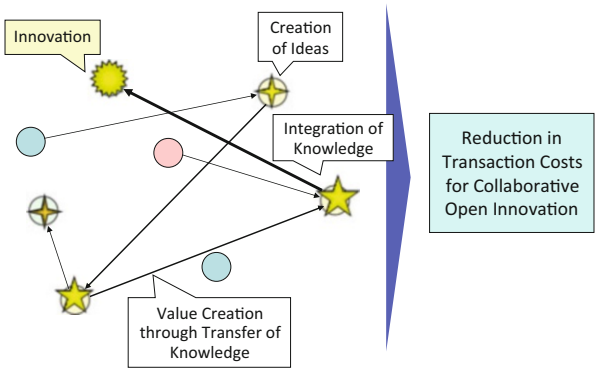

Fig. 1.1 Promotion of open innovation by reduction of transaction costs

These enormous transaction costs have obstructed and restricted communications that might have led to a breakthrough innovation. Even in companies where information and ideas should be exchanged and shared freely, the situation is nearly the same. For example, the sharing of various kinds of significant information related to product development is typically restricted to certain departments, groups, and individuals. It is because the transaction costs are unrecognized and the methodologies for reduction are undeveloped. If all transactions were executed efficiently and effectively, the probability of reaching new valuable solutions and creation of ideas and of earning huge profits must increase drastically.

University-to-business collaboration, B2B collaboration, and open innovation are all challenges for new creation across a variety of fields. Those intend to execute cooperative activities that have seldom arisen in the past due to huge transaction costs such as searching, mutual understanding, exchange, payment, problem solving, and enforcement, as described previously. While the costs have been too huge to perform a trial, successful cases were increasingly reported from the Silicon Valley area, with astonishing outcomes; collaborations began to be considered as a key success factor for innovation, and many attempts in various regions and countries were subsequently carried out. However, other success cases have rarely been observed.

Regarding what distinguishes the successes and the failures, Henry Chesbrough, a professor at the University of California at Berkeley and the author of *Open Innovation*, pointed out the standardization of communication as a crucial key factor after he investigated many cases in Silicon Valley. In contrast, the methodology adopted in Japanese trials has been the appointment of *collaboration coordinators*, which ended up without any perceivable reduction of transaction costs.

The difference in the methodologies of reducing transaction costs; the standardization of communication (including the establishment of communication platforms) and development of communication capabilities; and the appointment of coordinators are also going to be the central discussion subjects of this book.

1.2.2.12 Reducing Transaction Costs Incurred at Matching Demand and Supply of Electricity by the Smart Grid

The smart grid, which has been called the Internet revolution of the energy industry, was developed to process the gigantic volume of transaction information between suppliers and buyers. Situations in which only one monopolistic electric company supplies all the electricity are fairly simple, as calculation and estimation of all demands and supply are the only processing needed. In the USA and some European countries where the electricity industry is deregulated, the number of combinations of suppliers and demanders is enormous. Because it is difficult to coordinate the balances, large-scale blackouts frequently occur. A huge number of households are becoming the suppliers, as they are now being equipped with electricity generators such as solar energy, wind energy, and micro-water energy, a result of which complicates the coordination much more. The new smart-grid technology will monitor the energy consumption and generation of each household accurately and process the matching on online marketplaces. Transactions of measurement, invoicing, and payment will also be automatically processed.

1.2.3 Decrease of Digital Processing Cost as a Driver of Reducing Social Transaction Costs

Costs of the transaction in the digital space are decreasing drastically.

All the cases above depend heavily and indisputably upon the huge reduction of transaction costs in the digital space. It is not an exaggeration to argue that all digital technologies aim at the reduction of transaction costs. It seems intuitively obvious that the Internet infrastructure has enabled transactions and new business models such as the *freemium* that were impossible in the past, but the impacts will be examined quantitatively in this section.

The huge reduction depends on not just the Internet perceivable to all consumers but as well as the fundamental digital technology innovations underneath the surface. There are three key innovations as follows:

(1) Increase of information-processing speed and decrease of the cost (Moore's law)
(2) Increase of telecommunication speed and decrease of the cost
(3) Increase of data storage capacity and decrease of the cost
(1) Increase of information-processing speed and decrease of the cost (Moore's law)

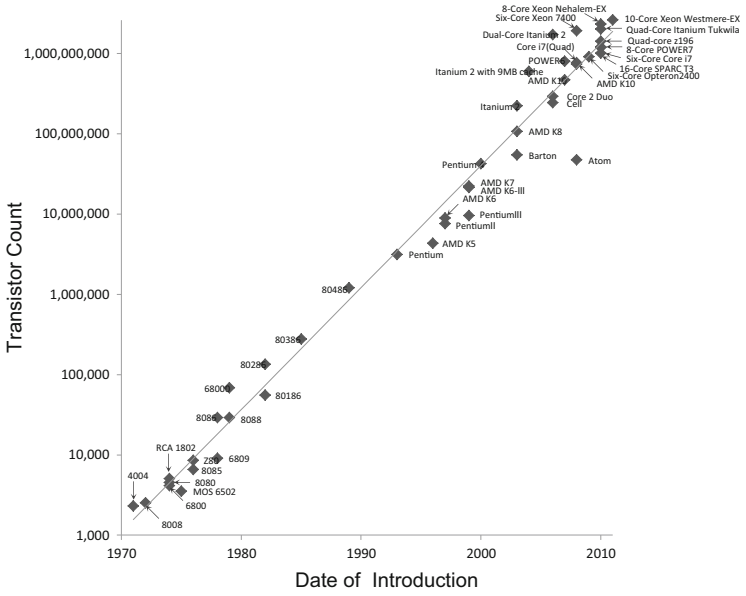

Fig. 1.2 Increase of microprocessor transistor count. Source: Wgsimon, http://commons.wikimedia.org/wiki/User:Wgsimon. This chart is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license.

The most well-known technology innovation is an increase of semiconductor density, called "Moore's law." Information-processing cost per unit decrease is correlated to the density. Gordon Moore, a founder of Intel, argued in his paper contributed to *Electronics Magazine* that the density of transistors on a semiconductor doubles every 2 years. It is equivalent to 40 % per year, and, actually, the increase rate in the last 40 years was approximately one million times or 40 % per year as shown in Fig. 1.2, which corresponds to a decrease rate of cost per transistor. This also has been increasing the telecommunication speed.

(2) Increase of telecommunication speed and decrease of the cost

The telecommunication speed of computers has increased 6.9 million times in the last 30 years, and the telecommunication infrastructure costs have decreased less than one millionth,[6] which is equivalent to 60 % per year, surpassing the rate of semiconductors.

(3) Increase of data storage capacity and decrease of the cost

Increase of storage capacity of the hard disk drive (HDD) was argued in the bestselling book *The Innovator's Dilemma*[7] as an example of innovation and

[6] *Information Economy Innovation Strategy*, 2010, Ministry of Economics, Trade and Industry, Japan.

[7] Christensen, C. (1997), *The Innovator's Dilemma*, Harvard Business Review Press.

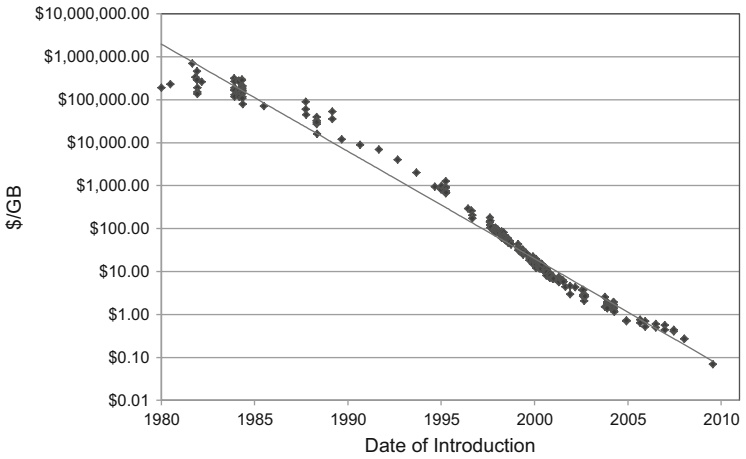

Fig. 1.3 Decrease of HDD cost per unit. Source: Mkomo.com, http://www.mkomo.com/cost-per-gigabyte

has become known worldwide. As shown in Fig. 1.3, the decrease of the cost per gigabyte in the last 30 years is amazingly more than one 10 millionth or 70 % per year. This surpasses even the rate of telecommunication cost.

(1), (2), and (3) above have collectively increased processing volumes of data, which leads to the enhancement of resolution in presentation and communication. It has promoted the transactions of digital contents and enabled free video conferences.

1.3 Industry Structures from Perspectives of Transaction Cost

Many new implications regarding industry structures are obtained from perspectives of *transaction cost*.

1.3.1 Transactions Are Universal Beyond Industries

There are production and transactions in any industry universally.

Businesses are usually classified by industry sector, such as manufacturing, distribution, service, and so forth. However, many manufacturing companies such as Sony and General Electric earn most of their profit from their financial services. The present industry classification is obviously insufficient to explain the conglomerates. In addition, the classification is not any more in accordance with the reality or the structural changes occurring in the world economy. Perspectives of a transaction cost will extract commonalities among industries and ongoing structural changes, which are rich in strategic implications.

Table 1.1 Examples of "service" and the methodologies to charge

Business	Value to customers	Charge methodology
Hotel	Concierge	Rooms
	Planning and management of wedding ceremonies and parties	Food, flowers, gifts, wedding costumes, etc.
Manufacturer of commodity products	Business consulting to resellers who sell their commodity products	Commodity products
Franchiser		*Franchise fees*
IT Consulting	Planning and development of IT	*Consulting*
IT Reseller/VAR		Hardware/software products
Franchise restaurant	Centralized production and distribution of foods and centralized control of manuals	Processed foods + *services*
Machine manufacturer	Maintenance services	Machine products
		Maintenance services
		Consumables
Department store	Comfortable and convenient environment	Products
Business consulting	Research and recommendation	*Consulting*
Private equity, venture capital		Capital gains

Items charged as "service" are shown in *italics*

For example, "service" is misunderstood due to its unreasonable classification as an industry. Table 1.1 exhibits examples of businesses that are usually deemed as "service," their values, and their methodologies to charge fees, showing the contradictions of the classification.

Hotels could be one of the most typical "service" businesses. They charge to their customers not by concierge service or party planning, which are their biggest competency, but by rooms and flowers in parties. That is, they are real estate agencies and florist shops as long as their methodologies for charging are concerned, especially in developing countries.

As salespersons at manufacturing companies of commodity products cannot differentiate themselves by product (a commodity is defined as a product that is not differentiated by product per se), they compete with services to retailers such as consulting of stock/order management, merchandising, and competitive strategy against their neighboring stores in recent years. Although they do not charge by those consulting services, franchisers charge franchise fees openly on their identical services.

In the IT industry, a customization service called *solution* provides value to customers, increasing the significance. However, the IT-related companies that do not carry the term *consulting* in their company names need to charge their customers by hardware or software products instead of charging a consulting fee, as all their services are provided for free, especially in developing countries.

It is widely known that the revenues of the manufacturers of machines such as elevators and photocopiers accrue from the maintenance services of products instead of their products per se. Some of those companies charge their customers on consumables instead of the maintenance service fees.

In reality, the fast-food shops serve centralizedly manufactured goods to their customers almost without any value added; however, they are classified as being in the service sector instead of the manufacturing sector. Their minimal services such as heating by juvenile part-timers can be seen in Japanese convenience stores, which are classified in the retail sector. Most of the fast food shops request customers to dispose of their waste, while the attendants who were trained at hotels serve potential customers a cup of expensive coffee in Lexus distributors that are managed by a manufacturer, Toyota. Which are *service* companies?

The financial industry, another representative example of the service sector, distributes financial products centralizedly produced as well. Japanese financial services in particular do not add value to the products, and those are being replaced by the Internet. The business model is identical to that of the manufacturing sector, instead of the services sector.

There are many other examples of businesses categorized as *service* that are not recognizable as *service*. All industries have service functions more or less these days to enhance their value added at the point of sales. In other words, there exists *service* as a function or a task in addition to *service* as an industry.

It should be noticed here that all industries have processes of production and transactions. Flows and structures of transactions are universal beyond industries, and produced goods are not delivered to the customers without them. The only difference is strategic allocation of resources to production or each element of transaction. Some industries allocate more resources prominently to the service function than others do.

In addition, changes in the market situation have been altering companies' attitudes toward the service. For example, although almost all manufacturing companies have been enhancing services offered to their customers, the resources allocated to the service have been much less than the service industry, relying on mass marketing such as TV commercials. Since the mass consumer market has been their target, they created the image that they do not prioritize the service. However, they began to get involved in the service function by replacing their distributor function with their own customer centers, their own consulting departments (IT-related companies), and their own attendants trained at hotels (high-end automobile manufacturers).

This is because the competitions became fiercer and the companies began to pursue their differentiation by customization, thus responding to the more diversified needs of the markets. The trend certainly has accelerated.

As for the restaurant business, an example of the service industry, the services also vary from company to company. At "mom and pop" restaurants, both production and transactions are executed by chefs or the owners themselves. In contrast,

chain food shops are very similar to manufacturing companies, where production is controlled efficiently and systematically and transactions are done in the same way with low-cost laborers. High-end restaurants at hotels try to deal with any requests from customers thoroughly to differentiate themselves and to achieve high profitability.

Distribution and retailing industries execute transactions on behalf of manufacturing companies. In the past years, manufacturers have developed their own distribution channels and logistics because they were the first modernized large-scale organizations that had accumulated enough resources. Afterward, distributors and retailers matured enough to be independent from their sponsoring manufacturing companies and reorganized themselves to deal with products of multiple manufacturers. The newly independent distributors and retailers have followed manufacturing companies to become modernized.

Those examples clarify commonalities among manufacturers, distributors, retailers, and servicers. All industries have a universal structure composed of production and transaction. It should be emphasized that analyses of mutual comparison applying this universal structure—that is, production and transaction, and additionally each element of transaction—provide many strategic implications. Analyses based on the classification and extraction of common success/failure patterns that can be applied to every industry and company are the most valuable. The present industry classification is based on an obsolete structure of markets and does not keep up with the present situations after the businesses' continuous innovations with their risks and efforts. The perception of *service* has differed from industry to industry despite the structures being universal, resulting in fewer opportunities to learn from each other. The significant lessons can be obtained by applying the transaction structure.

1.3.2 Structural Changes of Transactions with Industries Level

Valueless transactions are replaced by IT, and valuable transactions expand.

The discussions above illustrated some kinds of transactions that decrease or disappear (being replaced by IT) and also other kinds of transaction that increase or emerge. A typical kind of transaction becoming less important is obviously that of commodity products. The most complicated element of a transaction, determination of specifications, is fixed a priori with commodity products. Therefore, the transaction is much simpler and is more readily executed by online ordering/acceptance, substituting human activities. Actually, the substitution of human activity by online automated processing technology started from the simple elements of a transaction, such as connection, ordering/acceptance, presentation, and logistics (e.g., online delivery of digital contents), and extended to the more complicated elements, such as credit information provision, maintenance (e.g., online marketplace of repair goods), and education (e.g., know-how sharing among users). Technology

innovation in machine learning, which automates the customer services, has been advancing rapidly in this field.

Contract transportation companies have been undertaking deliveries of various products collectively, and digital contents (e.g., movies, music, and games) have been distributed through the online markets. As those examples exhibit, the tasks in each element of a transaction have strong commonality in their characteristics, processing methodologies, and procedures. Therefore, the concentration of tasks embodies economies of scale and improves efficiencies greatly and easily. This perspective is significant throughout this book.

Tasks that are readily outsourced include IT, accounting, recruiting, general affairs, welfare, and call center. In addition to those, even production, design, R&D, and sales are also considered seriously these days. Those are perceived as transfers of internal activities to external outsourcers. This trend is caused by the reduction of transaction costs with external servicers—that is, transaction costs of the transfers such as searching of the substitutes, presentation, negotiation, and contracting for the transfers. The reduction of transaction costs has been arising not just internally (in day-to-day operations) but as well as externally (in substitutions of transaction partners), which embodies the outsourcing of any function.

As described above, the transactions of substituting business partners have increased because companies can more readily access and interact with substitutes with much less transaction costs. The trend of modularization of mechanical components is proceeding based on this background. An increasing trend of the modular structure among companies can be explained in the broader sense of the terminology. And modularization is conceived to be embodied by the establishments of interfaces and the reduction of transaction costs.

Substituted tasks are collectively concentrated to one company achieving economies of scale for higher efficiencies of operation. Due to the reduction of external transaction costs, tasks are thoroughly decomposed, and each fragment with strong commonalities is collected to pursue economies of scale. Horizontal distribution of functions among companies and industries is proceeding, resulting in an open economy.

It should be noticed that the spread of the Internet and various products and services built up on the Internet, the infrastructure, have decreased transaction costs drastically. Utilizing this opportunity, an enormous number of companies have begun to establish and standardize their own interfaces to promote their substitution functions. As a result, transaction costs (not only in day-to-day operations) of searching for, presenting to, and contracting with substitute business partners have decreased incredibly, a result of which is to promote fiercer competition to decrease transaction costs further.

1.4 Where and How Transaction Costs Are Incurred

Establishment of a transaction interface incurs transaction costs.

1.4.1 Structure of Transactions and Transaction Cost Incurrence

A transaction is composed of five elements: connection, presentation, negotiation/agreement, exchange, and ex post processing.

In order to reduce transaction costs and to increase the efficiency and effectiveness of a transaction, an essential understanding of transactions is indispensable. In this section, the structure of transactions and the incurrence of transaction costs are discussed. Starting with a simpler case of commercial transactions (between companies), the commonality of organizational transactions (inside companies) will be examined subsequently.

A transaction is basically a simple exchange in which a certain outcome is supplied and a counter value is paid in return. As described previously, it exhibits a universal pattern in all aspects of business beyond products, outcomes, companies, industries, functions, and so forth.

All activities except transactions produce outcomes to be exchanged. Activities of production vary depending on outcomes such as cars, mechanical components, apparel, software, design diagrams, movies, services, and so forth. All those activities are defined as *production* in this book, and any difference in production is not an object of this book. The focus of this book is on transactions, which have a universal pattern.

Production cost includes all costs to produce an outcome such as component/material costs, equipment/facility costs, assembly/fabrication costs, labor costs, and management costs. Production costs and transaction costs compose the whole cost.

There are broad and narrow definitions of transactions, which should be distinguished carefully[8]:

- Broad definition: all activities of exchange including production
- Narrow definition: all activities of exchange excluding production

Although logically a *transaction* refers to the narrow definition, sometimes it also implies the broad definition customarily. When transaction costs are mentioned, a *transaction* refers to the narrow definition. However, when somebody says "a *transaction* with Company A was completed," it often refers to the broad definition.

This book refers to only the narrow definition in which a transaction is composed of five elements, each of which is also decomposed to sub-elements, as described in Fig. 1.4. Transaction costs are incurred in processing of these elements.

Those five elements are as follows:

(1) *Connection*

In the first element of a transaction, a transaction partner is searched, selected, accessed, and communicated with, and *presentation*, the next element, is proposed. It is possible, of course, for both transaction partners to reject further communication even if the other desires to continue. In organizations, as

[8] In addition to the definitions in economics, a *transaction* also refers to a unit of information processing, especially database processing, which has no concern with the discussion in this book.

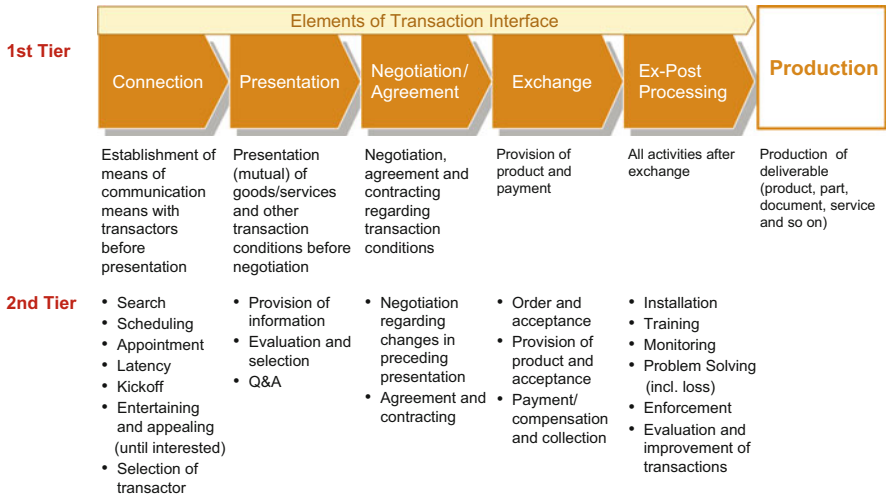

Fig. 1.4 Elements of transaction

potential transactors are usually known or designated a priori, the necessary activities are limited to the coordination of time, venue, and method of access, travel, and so forth. Therefore, the related costs are relatively small. However, in a case of starting a commercial transaction with an entity located on the opposite side of the globe, the cost will be enormous. First of all, potential suppliers of resources or prospects who are interested in products should be searched and accessed in a certain way. These days, it is quite possible to communicate with any entity in the world by email, but the communication with entities in developing regions still necessitates faxes, telephones, postal mail, or hand-carried private letters like in the past. Next, the appeal to potential transactors to accept a presentation regarding themselves is made, which is not only from suppliers but also from customers who may not be perceived as credible, especially without past records. Planning and preparation of the appeal is also one of the significant activities in *connection*.

(2) *Presentation*

The *presentation* element starts after both transactor partners agree to communicate. Presentations of information are bilateral, and the information is provided from both the supplier and customer sides. The information required by the customer side is regarding the potential supplier's products and capabilities, such as the quality, cost, and delivery. In addition, all other transaction conditions such as payment and discount conditions should be confirmed. Moreover, the information regarding the credit, responsibility, and sincerity of the transaction partner and its problem-solving capability also needs to be provided. Suppliers need more information than customers, such as customer's requirements and satisfaction with the background information. One of the most significant pieces of information for suppliers may be the customer's credit information—that is, if the customer will or can complete

payment.[9] The potential of the transaction partners is considered as well. Q&A regarding the presentation is included in this element.

(3) *Negotiation/Agreement*

After the bilateral presentation for basic understanding of each other, the transaction partners negotiate and agree about concrete specifications and detailed conditions of the transaction that they are going to execute and conclude contract documents. Various conditions regarding the specifications, prices, deliveries, contingencies, and so forth are negotiated and adjusted mutually. In addition to basic pricing systems, methods to adjust prices by changes of ordering dates and quantities may be determined. It usually requires internal coordination on both sides.

(4) *Exchange*

According to the agreed transaction conditions, the delivery and acceptance of the product, the inspection, the payment, and so forth are executed administratively and technically. While it is an exchange of a product and cash at commerce, the future cash such as evaluation for promotion instead of real cash is paid in the organization. The activities of ordering and acceptance are classified as *exchange* activities, which are just executed administratively and technically. In this process between companies, first, ordering/acceptance documents are exchanged for confirmation of execution (as is often the case even within organizations); next, confirmation and inspection of the delivery are executed; and finally, invoicing, payment, and confirmation of payment are executed.

(5) *Ex Post Processing*

It is not the end of a transaction when the *exchange* is completed. There exist various significant sub-elements in the *ex post processing*. Products may need to be installed or retrofitted at customers. Complicated machines and equipment may need operation training. Customers need to monitor their running for validation of the specifications. If there are any problems, those should be solved by themselves or reported to the supplier for solution. Problem-solving costs are imposed on customers if those are relatively small. If not, they claim the supplier to pay the cost with some administrative paperwork. The customers may need to attend the repair. All those are also transaction costs that are likely to be neglected as managerial objects. If the supplier rejects problem solving, a legal transaction may be needed, which incurs far more transaction costs. Last, the transaction is evaluated to make a judgment of the continuation and modification.

As the five elements above are usually sequentially processed, they can be called *steps* as well. However, this is not always the case. For example, *production* is processed at a certain moment before the *exchange* element is executed on the suppliers' side, specification design on the buyers' side may be processed before

[9] In the case of an organization, it corresponds to the information regarding whether the customer, or boss, evaluates and rewards fairly.

connection with the suppliers, and required specification is presented before *connection* in online marketplaces. Therefore, the term *element* instead of *step* will be used in this book.

All the cost except for transaction costs is production costs. In order to clarify a *transaction cost*, *production* is elaborated below:

(0) *Production*

In this book, *production* refers to all activities to produce an outcome (e.g., a product, a component, information, or intellectual property), including fabrication, assembly, writing, editing, planning, designing, development, and so forth, which is exchanged in the transaction.

The concept of a transaction cost has never existed in the past, and therefore it has been allocated and embedded in this *production* cost. It is impossible to measure, analyze, or manage embedded costs.

There have been numerous challenges to analyze activity cost and its efficiencies—in particular, overhead cost. Actually, classification of activities and effectiveness analysis by cost elements has been one of the major revenue sources of management consulting firms. During their analyses, all targeted activities are classified for their decisions of demise, integration, or standardization.

All those conventional classifications of activity costs have depended on this *production* and have been designed or modified according to the produced outcome. In addition to an obvious deficiency of the cost classification based on *production* by which transaction costs are not measured, analyzed, or managed, it is incapable of benchmarking data. Because *production* varies by industry sector, type of business, company, department, individual, date and time, and so forth, standardized classification and comparison analysis have been impossible. Comparison analysis including best practice benchmarking provides significant implications for evaluation of efficiency and effectiveness.

The lack of comparison is, of course, caused by the lack of a standardized classification. For example, management consulting firms create a new classification of activity cost measurement and analysis for their clients with each project because the classification varies. They usually charge a few hundred thousand US dollars per project, which is too expensive for most of the companies to afford despite its significance. If a standard classification could be established utilizing the universal structure of a transaction, the project costs above would drastically decrease. Super expensive elite consultants would no longer be necessary, and IT would be able to be fully utilized for the measurements and analyses.

While the classification of transaction costs is possibly standardized based on the universal structure of a transaction, production cost classification still remains to be customized by products. However, a huge portion of production costs is composed of transaction costs[10] because production activity involves many transactions. It is

[10] The structure of *transaction costs in a production cost* will be clarified by defining levels of a transaction such as a company level, a department level, and an individual level. Detailed definitions including this leveling will be explained in the next chapter.

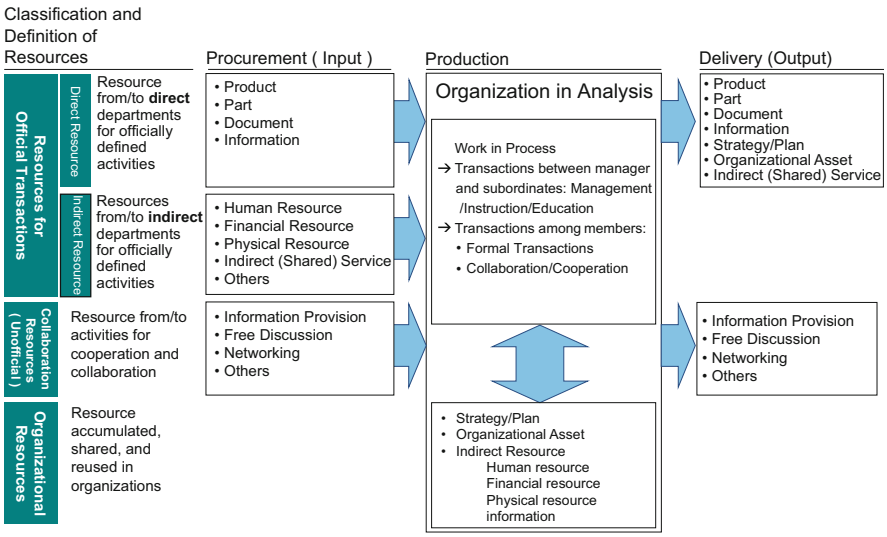

Fig. 1.5 Classification of resources transacted

especially true in intellectual activities such as research, planning, and software development, which are highly transaction driven. Therefore, even a standard classification of transaction costs only (excluding production costs) creates benefits.

Another standard classification for transacted resources as proposed in Fig. 1.5 can also be useful in order to make the comparisons more precise among various functional departments, such as a production department versus a sales department, a R&D department versus a personnel department, and so forth. It classifies transacted resources in a standardized manner.

(1) Direct resource for officially assigned activity

This class of resource is delivered from *direct departments*: business departments, which are contributing revenues directly (e.g., sales, design, and production), as an outcome such as products, parts, documents, information, and so forth, for the production activity officially assigned to the targeted department, or is delivered to direct departments as an outcome of the targeted department.

(2) Indirect resource for officially assigned activity

This class of resource is delivered from *indirect departments*: administrative departments with supporting functions (e.g., personnel, general affairs, and accounting) which are not directly associated with revenues, but delivers indirect resources and indirect (shared) services (e.g., human, financial and physical resources, and information) plus a strategy/plan, which are classified as *organizational resource* here, for production activity officially assigned to the targeted department. In this standardized manner, the activities of direct and *indirect departments* can be compared to each other.

(3) Collaboration resource

This class of resources is delivered from and to other departments for voluntary collaboration and cooperation, such as information provision, free discussion, networking for the future collaboration, and so forth.

(4) Organizational resource

This class of resource is developed to be accumulated, shared, and reused in the targeted department, such as the strategy/plan, organizational assets (e.g., work process and manual), and indirect resources (e.g., human, financial, and physical resources and information).

It is especially important that all resources transacted in any industry sector, any company, any department, and any individual are classified in the standardized manner, a result of which embodies comparisons even between indirect and direct departments and provides valuable perspectives for the cost analysis. And assuming that innovation is promoted by not officially assigned activity but collaborative exchange of information, the *collaboration resource* is designed to be tracked separately in this classification.

1.4.2 Transaction Costs Are Incurred on the Customer Side As Well

Transaction costs incurred with customers should also be analyzed especially at the point of transfer of information.

The perception of a transaction cost clarifies the costs incurred with not just suppliers but as well as customers or buyers. Although the transaction costs on the suppliers' side is usually analyzed and managed for reduction, buyers seldom recognize even the incurrence per se. The perspective has been seriously missing in *production*-centric researches. Transactions are frequently obstructed due to too high transaction costs, which should be analyzed for reduction, especially in the present era when the transactions of information should be encouraged proactively for innovation.

Transaction costs incurred with buyers include:

- Connection cost: Searching and accessing the most appropriate suppliers
- Presentation cost: Presenting their needs and requirements to the suppliers and understanding and evaluating their products/services and characteristics.
- Negotiation and agreement cost: Negotiating and contracting all transaction conditions, including price and specifications with the suppliers, and also coordinating with their own departments internally.
- Exchange cost: Processing documentation of orders, confirmation of acceptances and deliveries, inspections, payments, and so forth.
- Ex post processing cost: Installing the delivered product, training themselves for operation, and embedding it in their own business processes. Monitoring the performances and reporting and solving the problems, if any. Requesting and enforcing the solution. These transaction costs may be larger on the buyers' side.

The reason that one-stop shopping at shopping centers and large-scale online marketplaces is popular is that reduction of transaction costs was recognized as valuable, even by the consumers. However, it is just an intuitive perception. Due to the characteristic of transaction costs, in which the effectiveness of the transaction improves as more transaction costs are expended, transaction costs should not be simply reduced but analyzed carefully for reduction while monitoring the change of effectiveness.

This characteristic will be discussed in detail in the next section, but as a simple example here, in spite of the fact that the more the searching cost, the higher probability of finding most appropriate suppliers, customers rather frequently select suppliers who visit every day because it is easier. Although competitive quotes should be obtained while negotiating with a supplier, this is often neglected just because it is cumbersome. Despite the fact that transactions involving a great deal of information from a countless number of entities will increase the possibility of leading to breakthrough innovations and appropriate information sources should be searched and accessed as much as possible, it usually does not happen. It is important to decrease valueless transactions in order to increase valuable transactions.

To be more precise:

- Efficiencies of searching and selecting most appropriate suppliers should be increased in order to increase probabilities of encountering them.
- Efficiencies of understanding potentials should be increased in order to increase the volume of the information processing, which leads to selecting the most appropriate suppliers.
- Efficiencies of negotiating and contracting should be increased in order to increase the number of transactions, which leads to finding the best win-win and sustainable relationship.

Information valuable for innovation will never come up by just sitting and waiting. This is the reason why transaction costs should be analyzed and reduced carefully so that transactions are processed agilely, thus increasing the number of transactions and improving the effectiveness.

As described above, the perception of a transaction cost on the buyers' side is increasingly important, and the development of the methodologies for the management is indispensable. In any case, the first step is to perceive the existence and comprehend the concept of a transaction cost.

1.4.3 Transaction Costs Are Incurred at Transaction Interfaces

Issues of *transaction costs* correspond to issues of a transaction interfaces.

In this section, the concept of a transaction interface, which is the source of transaction costs and the most critical factor for modern management, is discussed. The transaction interface exists between transaction entities. The adjustment of the differences between entities by establishing the interface incurs the transaction

costs. That is, the issues of transaction costs correspond to the issues of transaction interfaces.

It should be noticed here that transaction costs are *nearly* (the explanation of using the term *nearly* will follow) equal to the cost of establishing transaction interfaces. Consequently, the analysis of transaction costs *nearly* coincides with the analysis of transaction interfaces.

Transaction elements are classified into two major categories:

(1) Agreement on interfaces (specifications and transaction conditions) for exchange—that is, activities in the elements of the *connection*, *presentation*, *negotiation/agreement,* and *ex post processing*[11] (the *exchange* is excluded).
(2) Execution of exchange complying with the agreed interfaces (specifications and transaction conditions)—that is, activities in *exchange* such as ordering/acceptance, delivery, inspection/confirmation, payment/confirmation, and so forth.

Obviously, (1) corresponds to the establishment of transaction interfaces and is indispensable for (2) the execution of exchange. (2) is the less significant administrative and technical activity, just involving compliance with the interfaces established in (1). Most of increases in transaction costs these days are related to the activities of (1), and therefore the efficiencies and effectiveness of organizations significantly depend on (1). The methodologies to execute (1) efficiently and effectively are increasingly crucial.

Some researchers exclude (2) ordering/acceptance, inspection/confirmation, payment/confirmation, and especially transportation from the definition of a *transaction cost* (please refer to Chap. 7). However, this book prioritizes simpler structuring and defines all activity cost (except for production costs) including transportation as a transaction cost. Information exchanges such as confirmation of delivery, confirmation of inspection, invoicing, receipt, and payment are often performed concurrently with transportation activities. In those cases, it is practically unmanageable as well to separate only the transportation costs.

Because (2) activities of the *exchange*, ordering/acceptance, delivery, inspection, confirmation, and payment, are different qualitatively from (1) the central activities of a transaction, it is possible to separate them to create another category of cost. However, the increase of the number of category complicates the classification system. Inclusion of (2) in the definition of a transaction cost is the reason why "transaction costs are *nearly* equal to the cost of establishing transaction interfaces."[12]

Hereinafter, throughout this book, the concepts and methodologies of establishing transaction interfaces will be further examined.

[11] Ex post processing is included in (1) agreement on interfaces because it is the activity to confirm the interfaces as agreed and to adapt their own interfaces as agreed.

[12] In other words, if (2) *exchange* is not included in the definition, transaction costs *completely* become equal to the cost of establishing transaction interfaces.

1.4.4 Reduction of Transaction Costs by Fixing Transaction Interfaces

Transaction costs are reduced by fixing transaction interfaces.

The transaction interface corresponds to agreed transaction conditions. Both transaction entities need to adapt their internal activities to the interface agreed. One or both of the entities need to alter their own business processes and document formats such as ordering/acceptance, their internal interfaces, and so forth to the interface newly agreed.

If those are not shared or standardized, they need to alter them every time when they change their transaction partners. If there is a socially standardized interface, they are able to fix their internal interfaces to adjust to the standard. It increases the usage, enhances economies of scale, and enables systemization and replacement by lower wage labors to decrease the costs. For an example of credit information of transaction partners, a considerable cost would be incurred if they collect and analyze the information for every potential partner by themselves. In contrast, if they accept the information of a credit bureau and fix the process as an internal interface, they are able to reduce the cost greatly.

If entities have different transaction conditions such as specification, delivery time, payment method, and so forth, both entities are required to adjust to each other. If they fix the interface instead of adjusting and determining every time, the transaction costs will be reduced considerably.

As described above, the concept of fixing interfaces or establishment of fixed interfaces and the economies of scale obtained consequently has significant implications for the analyses of transaction interfaces.

1.4.5 Costs that Are Not Transaction Costs

Pure production costs, which do not contain a transaction cost, are very limited.

In order to deepen our comprehension of a transaction cost, the costs that are not transaction costs will be examined in this section. It was previously explained briefly that *production costs* comprises component/material costs, equipment/facility costs, assembly/fabrication costs, labor costs, and management costs of all the above. Focusing on *production costs*, which are frequently contrasted with *transaction costs* in economics, the concept of a transaction cost will be examined here.

Before transaction cost economics was introduced, the cost was only *production costs*. Since transaction costs were separated from them, the cost that is not transaction costs is supposed to be *production costs*. There exist several dozen definitions of a transaction cost in economics, as described in Chap. 7; consequently, the definition of a *production cost* is vague. Actually, various kinds of transactions can be observed in production when the activity of production is decomposed. For example, a production department has transactions of information with a sales department such as production control (e.g., order information and

production schedule) and product development (e.g., market needs and mass-production technical constraints). Ordering parts and materials to suppliers is also a transaction. Delivery information will be distributed from the procurement team to other teams and other departments. There are various departmental and internal transactions. On shop floors of production facilities, managers and foremen may order and educate their laborers, and these are also classified as transactions. The production costs that are never related to a transaction are limited to only parts/material cost, production facility/equipment cost, and labor cost of the workers who operate those machines.

Creating design diagrams for product development involves information not just for production but also for confirmation of requirements with customers, which is supposed to be classified as a transaction cost. If many internal presentations for approvals of executives are required to launch a product development project, huge internal transaction costs are incurred, including preparations for the presentations.

Activities to determine internal standards of transaction conditions regarding a company's own products may be regarded as production costs. However, presenting and negotiating the transaction conditions with customers or suppliers, even in the production department, must be classified as a transaction cost.

For reconfirmation, the definition of a transaction in this book includes all kinds of internal communication, in order to develop the standardized and universal methodologies to analyze organizational activity.

In contrast, alternative definitions for a *production cost* are also shown below. Those have apparent contradictions and are difficult to justify.

(1) All costs incurred in a production department

The biggest problem of this definition is that definitions of a *production department* vary from company to company. Whether a production department includes design functions or not, how much product development functions belong to a production department, which may belong to a marketing department in other companies, and so forth vary considerably. In short, because a precise definition of *production department* is impossible, it should not be used to define something else.

(2) All costs related to production activity

Definitions of production activity are vague. All those activities should be defined as production or not, such as drawing diagrams to confirm requirements with customers, adjusting delivery dates with customers, negotiating prices with customers to change specifications, installing products for a customer, maintaining products at a customer, and many others. Eventually, the definition of a transaction is required for the definition of production activity.

(3) All costs related to production and design activities

Design activities are able to be included in *production* as long as a company's own in-house products following its own standard specifications are concerned. However, determination of design specification at order-driven contractors includes adjustments and negotiations with customers, which are obviously regarded as transaction costs.

(4) All costs except for commercial transactions with external entities such as customers and suppliers

This definition includes only external commercial transactions in transaction and excludes internal organizational transactions. The disadvantages of being incapable of analyzing internal communication, the managerial value of which has been increasing drastically, are not negligible.

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As shown above, the definition by which all communication is perceived as an economic transaction is most concise and can provide valuable implications.

However, a transaction depends on which level of entities is targeted. For example, when an external transaction between companies is focused, most of the transactions in a production department on the suppliers' side should be considered as *production* because they do not transact with the customer and they do not relate to the external transaction subject to the analysis. That is, by designating the level of a transaction (e.g., company level, department level, and individual level) and recognizing activities as *production* that are not related to the transactions subject to the analysis, the analysis becomes much simpler. *Production* depends on the determinations of not just the transaction but also the level of a transaction that is subject to an analysis. A methodology to simplify the seemingly complicated structure of a transaction will be discussed in detail in the next chapter. It is limited here to a statement that a production cost defined as all the cost of activities that exclude transactions between the entities subject to an analysis, and in order to do so, the level (the entities) of transactions that are subject to an analysis should be determined.

1.5 Reduction of Transaction Costs Leads to Increase of Sales, Enhancement of Product Development, and Development of Resources

Reduction of transaction costs improves not just efficiency but as well as effectiveness.

1.5.1 Efficiency and Effectiveness

What are the differences between efficiency and effectiveness?

1.5.1.1 To Distinguish Between Efficiency and Effectiveness in Business Is Critical

Cost in the term *transaction cost* automatically invokes the cost issues in management such as cost reduction, efficiency improvement, and so forth. Analysis of transaction costs is likely to be understood as incapable of handling the issues such

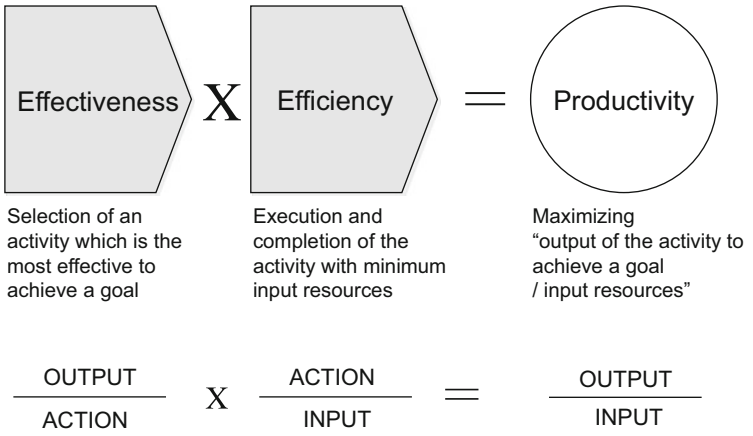

Fig. 1.6 Effectiveness and efficiency

as increase of sales/profits, enhancement of product development, and development of managerial resources. In other words, analysis of transaction costs does not contribute to solve the significant management issues that most companies are currently facing. This is totally a misunderstanding. The analysis strongly relates to effectiveness issues (e.g., sales, product development, and resource development), and rather it is not an exaggeration to describe that it is for effectiveness issues.

In order to explain this, it should be confirmed first that the axes of evaluating business activity include *efficiency* and *effectiveness* and productivity of business is the product of *efficiency* and *effectiveness* (Fig. 1.6). The axis of *effectiveness* refers to how effective (appropriate) a certain activity is for an achievement of a managerial goal (e.g., increase of sales, reduction of cost, increase of market share, and enhancement of product development) independently of its efficiency. And the other axis, *efficiency*, refers to how small an amount of resources a certain activity expended independently of its effectiveness.[13]

Productivity is frequently confused with efficiency. To do the right thing is *effectiveness* and to do the activity with minimum input resources is *efficiency*. The product of those two becomes *productivity*. The terms *effectiveness* and *efficiency* are also used confusingly on a daily basis, but those two should be distinguished carefully in any aspect of business, particularly in analyses of transaction costs.

1.5.1.2 ROI of IT Development Projects as an Example

Complexity of effectiveness is explained here using a case of the return on investment (ROI) of IT development projects (Fig. 1.7). Explicit qualification of

[13] Infinite amounts of resources can be expended for perfect effectiveness, and totally ineffective activities can be executed with perfect efficiency. *Effectiveness* and *efficiency* are mutually independent.

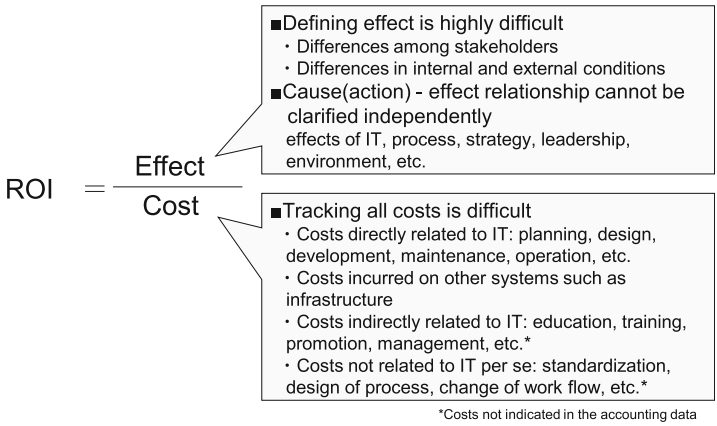

Fig. 1.7 ROI of IT investment projects

ROI has been imposed on project managers of IT development by CEOs from the past, and the accuracy or even the feasibility of the calculation has been repeatedly debated. The reason this issue has been extremely controversial is because the qualification of *effectiveness* is highly difficult.

In order to calculate ROI of IT investment, the effect or outcome of investment is divided by cost or investment. A bottom and a top of the fraction are discussed respectively in the following.

(1) The denominator: cost (investment)

The denominator, the cost or the amount of the investment, appears simpler, but the reality is still complicated. The issue here is a definition of the expended or invested cost—that is, which costs should be or can be included in this calculation. Fees paid to IT hardware and software suppliers are tracked and recorded without exception, which are easily included in the *cost*. However, it is obviously just a small piece of the total enormous costs actually expended.

First, the activities for planning and designing of the new IT system should be considered. An enormous amount of the time of executives and the new IT system users is expended for these activities. The more time they expend, the more appropriateness they achieve. However, those costs are seldom tracked or measured. Activities of business process redesign and standardization for the new system incur a huge cost as well. All professionals related to IT development understand very well that those activities determine either success or failure of projects. Standardizations of data and other processes indispensable to the system development necessitate a huge amount of time, especially in a case in which the establishment of consensus among departments becomes confused. Although the improvement of work process takes a significant role in any IT project, whether and how much those costs should be included in *IT costs* varies from company to company. The decisions differ even in one company, according to conditions.

Furthermore, education and training for operating the new IT system incur a huge cost as well. Network infrastructure must have been already established in

larger-scale companies the asset costs that should be allocated to the new IT system. Other similar infrastructure costs incurred in past projects such as the training on basic operation of PC and office software and the establishments of user support departments are the same. The issue is not how much of the hidden costs should be included but whether those costs have been tracked and recorded or not. After a concept of *IT life cycle management* was proposed, the costs in the calculation have been becoming more accurate and closer to reality. However, it is not yet enough.

(2) The numerator: effect (outcome)

Effect, the top of the fraction, is more difficult to measure. The first difficulty is to overcome the differences in viewpoints of stakeholders who evaluate: CEOs, heads of strategic business units, managers, equity holders, customers, and employees. For example, while the CEO is interested in effects contributing company-level optimization, unit leaders are interested in only their own local optimization. Equity holders have different preferences on profits, growth rates, and risks. That is, the value of effectiveness varies greatly according to who evaluates and when and how it is evaluated.

Furthermore, when an effective outcome is accomplished, it is absolutely difficult to judge that the cause is the new IT system, a leadership by a newly appointed CEO, or newly hired recruits who are exceptionally capable and lucky. Each of the innumerable outcomes accomplished in a company depends on a countless number of causes, and all those are interlinked. None of them is able to be measured and analyzed with perfect independency and objectivity.

1.5.2 Objective Evaluation of Effectiveness in Management Is Impossible

Effectiveness in management is just a subjective issue.

It should be noticed that effectiveness is unable to be measured, assessed, analyzed, and discussed objectively when productivity in business is discussed. Questions may arise that business is unable to be improved without an objective discussion about effectiveness. The detailed explanation is as follows.

There are an infinite number of goals in business, such as increase of sales, increase of profit, reduction of cost, increase of market share, enhancement of brand image, strengthening of function (e.g., product development, R&D, and marketing), enhancement of customer relationship, enhancement of relationship with Customer A, development of skill, development of skills of Mr. B, and so forth. Increase of sales and profit is usually located on the top of the list, but an innumerable number of goals are in quest by managers and employees every day synchronously and concurrently, which are judged super multidimensionally by all managers and employees either consciously or unconsciously.

In addition, accelerating the changes of business environments complicates the decisions further. Intensive and objective analyses of market needs is not good

enough for launching products because markets become so diversified and change so promptly. An attitude of trial and error by introducing as many products as possible into a market and of "do your best and let God do the rest" should be accepted.

There exist other influential factors such that the dimensional basis of managerial judgment frequently varies from person to person and from time to time. For example, even the evaluation of activities to increase sales is very complicated. Salesperson A obtained an order that caused a deficit from Customer X, who was expecting a large-scale successive order in the future. Salesperson A neglected the axis of short-term profit. Salesperson B resold inventories returned from another customer due to a defect; that is, he gained his sales at the cost of his company's trust. Sales in the short term at the cost of neglecting activities to develop employees' skills are also possible, but losses in the future are obviously the same as neglecting customer satisfaction. While Salesperson C focused on a new product with a strategic significance, Salesperson D sold only an old product that does not need his additional efforts. Salesperson E gave an important role to one of his favorite staff members merely to provide him/her an opportunity of growth.

Decisions regarding the day-to-day business are not simple or easy. It is impossible to track and evaluate all the results.

A sales effort to Company X instead of Company Y is caused by someone's judgment that the expected value from Company X will be larger than the one from Company Y. However, that anticipation regarding the future is subjective and not so accurate. Salesperson C focused on a strategic product without accomplishing his sales target, instead, Salesperson D focused on obsolete products that led to a huge amount of sales readily. Which salesperson should be evaluated more highly?

It is not easy to conclude an action of adding inventories, whether in preparation for upcoming increases of sales or just falsifying sales records. Effectiveness of activities increasing sales is highly difficult to quantify objectively, despite its significance.

It is the same in terms of prediction of the future that an investment on Department X is prioritized over an investment on Department Y for the purpose of increasing sales. Staff G was promoted for the opportunities of growth but Staff H, who has more experience and is expected to contribute to an increase of short-term sales, should have been promoted instead. Those managerial decisions are nothing but just subjective predictions of the future made by certain managers based on their past experiences. In short, it is impossible to evaluate the effectiveness of business activities objectively.

Strategy and rule are determined by someone who is appointed or claims to do so from his/her past experiences. It is often a person who just speaks loudly with a big attitude. It may just be an organizational custom or groupthink.

In studies of managerial decisions, the Garbage Can Model[14] by March, Cohen, and Olsen is widely accepted, which argues that problems and solutions are

[14] Please refer to Cohen, M, D., J. G. March, and J. P. Olsen (1972), "A Garbage Can Model of Organizational Choice," *Administrative Science Quarterly* 17.

accumulated separately in a garbage can, and integrated and pulled out by decision makers at a moment with certain triggers determining whether these are correct or wrong. They asserted that decision makers and their information, assumptions, and axes for logic are inconstant and inconsistent, and decisions are always enforced to make in such garbage cans, meaning any reasonable decision in organizations is impossible.

In reality, persons in charge of making decisions predict consequences in the future and make final decisions. The decisions frequently reverse expectations or failures may often cause breakthroughs. As described above, all activities in business are evaluated by a countless number of axes consciously and unconsciously, and all of the evaluations totally depend on the future predictions. There is no argument that scientific approaches should be pursued as much as possible in any aspect, but eventually decisions in business are heavily subjective and intuitive.

1.5.3 Evaluation of Efficiency Is Much Easier

There are many evident opportunities to improve efficiencies, the evaluation of which is easier.

While the objective evaluation of effectiveness is highly difficult, efficiency is measured, analyzed, and evaluated much more easily. Cost invested or expended is possibly tracked if it is intended to do so. It is evident to everyone that there exist many activities with little or no value in operations. Repetitions and redundancy in activities are obviously less valuable.

For example, there are numerous valueless activities observed easily in meetings, such as repeating presentations of a document only for a participant who did not attend the previous meeting, repeating the same discussion regarding one issue, wasting outcomes of a participant caused by other participants' violated commitments, even though they agreed to them in a meeting, and floating discussions without focus due to lack of defining assumptions. There are also countless activities evidently with little or no value to companies such as multiple uncooperative visits to one customer by different salespersons and multiple business trips that could be arranged as a one-day trip.

Assuming that effectiveness does not deteriorate, if evident wastes could be eliminated, some volume of activities and costs would decrease certainly. This is an issue of *cost* thus far.

However, based on another assumption that total time of activity is constant, when the evident waste is eliminated, the rest is activities that were conceived not valueless. It could be effective or not, or it could end up wasted or lead to a breakthrough. As described previously, it is impossible to evaluate effectiveness objectively. One thing for certain is that the rest has more effectiveness than the waste that was eliminated.

That is, for example, if 25 % of total activity that is evidently valueless is eliminated, and if the total time of activity is constant, the effectiveness increases

by 33 % (calculated by 100 % ÷ 75 %) for certain. It may be attributed to increase of sales or profit, enhancement of product development, R&D, brand image or customer satisfaction, development of human resources, or shaping innovative strategy. In any way, total effectiveness increases definitely by theory. This is the logic: that the analyses of transaction costs involve not merely cost (efficiency) issues but also effectiveness issues.

Outsourcing the activities with strong repetitiveness, even in departments of sales or human resources, to the business process outsourcing (BPO) servicers has obtained popularity worldwide. Relegating the activities with minimum value to the BPOs, companies focus on high value-added activities themselves. Outsourcing is targeted to the repetitive and redundant activities that can be systemized and replaced by laborers so that companies focus more on effectiveness.

To extract evidently valueless or inefficient activities is much easier than to improve the effectiveness of activities. To eliminate absolute waste is the best solution, because to evaluate and increase absolute effectiveness is impossible. Although any challenges to decision-making capabilities regarding effectiveness are always significantly important, the elimination of wastes should be most prioritized. As shown in Chap. 8, as practical examples of measurement, there exist numerous wastes in companies, which are perceived very easily. Companies with this attitude are likely to accomplish a much higher business performance than the average.

This approach, which emphasizes eliminating wastes, benefits especially governmental organizations, as evaluating the effectiveness of public administration is much more difficult than evaluating businesses.

Finally, it cannot be overemphasized that excess time obtained from elimination of wastes should be allocated to higher value-added activities. In other words, possessing an attitude toward innovation is indispensable as a condition under which the discussion above comes into effect.

1.5.4 Value of Transaction Cost Analysis in Improvement of Effectiveness

The more transaction costs are expended, the more effectiveness is gained.

A structure in which the more transaction costs are expended, the more effectiveness is gained—that is, the reverse of the normal cost issue—is elaborated in this section. Transaction costs are incurred in each element below, all of which increase effectiveness as those are expended more.

1. *Connection*: If more time is expended for creating a longer list of potential transaction partners who have the capability of supplying the best cost-performance products or who intend to purchase products with the highest price, the probability of encountering the best partner increases. That is, the expected value of the transaction or the expected effectiveness of the transaction increases.

2. *Presentation*: If more information regarding a partner, such as capabilities, credit, loyalty, and flexibility, and regarding products and transaction conditions, such as specification, price, and delivery, is presented in both directions, the probabilities of selecting the best product and partner and of determining transaction conditions that satisfy both transaction partners must increase. Therefore, the effectiveness of the transaction increases.
3. *Negotiation/Agreement*: In this element, both partners negotiate, adjust, and agree with transaction conditions bilaterally. If more time is expended on this element, the probability of reaching an optimal point increases—in other words, the summation of satisfactions or the effectiveness of the transaction increases.
4. *Exchange*: If more time for inspection is expended, the probability of avoiding problems and augmenting the effectiveness increases.
5. *Ex post processing*: The activities related to assuring the performance of supplied products that are executed in this element include installing, training/education for operation, monitoring a specified performance, solving problems, and improving relevant issues for the future. All of them increase the effectiveness of the transaction.

This characteristic clearly distinguishes transaction costs from production costs, which is purely a cost issue. In production, which arises *after* specifications and transaction conditions are determined, the cost reduction is one of the most critical goals. This is the cost issue under normal circumstances. In contrast, transaction costs are incurred, *while* specifications and conditions are being designed, selected, and agreed upon, the consequence of which is that the effectiveness increases as more time and cost are expended.

Although the effectiveness increases as more transaction costs are expended, it is obviously unacceptable to expend an infinite amount of transaction costs. That is, the issue of effectiveness corresponds to an issue of cost (resource) allocation and, at the same time, the issue of transaction cost reduction. It is essentially an issue to extract waste resources from total resources and convert them to valuable resources.

As confirmation again, it was not meant to assert that any analysis of effectiveness is negligible or insignificant. Rather, the analysis of effectiveness is perpetually crucial. One of the managerial tools for evaluating and managing effectiveness that has been taking root in businesses is the Balanced Score Card (BSC). A BSC assesses effectiveness by scoring decomposed business activities, but the scoring inevitably depends on the subjectivity of the assessors. Here happens the problem repeatedly that objective and absolute assessment is impossible, as the future is not predicted. The elimination of evident wastes is more credible. Concurrent analyses of effectiveness and efficiency based on transaction costs are conceived as a significant methodology to advance the science of management studies.

1.5.5 BSC as a Means for Effective Assessment

The BSC, which is becoming a standard position, is just a subjective assessment.

The BSC is becoming a standard methodology for assessment of effectiveness, but it is literally a *scoring* methodology; that is, each individual's subjective evaluation is directly quantified by *scoring*, a result of which reconfirms that evaluation of effectiveness is merely subjective.

The BSC assesses performances of organizational and individual activities on four dimensions. While four dimensions are not enough to cover all of an infinite number of possible evaluations, it seems appropriate as an increase of the number possibly causes confusion in practice. BSC uses the following dimensions:

- Financial
- Customer
- Internal business processes
- Learning and growth

Usually, those four dimensions are decomposed further to key performance indicators (KPIs). Examples of KPIs include sales/profit by customer, number of new contract deals, ratios of repeat customers, submission lead time of quotes, levels of customer satisfaction, and claim rates.

However, as previously mentioned, it is easy for any individual to obtain higher evaluations by outmaneuvering the BSC dimensions. In order to deal with this typical problem, companies decompose goals and increase the number of KPIs to as many as a few dozens or hundreds. That is, a vicious cycle of decomposition and outmaneuvering has arisen and caused the creation of complicated and costly evaluation systems.

No matter how decomposed activities are, it is not enough to track perfectly. The perpetually valuable activities such as customer satisfaction and human resources development are not always visualized by the BSC. In the mature markets such as services where value adding plays a significant role, individual professionalism and work ethics in locals are critical. Those are not overcome merely by the further decomposed evaluation. Transaction cost analysis will provide various methodologies discussed in the following chapters for solving this ultimate management issue.

Transaction Interface: Organization, Process, and System

2

All organizations, processes, and systems are transaction interfaces. The design skills of these determine the amount of transaction costs incurred.

2.1 Enhancement of Organizational Competitiveness Corresponds to Establishment of Interfaces

Improvement of the efficiency and effectiveness of transactions by fixing interfaces is the essence of managing organizations.

2.1.1 The Organization Is a Nexus of Interfaces

Any exchange of information in the organization is a transaction, and the organization functions to issue transaction interfaces.

The preceding chapter described how transaction costs are incurred at transaction interfaces. This chapter will illustrate that organizational functions are essentially synonymous with transaction interfaces. From this perspective, both strategy and IT can be handled identically as organizational issues. Modularity, standards, and innovation management are also included and discussed in the following chapters. In this book, new universal management methodologies to deal with organizational and strategic issues are proposed applying this perspective.[1]

Most of the transactions within organizations are exchanges of information. Intercompany commerce or transactions in the market are much simpler; therefore, information exchange within companies, the more complicated case, will be mainly

[1] "Organizational competitiveness" in the title corresponds to the productivity of an organization. The efficiency of communication in an organization is improved by applying the methodologies of transaction cost management, and, as a result, effectiveness and productivity improve.

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
Springer Cham, https://doi.org/10.1007/978-3-319-06889-3_2

addressed in this chapter. In all individual exchanges of information within companies, the elements of transaction—that is, *connection,*[2] *presentation, negotiation (adjustment)/agreement, exchange, and ex post processing*—are the same as those in intercompany commerce, which was described in the previous chapter.

Transactions of information incur huge transaction costs. For example, what kind of information do transaction partners need? What kind of information do the partners have? How should information be edited and modified to satisfy the partners? How should the information be delivered? How should it be confirmed that the information has been delivered appropriately and completely? How is the value of the information evaluated? How is a reward decided? When a problem occurs, how is it solved? And there are much more. If all these are not fixed, it will be very costly to execute the transaction, even within an organization. All those incur transaction costs.

It is often misunderstood that most of those have already been addressed well in rules, norms, or customs in companies. However, the reality is that most of them are determined on an ad hoc basis. Arguments and negotiations between the transactors occur during those determinations, sometimes leading to quarrels and hard words, which are also transactions incurring transaction costs.

Two aspects of transaction interfaces are analyzed throughout this book: *interfaces determined on a case-by-case basis (on an* ad hoc *basis)* and *interfaces agreed upon and fixed* a priori. The distinction provides significant perspectives that lead to substantial comprehension of an organization.

For example, if data formats on a document form are fixed a priori for transactions of information, communication becomes very efficient, providing great value to both providers and receivers of the information. Furthermore, the transaction costs decreases greatly if a database is established in which data are archived according to formats and procedures of access are shared across users. On the other hand, there is a disadvantage when information that is not prescribed in the provided formats is needed. As long as the formats and forms are designed appropriately for all cases, the cost benefit is significant. If not, very crucial information may not be transferred. The problem is that effectiveness can decrease even when efficiency increases.

Another example is that an employee of a company who is not in charge of sales may receive an inquiry about a big order from his/her acquaintance. Without a

[2] The only difference between transactions within companies from ones in the market is that the transactors are usually determined a priori, as responsibilities and appointments are designated in companies, and, consequently, the volume of activities of *connection* becomes much smaller than in the market. However, the search for transactors in other departments and creative collaboration is increasing these days as power becomes more delegated to autonomous entities. For example, when an autonomous Google group plans a new business, and when a Kyocera amoeba group proposes company-level *Kaizen* (improvement) activities, they are supposed to search other units to ask for collaboration through internal presentations. This trend is growing rapidly as individuals' and small groups' initiatives and autonomy and, consequently, collaborations increase the significance of strengthening competitiveness. In addition, market-driven transactions increase even within companies, resulting in increased intracompany commerce.

direct pathway of such information, the information will be reported to his/her boss and subsequently to the person in charge of sales from the boss. More persons may need to intervene in this process. As it is quite possible to end up with just troubling all the related persons without gaining any benefit, the employee may hesitate to execute such a transaction. If there is a database and a procedure established to input such information about the prospect, it is much easier for him/her to initiate the transaction.

If a bonus were provided for the contribution, the chance of challenging the transaction increases greatly. However, if an evaluation procedure for the reward is not fixed, it must be argued and agreed at each occasion, which is very troublesome. If fixed procedures were established regarding what kinds of information are required, whom the information should be reported to, how it will be rewarded, and how all those activities should be processed, the transaction would be much easier to conduct.

2.1.2 Fixing Transaction Interfaces That Are *Seemingly Irrelevant*

The efficiency of a transaction improves drastically by fixing interfaces.

A key factor in successfully fixing and standardizing an interface is focusing on an interface that is *seemingly irrelevant*. The effectiveness of a *seemingly irrelevant* interface does not deteriorate by fixing. The quantitative evaluation of benefits is always significant, of course, and it will be discussed later in this chapter. However, intuitive judgment and proactive challenges for fixing should be appreciated so that the design and evaluation capabilities will be developed in companies.

An interface constitutes agreements on the contents, conditions, and procedures of transaction that are supposed to be shared with all concerned transaction parties. It does not involve personal proprietary expertise such as production activity. If an interface can be fixed without diminishing value added, effectiveness, and individual motivation, then the efficiency improvement is purely valuable. The transaction costs decreases further when it is shared by a larger number of people.

In order to elaborate *the interface that is seemingly irrelevant*, agreements in activities that should be conceived as *irrelevant* will be listed below:

(1) Forms of sales activities daily reports

Fixing formats and documents of reporting activities improves efficiency greatly on both writers' and readers' sides by avoiding omission and misunderstanding of information. It is a typical advantage of fixing interfaces and certainly not limited to sales activities. However, at the time of the introduction of the interface, issues such as fixing data entry procedures, complaints, rejections, and dissatisfaction regarding the positions of lines and font styles are sometimes expressed, and reaching a consensus takes a long time. The introduction of fixing interfaces unavoidably raises minimum changes and inconvenience to the users. It should be noted that the individual losses are

much smaller than the gains brought to the whole, which are made by mutual concession.

(2) Databases (CRM, SCM, ERP, PDM, etc.)

Databases such as customer relationship management (CRM), SCM, enterprise resource planning (ERP), and product data management (PDM) contain data formats and functions similar to those of paper documents. The only difference from paper documents is that database processes are electronic and automatic. Complaints, rejections, and dissatisfaction are expressed quite frequently about fixing the formats in the same way as the sales reports. This should be deemed as an interface that is seemingly irrelevant.

(3) Filing indexes/Directories

Many organizations have filing indexes to manage an enormous amount of documents. Creators of documents store them according to an index, and users of the documents search out and use the documents also according to the same index. Indexes function as interfaces between creators and users of documents, which dramatically reduce the time needed to search out documents from a huge pile of files. The purpose of an index is to fix a framework to classify information. It should be shared and used by creators and users. This concept of a directory has been applied to information management on computers (the "tag" system is becoming more popular these days as it enables people to manage information more flexibly).

As the advantages of sharing information by an index are enormous, even if uncomfortableness with the wording of an index exists, it should be conceived as an interface that is irrelevant instead of denying them emotionally.

An index is an interface used not only between creators and users of documents but also for personal use. That is, it functions as a system for individual information management, and it is a transaction interface between oneself in the past (at the time of making the document) and in the future (at the time of using the document). Individuals with higher performance are likely to construct a personal index to manage information for both work and study. Experiences in making efficient indexes for personal use become valuable for making indexes for organizations.

(4) Fixing time, venue, and participants of meetings

It is inefficient to decide time, venue, participants, and so forth for every meeting on an ad hoc basis. Holding meetings periodically and routinely avoids redundant discussions that are seemingly irrelevant interfaces; these exist in large quantity, and the transaction costs can be reduced enormously by fixing.

(5) Definition of terminologies, codes, and work flows

If a coding system differs from department to department, it will be extremely inefficient to process activities across departments. Similarly, errors, omissions, and misunderstandings will arise frequently between departments if there is no unified definition of terms; communication cannot be established. In the course of orders processing, for example, if formats of documents such as a quote, a purchase order, an order confirmation, a delivery confirmation, an inspection certificate, and a receipt are designated and fixed, and if the data

input procedures and submission dates are standardized, the paperwork becomes much more efficient. Differences in processes of such back-office administrative work are unlikely to influence any performance or effectiveness.

Fixed interfaces have various names such as "systems," "business processes," "work flows," "manuals," "procedures," "protocols," "rules," "structures," "routines," "norms," and so forth. It is impossible to describe the differences between those precisely, and, in fact, those are essentially identical. IT computerizes and automates all of those. Although its physical form is different, IT can be included in the list above.

The phrase "business processes" has obtained popularity in the business society these days, but the definition of "processes" is ambiguous and the difference from conventional "systems" or "management systems" is unclear. The phrase "management control systems" is widely used in the academy of management. Both phrases are used without clear distinction.

Eventually, all of these, even with the various names, are tools to manage an organization for the same goal and with the same approach—that is, to fix ways of transacting a priori in order to reduce the cost and time. In this book, all of these devices will be generalized by the concept of a transaction interface, emphasizing that these functions are essentially identical.

The term *fixing* has been used intentionally in this section, but it nearly corresponds to the concept of standardization. The term *standard* has various meanings and is often misunderstood to have negative meanings. Although there are many disadvantages, obstacles, and issues in standardization, it is a crucially significant concept in management. It is not an overstatement to say that managing organizations corresponds to using standards appropriately, which is going to be examined throughout this book.

2.2 What Is Transaction Interface?

Cooperation and collaboration become possible when there are interfaces to unify people's activities.

2.2.1 Interface Between Organizations/Departments/Individuals

The organization is a nexus of interfaces between departments and individuals.

2.2.1.1 Reduction of Transaction Costs by Fixing Interfaces

An overview of the concept of a transaction interface was given in the previous section. This section outlines a detailed discussion of the concept.

To facilitate communication within an organization, various transaction interfaces must be created, including natural languages, media (e.g., telephones, emails, videophones, and paper documents), formats of information, information

specifications, dates and venues for delivery, and methods for confirming acceptance. If the interfaces for exchanges are not determined a priori, these must be negotiated and agreed on an ad hoc basis. That is to say, an interface is set either in advance or ad hoc. If it causes little problem by being predetermined, efficiency increases greatly; opportunity loss can be also avoided that may otherwise have occurred as necessary transactions were obstructed due to huge transaction costs.

Fixing interfaces corresponds to fixing ways of transacting. If an interface is irrelevant, it is unnecessary to repeat the argument and expend extra time and effort for the determination. It incurs an enormous amount of cost if the argument repeats at every transaction. If it is repeated every day in every department, the amount of time wasted increase immensely. If it is an interface that is *irrelevant*, it should be fixed appropriately a priori, and communication can be started and completed more promptly at much lower cost. As described previously, if all parties accept the small inconveniences caused by the changes, this would ensure improvement in the overall efficiency.

Hereinafter, interfaces of a transaction that are predetermined or fixed in advance will be referred to as *fixed interfaces*. On the other hand, ways of transacting that are determined on a case-by-case basis, with agreement or by force, will be referred to as ad hoc *interfaces*.

An organization is a nexus of fixed interfaces, in a manner of speaking. Many of the individual transactions are determined as rules, norms, protocols, and regulations in the organization. These collectives form a system or an institution such as an accounting institution, a reporting system, and an assessment system in companies. Rules of conventional organization are used to address roles, responsibilities, or missions of each department/section/individual, but these days they have been changed to describe how to deliver or exchange outcomes among departments/sections/individuals instead, which literally means *interfaces*. Often when roles or missions are addressed, problems may arise between departments due to ambiguous description of responsibilities, but the possibility decreases greatly if interfaces are set explicitly. The interface is meant to designate both parties' roles while simultaneously defining the organizational structures.

All the discussions regarding interfaces can be put into manuals, which can also be defined as transaction interfaces between managers and staffs. Accordingly, subordinate staffs complete and report outcomes to managers, who, in turn, act by comparing the outputs against the instructions prescribed in the manual. If the outcome is not as described in the manual, the managers will manage, assist, instruct, or educate the subordinate staffs according to the manual. Costs of communication, management, instruction, education, and evaluation between managers and staffs will be reduced greatly by the manual. The advantages in developing a manual, fixed interface are huge, as it eliminates the repetitive need for managers to instruct staff members on their tasks or for staffs to inquire about how a certain task should be done.

Organizations such as companies have been improving efficiency by forming innumerable fixed interfaces like those described above for strengthening their competitiveness. This has opened doors for more transactions to be executed within

organizations, which can utilize fixed interfaces flexibly, rather than in the market, which hardly provide fixed interfaces. This concept was first noted by Ronald H. Coase, a Nobel Prize economist.

The origin of an organization is the establishment of the most basic and most significant fixed interface: allocation of authorities to determine interfaces. If no fixed interfaces (rules or manuals) are provided, it becomes inefficient and difficult to make every decision by ad hoc arguments, which often result in confusion and conflicts. The first fixed interface determines who makes the decisions and whose decisions are always prioritized. This is a very simple and basic interface that covers most of the transactions in organization. It is the most primitive interface by which all interfaces are decided in a dictatorship manner (enforcement by power is used instead of negotiation and agreement). In modern organizations, authority typically is hierarchically distributed. When this fixed interface is introduced, just an aggregation of people forms an organization with higher productivity.

In addition to the hierarchical structure above, another basic fixed interface in an organization is allocation of functions such as production, sales, and accounting. The development processes of interfaces and organizations will be elaborated in Chap. 5.

2.2.1.2 Improvement of Autonomy by Fixing Interfaces

As described above, the biggest advantage of fixing transaction interfaces is the cost reduction by preventing redundant transactions to execute a transaction. The more transaction costs are spent in a transaction, the higher the effectiveness of the transaction; therefore, the most objective and reasonable approach to productivity improvement is to reduce activities that are clearly of no or less value to the transaction.

There are many more advantages to fixing interfaces. Fixing makes each entity (i.e., department, section, or employee) function as an independent and autonomous module. This will be elaborated in detail in Chap. 4; therefore, the points are only briefly described in this section regarding increase in independency and autonomy for each entity or the advancement of modularization as one of the key advantages of fixing interfaces.

(1) Enhancing motivation

One of the key advantages of capitalism over socialism is attributed to the difference in thought about proprietary rights. The fundamental thought of capitalism that protects the proprietary rights of asset owners leads to enhancement of individual motivation and, consequently, productivity. An explicitly defined interface between a manager and a staff clarifies their responsibilities, the authority, and also the attribution of outcomes. If a manager has the power to set interfaces arbitrarily and freely, he/she can easily exploit the outcomes. By means of the fixed interface, the staffs can assert their ownership of their outcomes and become independent, and consequently their motivation will be enhanced.

(2) Encouraging competitive culture

Because fixing interfaces enables comparison of individual outcomes, competition among entities (e.g., individuals, departments, or companies) is encouraged, which can lead to productivity improvements.

(3) Promoting improvement and innovation

Fixed interfaces between entities clarify individual responsibilities, which promotes improvement and innovation of outcomes. If the responsibility for improvement is ambiguous, then the activity will hardly be executed. Moreover, encouraging competition will result in further improvement.

(4) Improving resource efficiency by coordination among entities

When a fixed interface is shared by multiple entities, it is possible to add and remove resources more easily, which enables organizations to enjoy the following advantages:

(a) Resource efficiency improvement by adjusting the quantity of input resource

Because the transaction costs for adding and removing input resource is smaller, it is easier to adjust the volume of input resource (e.g., human resources, equipment, or facilities) depending on demands. As a result, utilization rates and, subsequently, overall efficiencies of resources increase.

(b) Input resource efficiency improvement by functional specialization

With a transaction interface of adding and utilizing heterogeneous resources, functional specialization can be embodied easily, which makes respective operation simple, easy, and repetitive. It consequently enables the substitution by lower wage labors or by IT and decreases the operation costs. Productivity improvement is achieved through economies of scale and learning curve effects with the simpler, easier, and repetitive tasks.

(c) Resource efficiency improvement by sharing resources

Because resources of special functions and capabilities (e.g., facilities, equipment, and professionals) are rarely used, when they are shared by multiple entities instead of individually owned, it will increase usage frequency and improve resource efficiency.

2.2.2 Interfaces Between Mechanical Parts

Interfaces set between parts also separate and designate human operations.

The term *interface* is usually applied to physical objects such as mechanical parts and electrical signals. Physical interfaces regulating exchanges of information by electric voltage/current and mechanical interactions by mechanical specifications (e.g., size, weight, and shape) are set between electrical and mechanical parts, respectively. For example, in a watch, the functions are allocated to springs, gears, and needles with the interfaces, which determine each mechanical specification so that each part performs its function and at the same time interacts to work as

a whole synchronously. If there is inconsistency with the interfaces, the watch does not function.

The interfaces between mechanical parts and between electric parts are not negotiated or decided by the parts themselves spontaneously. It should be noted that human designers determined them artificially—that is, those physical interfaces function to determine the tasks and responsibilities of workers who are in charge of designing and fabricating each part. In the production procedure, the section in charge of component A will produce it according to the interface of prefixed design specifications and deliver it to the section that uses component A. Regardless of whether the required transaction is a component or information, this interface determines the interaction of tasks between humans eventually. Mechanical production guidelines, electronic design diagrams, software flowcharts, information-sharing rules, and service manuals at restaurants are all transaction interfaces between people in organizations.

Software programs as artifacts can be used to illustrate this discussion most distinctively. The term *interface* in software engineering refers to the regulation for interconnecting programs. For a computer program, the outcomes developed in the past can be reused repetitively without any reproduction cost (very little cost), thus remarkably increasing the efficiency of the development. A development methodology emphasizing this reusability is called "object-oriented programming," which was developed in the 1970s and has been gathering attention recently.

For example, OSs in computers are developed by necessity so that various systems, devices, and application software can be created without developing programs with duplicating functions. The OS facilitates not only a smooth operation but also the reuse and substitution of each module. It also functions as an interface for communication between the developers of the OS and the developers of the modules.

Because the reuse of programs is prioritized, the programs are designed to be applied to various applications, instead of custom-made for one application, a result of which possibly deteriorates the performances in individual applications. This has been a long-term obstacle in adopting the object-oriented approach in software development. In the case of software, processing speed decreased. Today, various speedup technologies have been developed, including technology advancements in CPUs, and they have managed to solve the problem. In the current business environment where the significance of program development has been increasing, the efficiency of software development is becoming relatively more emphasized and the object-oriented methodology is getting attention.

When an interface is fixed for reducing transaction costs, various needs in various application cases should be considered, rather than a single specific application. In general, it causes inevitable deterioration of the performances compared with the method that focuses on only one specific need. This is a severe structural problem; a methodology must be developed to design interfaces appropriately so as to minimize the problem and to enhance the advantages of the interface. This topic will further be discussed comprehensively in Chap. 6.

2.3 Examples of Transaction Interfaces in Organizations

Issues regarding the organization correspond to processing of transaction interfaces.

2.3.1 Interfaces for a Cross-Functional Team

Management rules for a cross-functional team are an aggregate of interfaces.

In order to illustrate more clearly the basic concept of a transaction interface, a number of simple examples such as filing indexes and business processes have been cited in the preceding sections. In this section, several examples of more complicated interfaces will be explained to deepen the comprehension of the concept.

Establishment, management, and operation of a cross-functional team (CFT) are great examples of fixed interfaces that predetermine and describe very complicated practice procedures.

A purpose of a CFT is to plan, implement, and promote/enforce necessary company-wide innovations that go beyond individual functional departments. It is one of the most complicated activities in companies because it is aimed at company-wide, large-scale innovation. Companies with the capabilities of managing the fixed interfaces become superior in power for innovation. Needless to say, the capability leads directly to competitiveness in the turbulent and uncertain business environment of these days. It is the management technology that has been developed widely among leading-edge companies, including the ones in Silicon Valley. Carlos Ghosn, the CEO of the Renault/Nissan group, deployed it during the time when he led Nissan's reformation, which made CFTs widely known even in Japan.

Specifically, the following interfaces are predetermined explicitly for a CFT:

(1) Proposal and selection of innovation plans

Procedures for proposing an innovation plan when an employee acknowledges needs of cross-functional changes; the processes of evaluation, selection, and adoption of the proposal; and the responsibilities (of a committee or an executive) are fixed explicitly. Consequently, these encourage employees to make proposals.

(2) Team formation

It is important that multiple departments participate in the solution of cross-functional issues. Because each department usually regards ordinary business routines inside departments as its primary concern over the cross-functional projects, it is quite difficult to collect capable team members. In the procedures, it is ruled to prioritize the project and to assign the most suitable persons.

(3) Processes of handling the project

The team members are not accustomed to such activities related to initiating and driving changes, especially with the large scale. Guidelines of handling tasks are prepared to assist all team members to execute the unfamiliar activities. This also encourages employees to make proposals.

(4) Allocation of tasks in the project
Allocation of tasks and responsibilities are designed and prepared in advance so that the project is easily managed.
(5) Presentation of project outcomes and its evaluation
Procedures are provided regarding to whom and where outcomes of the project are presented and how the outcomes (e.g., an innovation plan) are evaluated, selected, and adopted.
(6) Promotion and enforcement of the changes
It is very common to find that the innovation recommendations remain unimplemented without prepared processes of promoting and enforcing the changes. In order to avoid this waste, responsibilities and schedules for the implementation and monitoring and modification processes should be determined in the form of an action plan.
(7) Evaluation and rewarding of the team
Costs and risks of forming, executing, and implementing the plan are largely reduced by the preparation of those interfaces above. In addition, rewarding the team will enhance their motivation. Experienced companies, for instance, are likely to hold formal dinner parties for the team members and their families instead of providing financial incentives as a part of a reward mechanism.

2.3.2 Design Concept

The design concept ensures consistent decision making for each design activity and reduces transaction costs.

The previous examples such as rules, regulations, and processes can be easily recognized as interfaces. In this section, some abstract interfaces that are difficult to identify will be exhibited hereinafter.

In design activities, if targeted customer segments, applications and conditions of the customers' usage, and a pricing range, or even outlines of those, are designated, the transaction costs incurred among designers is largely reduced. If all of these are to be negotiated instead, an enormous amount of time and cost will be required. However, if such ad hoc adjustments (transactions) are omitted just to avoid the cost, the decisions reached become inconsistent because of chaotic activities. It is no exaggeration to say that the value of a product depends greatly on the quality of the prefixed foundation of activities.

The more precisely and properly the foundation is fixed a priori, the higher probability of success. The philosophy, concept, and policy of the design rule every activity as transaction interfaces: they drastically reduce transaction costs and improve effectiveness eventually.

2.3.3 Strategy and Policy

Strategy ensures consistent decision making inside and between departments and reduces the transaction costs.

There are various definitions of strategy, but perhaps the most widely accepted one is "common guidelines that ensure consistent decision making of each entity to achieve a goal." This implies that a product is developed and produced with a common understanding and is then marketed to an identical customer segment based on the shared guideline. The more consistent activities are, the stronger concentration in power companies obtain. Consider, for example, a product designed for elderly women but appealing to young men with emphasis on characteristics suitable for children: no success can be accomplished in marketing of such a product. This example shows that the roles and responsibilities of each entity should be assigned and managed consistently under the strategy shaped and shared in advance.

The more precise and concrete these interfaces are, the stronger organizations become. Under a well-planned strategy, a manager is able to work with his/her subordinates easily, the subordinates can satisfy the manager certainly, and they can collaborate effectively. That is, a strategy acts as a rule or a guideline for decision making and activities in an organization. Fixed interfaces avoid repetition of argument and confirmation that arise ad hoc and individually, hence reducing transaction costs in an organization. When the description is more abstract or implicit, it becomes a policy rather than a strategy.

2.3.4 Mission, Corporate Philosophy, and Shared Values

Mission and philosophy facilitate communication in an organization.

Mission, corporate philosophy, and shared values function as guidelines of conduct for all members of an organization. These guidelines are more abstract than those comprising a strategy.

For example, if a corporate philosophy by which innovations are prioritized over ordinary business routines is indicated as an interface, it is easier for the entire company to form CFTs and collect the highest-caliber members. The consulting firm McKinsey & Co., for instance, has a corporate philosophy of "clients' interests first," meaning their employees should prioritize clients' interests over those of the firm if they do not converge. Accordingly, the philosophy guides the employees into making decisions that will ensure they deliver the best recommendation for their clients despite emotional or political implications that might result in cancelation of their contracts. Consequently, such a philosophy ensures an increase in the company's lasting value and brand image. However, such recommendations may bring short-term failure or weakness for the company's business, wasting time in recurring arguments on whether or not to make the recommendations, which will consequently incur massive transaction costs.

Also consider the case of a venture startup that needs more organizational controls, even though it has been growing rapidly through self-initiated efforts. When new rules are introduced in the company, rejections are likely to occur, such as claims that "we have been growing successfully without rules, unlike large companies, which are failing, and so we do not need them. That is our strength." This kind of argument will repeat with every single challenge to introduce rules, causing extensive strain for the whole company. In a company, such a problem could be resolved by the introduction of a new management principle such as "activating our internal communications/transactions in line with the introduction of our processes."

It is widely known that successful companies utilize philosophies and shared values appropriately, even though the majority of them set meaningless mottos such as "coexistence and coprosperity" or "contribution to the prosperity of our society." Too reasonable philosophies make no contribution to solving internal conflicts or facilitating communications. Therefore, it is important to note that philosophies and principles should be carefully designed to reduce unnecessary transaction costs.

2.3.5 Customs and Tacit Knowledge

Customs also function as fixed interfaces, but their management is difficult.

Customs and tacit knowledge also function as interfaces, although these are more implicit than philosophies and shared values. Those of Japanese companies in particular were analyzed as their competitive source by many researchers during their high growth period. Japanese companies have created homogeneous human resources through a lifetime employment system; as a result, the employees can understand each other tacitly. As they were excellent in prompt coordination ad hoc, efforts to develop interfaces were not necessarily required. They spent many hours together, even outside the office, which deepened their mutual understanding. In that way, fixed interfaces of presentation, coordination, and negotiation had been established as customs or tacit knowledge. This capability contributed to the manufacturing of high-precision products and explained satisfactorily the success of Japanese companies before 1990.

Western companies were struggling with reducing transaction costs among diversified employees and in open business relationships at that time. They had started trying to find means to reduce transaction costs, such as utilization of IT, much earlier than the advent of the Internet. As long as they pursued open relationships, they struggled with transaction costs. The fixed interfaces of Japanese companies, however, had proven to be a competitive advantage, as their transactions could be completed much more readily.

The Internet revolution, which started in the 1990s, became the turning point, and the situation has changed completely. The transaction costs in the open business relationships decreased drastically. Many obstacles to transactions between the USA and China as well as the USA and India disappeared, and many

similar attempts occurred, as described in Chap. 1. Japanese companies were trapped in their past success and were not able to utilize the new technologies. Rather, they denied and rejected the essential changes necessary for the new global open economy before consideration and missed out on the wave of digitalization. Consequently, the "Lost Decades" of Japan, the stagnation era after the 1990s, started and continue to this day. Customs and tacit knowledge showed a crucial problem that the establishment of interfaces necessitate an enormous amount of time and cost because those are spontaneously generated in grass-roots style, not artificially controlled. It is impossible to wait a few years to establish one interface of tacit knowledge or to educate new employees about one interface in this fast-changing, global environment. Interfaces should be planned and managed artificially.

2.3.6 Trust

Trust functions as fixed interfaces, but it is also difficult to manage.

Trust is more implicit than customs but also functions as interfaces based on a mutual tacit agreement. It obviously decreases transaction costs of authentication, accreditation, and monitoring (such as performance assessment). For example, if a business order is accepted only by a telephone call without much effort to exchange a contract, the transaction costs decreases. Trust can also adjust conflicts of profits in the short term from perspectives of a long term and enables handling uncertainties in the relationship flexibly. A breach of trust will collapse existing interfaces with not just the present transactor but as well as future transactors, the prospects, which will definitely increase the transaction costs in the long term. On the contrary, if both entities do not break their mutual trust, the transaction relationship will be further strengthened and be maintained continuously. When trust is established in communities such as regions and industrial clusters, it is called "social capital," which functions as a strong and stable platform. In the USA, for example, Chinese, Koreans, and Indians have been establishing strong social capital, which has grown to supplement their adverse social situations.

2.4 Examples of Transaction Interfaces in Markets

The market is also a nexus of transaction interfaces.

Interfaces in an organization (company) have been discussed mainly in this chapter, but all those previous discussions regarding organizations can also be applied to the market. In fact, transaction interfaces in the market are easier to understand intuitively.

Besides proprietary interfaces owned by organizations, there are also an enormous number of interfaces shared publicly in markets and societies. If there are no rules of transactions in the market, everyone would argue and determine all the

interfaces at every transaction. Interfaces in the market and those in companies coexist, and they function integratively as a consistent collection of transaction interfaces as a whole.

(1) Trading rule

Trading rules of financial products are regulated by laws such as commercial law and the Securities Exchange Act; additionally, each security exchange market (private company) also has individual transaction rules. Besides trading rules and procedures of stocks, there are many rules regarding the listing of products (stocks) on the markets from the perspectives of social responsibility and investor protection, which include application processes and criteria of examination.

If a listed company does not comply with the rules, the security exchange market may delist it. As the laws of a society and the proprietary rules of private companies jointly form an aggregate of reliable transaction interfaces, consumers can execute transactions securely with minimum transaction costs.

A good practical example is a World Heritage shrine near our university that holds flea markets regularly in its large garden. Even the flea market in the shrine has rules of trading under which exhibitors apply for the registration, goods for sales are regulated, fees for transactions are charged, and so forth. Exhibitors comply with physical interfaces with next-door exhibitors to line up their goods. Needless to say, there are business laws and common sense in societies as a foundation of transaction interfaces.

(2) Specification of standardized product

When a product specification is standardized, such as a product that is regulated by the government and for which only cost and delivery time can be differentiated, the product is called a commodity. As standardization bodies such as International Organization for Standardization (ISO), American National Standards Institute (ANSI), and Deutsche Industrie Normenausschuss (DIS) determine specifications and certify products or suppliers when they comply with the specification, customers need not investigate the specifications during transactions. In addition, companies may set their own specification standards that are less flexible in terms of qualitative specifications but more competitive with cost and delivery time due to economies of scale by mass processing.

(3) Vocational license and skill certification

There are more than 4,000 licenses and qualifications in Japan, including the licenses of lawyer, accountant, medical doctor, financial planner, chef, pet trimmer, language proficiency test, mathematics proficiency test, Microsoft Office Specialist, and Oracle Certification. The licenses guarantee customers that the licensees have a certain level of capabilities and knowledge, and the transactions with them are supposed to be satisfactory. That is, the licenses and the qualifications function as transaction interfaces between the professionals and their clients. The interface omits activities in a transaction such as investigation of expected service quality, evaluation of their capability, and confirmation of their credibility, thus reducing the transaction costs.

(4) Telecommunication protocol

These are not interfaces for commercial exchanges but types (protocols, formats) of data, packets, and files that must be fixed for the transmission. Examples include TCP/IP,[3] PDF,[4] HTML,[5] CVS,[6] and SQL. The Internet is a nexus of interfaces by which an enormous volume of data can be transmitted every second. ISO, ITU, and others of international standard bodies have been established to set telecommunication standards, but there are also an increasing number of proprietary standards (de facto standards), such as Microsoft's own protocols, as a result of market competition.

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As described above, there is no essential difference of function between organizations and the market from the perspective of transaction. The only difference is who designs, develops, manages, maintains, and owns the interfaces.

In markets, governments and their international aggregates have authorities to determine, manage, and enforce interfaces. These days, however, private companies and NPOs are more active in standardizing products and technologies, and they are desperately competing for standardization in markets. As the great example of Microsoft showed, if a company acquires a proprietary standard, it is extremely valuable. Proprietary interfaces increasingly become standards as the result of market competition; it is so intense that product prices come down even to zero these days.

Interfaces in markets are likely to be called *standards*. In the next chapter, "Standard as Interface," the increasing value in marketing strategies will be discussed from the perspective of strategy.

2.5 Layered Structure of Transaction Interface

It is significant to acknowledge and conceive the hierarchical structure of the interface.

As discussed thus far, various interfaces in organizations and the market are intertwined to establish aggregates of interfaces to complete transactions. If the existing layered structures are acknowledged, it is much easier to comprehend the deceptive complexity.

There exist two kinds of layered structures in the aggregates of transaction interfaces.

[3] Transmission Control Protocol/Internet Protocol.

[4] Portable Document Format.

[5] HyperText Markup Language.

[6] Comma-separated values.

(1) Layered structure of ad hoc interfaces on fixed interfaces

Interfaces are classified into two categories: *fixed interfaces* and ad hoc *interfaces*. Without exception, those two function in integrative ways when a transaction is executed. Fixed interfaces form the foundation for processing basic activities in transactions, and ad hoc interfaces are built on the fixed interfaces to process details and exceptions ad hoc and flexibly. The reality, however, is that those are confusingly mixed, not structured systematically, frequently resulting in obstructing efficient transactions.

(2) Layered structure of general and specific fixed interfaces

Fixed interfaces are also decomposed into general interfaces and specific interfaces. As general interfaces are frequently used for general purposes, they are likely to be corporate-wide or social platforms. Specific interfaces are built on top of general interfaces for specific purposes. The reality is again that they are unstructured and confused. Especially in developing countries or companies, the infrastructures, the general interfaces, which will be described in the following, are not yet well established and become obstacles to economic growth. When interfaces are general and basic, the usage frequencies become higher. Specific interfaces should be built up on top of the general interfaces for specific purposes. In addition, ad hoc interfaces described in (1) are consolidated on those fixed interfaces to deal with any kind of transactions. Examples of the most general fixed interfaces include:

(A) Laws: Laws are the minimum rules regulating how citizens behave in the society and the most basic interfaces with which all individual entities must comply. People can organize their social lives assuming that they are protected from homicides and robberies by the interfaces. As laws enforce people to honor contracts, they can conduct the business activities placing credit in contracts. Without laws, there must be conflicts, fights, and wars everywhere, which are the transaction element of *ex post processing* incurring a large amount of transaction costs. When those costs are eliminated, the economy grows. In contrast, in societies where corruption is widespread, transaction costs of *negotiation/agreement* and *exchange* (bribe cash delivery) are so high that development of the economy is restricted.

(B) Natural languages: English, French, German, Japanese, Chinese, and so forth are shared interfaces. Transactions across borders with non-English-speaking companies are very costly. However, once people become used to the interface, the transaction costs are no longer incurred. Computer languages also function similarly.

(C) Customs/habits: Existing business customs should not be neglected as interfaces. Transactions across borders necessitate learning of customs in different business environments or assistance from third persons who play the roles of the interfaces.

(D) Problem solvers: Normally, the court that has jurisdiction over the location is designated in advance. As trials require costs and time, there is an option to ask a third person for problem solving privately. In societies that are not ruled by law, fixers and masterminds play active roles.

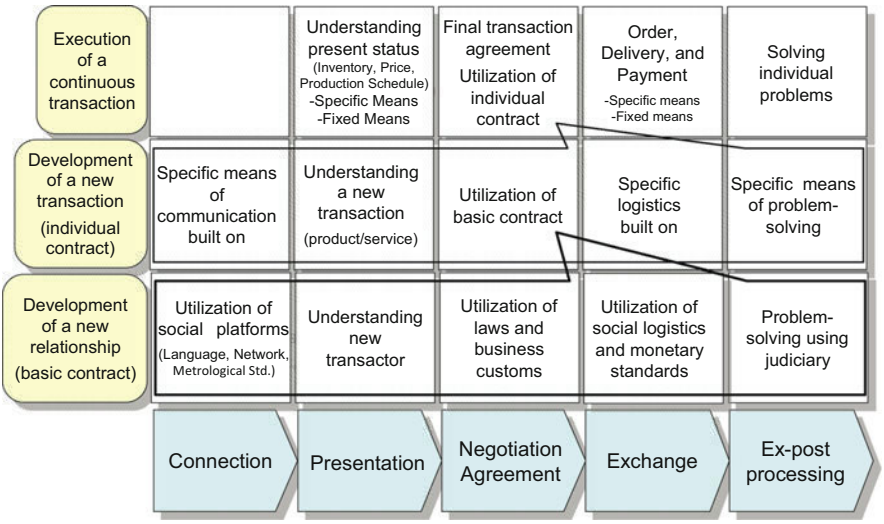

Fig. 2.1 Layered structure of transaction contract

(E) Communication infrastructures: The postal system, telephone, fax, mobile phones, the Internet, and so forth are established as widespread interfaces to support communication with low transaction costs.
(F) Payment infrastructures: Bank transfers, checks, credit cards, online payment, and so forth are established as widespread interfaces to support payments with low transaction costs. Standardization of currency must be established first.
(G) Transportation infrastructures: Public transportation such as railways, high-speed railways, aviation, highways and subways, sharing systems of bicycles and automobiles, and port facilities should be established with high-level security, reliability, and safety.

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On the socially available interfaces above, various proprietary interfaces (both fixed and ad hoc) have been built up accumulatively.

A layered structure of transaction contracts is explained below according to Fig. 2.1 as an example of the layered structure of general and specific interfaces. Although three layered levels are shown for a simple illustrative purpose, the number varies depending on the case. In business transactions, for example, companies conclude basic contracts first in which the most basic transaction interfaces, such as terminologies, definitions, applicable scopes, and durations, and basic transaction conditions are determined, avoiding transaction costs for repeated discussions related to those basic issues.

In the second layer, individual contracts are signed for such as individual products. Specifications and qualities, prices, deliveries, conditions for payment, conditions for returning, and so forth are agreed and fixed.

In the third layer, quotations, purchase orders, acceptances of order, certifications of inspection, invoices, receipts, and so forth, which contain specific product names, model numbers, prices, quantities, and delivery dates, are exchanged. Final agreements on transaction conditions at the moment of the transaction (e.g., the most recent inventory availability, production schedules, and the present prices) are described in those documents.

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As described above, interfaces are built up accumulatively from basic ones to specific and individual ones to shape the layered structure. The ROI of basic layers is improved due to their frequent use. Socially fixed and standardized interfaces contribute substantially to nations' competitiveness. The same holds true for business organizations. Companies that can utilize the layered structures enjoy higher efficiency and effectiveness. The ROI of an interface strongly correlates to its standardization (i.e., the increases of users in number), and this is going to be a main subject of the next chapter.

Standard as Interface

3

Standard is also a measure to reduce transaction costs.

3.1 Standard Corresponds to Interface

The standard functions as a fixed interface in the area of management.

3.1.1 Discussion of Standard from Perspectives of Interface

Perspectives of interface elaborate the structure of standard simply.

The concept of fixing interfaces strongly relates to the one of a standard. In order to gain higher ROI of an interface, fixing alone is not sufficient enough. The recognition and full use by every related person (effectively the standardization) is indispensable. If the number of users is small, the ROI decreases, which prevents compensating the cost for fixing the interface. Such valueless developments frequently occur in companies, amounting to huge losses.

Such losses could be avoided by comprehension of the advantages and disadvantages, and necessary actions, not just by the designers of interfaces but also by the users. The purpose of this chapter is to deepen the comprehension of a standard as a fixed interface and to improve the effectiveness in practice. It is highly difficult to conceive the essential concept of a standard and to embody the maximum utilization despite the fact that most of basic management tools are strongly related to standards.

The standardization of interfaces plays a significant role not only in operation but also in product market strategies. Companies that successfully achieve standardization of their products dominate all profit in the market. This "winner-takes-all" phenomenon is evident in the cases of the Microsoft Windows, the Google search engine, and the Facebook communication platform. It is not an

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
Springer Cham, https://doi.org/10.1007/978-3-319-06889-3_3

exaggeration to argue that the acquirement of standards became the most significant strategic goal. The argument is applicable not only to software and services on the Internet but also to all physical products.

It has been frequently seen that alliances of the weak are formed to compete with the "winner" for the market share and the standard position. The JAVA consortium was formed and the open source initiative was spread to compete with Microsoft. The Open Handset Alliance and the consortium for standardizing Android are currently competing with the Apple iPhone.

At the opposite side of such leading-edge industries, the wine industry exhibits a similar trend. French wineries with histories as long as 2,600 years have dominated the market for a long time, and just until recently, extremely complicated interfaces of products using location and year of production have been used by which the values are not easily evaluated and compared. Consequently, other regions have not been able to compete, and the French wineries' high prices supported by their elite brand image have been maintained. Despite the inefficiency of the small-scale family businesses, they have been the standard of the market.

The emerging competitors from "the new continent" such as California, Australia, New Zealand, Chile, and South Africa have been increasing in number due to the spread and new developments of technologies such as improvements of soil, cultivars, and cultivation. They selected grape cultivars (e.g., Cabernet Sauvignon, Pinot Noir, and Chardonnay) as their product interface in the standardized manner.[1] California (such as Napa Valley near Silicon Valley) adopted the interface first, and all other new-entry countries and wineries followed and standardized it.

With this standard interface, the consumers can compare products and make buying decisions very easily without feeling confused as they did before. Modern management technologies such as mass production and scientific analyses were introduced entrepreneurially into the whole winery processes, while the production and consumption as art have been respected conventionally. The consequences are that the prices were reduced and the quality improved drastically, making a contradiction that the quality of low-priced wine is more stable regardless of the weather (the high-priced wines are regulated not to blend across the production location). Since the conventional wineries have started adopting the interface of grape cultivars as well, it will enhance the standard position further except for the very best brands. It will improve the cost performance further and increase the market size globally. In this manner, the consumers greatly benefit from standards having been established.

The value of standards as interfaces can be apprehended by anyone from day-to-day operations, but often only standards' negative features are emphasized, and standards per se are frequently rejected entirely, with comments that standards rigidify behaviors and robotize people. As the comprehension of the market dominance of standard-

[1] The presentation of wine varieties by location of production is called "terroir" and by grape cultivar is called "cepage." As terroir is regulated and protected by law and the comparison is extremely complicated for the ordinary consumers, there arises no substantial competition.

setters is superficial, market strategies are not appropriately formed. In the significant processes of establishing standards in the society and companies, it is often seen that the arguments become unreasonably emotional or political.

While there have been various definitions of a standard in convention and academia, a consistent comprehension can be obtained by deploying the concept of an interface and conceiving a standard as a fixed interface. In this chapter, it will be argued that the objects of standardization are always interfaces regardless of the type of standards, whether in organizations or in the market. It will be concluded that the standard as an interface is one of the most significant sources of competitiveness and objects of management. It will be discussed that organizations *nearly* correspond to standards and fixed interfaces correspond to standards. Without harming the diversity or personality of people, fixed interfaces and standards make people function collaboratively, not destructively. Organizations can never be efficient or effective without standards being understood and utilized by all employees. Without standards or fixed interfaces, organizations would process all activities in nonstandardized ways and inevitably depend on individual skills and expertise, which is no more than a community or a collection of people without any organizational arrangement. Although it is no argument that individual flexible processing and growth are necessary, organizations with standards are the foundation of all competitiveness of strategies and products. In order to create competitive strategies and products intentionally. Competitive organizations must be shaped first.

In this chapter, standards in markets, those in companies, and those in societies will be discussed systematically, and the practical applications in organizations and strategies will be explained from the perspective of transaction interfaces. This chapter is an awkward but significant step to deepen the comprehension of transaction and a transaction cost.

Practical methodologies to design and manage standards will be discussed in Chap. 6. The cause of the emphasis on the negative features of standards is identical with modules, processes, systems, and IT and therefore will also be included in Chap. 6. This chapter will focus on explanation of the structure of standard per se using illustrative cases and examples.

3.1.2 The Term *Standard* Has Various Aspects

The term *standard* has many definitions and is used on various occasions.

3.1.2.1 The Concept of Standard Covers Much Ground

Because *standards* appear in every aspect of society to a greater or lesser extent, everyone has his/her own opinion on them. The following is a list of some of the typical examples which are conceived as *standards* by researchers:

Telephone, mobile phone, the Internet (TCP/IP, HTML), electronic commerce, Electronic Data Interchange, the OS and software of the PC, user interfaces of the PC, connection protocols of the PC peripheral device (PS/2 of mice and keyboards,

DVI, RS-232 of projectors), USB/micro USB, terminals and shapes* of earphones, WiFi, keyboard sequence, GPS, Facebook, Twitter, Google, electronic money, prepaid card, credit card, iTunes, game console, VCR, DVD, Blu-ray, the electric voltage, dry cell battery, screw/bolt, paper size, building materials (e.g., 2x4), gasoline, metrological standards, qualification/license, standard weight*, standard height*, standard income*, franchise chains (hamburger shops, family restaurant), cooking time* of instant noodles, shape of plastic bottles, driving method of cars, number of the wheels of cars*, uniforms, fashion trend*, ISO, IFRS/accounting standards, CMMI[2]/COBIT[3] (the process level of companies), de facto standard*, textbooks of compulsory education, rules (standard process, standard operation time, standard procedure, standard parts, manual, and so forth) in companies, standard specifications, traffic rules/sign, diplomatic protocol, culture, custom, manner, ethics, railroad system, currency, law, the society of Japanese, and the society of the USA

*Regarding a feature of standards: *models most widely accepted and employed*, which will be explained later. The rest are regarding another feature: *rules/criteria*.

At the end of the list of standards above, the society of Japan and the society of the USA are listed. These interesting examples were picked up from comments from my American students who mentioned that Japan is a very standardized country while the USA, with national hamburger chains, shopping malls, and supermarket chains, appears very standardized to Japanese. The cause of these diametrically opposed perspectives raised a significant question that leads to the profound comprehension of standards and will be discussed later in this chapter.

Standards in the market have been gaining attention after Microsoft and Intel established the de facto standard positions of OS and CPU, respectively, in the 1980s, showing extremely high business performances. In the late 1980s when this trend began, the US government was strengthening pro-patent policies and becoming relatively tolerant with monopolies.

The term *standard* originally refers to the specification protocols designated by the authorities such as ISO, ITU, and national governments. However, after products of private companies obtained major market shares, which became the infrastructures of exchanging and sharing data, the establishment of de facto standards became the critical strategic object, especially in the IT-related industries. Riding on this tide, free or nearly free products and services have been increasing. During the writing of this chapter in 2013, Chinese Internet commerce companies have been intensifying the price competition, and, as a result, their shipping charges are becoming zero and sales below cost are increasing. It is because the company that survives this competition will dominate all the profits as a standard of the market. This is a typical example of astonishingly intensifying price competition in quest of a standard. At the same time, multiple companies increasingly ally to promote their own products or technologies to establish standards.

[2] Capability Maturity Model Integration.

[3] Control Objectives for Information and Related Technology.

De facto standards in the IT-related industries besides OS and CPU include office tool software, database software, ERP software, network routers, sound cards, groupware, HDDs, communication protocols (e.g., USB and PSI), and many more. The Internet is an aggregation of de facto standards. Standardization proceeds in services on the Internet as well, such as Amazon, Google, and Facebook. As described, standards have been established mainly in the IT-related industries in which connection, exchange, and sharing are relatively significant. However, as the merging of IT with home appliances, mobile phones, automobiles, and entertainment contents continues, this trend proceeds beyond the IT-related industries.

The standardization regarding business processes may be considerably influential to companies. ISO9000 and ISO14000 standardized companies' business processes to guarantee the quality of business outputs. EDI and ebXML,[4] which expands EDI to computerize all processes of commerce, are trying to standardize business terminologies and even business processes in various industries.

In the IT industry, also for the promotion of outsourcing businesses, the criteria that assess and evaluate the level of standardization of internal business processes (there are many standards such as CMMI, COBIT, and so forth, all of which are essentially identical) are competing for a standard. These qualify the status of business process standardization and designate the level of the processing capability as follows (CMMI example):

Level 1: Initial: Processes are ad hoc and not well defined.
Level 2: Repeatable: Processes for managing costs and schedules are standardized.
Level 3: Defined: Standardized processes are organized for every activity.
Level 4: Managed: Activities are monitored quantitatively and controlled.
Level 5: Optimized: Standardized processes for continuous improvements are prepared.

3.1.2.2 Standard and Winner-Takes-All (De Facto Standard)

In IT, networking in particular, connection, exchange, and sharing take significant roles, and therefore one product is preferably selected by consumers to have common protocols with others. This is called *network externality* in economics. However, even in consumer goods that do not appear to relate to it, the standardization called "winner-takes-all" has been frequently observed. In professional sports such as football and basketball, very few athletes dominate popularity and obtain a major portion of salaries. In entertainment, very few entertainers oligopolize the market. The same phenomenon has been seen with best sellers, but it is interesting that a limited number of brands dominate even the fashion markets, in which uniqueness should be valuable. In Japan's cramming school businesses, their success or failure depends on a few teachers who gain super popularity among students.

In the electronic components industry, the winner-takes-all idea does not seem to relate, but actually many examples of de facto standards exist. The following

[4] Electronic Business using eXtensible Markup Language.

products have 60–90 % market shares: Mitsubishi Chemical's LED red fluorescent material for LCTV, Nidec's spindle motors for HDDs, Kuraray's LCD polarizing films, Toppan Printing's LCD anti-reflection films, Murata's ceramic capacitors, and many more. The semiconductor manufacturing equipment industry has the same tendency, and companies like ASML of the Netherlands (steppers), Tokyo Electron (resist coating and developing apparatus), Advantest (DRAM testing equipment), Nidec-Read (CPU package testing equipment), Shibaura Mechatronics (BD-ROM sputtering equipment), and Ushio (FPD lithography UV lamps) gain the vast majority of market shares. Similarly, the winner-takes-all by Toyota in the automotive industry was argued in the early 2000s.

The issue is how those seemingly complicated standardizations should be structurally analyzed.

As to the methodologies to establish standards, the great shift has arisen. Many product prices are set at zero from the launch to achieve the purpose these days. Almost all the services on the Internet and most of the application software on mobile phones are free or very low-priced. As the prices of using standards reach to free, the methodology to earn profits from the acquired standards is becoming the biggest issue of concern for companies. That is, not just the establishment but also the application of standards is crucial for recent corporate strategy.

Apple, a famous unilateralist, obtained the dominant market share through the iTunes store, an online market of application software and content, and the effective utilization of the platform drove the promotion and success of the iPhone. Currently, competition for the online market share has been intensifying with the entries of most of the world's telecommunication companies, smartphone manufacturers, PC hardware manufacturers, Intel, Microsoft, and so forth, all of which are in quest of the standard position. Nexus of Google, Kindle Fire of Amazon, and Kobo of Rakuten are reportedly all distributed below cost to acquire the standard position of a window to the online market.

As described, structuring the phenomena of the standardization and the winner-takes-all for better understanding and applying in marketing strategy increases significance. In this chapter, first of all, the definition of a *standard*, which has remained ambiguous for a long time, will be clarified. In order to obtain profound comprehension, the borders of problem space and the framework of discussion will be systematically designated. Second, the strategic shift from establishment to application of standards will be discussed. Although intellectual property becomes open (lower-priced or zero-priced) quite commonly these days, without an explicit scenario of applying standards as means to earn profit and to expand growth, the free distribution of products becomes just a social service. Last, the neo-marketing strategy in the open network economy will be examined by universally extending the frameworks proposed later in this chapter.

3.1.3 Commonalities in Various Standards

A standard refers twofold: models most widely accepted/employed and rules/criteria.

In order to deepen comprehension of standards, a complicated concept, some discussion must be endured for a while. Because it is so abstruse, the methodology of application has not been developed and utilized, except by a few quick-eyed companies. However, after equating the standard with the interface and the standard with the organization, the application of standards can be managed with quite simple and universal methodologies. Even de facto standards in markets have structures identical to the ones in companies such as standard processes, standard costs, and standard procedures, and both should be managed by means of the same methodology.

Reference to dictionaries provides a brief overview regarding how a *standard* is conceived generally, and the two definitions below are most frequently seen relating to the context of this book.

(1) Models most widely accepted and employed or the situation
(2) Rules, norms, or criteria

In the previous list of standards, items with an asterisk are examples belonging to (1) and the rest belong to (2). A critical perspective for the following discussion will be obtained by distinguishing those two definitions. In management studies especially, (2) is more likely to receive attention, but the increasing significance of (1) in the global competition and that of the combination of (1) and (2) will be argued emphatically.

Although the term *standard* in management studies generally implies an artifact created and managed artificially, in conventional usage it means a spontaneously generated situation. Therefore, both artificially created and spontaneously generated *standards* should be included in this discussion.

As described thus far, (2) corresponds to interfaces that are designed and developed with the purpose of becoming (1). In the situation of (1), various types of positive feedback (self-amplified effect), which will be discussed later, are likely to lead to the domination of the market (i.e., the situation perfectly accepted and employed or winner-takes-all). Therefore, the strategic significance of (1), not only (2) is increasing. In the next section, (2) is discussed first and then (1).

3.1.4 Interface Standard

Quality standards also function as interfaces.

3.1.4.1 Interface Standards and Quality/Performance Standards

Leading researchers of standard studies in management usually classify *standards* into *interface/compatibility standards* and *quality/performance standards*.[5] According to the researchers, quality, product structure (specification), production process, and so forth are classified as *quality/performance standards*, but eventually

[5] The following studies are useful:
P. Grindley (1995), *Standards Strategy and Policy; Cases and Stories*, Oxford University Press.

quality/performance standards correspond to *interfaces* as defined in this book, due to the following reasons. Frequently cited examples of *quality/performance standards* will be examined below. The definition of this book deems both *interface/compatibility standards* and *quality/performance standards* as *interfaces*, and therefore it will be concluded that all standards in the area of management correspond to interfaces.

Interface/compatibility standards defined by the researchers are of two types:

- Interconnection interfaces between products and parts, such as telephones, faxes, software, and cameras/film
- Operation interfaces between users and supplier (products or manufacturers), such as typewriters and services

Those are predetermined so that compatibility is assured. Those features are exactly identical with the transaction interfaces in this book.

Meanwhile, another class, *quality/performance standards*, is explained to be applied to quality, product structure (specification), production process, and so forth, but it will be concluded that a *quality/performance standard* is also included in an *interface* if the concept of a *transaction interface* is understood correctly as below.

Quality, product structure (specification), and production process define the quality level on the basis of which users make purchase decisions. The term *quality* in *quality/performance standards* refers to configuration/performance specification of products, service performance quality, product structure/production process (as assurance measures), and errors of all the above, all of which are presented to potential users during the purchase process. Users purchase the quality (through the product). Those are significant pieces of information regarding the transaction conditions that must be presented to, negotiated with, and agreed upon with potential users. *Quality* is one of the most significant transaction interfaces. In this manner, quality specifications and related conditions should be included in transaction interfaces, and the one predetermined between consumers and suppliers as a fixed interface becomes the *quality/performance standard*.

Manuals, work processes, management systems, institutions, rules, and norms, which are agreements regarding the assurance of quality (including production errors), should also be deemed as the *quality/performance standard* such as ISO9000. Various licenses provide the assuring information regarding the

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P.A. David (1987), "Some New Standards for the Economics of Standardization in the Information Age," in P. Dasguputa and P. Stoneman (eds.), *Economic Policy and Technological Performance*, Cambridge University Press.

P.A. David and S.M. Greenstein (1990), "The Economics of Compatibility Standards: An Introduction to Recent Research," *Economics of Innovation and new Technology*, Vol. 1, No. 1.

P.A. David and G.S. Rothwell (1996), "Standardization, Diversity and Learning Strategies for the Coevolution of Technology and Industrial Capacity," *International Journal of Industrial Organization*, Vol. 14, No. 2.

R. Hawkins, et al. (1995), *Standards, Innovation and Competitiveness*, Edward Elgar.

suppliers' capability of embodying the specifications such as the production, training, and governance processes, and therefore all of them function as interfaces that are *quality/performance standards*.

Standards in organizations function as interfaces between people to define the *quality* of activities. For example, a manager manages, controls, and educates his/her subordinates according to a manual, expecting that his/her subordinates will also comply with the manual. Standard processes function as manuals identically, in this case interdepartmentally instead of hierarchically. All those are organizational interfaces that are applicable to any kind of human relations, including those between managers and subordinates, between peers, between departments, and between companies. All those are *standards* when those are widely accepted and employed.

Most of the interfaces between managers and subordinates used to take the form of *manuals* that prescribed behaviors in detail. However, manuals are frequently criticized these days for restricting the activities of individuals and destroying individual creativity and autonomy. As organizations become flat and autonomous, the specification of outputs (and other transaction conditions such as delivery) is increasingly emphasized instead of the employees' conduct. That is, only transaction interfaces become determined instead of *production*, as autonomy, creativity, and collaboration are highly prioritized. Distinguishing *production* and *transactions* as objects of manualization makes it easier to understand this argument.

Metrological standards, a typical example of standards, correspond to the rules regarding quantitative presentation in transactions of information. When information such as 1 kg or 1 cm is determined and publicized, the transaction costs for communicating complicated information such as 1 kg and 1 cm decrease drastically. The value would be easily understood by inferring an alternative way to communicate such complicated information without using the metric system.

3.1.4.2 Network Externality of Standard as Interface

Externality in economics refers to the influence of other (external) entities' activity. *Network externality* or *network effect* refers to the externality that affects products connected to networks and the popular phenomena, such as e-mails and online markets, by which the value of the products increases as users increase in number. The term was introduced recently after the spread of the Internet. Networks are a type of transaction interface, the efficiency of which increases as the users increase and the cost per user decreases. This phenomenon is seen in databases as well, where the quantity and quality of the data increase as the users increase.

This also holds true to some extent with regular (not networked) products because it becomes easier to obtain the information regarding usage, operation, and problem solving as the users connected online or offline increase. For example, the Excel spreadsheet software offers a tremendous number of functions, but it is considerably easy to acquire the operational information from users through the Internet. Even Word is valuable because there are so many users who exchange and share data either online or off-line. It is the same with regular home appliances, as information regarding operation, exceptional usages, modification, repair,

maintenance, returning, disposal, and user support can be exchanged and shared with users. The *network externalities* have existed from the past but have been gaining attention as the network spreads and its effect becomes conspicuous.

Interfaces in organizations (e.g., processes, systems, and rules) also increase their value as the users of the interfaces increase. This phenomenon is not limited to interoffice mails or information sharing systems, which originally contain network externality; it becomes easier to acquire any kind of information for any resource as the users increase with or without network. This means that network externalities correspond to *interface externalities*; it is more efficient to access and utilize others' resources, the accumulated value of which increases as the users increase. Although *network externalities* have existed long before the Internet, only *network* has been focused due to the phenomena caused by the accelerated spread of the network, such as the drastically increasing value from the users and of the resources, which had been impossible to obtain without incurring huge transaction costs.

In this manner, positive feedback functions with interfaces and standards to further increase the number of users.

This is another *economy of scale* by the number of consumers in the consuming activity, meaning the increase of the value (from other consumers) caused by the reduction of transaction costs per capita due to the increase of the consumers. These are the *economies of scale on the consumer side*[6] that have never been discussed in the past. In addition to the conventional economies of scale on the producer side, utilization of the new type of economies of scale has become crucial in the open global economy, which will be emphasized repeatedly in this chapter.

3.1.5 Standard as Product with Majority of Market Share

A product becomes closer to the standard position as its users increase in number.

The above discussion regarding interfaces is related to the features of standards: (2) *rules, norms, or criteria*. In this section, the features of (1) *models most widely accepted and employed or the situation* will be examined. It corresponds to market share in the management domain, obviously. For example, a standard in fashion is the style with the largest market share, which does not relate to an interface. Particular fashion colors dominate the market every year, and there have been fashion trends such as skinny jeans, minimalism, vintage clothing, and hippie garb.

Given this background, there seems to be a behavioral pattern of following others' consumption decisions. This herding behavior is called the "bandwagon effect" in economics. It refers to the positive feedback structure in which consumers follow the buying decisions of the majority and products with larger market share increase the market share further, leading easily to the winner-takes-all. Such behavior has increased as the information regarding others' buying decisions has

[6] It is regarded as economies of scale because output (value obtained by consumers) increases with the same amount of input (transaction costs expended by the consumers).

become more readily available via the Internet. For example, the "Like" click function on Facebook transmits the information instantly to a large number of "friends," who are likely to be influenced by the information. This reputation information has existed in the past, but the spread of the Internet enhanced it tremendously and brought wider attention.

The reasons that consumers follow others can be explained by:

(A) Rational psychology to minimize risk associated with an uncertain buying decision
(B) Security psychology to connect and gather in a herd

A typical example of (A) is a popular question at a restaurant in an unfamiliar town: "What is the most popular dish in this restaurant?" This can be accomplished by much lower transaction costs than issuing a questionnaire to the past patrons of the restaurant. In the same manner, following the decision by the majority generally reduces the transaction costs by eliminating the need for a detailed investigation of the market and product. The companies that satisfy many customers can be judged as credible, and the products that satisfy many customers possibly would satisfy any given individual. Actually, Web sites that collect the reputation of products and restaurants have gained enormous popularity these days. The products and restaurants that are selected by consumers gain more consumers. This phenomenon is not new, but it has become conspicuous due to the decrease of the transaction costs and the increase of the information available on the Internet. This is another network externality.

The market shares as buying factors to minimize the risk appear to be significant with consumer goods, but the principle holds true even in business markets. For example, the largest management consulting firm, law firm, and system integrator are most likely to be selected because the buying manager responsible for the buying decision can make an excuse that his selection itself is blameless if the project failed.

Examples of (B) include all kinds of trends. The reason why one or a few best sellers dominate all readers is not explained only by the quality satisfying most of the readers. It holds true with baseball players and musicians, and a few dominate all the popularity and rewards. In the recent trend of Japan and Asian countries, the most popular musicians play as units or groups, not solo, to absorb some diversity of the audience in the bandwagon. Korean superstars, who are designed and developed under a national strategy, fit the argument perfectly. They are the artificial products designed to appeal to the security psychology.

3.1.6 Standards that Are Not Accepted by the Majority

> *Standards* conventionally also refer to models not accepted by the majority, but they are excluded from the discussion in this book.

The term *standard* is generally conceived as (2) rules/criteria that are accepted (or supposed to be accepted) by (1) the majority. However, there are *standards* that are

not accepted by the majority. Rules/criteria that are developed supposedly or purposely to be accepted by the majority but failed to be diffused are occasionally called *standards*. Rules/criteria obligated by law, even not accepted by the majority, are the same.

For example, Open Systems Interconnection or OSI was designed and designated as an international standard by ISO and ratified by the governments of the world. Therefore, it was supposed to be a standard legally and had been called a standard despite its low penetration in the market. However, the Internet protocol or IP coexisting with OSI at that time grew in its market share gradually, and as a result it has come to dominate the market completely.

Another example is the electronic money card, which was booming in the 1990s and promoted by many local governments. In reality, however, they did not reach the majority or the level of penetration that leads to positive feedback, and, as a result, all of them disappeared without any success. Buyers (consumers) did not carry the cards until sellers (shops) carried the card readers, and sellers held down their investment until buyers carried the cards. That is, a situation that illustrated the opposite of the bandwagon effect arose, in which everybody waited for others to start using a product. In this manner, there have been countless interfaces designed to establish standards failed to gain users.

Standards that are not accepted by the majority are also included in the conventional usage of the term, but the value in management is trifling, except the term may be used as a means of political promotion. Therefore, standard rules/criteria that are not accepted by the majority are beyond the scope of this book. Instead, methodologies that do not fall into this undiffused situation will be the focus of this book.

3.1.7 Positive Feedback Structure During the Standardization Process

Positive feedback effects appear stronger when users increase.

Acknowledging the positive feedback effect (self-amplified effect) during the standardization process is crucial for understanding the essence of standards, especially standards as transaction interfaces. Appropriate utilization of the effect increasingly determines the success of standardization strategies. In order to achieve the establishment of an interface as a standard, not for self-complacency, an increase in users is indispensable. It generates positive feedback not only for IT-related products that have network externalities but also for any kind of general products. In this section, the positive feedback effect will be examined further by decomposing it into three aspects:

(1) Network (interface) externality effect
(2) Bandwagon effect
(3) Economies of scale (the conventional one on the production side)

The interaction mechanism of these three will then follow.

The network externality effect corresponds to the economies of scale in consuming activities (transaction) *after purchase*, the bandwagon effect corresponds to the economies of scale in consuming activities (transaction) *before purchase*, and economies of scale corresponds to the traditional economies of scale in production.[7]

The three types of positive feedback effects in standardization will be discussed in the following:

(1) Network (interface) externality effect

Network externality corresponds to the structure in which transaction costs per unit (transactions) are reduced as the numbers of users and transactions increase, thus increasing value from the network and the efficiency of transactions through the network. It increases users of the network further and shapes the positive feedback cycle. This effect has existed from the past because the increase of users provides advantages even with general products unrelated to networks; however, the effect has become conspicuous as the quantity and quality of resources from other users have increased drastically due to the spread of the Internet. In today's economy, this effect should be carefully considered in planning any kind of strategy.

(2) Bandwagon effect

Bandwagon effect refers to the mechanism where after the larger number of buyers selects a product, the followers of the buying decision increase. As a market share increases, it is more likely to shape the positive feedback to generate winner-takes-all. This behavior is based on both rational psychology and security psychology. Rational psychology, by which buyers follow the buying decision of the majority, reduces uncertain risks. And the security psychology of herding behavior generates concentration of purchase and winner-takes-all.

(3) Economies of scale (the conventional one on the production side)

Economies of scale are one of the most significant concepts of modern management. All the managerial devices such as strategy, organization, and market segmentation are aimed at improving productivity due to the economies of scale. As purchases and revenue increase, economies of scale are enhanced in every aspect of management, such as production, sales, and overhead, which leads to increased competitiveness. When sales concentrate from all over the market, the information regarding the market concentrates as well to provide a comprehensive view regarding growing customers and emerging innovations. This is significantly advantageous for strategic resource allocation (e.g., inventory, production capacity, and R&D resources). This is also contributed by the reduction of transaction costs for collecting the market information dispersed all over the world.

[7] In order to simplify the discussion and to illustrate the significance of issues, both internal and external activities are included in the "economies of scale" discussion here.

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There occurs a synergetic interaction of the three positive feedback effects as follows.

Increase of transaction volume is also critical to increase ROIs of fixed interfaces developed for reducing transaction costs. The key success factor of fixing interfaces is to increase the usage frequency, for which the increase of transaction volume is indispensable.

Surplus profits gained by the success of fixing interfaces due to the increase of transaction volume and by the improved productivity will be allocated to enhance the cost performance of products or to decrease the price for competition. Reduction of transaction costs on the supplier side provides an infinite number of strategic options to enhance the effectiveness (e.g., product development, brand image, customer support, and R&D). That is, as economies of scale are enhanced, not just cost competitiveness but as well as effectiveness will be strengthened, leading to further increase of customers and eventually strengthening the positive feedback effects.

3.1.8 Drastically Increased Significance of Standard Due to the Structural Change by the Internet

Standards correspond to products and technologies that are in the positive feedback cycle.

According to the discussion above, a standard comes to correspond to the product (including technology, service, and the supplier) that has increased the market share and eventually has dominated the market by means of the three positive feedback effects: (1) network (interface) externality effect, (2) bandwagon effect, and (3) conventional economies of scale. All those effects have been enhanced drastically due to the spread of the Internet and their synergistic interactions. In this section, the seemingly complicated phenomenon will be elaborated and summarized simply.

First, the Internet and mobile communication network has advanced in the application products and services, including home appliances, TVs, and automobiles, have increased, which share some kinds of interfaces. As a result, the network (interface) externality effect and the related positive feedback started functioning more conspicuously. In addition, platforms such as blogs, SNSs, and Twitter, which propagate reputations, have become widespread all over the world, as a result of which the bandwagon effect is enhanced much more than in the past. The Internet reduced transaction costs so that purchases from remote locations that were practically impossible before have increased. Sales accrue to only one company that supplies the product with the best cost performance. In the past, a few companies could exist in each local market, which were few enough to adjust the prices in closed communities. However, after many unknown competitors from

unfamiliar countries entered into the market, fierce battles started without concern for existing business conventions. Jack Welch, at that time chairman of General Electric (GE), announced its withdrawal from businesses that were not ranked in the top three in the world market, proposing the notion of "selection and concentration" in the 1990s. Shigenobu Nagamori, a president of Nidec, which has 80 % market share in the precision motors market, describes the current situation of the winner-takes-all by saying that No. 2 cannot earn profit at all, No. 3 goes into deficit very seriously, and No. 1 gains all the profits from the market. The consequence of the large-scale concentration of sales accelerated the speed of the companies' growth in volume. The companies that dominate others by volume also overwhelm both cost competitiveness and value added. Eventually, the conventional economies of scale and the related positive feedback started functioning astonishingly.

Synergetic interactions of the three positive feedbacks also arose; the companies with larger market share continue to thrive and expand further their market share.

The increasing significance of standards cannot be overemphasized, although it is not well acknowledged publicly. The companies that conceive this structural change, consciously or unconsciously, intensified the competition to obtain the winner-takes-all and started taking enormous risks (e.g., the price competition among online commerce companies in China). Those risk-taking actions will likely result in failure. However, there is no more chance for companies to obtain success without taking such enormous risks in the current business environment.

The three strong positive feedbacks above are theoretical; to obtain real benefits, management needs to activate and control the effects appropriately. Thus, very basic management technology distinguishes companies' performances. Some companies, even in large scale, do not acknowledge it precisely, having grown only by coincidence or luck. Those large-scale companies possibly become the prey of start-up companies and module-oriented SMEs that concentrate all their resources onto one point in a quest for the maximum utilization of economies of scale. The management technology regarding economies of scale becomes crucial given the fact that the global competition is intensified. In that case, the transaction interface needs to be focused to ensure improved efficiency.

Only network externalities appear to be related to the discussion of *standards* and focused generally. However, both the bandwagon effect and conventional economies of scale are increasing the significance as well, and all of them enhance their powers mutually and synergistically. In practice, utilizing the effects in those three axes has become strategically important.

3.2 Values of Standards

By conceiving standards as interfaces, the effects and values are easily perceived.

3.2.1 Variance in Values of Standards According to Stakeholder's Position

Values of standards vary among standard users, standard advocators, and product manufacturers.

Variance in values among stakeholders causes some confusion in the discussion of standard. Thus, a perspective to distinguish the values of the standard user's side from those of the standard advocator's (supplier's) side is proposed here. In addition, a standard is just an intangible description of an interface that needs to be corporealized by introducing products; the values also differ depending on either the advocators of the standard manufacture the product or they are just only the users.

In this section, after distinguishing the four stakeholders' positions in Table 3.1, the value of standards will be discussed for each group. Companies should select their own appropriate position strategically by comparing each value and their own capabilities.

Case 1: Values for Users of Products Complying with a Standard

This is a discussion regarding the values from the position of using a product that complies with a standard, not relating to the standardization activities, or the value in a transaction from the buyers' side. The reason why users select standard products is because network externalities, the bandwagon effect, and conventional economies of scale contribute as described in the previous chapter. As for network externalities, the transaction costs per volume of shared resource with other users decrease as users increase. As for the bandwagon effect, buying risk decreases as the decision was made by the majority and security psychology in a herd is obtained. As for economies of scale, the product selected by the largest number of users probably provides the best price, quality, and service as it was produced and sold most efficiently due to the scale effect.

Case 2: Values for Supplier Companies of Products Complying with a Standard

This is a discussion regarding the values from the position of supplying products that comply with a standard, not relating to the standardization. It is much easier to appeal to customers when the specification of the products is already well known and accepted. Users prefer standard products as described above in Case 1, and a certain amount of revenue is promised for the suppliers as long as their products comply with the standard. However, fierce price competition possibly arises as the product is a commodity—that is, the interface is also open to the competitors. In the case that a high license fee for using the interface is charged by the interface owner, the number of competitors is smaller, but the profit becomes less favorable.

Table 3.1 Positions of standard stakeholders

Value for users of standard		Value for advocators of standard	
Value for users of product	Value for product manufacturers		Value for advocators who do not supply a product
Case 1: Only use of a product	Case 2: Only supply of a product	Case 3: Use of both a standard and a product	Case 4: Only supply of a standard

Case 3: Values for Companies Both Advocating Standards and Supplying the Products Complying with the Standards

It is overwhelmingly advantageous to standardize an interface and supply the product complying with the standard. Microsoft, which has standardized Windows OS, is a typical example. In that case, it is possible to apply the standardized interface to various products. For example, Microsoft developed Office software and other products on the OS to dominate all the markets and standardize all the products successfully as well.

In order to standardize an interface, products complying with the interface should flood the market, which is benefited by cooperation from other suppliers. In that case, because the supply of the product from the advocator (owner) of the standardized interface is competitively most advantageous, other suppliers are likely to hesitate to enter the competition by adopting the interface, as a result of which the suppliers do not increase in number. Therefore, the advocators of standardized interfaces tend to focus on the standardization, not committing to the supplies of the products. Case 4 below is the case in which the suppliers of the products complying with and applying the standards differ from the advocators.

Case 4: Values for Companies Advocating Standards, Not Supplying the Products Complying with the Standards

If a company's interface becomes a standard, a large volume of sales and profit is expected as users acknowledge the value as described in Case 1. However, an enormous number of companies intensify the price and quality competitions in a quest for standards these days, finally reaching to the business models of zero-price, as a result of which the high profitability is no longer expected. In this situation, the advocators become likely to disregard the supplies of products and focus on standardization by increasing their allies.

3.2.2 Values for Standard Advocators Besides Direct Revenues

The advocators need to prepare for increasing fierce competition pursuing values besides direct revenues.

Many companies start setting their prices at zero, offering free services such as shipping, reducing delivery time, or increasing quality of products with the same price as competition intensifies. In that manner, only small profit can be expected. In order to make businesses sustainable, the advocators need to recognize and utilize values from the standards besides direct revenues. It will be explored in detail here by subclassifying *Case 4: Values for companies advocating standards,*

not supplying the products complying with the standards in the previous section further into two cases: *direct quantitative value* and *indirect qualitative value*, where shaded cells indicate the values obtained without regard to the prices of standards, the utilization of which is increasing the significance, and white cells indicate the values from selling standard products, which are decreasing these days. These have been utilized actively by the currently expanding business models of zero-price, the cases of which will be illustrated in Sect. 3.5.2 in detail. In this section, only the fundamental concept will be discussed.

(1) Value from network externality of a standardized interface

If it is charged for the uses of standardized interfaces to the users, direct revenue is expected (the white cell of Fig. 3.1), but it has been decreasing drastically due to fierce price competition. It is significant to focus on other values from utilizing standardized interfaces. As standardized interfaces are shared by the majority, people are interconnecting and cooperating through the interfaces and the network externality functions. This network of people benefits recruiting engineers and developing partners, not only for introductions but also for personal profile information collections. Through the establishment of standards, expertise and information must have been accumulated to overcome other competitors, all of which must be fully applied to expand businesses. This will also lead to "first-mover advantages." Above all, the largest value of standards for advocators is obtained from transaction interfaces established with customers, which include information on both transaction parties such as specifications, trust, and methods of access, delivery, and payment. In practice, the resources such as accumulation of customers' data, brand awareness, popularity of products, and opportunities for cross-selling can be utilized for attracting customers and launching other related businesses. It will contribute to the promotion of the products related to the standardized interface, such as education and training, consulting services, live-actions (e.g., speeches, lectures, book-writing, and concerts), item-based payments on online games, and brand/character goods business.

(2) Value from the bandwagon effect due to the dominant market share

As dominant market share and consequent brand awareness attract a large number of customers by the bandwagon effect, it will benefit activities of advertisements and sales promotions (for own and others' products) especially in consumer markets. Another consequence of dominant market share is establishment of trust in the market, which leads to procuring resources such as recruiting and funding. Market and customer information, especially regarding growing companies and areas, will be collected overwhelmingly from the dominated market and applied to new product developments and marketing strategy formation. Companies with major market shares have relied on advertisement revenues thus far, but they should consider diversifying revenue sources early or late.

(3) Increasing value of products by the conventional economies of scale

Increasing the volume of sales and production will lead to various opportunities for reducing direct and indirect costs. The former is the narrow definition of *economies of scale* and the latter is the broader definition, which is

<table>
<tr><th>Dimension</th><th colspan="2">Direct Qualitative Value</th><th>Indirect Qualitative Value</th></tr>
<tr><td rowspan="3">Interface
(Value from network externality of standardized interface)</td><td colspan="2">-Revenue from standard products (decreasing drastically)</td><td>-Personal network (with recruits and partners)</td></tr>
<tr><td colspan="2" rowspan="2">-Revenue from related businesses
-Reduction (distribution) in promotion costs</td><td>-Accumulated expertise regarding related businesses (including first mover advantages)
-Attracting people for advertising businesses</td></tr>
<tr><td>Market Share
(Value from bandwagon effect)</td><td>-Brand awareness (for customers)
-Comprehensive information regarding the market</td></tr>
<tr><td rowspan="2">Product Competitiveness
(Value from conventional economies of scale)</td><td>Reduction in Direct Cost*</td><td>-Reduction in all direct costs of the standard product</td><td>———————</td></tr>
<tr><td>Reduction in Indirect Cost*</td><td>-Reduction in indirect costs of related businesses</td><td>-Enhancing product competitiveness and service levels such as market database</td></tr>
</table>

* Reductions are applied to the costs per unit

Areas in which the value increases by active utilization of standards

Fig. 3.1 Values of standards for advocators or owners of standards

frequently called *economies of scope*. As to direct cost reduction, bargaining power for parts and materials will increase. As to indirect cost reduction, all overhead costs (e.g., general affairs, personnel, finance, accounting, and IT) allocated to each product will decrease as long as economies of scale in the overhead activities are controlled to function appropriately. For example, if the market and customer information is archived in a database and utilized by all departments, the allocated cost decreases while the strategic value increases enormously.

(4) Other means to utilize value from standards

Probably the first idea occurring to anybody regarding other means to utilize value from standards is the shift from an advocators' position (the position of *Case 4: advocating a standard without supplying a related product*) to a suppliers' position (the position of Case 3: *advocating a standard and supplying related products at the same time*) after the success of standardization—that is, to start the supply of products complying with the standard after the standardization is achieved. This seems most advantageous to utilize a standard, but it means swindling the partners who trusted in and cooperated with the standardization by investing in their product developments, a consequence of which is losing trust from the society.

The most recent anti-example is Google's entry to the tablet PC market (e.g., Nexus 7 and 10, which are outsourced to ASUS) and to the mobile phone market (Nexus 4) by acquiring the mobile phone division from Motorola after the successful standardization of Android OS, which impacted all the manufacturers that adopted the OS from Google.

Google must have had appealed to those companies to adopt their OS to make it prevail. The selection of a standard is crucial to any manufacturer because its fate will be shared with the standard. Standard advocators should obtain assurance from the potential partners that they will never compete with them. In this case, however, the following three points should be considered carefully.

First, the OS that Google developed is distributed as open source software. Open source software is licensed for free use for anybody and basically not proprietary. That is, it can be conceived that the manufacturers used it just arbitrarily with or without trust in Google.

Second, the Google brand comprises a threat to the competitors not as the developer of the OS but as a popular consumer brand obtained from its global services. That is, the use of the brand as an advocator or an owner of a standard is unethical, but it is conceived that this is not the case.

Third, the standard competition has been intensifying to proceed beyond free software to free hardware, and the competition with hardware manufacturers has received little consideration. Google, Amazon, and Rakuten are selling their tablet computers below cost in order to acquire the standard position. Amazon even paid the 3G data telecommunication fee for some models of Kindle Fire. That is because the standardization of its hardware will lead to the standardization of the application and content marketplace. It is impossible to participate in such competition for companies that manufacture only hardware. As the competition between Google and the manufacturers is conceived over, the conventional ethics is conceived to apply no more to this case.

Applications and content are more profitable than hardware, but free software dominates the market increasingly and even content is offered for free. One thing one can say is that the competition for standardization has become so intensified that the common knowledge of the past is no longer relevant.

3.3 Design Methodology, Cost, and ROI of Standards

The design methodology of standards corresponds to that of interfaces.

The development of interfaces in markets or in companies without being enforced/promoted and utilized appropriately is valueless. Because the methodology of designing, developing, operating, and utilizing standards is identical to the one of interfaces, it will be discussed in Chap. 6, collectively. The subjects include design methodologies of standards, capability development of designers, costs and ROI of standardization, barriers and solution to standardization, and objections to standardization and counterplans.

3.4 Closed Standards and Open Standards (Level of Openness of Standards)

There are closed and open standards, and there are different levels of the openness.

3.4.1 Opening Property Rights of Standards

Opening of property rights corresponds to decreasing the use fee of standards.

3.4.1.1 Value of Opening Property Rights of Standards

As the establishment of standards in markets leads to enormous profits, many companies, organizations, and governments have been competing to obtain them. In order to achieve the goal cooperatively, alliances, such as the open source initiative, have become popular. As described previously, the prices are decreasing frequently to zero. Decreasing the use fee of interfaces corresponds to opening the property right of the interfaces. If property rights become open to the public, users increase in number. The more open property rights, the more users increase so that it becomes closer to the standard position. There is also a philosophy that the property right of software should be open to the public, and programmers increasingly follow the philosophy. However, when the right is opened, the use fee for the right is lost. In contrast, if the owner is so confident with the value of the interface and believes users will increase without opening the right, it could be possible to retain the ownership of the property right.

The property right of a standard to a varying degree becomes open to the public to obtain users, and the significance of the openness will be discussed in this section.

3.4.1.2 Closed Standard

If ownership of a standard is possessed by one or multiple parties proprietarily and it is not available to public, the standard is perceived as "closed." Following the miracle success of the standard products by Microsoft, many companies have tried to standardize their products and technologies, keeping the property right very closed up until the early 1990s. Some companies such as Adobe, Oracle, Cisco Systems, and SAP have reached to or nearly reached to the position through the fierce competition.

3.4.1.3 Open Standard

A standard of which the property right is available to the public is "open." However, the degree of *openness* of property rights varies. First of all, a property right is a complicated collection of various rights. In addition, there are various levels for each right, from completely free to any party to very expensive licensing with much additional enforcement (e.g., tie-in sales) that may violate the antitrust laws. The company that adopted the open strategy first to compete with the strongest closed

standard was Sun Microsystems. The company introduced an interface of a computer language, JAVA, to compete with Windows, setting the price reasonably low. The reason it could not break the wall was because it charged even a small license fee, and Sun Microsystems supplied not only the standard but also the products complying with it. Other companies hesitated to adopt the interface, fearing the relative competitive advantage of the standard owner. It was conceived as a bold, unique strategy at that time, but it may be considered not open enough today. Incidentally, the company's closeness in which it adhered to in-house development of the OS and in-house manufacturing of the CPU was widely known. In its difficult times afterward, it decided to release the JAVA interface as open source, which was too late. It was acquired by Oracle and disappeared eventually.

The proprietary property right of an interface that became a standard by selection of users is called a "de facto standard". In contrast, when it is owned by a government, it is called a "de jure standard". The de jure standards are developed for public purposes and the property rights are available to the public equally and fairly.

3.4.1.4 Degree of Openness

The levels and types of opening of property rights vary, and the example of software, which is a complicated aggregation of property rights, will be examined here. Originally, a property right is an aggregation of various rights, and the pieces are separated and conceded to others for compensation. The property right of software is copyright generally, and copyright holders decide to separate various pieces for profit. Free or charged, and the amount if charged are the factors to determine the degree of openness.

(1) Rights of use: Rights of use are generally charged by software businesses. In order to increase users (market share), software is likely to be offered for free, limited to some of the product functions and/or for nonprofit purposes, and the users are charged only for special functions and/or profit purposes.
(2) Rights of sales: Rights of sales are provided to many or few resellers, depending on distribution strategy, which is also frequently related to the standardization strategy. The degree of openness to confidential information regarding products determines the degree of the openness as well.
(3) Rights of modification: This is a right not only to use but also to modify acquired software. This degree of openness influences the degree of openness considerably as well as the rights of reproduction and redistribution.
(4) Rights of redistribution: As the purposes of redistribution of software are sales or free reuse by others, the rights of redistribution corresponds to rights of sales and reuse.
(5) Rights of reproduction: As software is reproduced only for the purposes of redistribution and reuse by others, the right of reproduction corresponds to rights of redistribution and reuse, essentially.
(6) Copyright: Copyright is opened only in the special occasion of "public domain," in which the use and redistribution are available to the public.

However, rights of publicity (the right to claim the presentation of the creator's name[8]) are conventionally respected.

In this manner, to open the property right, the significant strategy in today's business environment, is much more complicated than it seems, which is legally granted after multiple transactions of contracts regarding various rights.

Incidentally, it is popularly accepted to make exceptions of the programs to be open that are protected with patents, even when the property right of the software is opened.

3.4.2 Examples of Reducing Transaction Costs by Opening Property Rights

Examples of reducing transaction costs by opening property rights have been increasing these days.

3.4.2.1 Open Source

Transaction corresponds to transfer of property rights.[9] The example of intellectual property such as software programs that incur an enormous amount of transaction costs relating to presentation and negotiation shows the complexity of transferring property rights. The open source initiative simplified the complicated transactions of intellectual property rights drastically and reduced the transaction costs as described in Chap. 1. It impacted various areas of the society, and the idea has been spreading globally.

The stronghold of Microsoft, which established the strongest standards in history, became disrupted by an assemblage of software with open property rights such as open source. The core of the power is Linux (an OS), which was developed as a product adopting the interface specifications of UNIX, widely spread before. Because the specification is not a program, it is not protected by copyright. In addition to Linux, many peripheral software programs are provided for free. Usually open source programs are deployed in the core parts of systems out of visual scope of regular consumers, and therefore these are not easily acknowledged but are widely spread as the foundation of the society.

As the open source initiative distributed software for free *as a matter of fact*, no negotiation or agreement arose regarding prices, specifications or other transaction conditions, and monitoring the contract. This new interface drastically reduced transaction costs of distribution, reuse, and utilization, and as a consequence it has spread open source software to the worldwide market in an extremely short time.

[8] Rights of publicity or personality rights are more complicated, to be precise, but the detail is omitted here as it is not closely related to the subject.

[9] As to rental and lease, these are transfers of only the rights of use, not involving rights of sales and disposition.

In the open source community, the specifications of the developed programs are shared in a database with participants of projects, and bugs and latest versions of programs are easily tracked through a sophisticatedly standardized management system, which has reduced the costs of searching and presentation of programs. In addition, many other platforms have been established to assist an enormous number of project participants living all over the world to reduce transaction costs for collaboration.

Regarding simplified transfer of property rights for reduction of transaction costs, it is also possible for large companies. The largest software developer, Microsoft, has developed a huge number of excellent software products internally. However, the simplification of transferring property rights internally has been limited to few transaction elements such as contracting and pricing, as long as the individual employees seek for personal profit. Therefore, the impact has been much less than that of the open source initiative, which aimed to open nearly all the property rights.

3.4.2.2 Creative Commons

The success of the open source initiative influenced a wide range of activities beyond software. Basically, the property rights in all the creative industries are intricately intertwined. The transaction (transfer of property rights) is so complicated that the utilization is severely obstructed. A simply organized system of intellectual property rights for creative works (e.g., documents, movies, music, and pictures) is the "creative commons" license, which was developed by Prof. Lawrence Lessig of Stanford Law School and other professionals in cyber law and intellectual property. There are many property right holders related to reuse of past productions (e.g., directors, scriptwriters, producers, and actors, in the case of movies). Because those rights are not explicitly designated, transactions of transferring the property rights are so complicated that the reuse is practically impossible. In order to promote the transactions for use and reuse, those four rights are required for creators to designate copyright as either open or closed:

(1) Noticing attribution (copyright holder's name) or not
(2) Allowing commercial use or not
(3) Allowing derivative works or not
(4) Requiring the same or similar license as the original or not

Eleven patterns of these combinations are standardized, and creators select one to designate their intention to claim the property rights. Lessig intended that the open source philosophy be expanded beyond software to the wider range of creative works to further promote the culture in the world. In that manner, it has produced friction with the existing content holders who received the full business benefits from the huge vested property rights.

3.4.2.3 Open Courseware

Massachusetts Institute of Technology (MIT) launched the open courseware initiative in 2002 inspired by the success of the open source initiative, according to the then-president's comment on its website. Historically, universities and academic

societies have established various open platforms for transactions of knowledge, as the consequence of which they have successfully reigned supreme over the intellectual industries. Systems and conventions that have embodied the mutual utilization of free intellectual property are well established all over the world, such as academic conferences and accommodating rules of researchers. In addition, libraries had been the largest repositories of knowledge on which transactions of knowledge have been executed. Originally, research outcomes were managed in the manner of open source software, and open courseware is an initiative to expand it to courseware materials (e.g., lecturer notes and lecture videos).

All the competitiveness of universities is inevitably threatened by the Internet, and it encourages the initiative as well.

MIT positioned the open courseware initiative as a core strategy of its eLearning program. If the institution successfully standardizes its platform, even if it does not bring in revenue, it can establish a strong brand in the higher education market of the world. It will enhance MIT's market leadership, even in offline education and other related businesses. This is an illustrative example of standard strategies described previously. Incidentally, the creative commons license is adopted for the open courseware.

China, which acknowledges its backwardness in higher education, has utilized the platform actively and translated the contents nationwide. Japanese universities also participated and provided their courseware contents to the initiative for free.

3.4.2.4 Open Innovation

Open innovation is a corporate R&D strategy to utilize others' resources and outcomes actively, instead of adhering to their own, as described in Chap. 1. Conventionally, R&D departments have not been interested in utilizing other resources, technologies, and ideas, an attitude criticized as the "not-invented-here syndrome". Therefore, they are unwilling to exchange them as well. However, if utilization of those resources is well managed, it will encourage innovation obviously. The transaction costs for exchanging intellectual property have been the barrier; various approaches have been explored, including open source and creative commons.

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As discussed in this section, intellectual property has been becoming more open; prices have been decreasing, sometimes to zero. Standardization becomes critical in business and intellectual properties should be open to increase the market share. In this scenario, knowledge is distributed free and loses value. At the same time, wisdom (i.e., information processing and creating capabilities) is increasing the significance relatively. To be more precise, it is the ability of decomposing and reorganizing information for extraction of essences and creation of applications. It will put the people with the capabilities of rote memory and pattern recognition (and usually with vested rights) in trouble. In contrast, it will provide great

opportunities for many young entrepreneurs. The opening of intellectual property may be the most significant aspect of the information revolution.

3.5 De Facto Standard Strategy

De facto standard strategy as marketing strategy also needs the perspectives of standardization.

3.5.1 Enhancing Comprehension of Standards for Forming Effective Strategies

De facto standard strategy works only with precise comprehension of standards.

As a standard is a common affair, everybody has an opinion according to his/her experience and knowledge. However, structural comprehension of a standard cannot be achieved so easily, and the related argument is usually confused due to the difference of perceptions among the arguers. It inevitably obstructs the appropriate utilization of the standard.

As an illustrative example of standard strategy, the certificate and license business is considered here. There are a huge number of certificates and licenses, including accountants and pet trimmers, all of which require certificate examinations. If a certificate becomes a standard in the market, examination, education, and publication will become extremely profitable, promoted by the brand of the certificate authority. However, misunderstandings frequently occur:

– "A certificate is a standard, and therefore it makes huge profits."
– "There already exists a company issuing the certificate, and therefore it is impossible to enter the market."
– "The certificate business cannot be successful without an official approval from the government."

First of all, a certificate is not yet a standard just because it exists. Only after the positive feedback cycle starts functioning and increases the market share automatically can it be called a standard. However, huge investment is indispensable to reaching this position. Many companies launched the business and failed due to these kinds of misunderstandings. In contrast, even if competitors exist in the certificate business markets, whether the positive feedback cycle is already shaped or not and whether they are possibly caught up should be prudently considered. It is not impossible to overtake the antecedent competitors with an appropriate strategy and sufficient resources.

Although governmental approval will enhance the business' competitiveness, it is costly as well and even restricts the flexibility of the business. It should be judged considering the pros and cons of the consequent influences on the positive feedback. It is not always an indispensable factor to shape the cycle.

In this manner, the success of standardization necessitates an appropriate strategy. The de facto standard strategy has been increasingly significant in the global market. In the global business environment where all profits of the market are concentrated on only one company, global strategy corresponds to the de facto standard strategy. And even within companies as well, enhancing comprehension of standards among related individuals is crucial for the achievement of standardization.

3.5.2 Accelerated Spread of the Zero-Price Business Model

The essence of the zero-price business model corresponds to the utilization of values from standardization.

Various zero-price business models have appeared that utilize the value of standards more actively than revenue business models do. The fact should be noted that the value increases in an accelerated way due to structural changes in the global market.

In Chap. 1, several zero-price business models that have been expanding were introduced, such as Google (the search engine, the e-mail, the calendar, the online memo, the maps, the office software, YouTube, the directory service, and so forth), entertainment content, SNSs, social network games, photo-sharing services, cloud computing (Dropbox, SkyDrive, Evernote, and so forth), free WiFi connection services, and application software for mobile phones.

All those are essentially identical with the conventional promotion models existing from the past—that is, the acquisition of (A) present customers and (B) future customers by executing transactions of zero-price goods or services:

(A) Present customers: it promotes sales (transaction) directly to the visitors attracted by zero-price transactions.
(B) Future customers: it promotes sales (transaction) in the future to the visitors attracted by zero-price transactions by strengthening awareness of the company and archiving the customer information in the company's database.

The sales promotion by zero-price business models is classified into two types:

(1) Promotion of own products: Products are sold free or below cost (the incurred cost is regarded as sales promotion cost).
    (a) Free samples: Most cloud computing services are offered free to consumers and charged to business customers (e.g., Gmail, Dropbox, and Evernote). Personal file sharing services across PCs were started by Dropbox and are expanding to SugarSync, SkyDrive, Box, and so forth. As a consequence of the competition, the free data volume offered by those companies is increasing. A large portion of application software and entertainment content for mobile phones is also distributed free. Free samples for promotion have been known in the past, especially in the cosmetics industry, where variable costs are relatively small compared with fixed costs of brand development, and the pharmaceutical industry, where reproduction costs

are relatively small compared with R&D costs. The recent free samples especially in the IT and mobile phone industries have increased the scale considerably in comparison with the past. With the entertainment-related products, where the winner-takes-all phenomenon tends to arise, the competition is likely to intensify.

(b) Bargain goods (prices are below cost): Groupon is an online service to distribute coupons to purchase goods and services with special bargain prices (or zero-price). Merchandisers and servicers derive benefits from the large-scale advertising on the Internet even if they distribute them free. Actually, the lower price is better for obtaining attention. The promotion methodologies of bargain goods and coupons have been utilized by merchandisers regularly from the past. For example, hamburger chains are earning profits by cross-selling and up-selling to the customers who visit for products below cost (or zero-price).

(c) Item-based payments (micro-transactions) on online games: Online game services or software is offered free, while the items such as avatars needed for advanced gameplay are charged. This business model is identical with the past MRO (maintenance, repair, and operations) business model used for printers, photocopiers, disposable razors, elevators, and water purifiers, which earn profits from MRO selling the main products without profit.

(2) Promotion of customers' products: Customers' products are promoted to potential customers attracted by free services.

(a) Advertisement revenue models: Online services such as Google, Yahoo, and Facebook earn profits from advertisements. TV, radio, newspapers, and magazines have adopted the identical business model from the past in which contents are provided free or with low prices. Retailers and servicers also have been providing free events (e.g., music concerts and arcade live shows) for collecting customers. Free WiFi connections have obtained popularity as promotional means these days.

(b) Sales representatives: Online affiliate programs offer sales representation businesses with a commission fee of up to 30 %. It is possible to earn considerable profits by providing content for free as long as it attracts people.

As described above, the online zero-price business model is identical with the models from the past. The only difference is that the costs have decreased drastically, while the effects have increased enormously.

The reason why sales promotion by the zero-price business model became so popular is because reproduction costs and transaction costs have decreased greatly. In the past, those two marginal (additional) costs were so large that distribution of free samples incurred unpractical costs. In contrast, as the marginal cost and the transaction costs of digital contents becomes nearly zero, the increase of scale never increases the cost, enabling large-scale and effective sales promotions.

Fiercer competition among free products and services is expected hereafter, and in that case, the reduction of transaction costs incurred by customers will be the point of the competition. In other words, the enhancement of transaction functions

such as attracting customers' glances, appealing products, and leading to purchases effectively will become significant for the competitive advantage. Servicers also need to bear transaction costs for customers; they are already offering free online shipping. This new type of competition will be expanding at an accelerated pace.

The effect of the zero-price business model has increased as well. Because the positive feedback effects strengthen in the Internet markets, the effect of attracting the power of visitors and consequent concentration of revenues has increased greatly.

As a result of the fiercer competition, prices may go below zero to minus; that is, customers may get paid (or gifts) with deliveries of free products. As cross-sell revenues could be calculated precisely, the total discounts of prices (the total cost of sales promotions) that would maximize the profit can be estimated. For example, if 20,000 customers out of 100,000 who received free products are known to make cross-sell purchases, the minus price (the amount paid to the visitors) can be calculated backward from the required total profit and the sales promotion budget. The difference between zero-price hamburgers and minus-price hamburgers is only the increase of the amount of total sales promotion cost. Both are below cost. The impact of minus price on sales promotions must be much larger when the price is minus. Actually, a US time-share resort condo agency paid approximately $100 cash to Japanese prospects at their sales promotion event.

The zero-price business model may appear to be just an independent sales promotion methodology without any relation to standardization. However, a company cannot survive if the competitor obtains the standard position with all the positive feedback effects. The standardization became much easier to start then; the adoption of the zero-price business model as an easy sales promotion without profound consideration of standardization is likely to fail in the longer term. The strategic target should be the accomplishment of the positive feedback and the consequent standardization.

3.5.3 Summary of the De Facto Standard Strategy

Superficial comprehension and incomplete strategies fail easily.

The business models with free services and advertisement revenues such as Google have been effective thus far. Free samples have been able to attract a large number of customers. However, the direct advertisement market may reach to the saturation point someday in the future, and the effect of zero-prices may weaken when those become common.

The superficial comprehension that free products and services must generate advertisement revenues and cross-sell revenues, hopefully embodying standardization, is dangerous and too easy. It must be difficult to survive the fierce competition of zero-price business models with such a superficial strategy. Hereinafter, the various strategies to utilize obtained major market shares and consequent standards should be carefully considered, besides the present dependence on

advertisement. The positive feedback effects must be pursued not only with advertisement and sales promotion but also in all aspects of management. In this section, all the discussion in this chapter is summarized.

In order to standardize a company's products, the increase of the market share sufficient to shape the positive feedback cycle is indispensable. The following three cycles should be managed carefully.

(1) Utilizing the network externality effect on a company's interface

As the network externality (interface externality) effect is strengthening with the growth of networks, the increase of a company's market share and the consequent spread of its interface are crucial. The following actions should be carefully taken with interfaces.

(a) Appropriate design: In order to increase users, the interface should be designed so that the application ranges and the user satisfaction become maximized. Targeting too wide a range may decrease the satisfaction level of users, while a too narrow range may limit the spread of the interface. This balancing will be discussed in Chap. 6.

(b) Opening intellectual property rights: Users increase by opening the intellectual property of an interface. Opening of intellectual property rights will obviously be affected by the prices; that is, as prices are lower, the rights are more open and the users increase in number. In contrast, the revenue will decrease and the strategy to make earnings by utilizing the major market share instead is indispensable.

(2) Utilizing the bandwagon effect

The bandwagon effect, in which customers follow the purchase decision made by the majority, will decrease the transaction costs (searching transactors and information gathering) at the customers. The recent spread of reputation information available through the Internet increasingly enhances this bandwagon effect more than before. In order to utilize this effect appropriately, information provision through SNSs and Webs and response to increasing malicious negative postings should be carefully executed.

(3) Utilizing the economies of scale effect for the enhancements of cost and value-added competitiveness

Economies of scale improve efficiency, as a result of which surplus resources can be allocated for increasing value added or effectiveness. This increases the sales cyclically. Hereinafter, economies of scale should be pursued in all aspects of management more seriously than before.

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(1) and (2) above are related to economies of scale on consuming activities on the consumer side. The significance has increased drastically with potential users' explosive increase in number initiated by the reduction of transaction costs.

Although (3) classical *economies of scale* on the producer side have been continuously significant as the key issue of management, there occurs a structural

change. The accomplishment of economies of scale on hardware (e.g., material and equipment) in production becomes inefficient as it is reaching to the limit, while the methodologies to deal with economies of scale in transactions (creative activities, in particular) have just started being available. That is, the pursuit of economies of scale in organizations by focusing on interfaces (the methodology of designing and operating fixed interfaces) has become significant for the first time.

In particular, a modular strategy embodies economies of scale in hardware, software, and organization consistently, in spite of its remarkable applicability to the diversified needs. It has become indispensable in the new open global economy.

In the next chapter, this modular strategy will be examined.

Module and Interface

4

Modularity is a structure defined by interfaces. It greatly improves resource efficiency.

4.1 What Is Modularity?

The concept of modularity is very profound.

4.1.1 The Arguments About Modularity in Academia and Its Background

Why does the argument continue?

The goal of this chapter is to analyze and to deepen comprehension of a notion of modularity from the perspective of interfaces. It will show how the design and management methodologies of modules become established by clarifying that modularity is a structure defined by interfaces and by applying the design and management methodologies of interfaces.

Higher efficiency of modular structure has received widespread attentions in the fields of design and production of products/parts and programming. Modular design has been deemed as a promising methodology to develop products adaptive to more complicated market demands with more agility and lower cost.

Utilization of modular structure was advanced first in the computer industry. Before the concept of modularity spread out, computer manufacturers like IBM produced every component in-house, such as the OS, CPU, printer, application software, and network. The business model is called *closed vertical integration,* in which most transactions are executed only in a company or among group companies. This is also called "insourcing oriented policy" or "not-invented-here syndrome." However, when IBM entered into the PC business responding to the market needs, it converted its policy to outsourcing components, such as the OS to

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
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Microsoft and the CPU to Intel. It is generally known that this revitalized the industry, and IBM pioneered the global conversion to the new industrial structure of modularity. The structure has spread to other industries gradually and steadily and continues changing business models globally. Consequently, arguments about the potential for applications of the concept arose.

In today's PC industry, products are likely to be composed of standardized parts and software procured beyond group companies. Modular design has progressed, especially in the Internet era. Underneath the surface of the digital world, modularization has penetrated into every field, far more than generally recognized. After the PC, it has spread from DVDs, mobile phones, flat-screen TVs, and household appliances through semiconductors and various products, one after the other.

Regarding reusability of resources as an advantage of modularity, computer programs that do not need adjustments for assembling or physical transportation are obviously more favorable than mechanical products/parts. However, modularization has become pervasive even in areas of mechanical products/parts.

The aviation industry standardized interfaces of jet engines for the Boeing 787, and a new entry of jet engine manufacturers besides Rolls-Royce and GE is expected to provoke innovations in the stagnant technologies and performances.

At the time of writing this chapter, not a single day passes by without newspaper articles mentioning about the modularization happening in the automotive industry. It has been reported that the modular structure will certainly spread more when it shifts to electric. In China, because gasoline supply and demand is expected to become imbalanced more seriously and the nation is also watching for an opportunity to obtain the number-one position in the next-generation automotive industry, electric vehicles will presumably become mainstream. In order to decrease present prices for faster market penetration, modularization is considered a key success factor.

It has been said in the automotive industry for a long time that the modular structure was inappropriate to manufacture excellent products with perfect performance such as ride comforts. Even there, however, modularization has progressed rapidly in companies such as Volkswagen. Volkswagen leaped out of its stagnation over a period of years and caught up with Toyota and other companies with a momentum to dominate the world automotive market. The Renault/Nissan group follows the strategy successfully with aggressiveness as strong as Volkswagen's. No suspicion regarding the consequences of their modularization can be observed in the group. The wave that began with IT-related products and propagated to electronic products such as semiconductors, mobile phones, and home electric appliances has finally reached mechanical products.

A business model in which processes are distributed and parts are outsourced to various suppliers beyond company groups is called *horizontal division (of functions)*. As business relationships of companies extend across borders in the global economy, it is also called *global horizontal division*. Relationships of companies also become modularly structured in synchronization with products/parts. Accordingly, the term *modularity* has referred to relationships of companies.

4.1.2 Intuitive Comprehension of Modularity

There is no established theory of modularity.

4.1.2.1 Widely Accepted Perceptions

Although scholars have not reached a consensus on the definition of *modularity*, they generally agree on the following:

- The application of modularity is easy and effective in digital (electronic) industries, but difficult in analog (mechanical) industries.
- Modularity is conspicuously seen in innovation-intensive industries such as those in Silicon Valley.
- Modularity contrasts with the craftsman manufacturing practices that were responsible for the past success of Japan and that are still being emphasized even in Japanese electronic industries.
- Modularity weakens the past strengths of companies and undermines the vested power.
- It undermines existing competencies and strengths of companies thus resulting in radical changes in the vested power of industries.
- It has led to the decline of industries in developed countries and enabled the rise of industries in developing countries that have adopted and applied it.
- Companies and individuals in existing structures need to accept the conversion of their mindsets.

While academia agrees that modularity will bring about large-scale innovation, opinions vary regarding what is modular and what is not. To provide contexts for an analysis of modularity, academic discussions in economics and management science will be reviewed next.

There are two commonly used definitions of modules:

(1) Units that are relatively tightly and coherently connected inside and relatively loosely and weakly outside
(2) Quasi-independent units sharing multiple interfaces to order, interact, integrate, and combine

Even in the most accepted definitions, the important keywords (*tight or loose connections*) are qualified by *relatively,* the result of which is that the term *modularity* is still shrouded with ambiguity, and it is not clear how modularity should be identified. Melissa Schilling, a professor at New York University Business School, a leading expert of the modularity study, generalized all previous studies by saying that almost all systems are recognized "to some extent" as modular,[1] admitting that all systems are modular but the characteristics are unknown. Definition (1) also has apparent contradictions in that a unit is no longer modular when the inside becomes modularly structured. The definition denies all the attempts to modularize the inside.

[1] Schilling, M. A. (2000), "Toward a general modular systems theory and its application to interfirm product modularity," *Academy of Management Review*, Vol. 25, No. 2, pp. 312–334.

The comprehension of modularity is so difficult that an established theory or an explicit definition does not exist, but it is obvious that this situation hinders planning, implementation, and the effective utilization of modules in practice. We need to check examples of modules in businesses to recognize the facts and deepen our intuitive understanding before discussing the precise definition.

4.1.2.2 Most Common Examples of Modules

As described in the beginning of this chapter, the modular structure has been deployed aggressively in PCs and electronic devices so that the products are manufactured easily only by assembling components. The PC manufacturers deployed outsourcing of CPUs and OSs from the start and procured parts actively from foreign countries such as Taiwan. The contracted Taiwanese manufacturers pushed forward standardization of the PC parts, including the design and production of motherboards, and as a result, modularization has advanced.

In many semiconductor products, special processing functions such as analog data processing, graphic data processing, and telecommunication processing are provided by modules, and these functions are subdivided further into modules of the circuitry design diagram called the *intellectual property (IP) core* for the distribution. User companies purchase the IP modules separately, integrate them to make a circuit diagram, and provide it to the foundries. In Taiwan, this foundry business has been very successful since the 1990s. Taking this opportunity, modular manufacturing (e.g., of PCs, game machines, printers, mobile phones, bicycles, automobiles) has been promoted as a national strategy of Taiwan, which has led to the current success of the state.

An OS is a platform module—that is, an aggregate of the operating functions of the CPU, hard disk, DVD, network communication, and so forth, which all the application programs use frequently. Only frequently used functions are collected into one OS module, so that the same function no longer needs to be developed redundantly for each application program. Customizing these functions for every application program might be effective for miniaturization or speeding up processing, but modularization is a superior design philosophy from the perspective of efficiencies of development. As a result, this modular structure brought lower prices, extensions of product lines, technical innovations, and, as a result, the historic growth of the industry.

In the area of software development, a type of modularization called *object orientation* is of considerable interest. Because the reproduction costs in programming are nearly zero, the effect of cost reductions by reuse is substantial. As the reuse incurs only transaction costs, technologies to reduce the transaction costs have been investigated for a long time. Various interfaces between programs and between programmers have been built for each of the five transaction elements of *connection*, *presentation*, *negotiation/agreement*, *exchange,* and *ex post processing* to assure reusability. Structural frameworks of aggregates of these interfaces are called *architectures*, and it has been recognized that the success of a software product greatly depends on the capabilities of the architects in charge of the design.

It is significant that the last position of Bill Gates at Microsoft was chief architect. Architectures will be discussed further in Chap. 6.

Cloud computing, in which every demand of every client is processed by only one system on the network, has taken root in the market these days. It is essential for the sake of efficiency to respond to all those diversified demands only by a combination of modules instead of the conventional development customized for each client. This requires the architects' exceptional intelligence to design the overall modular architecture, precisely taking into account the trends of all their users in the global markets from the present to the future.

Applications for smartphones are much easier and quicker to develop than those of PCs, as the object-oriented approach (modularity) has been adopted so thoroughly that the frequently used functions are provided as modules in large quantities.

All organizations assume a modular structure without exception because the respective sub-organizations (departments) are supposed to carry out their tasks independently to some extent. If all departments make decisions independently (only by complying with fixed interfaces), then coordination between departments is unnecessary and the transaction costs are largely reduced. In reality, however, various activities are adjusted between departments depending on conditions and occasions on an ad hoc basis (ad hoc interfaces). Coordination for determining the ad hoc interfaces is indispensable if fixed interfaces are not well prepared and the organization is not accurately structured, causing too many coordination meetings in a company, such as coordination meetings between production and sales departments. The immaturity of the modular structure of organizations correlates significantly with the number of meetings, according to our research shown in Chap. 8. The amount of coordination that is required between modules is one of the important factors that determine *the degree of modularity*, which will be discussed later in this chapter.

4.1.2.3 A Platform Is a Module That Provides Redundant Functions, Including Interface Function

The term *platform* has also various meanings, but generally it is understood as a unit that provides basic redundant functions to support activities of all related entities. In addition, it is often used to mean a foundation to connect each activity. In short, it can be defined as a module to provide functions that all modules need in common. Consequently, it is perceived as a significant and special module comparable to a hub in a hub-and-spoke system.

OSs, networks (e.g., the Internet), and databases in which the most commonly used functions are aggregated are called *platforms* in the case of IT. The platform modules are used by all other modules (e.g., system programs, application programs, and human users). Online marketplaces offer functions such as search, presentation, exchange, payment, and so forth to all of their participants as a platform. A platform is basically a nexus of a large number of fixed interfaces that reduce transaction costs.

The Chinese government defines its mission as "Pin-Tie" in Chinese (translated as *platform* in English). This means that it emphasizes functions to support and promote free economic activities in the market, rather than to regulate or control individual activities of respective companies. The platform function here is to design and provide transaction interfaces between each entity (individual and organization)—in other words, to establish and operate economic institutions in order to activate transactions. In the sense that they provide interfaces to all modules, they are perceived as a platform module.

4.1.2.4 Examples of Products That Do Not Take the Modular Structure

To deepen comprehension of the concept of the modularity, it will be discussed from another perspective, "what is not modular?"

The most commonly cited instances of non-modular products are automobiles, particularly Japanese ones. Those are manufactured based on the design policy that all the parts must be custom designed, including ashtrays, to realize perfect ride comfort. To accomplish this, the design and development must be executed in-house (or within a company group).

It is strongly believed that the self-contained design, development, and manufacturing processes create the best products. If all the activities are coordinated with each other on an ad hoc basis for each model (i.e., all the coordination is conducted by ad hoc interfaces without using a fixed interface applied beyond multiple models) like this assertion, the degree of modularity is considered to be very low.

Even in automobiles, however, the tires affecting the ride comfort greatly are obviously structured to be exchangeable, namely, modular. The battery is the same. The parts standardized by ANSI, DIN, JIS,[2] and so forth including screws, volts, electric wires, and harnesses are also used in large quantities. Electric systems including air conditioners, car audio systems, navigation systems, and in-vehicle telecommunication systems are particularly modular, which are almost completely standardized so that the products of any manufacturer are applicable to almost all car models.

The Renault/Nissan group has been working on a structural conversion that promotes sharing of basic modules such as chassis and engines across their affiliated companies, called "CFM (Common Modularity Family).[3]" The modularization strategy of Hyundai KIA Motors has not been disclosed to the public, but it proceeds with modularization as its main strategy after merging of Hyundai and Kia in 1998. As for the conversion to the modularization, European automotive manufacturers are the pioneers. Volkswagen started modularization[4] as its major corporate strategy in 2007 and expanded its businesses aggressively.

[2] Japanese Industrial Standards.

[3] In CFM, the automobiles consist of the modules of an engine, a cockpit, a suspension, and an electronic control.

[4] "Modularer Querbaukasten" or "Modularer Längsbaukasten" in Germany.

By combinations of a few types of chassis (called "platform"), engines, and standard accessories (e.g., car navigation systems, air conditioners) like "combinations of Legos (the company's expression)," it realizes mass production from compact to medium-sized products with high efficiency. The company announced that the modular parts are planned to comprise up to 70 % of the vehicles.

Volkswagen pursues the aggressive expansion of its business scale including M&A synchronously with the promotion of modularization. This is a reasonable strategy because it is essential for successful modularization to expand the scale in order to obtain the higher usage frequencies of standard modules and the higher resource efficiency. Volkswagen entered the Chinese and Indian markets at the earliest stage and has been most active, and it is perceived as one of the most aggressive and innovative automotive companies in the world. It is more likely to become a leading player of the automotive industry in the future, alongside the Renault/Nissan group. As described above, "how much can be modularized?" becomes a central issue of the argument in the automotive industry instead of "it should not be" or "is it possible?"

It is truly more difficult to modularize mechanical products than electronic products because there is an inevitable physical problem in that mechanical parts cannot be machined to the exact design specification, resulting in delicate fabrication errors. It is not simple that products are produced only by assembling parts. The manufacturing errors of Japanese manufacturers are predominantly smaller than others, but still it is impossible to eliminate them completely.

On the other hand, the error does not accrue basically in electronic and digital signals. Every part is made to the exact specification and assembled to an end product without errors. The adjustment, like the one in shop floors, is not necessary. Therefore, the modules can be produced separately and independently as long as the interface is clearly fixed, which makes the production much easier than that for mechanical products.

The proportion of electronic parts in automobiles is increasing drastically these days. Even in Japan, the Ministry of Economy, Trade and Industry (ex MITI) started a project called the "Automobile Strategy Study Committee" to modularize the parts across Japanese manufacturers, and Japanese news media reported that Japanese manufacturers introduced modular methodology in 2012. In addition to automatic windows, automatic seat adjustors, windshield wipers, EFI, and air cooling fans, the electric parts include fuel pumps, electric brakes, electric dual clutches, and in-vehicle telecommunication systems connected to intelligent transport systems or ITS. When it comes to electric vehicles, the proportion is expected to increase much further.

The next mainstay fighter, the F35 Lightning II, is another interesting example. The F35 is the latest fighter planned to be deployed in the USA by the end of 2016, in Japan from 2011, and in countries such as the UK, Italy, the Netherlands, and Canada through 2035. It was developed as a part of the Joint Strike Fighter (JSF) program, which supports all the demands of the Air Force, Navy, Army, and the armed forces of the allied nations by modular structures. To overcome the recent defense budget reduction, approximately 80 % of the parts, mainly on the airframe,

will be shared as a platform with all the models, and the remaining 20 % are to respond to the different functional requirements of each military force, such as air-to-air/air-to-ground/air-to-ship attack and conventional/short-range/vertical/carrier taking off and landing. The modular structure was adopted by even the leading-edge fighters, the performance of which is most significant (obviously more significant than the ride comfort of automobiles), even with the political pressure of the budget cut in the post-Cold War years, and it realized 3–8 times the performance of the previous model. It is planned to substitute all existing models with the F35 and is expected to achieve a large improvement in efficiency by economies of scale. Incidentally, the term *module* is not used in the JSF program at all, but the concept is the modularity. Besides, there was identical criticism against the introduction of the modular structure into the fighters, which require perfect coordination and adjustment.

The IT outsourcing industry has grown drastically since the 1990s and contributed to the economic growth of India. A large number of labor-intensive positions not limited to software-related process but also various business processes have been transferred to the developing countries due to their cost advantages. The reduction of the transaction costs enabled access to the human resources, providing an overwhelming competitive advantage in terms of costs.

When admitting a language obstacle, there are still very few cases in which Japanese companies successfully utilize software outsourcing services in other countries. They have offshore software development centers in China and India, but the reality is that those scales are exceedingly smaller than those of US and European companies. In the IT outsourcing industry, a unique characteristic of Japanese companies is a "bridge engineer" who runs back and forth between China/India and Japan to perform coordination of the development. It is a well-known theory that the performance of outsourcing depends on bridge engineers' personal capabilities.

What are the competencies required for the bridge engineers, who play such significant roles? The answer to my question from the managers in charge is likely to be "a capability to understand atmosphere from scenes," which is too ambiguous to recruit or train such significant workers in large quantities. There seem to be two essential implications behind these vague answers.

The first one is the ability to supplement missing descriptions when necessary through Japanese development processes in which specifications are not so clearly described. And the second one is the ability to restrain their complaints against Japanese software development, which is not efficiently managed (never like their shop floor operations[5]).

Conventionally and commonly, large Japanese companies require their contract programmers to sit in the same room with them while they outsource software development. The reason why the contract programmers should be physically in the

[5] The difference between the reduction of transaction costs and the reduction of production costs regarding this issue will be also discussed in Chap. 6.

same place and why they cannot be managed remotely is because the development starts without a completion of design specifications and the specifications must be determined flexibly on an ad hoc basis.

On the other hand, in the modular approach, the development begins only after the overall framework and the interfaces of the modules are designed explicitly in detail, whereby all the modules can be developed separately and independently. Therefore, the overall architecture is emphasized in the modular structure. Complaints against the Japanese inefficient approaches are disliked as they disturb the "atmosphere" and their prideful harmonization.

The Japanese ad hoc development process causes critical problems in terms of efficiency and agility. As for the software development of mobile phones, their backlog of software developments has already exceeded the limits of capacities, and this issue has been growing similarly with many other products in which Japan has maintained strong competitiveness. When software is developed on an ad hoc basis, it easily becomes like entangled "spaghetti." The custom-made approach may work to complete one product perfectly, but the flexibilities such as design changes, additions, and removals of function, expansions of product line, and reuses of parts are obstructed. Whenever a new product is introduced, all redundant development works must be repeated from scratch.

Customizing or coordinating interfaces ad hoc incurs enormous transaction costs, including presentation, confirmation, negotiation, monitoring, and modification. As high functionality and novelty of products are emphasized too much, they are likely to neglect such transaction costs. Gaps between diversified needs of the emerging markets and their products, however, have been increasing. In the good old days, they could rely on the mass production and sales of one highly functional/high-priced product to compensate for the huge transaction costs. Because it no longer works, the business model has collapsed. Nevertheless, insufficient understanding of transaction costs and lack of the management expertise make them still persist in the obsolete strategy of the old business environment. In order to deal with product diversification and price reduction at the same time for emerging markets, the mindset should be changed to utilize fixed interfaces in applicable areas and to develop the technologies needed, just like they did for production costs in their shop floors.

A sole case of a non-modular product in the PC industry, in which modularization is most advanced, is battery chargers. A new PC comes with a new battery charger without exception and the manufacturers never provide information for their reuse. When an additional battery charger is needed, we are surprised with their high-price setting and apathy to environmental issues. Feature phones (old-type mobile phones) are identical. This example shows the fact that reusability increased by modularization makes users happy but not manufacturers.

In contrast, simple, standardized, and reusable battery chargers using a USB[6] and micro-USB were adopted for smartphones and tablet PCs. The power supply

[6] Universal Serial Bus: a connection standard for data communication and power supply.

function of the USB has been used for small electric fans and miniature lamps as well recently.

Since this protocol was standardized by the International Telecommunication Union (ITU), all mobile phone manufacturers are expected to adopt it. The International Electrotechnical Commission (IEC) has been promoting standardization of non-contact charging for smartphones, which will contribute to more convenience of the users.

The example of the battery chargers shows that modularization is possible, if there is a will.

4.1.2.5 Examples of Companies That Are Perceived as Being Not Modular Oriented

Let us consider Apple and Samsung, which are generally perceived as rejecting the horizontal division of functions, rejecting modular structure, and being self-contained.

(1) Apple

Apple is likely to be perceived as in-house and self-contained oriented. It devoted considerable resources to CPU manufacturing, merging a CPU design company in 2007, which is extremely exceptional among PC and mobile phone manufacturers. Apple differentiates itself by graphics processing and low-energy-consumption capabilities. However, all its CPU design is processed by aggregations of IP modules (off-the-shelf IC design diagrams), and contracted manufacturers such as Samsung are used for the CPU manufacturing—that is, Apple depends heavily on outside resources. It outsourced CPUs before iPhone 4 but altered to self-procurement, which seems a strategic conversion after it became easier to outsource the design and production capacities of the CPU. It is generally known that Apple's final assembling depends on Foxconn, a Chinese EMS and a subsidiary of Hon Hai Precision Industry, and many of its core parts are outsourced to various Japanese companies.

Apple's OS is not open to any other companies, while Google's Android uses open source software and has been adopted by many companies, resulting in rapid growth and domination of the smartphone market.

Apple's historical growth was triggered by the great success of its iTunes service (App Store was included later), a digital music distribution service. It started the service with huge risks for the first time among large companies but succeeded in establishing a market platform and strong competitive edge (only for Mac machines in the first place). The leading-edge products (iPhone and iPad) utilizing Apple's brand image, the company's other competitive advantage, were launched as additional modules on the platform.

Afterward, many companies that noticed the potential of the digital content distribution service followed Apple to enter into the business, and the competition became fierce as described previously.

For Android smartphone applications and content, individual markets operated by each company above and the Android Market by Google coexist

and provide the same functions and the products. They have been scrambling for customers, resulting in very bad dispersion of sales and profits. As Apple can monopolize all its OS users in its content and application market, the difference in the sales and profit rate is huge. However, the open competition would possibly vitalize the Android markets, jeopardizing Apple's present position.

As described above, Apple has managed the interfaces extremely well using insourcing and outsourcing distinguishably and strategically. Instead of the emotional decisions of inside or outside, it maintains internal resources judged to be the critical sources of competitiveness and procures the best resources from outside that are not critical, paying careful attention to the standardization of its own interfaces as well. It is reasonable to do so considering resource efficiencies; it must become the key success factor of the companies in the global open economy.

(2) Samsung

Samsung, with revenue accounting for approximately 20 % of the Korean GDP, has an increasingly strong presence. Its capabilities of active globalization and prompt decisions of strategic investments accompanied with considerable risk have made the company successful, and it continues to grow rapidly. It is natural that a company growing rapidly involves all business areas. Under the conditions that it is trying to increase the size of the organization, modularization is likely to be less prioritized. While the area that should be focused is clear and the strong leadership works well, centralization is privileged over autonomy in order to attain stronger competitiveness. Samsung is identical to the Japanese companies in their old years of high growth.

Samsung is often perceived as not aggressive with modularization, but the reality is that its movement toward modularization is most active. Ryozo Yoshikawa, who supported the company-wide reformation as requested by Lee Kun-Hee, the chairman who rebuilt the competitive power of the current Samsung, mentioned in his book[7] that they started the reformation from the deployment of PDM system. This is a database indispensable to promoting the company-wide use of standardized parts (modules), which was the symbol of the Samsung of the future at that time.

In addition, Samsung staff often comment in interviews that "systematization" is most prioritized at Samsung. Various definitions are possible for the term "systematization," but it refers to a meaning of standardizing interfaces in the company that is identical to modularization. The company can make the ROI of its modularization good enough even if it only modularizes internally. The internal information has not been disclosed officially, but our findings reveal that Samsung is one of the most advanced companies in terms of modularization. The company recognizes that Chinese companies will catch up to them in several

[7] Yoshikawa, R. (2011), *Why can Samsung make decisions most quickly?*, Kadokawa Publishing.

years and is preparing for the introduction of *selection and concentration*—that is, the utilization of external modules for the coming threads.

In a stage of growth with overwhelming competitive power in fast-growing markets, there is little need for *selection and concentration* of domains utilizing modularization internally or externally. But when technologies and products get commoditized and competitions intensify, efficiencies of resources become critical. At that time, *selection and concentration* by the modularization become strategically more significant. This is the reason why Samsung is considered to stimulate its modularization actively.

4.1.3 Definition of Modularity

Interfaces determine modular structure.

Modularity has various meanings and various definitions without an established theory as described previously, and the comprehension is confused in spite of the increasing significance of the concept. Although this section is a little technical, the structure will be explained as concisely as possible.

Experts of the modularity study usually refer to the following definitions:

(1) Units that are relatively tightly and coherently connected inside and relatively loosely and weakly outside ("units" are usually referred to parts and programs)
(2) Systems in which separation and exchanges are possible
(3) Units with functions of splitting, substitution, augmenting, exclusion, inverting, and porting
(4) Units that share interfaces

(3) is a definition by Carliss Y. Baldwin and Kim. B. Clark, professors at Harvard Business School in their most authoritative book[8] in this area. The description is difficult even for experts, with the difference of "splitting" and "exclusion," the difference of "substitution" and "augmenting," and the meanings of "inverting" and "porting." In addition, the book includes a long list of mathematical equations from financial engineering, which make it more complicated. The explanation of the definition is omitted here as it is considered not practically valuable.

On the contrary, the definitions of (1) and (2) are simpler but so ambiguous that they cannot describe what a module is precisely. For example, "relatively" in the definition: "relatively tightly and coherently connected inside and relatively loosely and weakly outside" eventually leads to a conclusion that "all the systems as module to some extent." Then the subjects of the modularity study cannot be identified objectively or measured as a matter of degree, which causes the studies to get stagnant and decline, despite a general attention.

As is obvious, the definition of (4), "units/entities that share interfaces," is being explored in this book, which deals with transaction interfaces. There are many

[8] Baldwin, C. and K. B. Clark (2000), *Design Rules*, The MIT Press.

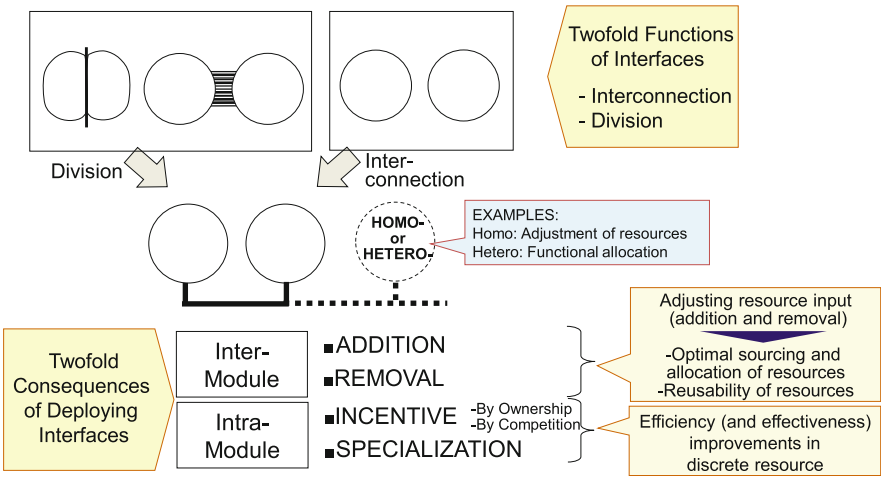

Fig. 4.1 Structure of module and interface

analyses focusing on modules, but only a few deal with interfaces that determine the modular structure. In this book, the modularity will be analyzed and explained structurally and concisely by analyzing interfaces. When we understand modularity correctly, a paradoxical conclusion that there exists no such concept of modularity in the first place will be obtained.

Modularity and interfaces will be explained below according to Fig. 4.1.

An interface between modules regulates the ways of *connection*, *presentation*, *negotiation/agreement*, *exchange, and ex post processing*. In other words, an interface defines/redefines the (new/existing) relationship. The functions of interfaces are twofold: interconnection and division.

(1) Interconnection

If there is no transaction between entities (e.g., persons, departments, companies, products, software, IT devices), the existing relationship is considered to be division, separation, or independence. When a new interface is established, a transaction relation (i.e., *interconnection*) becomes developed for the first time. For example, if a supplier has ISO9000 certification, customers can trust the quality of its products. It would be too costly for the customers to investigate the quality of an unknown company by themselves, but ISO9000 decreases such transaction costs largely and creates the interconnection. Online marketplaces such as Amazon decrease the transaction costs of searching, investigation, accreditation, and so forth, enabling transactions that would have been impractical in the past. This is an example of interconnecting separated entities to function as modules. While the cases above described fixed interfaces, ad hoc interfaces can also develop the interconnections, although the transaction costs are much larger.

Interfaces exist between a transactor and the transaction partner and regulate the activities of both of them. The transactor will comply with the agreement

and, at the same time, the partner is required to do so. When the promises are fulfilled mutually, the transaction becomes completed. This discussion is applied to both organizational interfaces and interfaces between products/parts.

(2) Division

In the case that an existing relationship of interconnection is redefined to increase the independence of entities, the function of the redefining interface is *division*. For example, when a director of a certain department needs to obtain approvals for all his/her decision markings from the president, the director is not independent but heavily dependent on the president. In this relationship, profit-and-loss statements and balance sheets can be introduced for his/her activity outcomes in order to allow all his/her arbitrary independent decision makings as long as he/she satisfies goals of revenue and profit. The new rule functions as an interface to redefine their relationship and allows the director to act independently for the most part. Accordingly, the introduction of the new interface brought independence of the director. It should be noted that it is not a perfect but a partial independence, as there still exist transactions.

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In short, in the case that there is no transaction relation as the transaction costs are too large, the function of the *interconnection* is applied to reduce the cost. And in the case that a transactor depends on a transaction partner heavily and the transactor is needed to be independent, the function of the *division* is applied. As seen above, it is significant in theory to distinguish the two functions: (1) the *interconnection* brought into separation and (2) the *division* brought into dependence.

4.1.4 Advantages of Modularity in the Global Changes

The significance of resource efficiency improvement by modularization is increasing.

4.1.4.1 Two Advantages of Modularity: Inter-module and Intra-module

The two cases above were based on extreme assumptions: a case of absolutely no relation and a case of the perfect dependence. However, in most of practical cases, the existing relations are redefined and reorganized through the combinations of *interconnections* and *divisions*, which makes the functions of interfaces seemingly complicated; the reality is likely to be the combination of those two. As the introduction of an interface defines/redefines relationships, the functions of both the *interconnection* and *division* are applied and utilized. In the defining and redefining processes, the interface should be designed to embody the advantages of modularity shown below.

4.1.4.2 Inter-modular Advantages (Advantages Between Modules)

Individual modules (e.g., persons, departments, companies, products, software, IT devices) sharing fixed interfaces execute transactions adhering to the interfaces. Interfaces should make addition and removal of modules easy to realize resource efficiency improvement.

When an interface shared by Module A and B1 is also shared by Module B2, B2 can be added to the transaction between A and B1, meaning the new transaction between A and B2 is possible without an additional cost. This can be applied to B3, B4, and so forth. On the contrary, if a specific interface is used between Module A and B1, and if B2 intends to start a transaction with A, coordination and agreement on specifications and conditions of the new transaction incur a large amount of an additional cost (this is the transaction costs for creating a new relationship). And if the transaction costs to create a new relationship are too large to invest for B2, B2 cannot start the transaction. If a common interface such as a standardized one is used by both B1 and B2, B2 can start it with a lower additional cost and shorter time. Removal of B2, B3, and B4 is easy in the same manner as the addition.

In the academia of management science, the entities that can be reusable, substitutable, and transferable by sharing interfaces have been defined as modules. However, it is significant to explore further and distinguish two cases: a case of functionally homologous modules and a case of functionally heterogeneous modules as follows:

(1) A case of functionally homologous modules → Resource efficiency improvement by adjustment of input resources (addition and removal of input resources)

When input resources (module) need to be increased or decreased, it is easily added or removed as long as the interface is shared. This avoids unnecessary use of resources and improves the resource efficiency. For example, resources of production (factories, equipment, and labor) can be added and removed easily and flexibly by outsourcing instead of owning if the interface is shared by outsourcers.

(2-1) A case of functionally heterogeneous modules → Resource efficiency improvement by functional allocation (economies of scale)

In the above case of (1), each module of B1, B2, and B3 is functionally homologous, and the addition and the removal are just quantitative adjustments. On the contrary, when each module is functionally heterogeneous, the addition and the removal are qualitative adjustments—that is, addition and removal of (new and existing) functions. Only when an interface is shared, the addition and removal of functions are possible without an additional cost. Examples include addition of an IC chip with a graphics processing function onto a PC to increase the performance and splitting overhead functions from multiple divisions for integrating and sharing in a company.

Different functions can be allocated to each module, as they are independent in the modular structure. The functional allocation makes tasks at each module simple, repetitive, unified, and specialized, thus enabling automation

and/or substitution by lower-wage labor and improvement of productivity by learning-curve effects.

(2-2) A case of functionally heterogeneous modules → Resource efficiency improvements by sharing resources

An addition of a module with a different function means addition of a new function on the system. If a module (function) is not frequently used but shared by all other modules, it increases the usage frequency—that is, the resource efficiency. Examples include sharing of a supercomputer for simulations, sharing of special equipment for manufacturing, and sharing of an M&A planning team. It is not limited to special resources to share for the improvement of efficiency. All platforms are shared by all modules on it and improve the efficiencies. A structure of options for minor changes to expand product line has the same aim as well.

All those are possible with lower costs and in shorter time only when the interfaces are shared. Only when procedures for use of supercomputers such as connection, data transmittance, processing operation, and payments are explicitly described, the users can start the operation immediately. Professionals with national licenses (e.g., accountants, pilots) can be contracted easily as their capabilities are guaranteed by governments.

Although only the reusability of a module is likely to be focused on, the sharing of resources described above is also another great advantage of the modularity. Improvements of resource efficiency at each module consequently lead to an improvement of the system—that is, all related entities (modules) as a whole.

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Advantages of modules—load balancing, functional allocation, and resource sharing described above—are also known as the "three functions of a network." A network corresponds to an interface, essentially; it is natural that the advantages of the interface are identical to those of the network. "Network," however, refers only to an artifact between modules (inter-modular); therefore, the phenomena inside modules (intra-modular) are not considered. Intra-modular advantages, which are as significant as the inter-modular ones, will be discussed next.

4.1.4.3 Intra-modular Advantages (Advantages Inside Each Module)

As long as a module complies with interfaces, it can act independently without being interfered with by other modules. The independence and autonomy contribute the following advantages to each module. This mechanism is applied not only to organizational modules but also to parts/products indirectly that are developed by the organizational modules.

(1) Strengthening motivation of each module by clarification of authorities and outcomes

With the independence in the modular structure, outcome attributes of each module are developed under clear responsibilities and authorities. If entities are not independent without the clear description of responsibilities and authorities, their superiors can decide the attribution ad hoc and arbitrarily. It is significant to note that authority corresponds to ownership in the organization. Clear ownership strengthens motivation of the owner (subordinate) and not only increases his/her productivity but also encourages his/her capability development.

Property rights theory[9] argues that ownership in an organization is classified into control rights and residual control rights.[10] Control rights correspond to authorities agreed in contracts (as fixed interfaces), and residual control rights correspond to all other authorities not described in contracts (authorities to determine all ad hoc interfaces). Authorities become explicit by fixing interfaces, and they are not when interfaces are determined ad hoc. If interfaces are not fixed, a superior can make decisions (i.e., determine interfaces ad hoc). In short, the more fixed interfaces, the clearer the authorities, and the more independence.

Fixing interfaces strengthens the independence and self-initiative of each entity. But at the same time, it will diminish rights of the superiors to determine ad hoc interfaces, which are also rights to satisfy desires to control, dominate, and deprive profits. Therefore, rejections to the fixing are likely to occur (this will be discussed in Chap. 6 as one of the structural problems of fixed interfaces).

In general, it is said that the success factor of capitalism was to confer ownership and the failure factor of socialism is to prohibit it. It is concluded that clear property rights as a basic concept of capitalism incentivize each entity and increase the productivity of the society. From a viewpoint of productivity, it is important to provide entities independence to strengthen ownership.

(2) Strengthening motivation of each module by promotion of competition

Because outcomes (revenues, profits, achievements of missions, and so forth) of each module are explicitly visualized and modules are easily substituted according to their outcomes, motivation and sense of crisis are strengthened and competitions among modules are promoted, resulting in higher productivities. They are objectively and fairly evaluated and rewarded or penalized according to their outcomes. The modular structure is an environment in which opportunities and threads coexist.

(3) Promoting improvements to each module by explicitly visualizing responsibilities and outcomes

[9] Alchian, A., A. and H. Demsetz (1972), "Production, Information Costs, and Economic Organization," *American Economic Review* 62(5): pp. 772–795.

[10] In property rights theory, ownership also includes residual claim, the right to distribute profit. But residual claim can also be classified into fixed interfaces and ad hoc interfaces. In order to make the framework simple, residual claim was excluded here.

Also related to explicit visualizations of outcomes, responsibilities, and authorities above, it encourages improvement of productivities at each module. If those are not visualized, the improvements are easily ignored.

4.1.4.4 Advantages of Modularity from Viewpoints of Transaction Costs

Two kinds of advantages of introducing the modular structures will be analyzed here from two viewpoints of transaction costs: transaction costs in day-to-day operation and transaction costs at changes (substitution and addition) of modules (effectively innovation).

(1) Reducing transaction costs in day-to-day operation

Each specific task is divided and allocated to each module for concentration and specialization in the modular structure, resulting in simplification and economization of those tasks (transactions become simpler to streamline by the repetition). This decreases the total amount of transaction costs inside each module.

At the same time, most of the decision making can be distributed to each module with increased independence. As it is no longer necessary to ask superiors for permission regarding every decision, the transactions between modules are greatly reduced. As the number of hierarchical layers increases, the volume of transactions increases, and therefore, the influence of the division on transaction costs by the introduction of the modular structure is considerable.

In order to reduce the transactions between vertical and horizontal modules in organizations, recurring ad hoc interfaces should be fixed to be simple and easily understandable, thus decreasing complexity.

(2) Reducing the transaction costs of changes of modules (substitution and addition for innovation)

Easy addition and removal of modules correspond to easy substitution—that is, lower transaction costs of innovation.

4.1.5 Requirements for Designing Interfaces of Modules

Interfaces of modules should be designed so as to minimize transaction costs.

4.1.5.1 Requirements for Interface of Modules

The previous section already clarified the requirements for design and development of interfaces of modules. Those are summarized below in terms of (1) requirements for interfaces of day-to-day operations, (2) requirements for changes of modules, and (3) requirements for development of interfaces (e.g., information systems.)

(1) Requirements for interfaces of day-to-day operations

Fixed interfaces of modules in day-to-day operations should be designed to satisfy the advantages described in Sect. 4.1.4: simplification, specialization, and independence (especially from superiority modules) by concentration of redundant tasks at each module.

(2) Requirements for changes of modules

Fixed interfaces should be designed to be as simple and easily understandable as possible to minimize the transaction costs of changing (i.e., substitution and addition) of modules. Parts changed (i.e., a cost for the change) should be minimized by subdividing functions into modules as small as possible, insofar as the disadvantages (i.e., the increase of inter-module transaction costs) do not appear prominently. In order to improve usability/reusability of external resources by simplifying interfaces, the structure and configuration of the platform and options should be appropriately adopted.

(3) Requirements for design and development of interface media

An interface is an intangible means to regulate activities; it is usually implemented using a network and/or databases as *interface media* these days. As the development of those information systems is more costly in particular, the resource efficiency of interface media should be carefully considered. For all systems, the appropriate modular structure is indispensable for higher resource efficiency, and, of course, it is required for the design and development of the interface media as well. That is, the requirements of (1) *day-to-day operation* and (2) *changes of modules* above are directly applied to the design and development of interface media; (1) corresponds to regular development of modules for the design and development of the interface media, and (2) corresponds to changes of modules for changes of the interface media, respectively. The advantages of the concentration and the specialization in (1) are applicable for simpler and easier design and development of the interface media as well. And the minimization of parts changed and the improvements of usability/reusability of external resource by the subdivision in (2) decrease the design and development cost of the interface media as well.

4.1.5.2 Avoiding Disadvantages of Modular Structure

Interfaces of modules should be carefully designed to avoid their disadvantages, which will be examined in this section.

In the case that the advantages are not realized and the initial development cost is not compensated, the cause of the failure is likely to be attributed to the disadvantages instead of the lack of capabilities. First, this obvious distinction of capability issues from structural disadvantages is significant to understand the disadvantages correctly.

Then next, what are the negative influences of the pure disadvantages? Introduction of complicated interfaces increases transactions immensely, resulting in the increase of total transaction costs. Concentration of redundant tasks on a module may create new inter-module transactions to utilize the module. Examples often cited include software processing speed that has deteriorated due to a newly standardized telecommunication protocol and larger physical shapes of products due to new interfaces for streamlining assembly.

In these examples, however, the advantages attained by economies of scale inside the module are neglected, which will be achieved by the capability of dealing with the issue. Investment and efforts to streamline the processing inside the

module, the volume of which increased due to the concentration, should be accompanied to realize the advantages of modularization. Examples of the investment include automation, speeding up, and miniaturization. In other words, without the technologies and capabilities, attempts for the modularization are reckless. Consideration on external environments is also significant. In environments in which the redundant functions are hardly extracted, such as right after an introduction of a new product to a new market, it is impossible to achieve the economies of scale effect.

In the intensified global competition, however, there are an increasing number of companies that make the decisive investment with huge risk even in such adverse environments. Capabilities to predict markets and technologies and to manage risks become indispensable in making proper investments earlier than their competitors. In short, the advantages are realized with the capabilities, and the disadvantages can also be avoided with them.

An *integral model* as a counter concept to modularity is often argued. However, the situation where the modular structure is not adopted due to the lack of capabilities is likely to be conceived as the *integral model*. Therefore, it can never be an ideal strategy. This will be further discussed in Chap. 6.

4.1.6 Degree of Modularity

> Degree of modularity is determined by substitutability and independence of decision making under the business environment today.

It has been discussed that the concept of modularity is useful in various aspects of management. And the next questions are: how modularity is assessed and under what conditions an entity is determined to be a module. According to the previous discussions and under the business environment today,[11] a module should be identified as an independent entity in certain relations achieving higher resource efficiencies inter-modularly and intra-modularly. Therefore, the degree of modularity is appropriately determined by two axes: *substitutionability* and *independence*. As for the independence axis, however, it is not correct to evaluate isolation (absolutely no relation with others) positively. Independence of decision making—that is, the degree of freedom of decision making without enforcement by transaction partners—should be the focus instead of the isolation. Therefore, it could be illustratively expressed as *freedom of decision making* as well.

Substitutionability and *independence* of decision making will be discussed in detail below. These two correspond to *ease of escaping from the present dependent situation* (future independence) and *present independence*, respectively; these two axes are mutually exclusive. *Substitutionability* is determined by the transaction costs to substitute transaction partners, and *independence* of decision making is

[11] Although proper interconnection of modules is always significant, independence is more emphasized in today's business environment.

determined by the transactions in day-to-day operations. In other words, those two are keys for entities to be modules.

(1) *Substitutionability*

This is evaluated by three factors: *depth*, *breadth*, and *unilaterality/bilaterality* of fixed interfaces required for the substitutions.[12, 13]

(a) *Depth* (number and detail level) of fixed interfaces

In the case of substituting transactors or products/parts, the conditions of the new transactions must be determined again. If many of transaction interfaces are fixed and standardized, those can be shared with a new transactor; the transaction costs of the substitution decrease greatly, meaning it is easy to execute the substitution. Of course, if they are not shared with a new transactor even though they are fixed, the transaction costs remain large. The *depth* of fixed interfaces is determined by how much and how detail interfaces are fixed (to be shared).

On the contrary, if no interfaces are fixed (and shared), the transaction costs of substitution are much larger and it is hardly identified as a module (the degree of modularity is low).

(b) *Breadth* (ratio of entities sharing or penetration) of fixed interfaces

This is how much the ratio of potential substitutes shares the fixed interfaces. The more potential substitutes sharing them, the easier it executes the substitution—that is, the higher degree of modularity the entity is considered to possess. The level of sharing is determined by a level of the standardization, including the openness of the interface.

The more the interfaces are (fixed and) shared, the lower transaction costs become, that is, the higher degree of modularity the entity is considered to possess. In the case of commodities, because most of the transaction interfaces, especially the specifications, are (fixed and) shared by many, the transactor can be substituted with lower transaction costs.

Even depending on a transactional partner 100 % as to revenue, it is possible to substitute the one as long as expected revenue from a new partner exceeds the estimated substitution costs. Therefore, the concept of the breadth is significant.

If an interface is regulated by law, all potential substitutes share and use it certainly. On the contrary, if a proprietary interface is owned by a present transactional partner but not shared by any other entities, the breadth is zero, and consequently its modularity is also zero. Even when a fixed

[12] Although substitutionability is fundamentally determined by the amount of transaction costs of the substitution, the absolute amount varies according to the *resources* transacted. Therefore, only depth, breadth, and unilaterality/bilaterality, which can be evaluated universally, are discussed here.

[13] In reality, the uniqueness/competitiveness of a module with the consequent demands influences strongly the substitutionability more than transaction interfaces per se. This is also not a universal issue and is not related to modularity; therefore, it is excluded here.

interface is shared by both sides of transactional entities, but not by other entities (such as by a custom), the breadth is also zero.

(c) Unilaterality/Bilaterality of fixed interfaces

It is significant to recognize directions of substitutionability. Two directions, the substitution of suppliers by customers and the substitution of customers by suppliers, should be distinguished. It is reasonable to define that bilateral substitutionability has a higher degree of modularity than the unilateral type.

If only one side of transaction entities has the ownership[14] of an interface, the other entity cannot reuse it with potential substitutes. For example, as an OEM has the property of design specification of a product, the contract manufacturers cannot sell the product to other end-product manufacturers. Therefore, the modularity degree of the contract manufacturer is low. If both sides have the ownership, it is bilaterally substitutionable. For example, as standardized interfaces such as open EDI can be used by both sides, they are bilaterally substitutable.

(2) *Independence* of decision making

This is the degree to which a company's decision making is not influenced by its transaction partner. In this axis, only the seller (including supplier, subcontractor, and subordinate)-to-buyer (including customer, end-product manufacturer, and superior) direction is an issue, as buyers/customers are never controlled by sellers/suppliers (except when a customer has no choice of suppliers, in which case the *substitutionability* and the modularity are already zero).

The Independence of decision making is determined by the ratio of fixed interfaces to ad hoc interfaces. If ad hoc interfaces account for a substantial portion, a supplier is dependent on a customer who makes decisions arbitrarily. Fixed interfaces such as contracts are considered to be deployed with agreements of free wills (in the case of customs, they are considered to be established under long-term mutual relationship of own free wills without utilizing opportunities to become independent).

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To summarize the discussion above, the degree of modularity is measured and evaluated as shown in Fig. 4.2.

(A) Seller-to-Buyer Direction (the Degree of Modularity of Sellers from Buyers)

The sellers' degree of modularity is determined by (1) *substitutionability* multiplied by (2) *independence* of decision making (the area shaded in Fig. 4.2). The Y axis is the ratio of fixed interfaces, which implies the ratio

[14] In the case of a proprietary interface owned by one private company, the *ownership* here includes all the property rights while it is only applied to the use rights in the case of public interface (e.g., de jure standards).

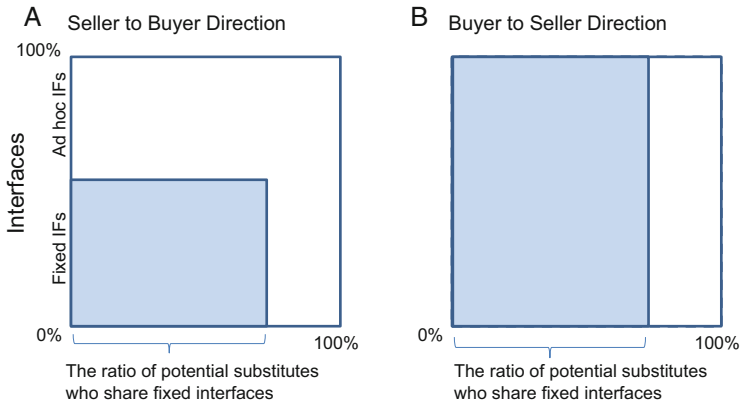

Fig. 4.2 Measurement and evaluation of modularity

of independent decision making. As ad hoc interfaces set by buyers increase, the degree of (2) *independence* of decision making decrease; for example, little power is delegated to a subordinate from his/her superior. The X axis is the ratio of potential substitutes that share the fixed interfaces. The ratio increases as the standardization proceeds further. If no entity shares the interface, the ratio and the modularity become zero, such as the case in which a seller perfectly depends on the fixed interfaces of its buyer. If unsubstitutable fixed interfaces such as customs are dominantly established, the degree also becomes low.

(B) Buyer-to-Seller Direction (the Degree of Modularity of Buyers from Sellers)

Only the X axis is an issue here because the Y axis (the buyers' freedom of decision making) does not make sense; decisions about all ad hoc interfaces are normally made on the authority or under the permissions of buyers. If there is no substitute of a seller's unique technology, there is also no substitute to share fixed interfaces; the buyers' degree of modularity is zero. On the contrary, if a product is completely standardized, such as a commodity, and the transaction costs of a substitution are zero such as at an online marketplace, the substitutionability and the modularity are 100 %.

The discussion above is about the modularity of each entity, and the modularity of a relationship could also be acquired by a multiplication of the two directions.

4.1.7 A Module as a Composite of Components in the Automotive Industry

The automotive industry has a different background for modularity.

In this section, a *module* as defined by the automotive industry as a composite of components will be examined. In the automotive industry, a *module* means a

composite unit of components that are integrated in advance in order to decrease the number of end-product assembly processes for higher efficiency in the assembly lines. This is seemingly unrelated to the discussion of the modularity in this book, but it also contains the identical philosophy in the background.[15]

The composites of components have been applied to parts such as dashboards, doors, front panels, and rear panels. The assembly of the internal components is relegated to the suppliers for the improvement of their own efficiencies. This synthesis was embodied by sharing of the mechanical and electric interfaces among each supplier of the components. At the design of these interfaces, the efforts to simplify them must be expended because the simplification increases general versatility, the consequence of which increases the volume of applications in both components and end products. The increase of usage frequency of the interfaces increases economies of scales and the ROI, eventually.

As the intellectual property of the interfaces has been owned by the automotive companies until recently, the substitutionability functions only unilaterally but still improves the efficiency and the ROI as follows:

- For the production (assembly) of the composites: The efficiency of assembling the simplified and standardized components increases.
- For the maintenance service of the composites: The efficiency of maintaining the simplified and standardized components after the sales increases.
- For the design of each component in the composite: The efficiency of designing each component is easily standardized as the interfaces are standardized, and therefore, it increases.
- For the production and the procurement of the material and parts for each component in the composite: In the same manner, the efficiency of the production and the procurement of the material and parts increase due to economies of scale.
- For the testing of each component in the composites: In the same manner, the efficiency of the testing increases.

When Volkswagen announced its comprehensive modular strategy, there was criticism in Germany that the impact of recalls and the consequent risk when such parts were manufactured in large volume would cause serious trouble. This is a superficial consideration. As economies of scale function at the testing, it can be executed by lower costs, or the larger and stricter testing can be executed with the same cost. The reduced costs can be transferred to the enhancement of automobile safety (i.e., effectiveness). The stricter testing and the greater cost for safety design will definitely make the expected cost of recalls smaller than the present.

All those advantages are the efficiency improvements to be gained by predetermining interfaces, consequently increasing the usage frequency of interfaces in each element of transaction: *connection*, *presentation, negotiation/agreement, exchange*, and *ex post processing*.

[15] Since 2012 when the modularization reached even to the automotive industry, the term *module* in the definition of this book has started to be used.

The term *module* as the composite of components in the automobile industry has not been used in the definition of this book, but actually the expected advantages are based on economies of scale—that is, exactly the same scheme as the *modularity* in this book. In the industry, there have been objections against the introduction of modules on the grounds of deterioration in product competitiveness such as ride comfort and downsizing. In reality, however, the industry has been adopting and utilizing the concept from a very early stage.

The substitutionability of the modular structure should be indispensably utilized when outsourcing is introduced. The modular structure ensures the substitution of suppliers to increase the bargaining power for selection of the best partner. At the early stage, the automotive companies with own company groups had little interest on the substitution of suppliers, and the applications of the fixed interfaces were limited to the own company groups. Afterward, however, since the substitution came to be conceived as crucial for enhancing competitiveness prior to the groups' affiliates, modularization has spread quickly by necessity.

The wider the range in which a module is applied, the higher the ROI obtained. The modularity in the closed relationship consequently became open to widen the application range. The reorganization and consolidation in the automotive parts industry is growing, and subsequently the competition for standardization of parts will become fierce. At that moment, the unilateral modular structure will turn into the bilateral one for certain.

4.1.8 A Module as a Composite of Components in the Electronic Parts Industry

The electronic parts industry also has a different background of the modularity.

In the electronic parts industry, the term *module* refers to another meaning customarily. Examples include power modules, telecommunication modules, Wi-Fi modules, GPS modules, LTE modules, and sensor modules. In their customary usage, the modular features of self-containability and independence are emphasized instead of the substitutionability. The electronic parts manufacturers take the lead in this new trend with their marketing messages that their modules contain all necessary functions; the efficiency will be improved in production, design, and maintenance by the introduction; and it will be substitutionable with competitors' products without a risk of being locked in (this is just an image and not yet true in reality). At the same time, it is driven by their strategy to increase their value added by integrating peripheral parts with their core parts, which have dominant technology and market share. This is the reason why they actively use and diffuse the term.

If the customers' benefits—that is, the efficiency increases of production, design, and maintenance—are seriously considered, it is necessary to standardize the interfaces of the modules just as in the automotive industry case. The substitutionability, the most significant feature of modules, will contribute to the industry considerably. At an early stage, the standardization will be focused on the company's proprietary

interfaces, but it must expand beyond companies under the pressures from customers in the future.

4.1.9 Organizations as Modules

All organizations are modular.

Modularity in products/parts and organizations are very similar. The interconnection, division, and substitution of products/parts are directly applied to organizational issues. In the first place, the idea that all organizations are more or less modules with some independence should be reconfirmed here. In the ancient hunting age, functions of hunting and cooking were divided, with transaction rules as interfaces. Even within hunting functions, watching, goading, and shooting were divided, and interfaces to organize hunting teams were deployed. That is, if a group of people is organized even slightly, some fixed interfaces must have been introduced; organization is considered to be a module.

In this chapter, starting the discussion regarding the interface of products/parts, it will be shown that the concept can be applied directly to organizations. In general discussions of organizations, the roles and responsibilities of each department are likely to be described conventionally. However, significant issues exist in the interfaces that are hardly perceivable. While designing organizations, those interfaces such as rules, systems, processes, protocols, standards, and regulations should be more carefully considered. Meetings that deal with coordination of interdepartmental issues are also likely to be depreciated, although those are also the significant interfaces.

The reason that an organization has higher productivity than just a collection of people is that by utilization of the modular structure, an organization enhances specialization, competition, and people's motivation and achieves higher resource efficiency. Therefore, the history of the modern organization is that of modularity, and "*almost all systems are recognized to some extent as modular.*" It is not as if the concept of modularity has just appeared. The difference from the past is that the development of the interface has become much easier and faster on the accumulated foundation of interfaces, the fast-growing Internet. That has called attention to the competitiveness of the modular structure and spread its practical utilization.

It is inevitable that organizations become more modular if they need to strengthen efficiency and consequent effectiveness. That is, the concept of modularity corresponds exactly to the concept of organization, which leads to a conclusion that actually there exists no such a concept as *modularity*.

In the meantime, what distinguishes the modularity in an *organization*, *software, and mechanical parts*?

As shown in Fig. 4.3, the streamlining of redundant functions is realized by concentrations on an organizational module in the case of an *organization,* while those are realized by reuse of a software module in the case of *software*. While no additional cost is incurred with the reuse of a software module, considerable

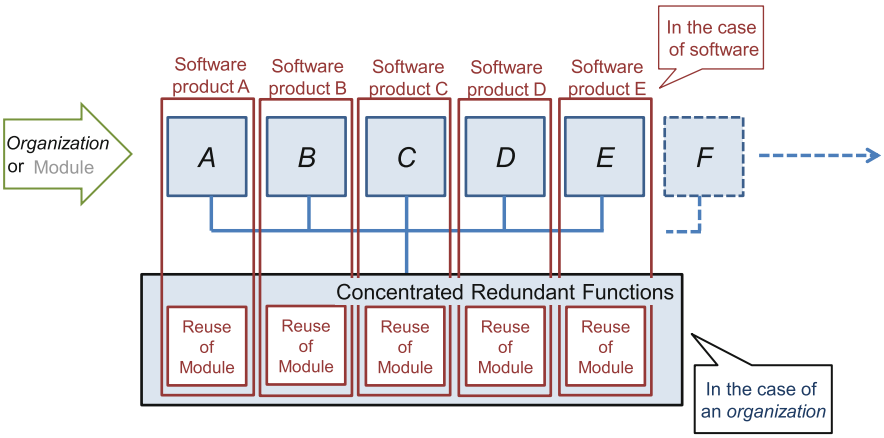

Fig. 4.3 Difference of modular structure and its effects between an organization and software

additional costs such as resource costs (e.g., human and facilities) and overhead costs are incurred with the utilization of a common functional module in *organizations*. The increase of the costs is not a significant issue as long as the efficiency improvement by economies of scale is satisfactory. If not, the initial costs introducing the interfaces will not be compensated. That is, *organizations* require much more precise design and sophisticated technology to make good use of modular structure than *software* does.

In the case of *mechanical parts*, some additional costs such as materials and labor also incur when a module is reused, but it is much easier to achieve economies of scale in manufacturing than in *organizations*. This is the reason why modular utilizations in *software*, *mechanical parts*, and *organizations* have obtained attention in this chronological order and the attention to *organizations* is still little.

4.2 Design of Modules: Methodology, Cost, and ROI

The design methodology of a module is identical to the one of interface.

As a module is defined by its interface, the design methodology, costs, and ROI of a module are identical to the ones of an interface. The methodologies of design, development, operation, and utilization of the module are included in Chap. 6. In Chap. 6, in addition to the design methodologies, the capabilities required for designers, costs, ROI, and obstacles, solutions, and political opposition of modularization will be discussed.

The discussion regarding dividing hierarchical functions by the modular design will not be included in the generalized theory of an interface. It was described briefly in the previous section; however, the delegation of authorities as the division among hierarchical levels is a related and significant issue, especially regarding when and how it should be done. Because this is not a universal problem varying from organization to organization, or individual to individual, it is excluded from this book.

4.3 Activation of SMEs by Shifting from Subcontracting to Winners by Applying Modular Structure

Introduction of modularity encourages independent growth of SMEs and independent modules have opportunities to dominate the global market.

SME's customary dependence on their customers and governments may become shackles restricting their survival in the fiercer competition of the global market. On the contrary, they have great potential to expand their businesses globally if they are willing to utilize proactively the power of the modular structure.

In the current global economy, only one or two companies in each market can survive and enjoy dominant market positions. Encouraging such venture spirits despite considerable risk and shifting the national resources from obsolete and exhausted companies to innovative ambitious companies are significant to revitalize the economy. Entrepreneurship should be respected and developed in the society much more seriously.

SMEs should learn from the failures of declining large companies and expand their businesses based on the standardization strategy deploying the modular structure. The accompanying risk is not small, but the opportunities are also wide open. Once they enter into the positive feedback cycles of standardization successfully, any small companies can become winners in the global market, even overnight.

The steps to embody the expanding growth for SMEs trapped in existing subcontracting relationships are proposed in Fig. 4.4.

(1) Step 1

In the developing stage of an economy, such as the 1970s and 1980s of Japan, the relationships between end-product manufacturers and suppliers are favorably stable, as there is no dissatisfaction on either side and it may seem sustainable. The subcontractors' success depends on being loyal and obedient to their customers (and governments). However, as the competition from the emerging countries becomes fiercer and end-product manufacturers start suffering from decreasing profits, the seemingly stable relationships must change. The subcontractors should consider the environmental change seriously and start preparation for changes in the relationships. Without spontaneous initiation of the change, it may become too late shortly.

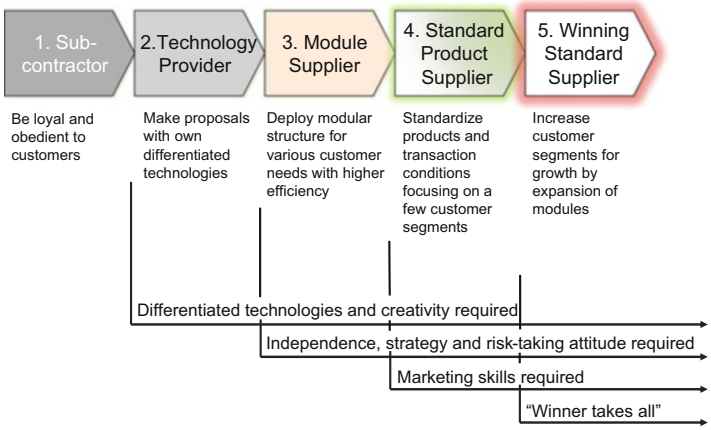

Fig. 4.4 Steps from dependence to winner-takes-all position for SMEs

(2) Step 2

As the competition becomes fiercer, SMEs without any differentiated technology may not be able to survive. The SMEs with the technologies need to start converting their passive attitude to a proactive one—that is, from just waiting for orders to giving advice and proposals regarding the applications of their technologies to the customers. In order to do so, the SMEs need to understand the requirements of the customers and the problems they are facing. It also means the SMEs need to change their position from advisees to advisors. An entry into the emerging markets based on relationships with the local customers may be one of the strategic options that embody the conversion easily, although some risks are involved.

(3) Step 3

Assuming that the proposals for the technology applications are well accepted by multiple customers in Step 2, their scope should be widened to perceive the market trend more precisely regarding the promising applications and technologies. The largest and most possible application should be extracted to obtain a standard position. At that time, the company should think inductively to consider all the possible matching of its technologies and their applications. From this step, the intellectual property belongs to itself as well as the inventory, which again brings risks. However, the profitability increases drastically, and the earned profits will be transferred to price reduction, shorter delivery time, higher product quality, and so forth, thus increasing their competitiveness further. The potential for continuous development of technologies also grows. Although there are considerable initial risks, a departure from subcontracting and perfect independence with possibility of further growth are embodied.

(4) Step 4

In order to expand its business domain, the company should more actively respond to the wider range of customer needs. At this moment, the maximum utilization of their standard core modules or platform modules should be considered instead of customizing them to customer needs individually. This would increase sales with minimal variable costs and improve profitability. The standardization of the company's modules in the market should be deliberately pursued. This necessitates marketing skills to understand market needs and to extract the most frequently used interfaces, the capability of designing the appropriate interfaces, and acceptance of some more risks. The capability will be and could be developed in the repetitive challenges in this step, while it will never be possible to achieve without them.

(5) Step 5

The modular structure of the products developed in Step 4 should be elaborated more sophisticatedly in this step to enlarge the application area. More modules should be developed utilizing the existing interfaces. According to the possibility of growth, new developments of platform modules should be challenged. At that moment, the extra resources gained from the increase of profitability should be allocated to product and technology development to enhance the marketing and technological differentiation. Repeating the utilization of the successful interfaces to expand the modular structure extends the product line, increases the efficiency, and embodies the positive feedback of standardization. After the establishment of the standard in the market, the innovation of next-generation technology should be challenged without falling into "the innovator's dilemma."

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As described above, companies' independence must be accompanied by considerable risks. However, the risk of doing nothing—remaining as a subcontractor and waiting substitution by the emerging competitors—is also increasing. The repetitive challenge will cultivate the possibilities to excavate and activate potential technologies. Globalization means fiercer competition, and only the companies accepting those numerous risks can survive in this environment. There is no assuring that taking risks leads to success, but it is at least certain that surviving companies are ones that take substantial risks.

Coevolution of Markets and Organizations 5

Organizations and markets coevolve sharing interfaces mutually.

5.1 Evolution of Organizations

Organizations grow by stages.

In this book, the commonalities of organizations and the market,[1] in both of which the transaction is executed in compliance with the transaction interface, have been emphasized. In economics, Ronald Coase clarified in Chap. 1 of his epoch-making book *The Firm, the Market, and the Law*[2] that "markets are institutions that exist to facilitate exchange—that is, they exist in order to reduce the cost of carrying out exchange transactions." This could be paraphrased, using the terminologies of this book, as "the market is a collection of interfaces to reduce transaction costs." That is, both organizations and the market are collections of interfaces with an identical purpose.

Then what is the essential difference between organizations and the market?

The only difference is the organizational hierarchy, which functions as an interface.[3,4] That is, the interface is determined and managed by the hierarchical

[1] "Market" means all transactions outside companies and corresponds to "society" in general terms.

[2] Coase, R.H.(1988), *The Firm, the Market, and the Law*, The University of Chicago Press.

[3] Coase also proposed the value of organizations for the first time with the clarification of the market. In Chap. 2, "The Nature of the Firm," of *The Firm, the Market, and the Law*, reprinted from *Economica*, n.s., 4 (1937), he focused on the economic planning function of firms and raised an objection to the absolute of market mechanisms functioning unconsciously.

[4] Nations also have the hierarchical structure to some extent, but the structures of democratic nations are much weaker than those of companies. Although the governments of nations have some influence on the structure of the market, *market* is defined here as controlled by the market mechanism.

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
Springer Cham, https://doi.org/10.1007/978-3-319-06889-3_5

structure of the organization much more flexibly and to a greater extent than they are in the market.

A hierarchy is a highly versatile interface to determine both fixed and ad hoc interfaces flexibly. That is, the hierarchy is an interface for establishing interfaces. Probably due to this reason, organizations are likely to be understood as ad hoc interface generators capable of responding to uncertainties and devaluing fixed interfaces. However, the situation has been changing rapidly these days, and more attention has been focused on the power of fixed interfaces such as modularity, standard strategy, business processes, and enterprise architectures. As a result, a line between the market, which was originally a collection of fixed interfaces, and the organization blurs. Actually, those have been coevolving through sharing fixed interfaces.

This chapter will discuss how the organization and the market with the same purposes and functions influence one another mutually, how the organization develops in the market, how the market is developed by the organization, and how both have been coevolving. The point is that both have been establishing and sharing fixed interfaces in concert with each other in order to reduce transaction costs. Four stages of the development process that both follow will be discussed as detailed in Fig. 5.1.

(1) First Stage: Emerging

This is the first of the four stages of an organization's development. A company normally originates from one or a few leaders. The leaders make all decisions, and others just follow. A fixed interface existing there (usually an implicit agreement) is that the leaders make all decisions and others follow. There is no other fixed interface, and all transactions are executed by ad hoc interfaces issued by the leaders. Individual motivation and skills are more emphasized than are institutional capabilities. "Mom and pop" stores are an illustrative example.

However, as systematic managerial methodologies have been promulgated through business schools and shared through media recently, even start-up companies are more likely to have the expertise and knowledge of the second stage from the beginning. Notwithstanding, it is still useful to analyze the basic staged structure in which companies advance by learning in a step-by-step manner.

(2) Second Stage: Centralization

In this stage, two kinds of fixed interfaces are introduced:

- Hierarchical: interfaces to determine hierarchical relationships (between managerial layers)
- Functional: interfaces to determine horizontal relationships (between departments, sections, and so forth).

Hierarchical interfaces define the managerial structure by which the roles and relations of superiorities and subordinates (e.g., directors, managers, and supervisors) are determined.

Functional interfaces define the roles of each function such as sales, production, and administration (e.g., accounting and general affairs).

		Emerging Efficient use of scarce resources	Centralization Efficient development and mgt. of resources by system	Decentralization Effective use of resources through decentralization	Unification Efficient use of decentralized resources by unification
Characteristics	Strength (early stage)	-Individual motivation -Flexibility -One charismatic decision maker	Organization/System -Scalability -Economies of scale -Standardized mgt.	Autonomy/Responsibility -Empowerment for agile and proper decision making -Individual accountability -Motivation -Competition	Total optimization -Resource sharing -Allocation of functions -Load balancing
	Weakness (late stage)	Dependency on individual -No scalability -No Economies of Scale	Limit of centralized control -Unmotivated employees -Delayed/improper decision	Limit of localoptimization -Redundancy -Meaningless competition	———
Example: Organization		- Craftsmanship - Apprenticeship	Bureaucracy (Headquarter with power)	Flat organization -Business Units -Holding company	Network organization -Horizontal division -Outsourcing -Corporate alliance
Example: IT	Hard-ware	———	Mainframe computer	PC, WS, Super-com, Word-processor specific device	The Internet
	Mgt.	———	Bureaucratic and standardized management by MIS department	End-user Computing	Internal: Corporate Architecture Social: Open Source

Fig. 5.1 The organization's stages of growth

The structure is subdivided into sections, teams, and so on.

Hierarchical interfaces and *functional interfaces* are adopted in this stage without exception as follows:

(1) Hierarchical interfaces

Hierarchical structure is adopted first because it determines the roles of issuing ad hoc interfaces, which contribute most to organizations in the first stage. There are various rules and regulations explicit or implicit in organizations, but the most universal agreement between employers and employees is that employees must comply with orders of employers (or delegated superiors), if there are no fixed interfaces (or agreements a priori). The superiors always have authority to issue ad hoc interfaces. This interface distinguishes organizations from the market.[5]

As the number of subordinates is limited to the number of people whom a superior can control by issuing ad hoc interfaces, the hierarchical organization of this second stage is subdivided further downward. This is the most efficient structure as far as issuing ad hoc interfaces is concerned. Compared with organizations in the first stage, where a leader issues all ad hoc interfaces to each member, orders from a leader permeate a company through a limited number of managers. More essentially, as most decisions are made locally

[5] In the market, obviously fixed interfaces such as regulations, rules, and contracts play significant roles, but ad hoc interfaces also exist. At the last part of every contract, a clause to designate the court to have the jurisdiction over disputes between entities is included, which delegates the third party to issue ad hoc interfaces if necessary. In countries where legal governance is immature, politicians and unofficial rulers frequently take this role.

under the authorities determined a priori, the number of transactions with a leader decreases and reduction of transaction costs are achieved (although effectiveness will decrease as well). This structure will be maintained up until the company reaches a considerable size.

If all fixed interfaces are established in the market and no ad hoc interface is required, transactions should rather be executed in the market instead of within organizations. All transactions can be executed under contracts and full-time employments, which bring some risk as fixed costs, are not needed. Because it has been impossible to execute all transactions in the market, the organization has had values. However, market contracts have recently been emphasized more and more in organizations, and entities have become more independent and modular rather than dependent and unseparated.

(2) Functional interfaces

When functional interfaces are fixed, each functional department (e.g., sales and manufacturing) has ownership as a module, which brings greater motivation and self-initiative. In addition, employees can concentrate on simplified tasks that provide plenty of opportunities to improve interfaces; efficiencies, skills, and expertise, and thus productivity are enhanced in each department. The effects of modularity can be obtained most easily with the deployment of the functional interfaces, and therefore this is the first selection for all organizations.

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Those two kinds of interfaces increase in quantity and quality gradually, and the structure as a collection of interfaces advances its efficiencies and competitiveness. In a hierarchical structure, the assignment of responsibility and authority in each layer (e.g., directors, managers, and supervisors) become more explicit. The functions are usually subdivided into segments (e.g., sales group by customer segments and production lines by products),[6] and interfaces to interconnect those segments are added and strengthened. Examples of interfaces between a sales department and a production department include communication rules, problem-reporting rules, and subsequent action rules. The communications are gradually fixed by document formats and databases. Surplus time obtained by efficiency improvements is allocated to tasks that require sophisticated, high-level capabilities such as customization, innovation, and new project planning. In the case of complicated communication such as scheduling coordination between sales and production departments that requires subtle negotiations and more than routine exchanges of formatted information, meetings are regularly held, which are also a collection of fixed and ad hoc interfaces. Efficient organizations are likely to fix procedures of

[6] Subdivisions by product, by customer, and by region are introduced, but those are just within departments. From the third stage, the whole companies are segmented by those axes.

meetings as interfaces. In contrast, inefficient organizations and societies typically do not fix interfaces explicitly; therefore, implicit ones such as customs and informal hierarchical structures (e.g., old schools, lands of origin, and races) develop spontaneously and function practically to reduce transaction costs. Those implicit interfaces are not manageable, causing confusion and producing insufficient effects.

Fixed interfaces are added in this manner along with the organization's increase in size, volume, and complexity. However, those fixed interfaces in this second stage are still introductory; that is, they are primitive in quality and quantity, requiring complementary ad hoc interfaces that are issued by internal coordinators (i.e., superiors such as CEOs and presidents). It is not until the fourth stage where fixed interfaces function almost completely so as to embody the effects of modularity.

(3) Third Stage: Division and Decentralization

In the organization, an increase in size is accompanied by an increase in operation quality as well as quantity, which include categories of product and customer segments (e.g., demography, regions, countries, and industries). As the hierarchical organization grows in complexity, it goes beyond the limit of standardized decision-making capability, and the disadvantages of fixed interfaces such as inflexibility and slowness become apparent. At such times, responsibility and authority should be divided, delegated, and decentralized. The entities that are thus formed are named variously as strategic business units, divisionalized organizations, or company-based organizations, all of which designate division and decentralization of organizations. Although it is good enough to remain in the second stage as long as the organization has only one product in one region, the growth has a limit, generally. It is time for the organization to innovate its structure.

It is effective to divide into modules when the organization increases complexity. Each task becomes simple enough to be routinized, and fixed interfaces are easily established to reduce internal transaction costs. Axes of the division (modularization) include product, region/country, and customer segment.

In the second stage, the organization was divided by hierarchy and function. Since the concentration of redundant tasks by modularization (division and integration) improves efficiencies, new axes were added in some local departments (e.g., sales and production) individually. In this third stage, the modularization (division) is the introduction of business units, which is a corporate-wide division by one additional common axis.

With this division of the organization, a business unit system is adopted, which clarifies each responsibility as profit by separate financial statements. Power is hardly delegated without conditions; each business unit should and can have its own autonomy only when its outcomes are monitored and evaluated. Outcomes (revenues and profits) of discrete divisions by function such as sales business units and production business units are influenced by in-house transfer prices, which are often determined arbitrarily. In contrast, profits of strategic business units can be calculated readily just by utilizing the

existing accounting information. One of the most significant reasons to introduce a strategic business unit structure with a comprehensive set of all the functions is the clarification of responsibility and authority.

Overhead departments occasionally remain in headquarters and the functions are shared by all the business units so as to achieve economies of scale. There are a large number of combinations of functions from R&D, general affairs, personnel, finance, public relations, accounting, and IT that remain in headquarters. In particular, the functions of basic R&D, finance, and investor relations are likely to remain. The smaller the headquarters becomes, the more decentralized the organization becomes. And they are reaching to the fourth stage.

By establishing interfaces of accounting between headquarters and each business unit, exchanges (addition and removal) of modules with other companies—that is, trading of business units—become possible, which illustrates the advantage of modularity. Promotion of competition among business units and consequent reactivation of the organization is another advantage of such a division.

(4) Fourth Stage: Unification

The problems of the organization in the third stage are quite obvious. Parts of delegated functions to each business unit are redundant, generating considerable inefficiencies. For example, many business units outsource IT systems with the same functions individually; they develop IT systems with the same purposes but with different specifications, resulting in inability to connect and share data with each other; and their sales departments visit one customer separately and compete with each other.

In the third stage, division into modules, which realizes autonomy and independence, was prioritized to these inefficiencies. The interfaces deployed in the third stage are for *division* of each business unit. However, as each business unit grows and redundancy in their activities appears, reduction of the waste becomes recognized as a new organizational issue. A purpose of interfaces deployed in this fourth stage is interconnection of modules so as to enable the collaboration among business units that have been working discretely.

For example, new accounting interfaces are introduced to standardize accounting processing procedures across business units. New facility management interfaces are introduced for sharing the assets. New IT interfaces are introduced to integrate all data centers, all system-developing functions, and all customer data. These new challenges require each business unit to implement costly changes in business processes, which deteriorate their short-term profitability. Various objections and rejections arise.

Many companies that are adaptive enough to undertake such difficult but reasonable innovation even have replaced the integrated functions by outsourcing service providers. Obviously, more economies of scale can be obtained if a professional company integrates multiple clients' tasks than if the integration is attempted in-house. Examples include functions of data

centers, accounting, call centers, recruiting, public relations, risk management, business planning, product design, sales, and even production. This practice, business process outsourcing, is firmly entrenched in the global business community. Furthermore, outsourcing of R&D functions, which was never imagined in the past, is also gaining attention these days.

Outsourcing requires an increase in costs as much as the outsourcers' profit, but the efficiency improvement obtained makes up for the increase in cost. Companies are becoming more likely to utilize outsourcing for better resource efficiencies, especially in developed countries where equity owners require higher profitability prior to revenue.

After the spread of the Internet, which reduced global transaction costs, companies started outsourcing functions as much as possible. Then questions arise: What functions remain in-house after irrelevant functions are outsourced? What is a company per se? Actually, the utilization of outsourcing has changed the concept of a company.

Answers to those questions were already proposed in the early 1990s as key success factors of high-tech start-up companies in books such as *The Virtual Corporation*[7] and *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*.[8] Eventually, the solutions have been embodied after the 2000s. Competition based on size has become obsolete, replaced by a newly popular, technology venture management style, in which companies outsource irrelevant functions and allocate their own resources strategically to their unique strengths. Assuming realization of further reduction of transaction costs, this is a reasonable strategy for gaining competitive advantage.

Incidentally, fixing interfaces between outsourcing service providers and clients a priori as much as possible is a key success factor for reducing transaction costs. Although the fixed interfaces between functional departments were established in the second stage, they were not perfectly designed, as there were internal coordinators such as CEOs and presidents who complement the immature fixed interfaces by issuing ad hoc interfaces. Actually, the structure heavily depended on the ad hoc interfaces. Because coordination costs between companies (outsourcers and clients) in this stage are huge, however, the fixed interfaces must be prepared for any situation and described completely as contracts.

This kind of unification is also performed by orders of superiors (e.g., CEOs) in the early third stage when the perfect independence and autonomy are not established. In contrast, the *unification* of this fourth stage is performed by consensus-based decision making.[9] Third-stage unification is considered less

[7] Davidow, W. and S. Malone (1992), *The Virtual Corporation*, Harper Business.

[8] Saxenian, A. (1994), *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, First Harvard University Press.

[9] The structure of this fourth stage can be also deemed as a derivative from the one of the third stage that has additional fixed interfaces of interconnections among business units in the third stage.

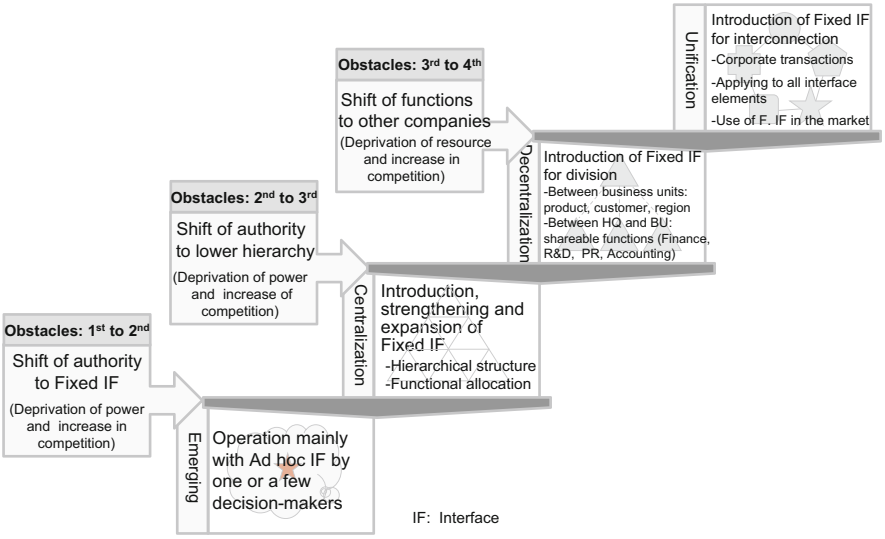

Fig. 5.2 Organizational obstacles at shifts to the higher stage: deprivation of vested rights

mature. All the organizations in the third stage should aim for *perfect independence and autonomy* to ensure further growth.

5.2 Obstacles to the Advancement to Higher Stages

The organization faces huge obstacles while they attempt to advance to the higher stages.

Although describing all the processes of the organizational growth in only a few pages may give the impression that the processes are executed without any problems, the reality is totally the inverse. The organization reaching the limits of each stage frequently cannot overcome rejections of reasonable innovations and end up with crucial decline or collapse. This subject has been explored throughout this book. The shift in and loss of vested interests destroy the significant attempts, which inevitably accompany any kind of innovation. In this section, structural difficulties in implementing corporate-wide innovations will be discussed, as diagrammed in Fig. 5.2.

(1) Organizational obstacles characterizing the transition from the first to the second stage

There are only ad hoc interfaces in the first stage, where flexibility is required for handling uncertainties in emerging environments. However, they are not good enough to make organizations efficient. The introduction of fixed interfaces for further growth is indispensable. When fixed interfaces are introduced to replace ad hoc interfaces, the power-driven, dependent relationship between a leader and subordinates gets replaced by the agreement-driven, equal relationship. Unfortunately leaders are likely to adhere to their power (i.e., ad hoc

interfaces) because not only do they lack the capability to design fixed interfaces properly, but they also lack the ability to control their behavior. Although it may be more efficient in many cases to rely on one prominent leader's excellent capabilities, growth of organizations (complexity) and confusion of the aging leader make the problem more difficult.

During the first stage, the leader dominates the company with his/her prominent capabilities by making proper decisions, thus ensuring good results. However, he/she adheres to old customs even when the deployment of fixed interfaces is badly required, believing that he/she is an exception, being afraid of losing his/her power, and disrespecting the newly introduced rules. In this situation, the leader is destroying the change despite the fact that he/she should take a significant role as a change agent. This kind of attitude on the part of a leader constitutes a crucial obstacle to the implementation of corporate-wide changes in behaviors and styles.

Moving from the first to the second stage basically challenges the deployments of hierarchies, processes, systems, and standards—that is, fixed interfaces. The loss of authority to issue ad hoc interfaces affects not just the leader but also a group of people near the leader who have been enjoying positions of power. The same kind of objection is expected from them. A similar complaint is expressed by craftsmen whose expertise is going to be standardized and shared by their young disciples.

Arguments against the deployment of hierarchies, processes, systems, standards, and fixed interfaces typically include statements that humans will be robotized; explicitly described know-how will be leaked easily; and individual creativity will be eliminated. It is also frequently argued that subordinates are immature and yet able to delegate. However, it is quite difficult to educate them without systematic and structured simplification of tasks.

In the next chapter, which will discuss design methodologies for processes, systems, standards, organizations, and interfaces, the countermeasures against those objections will be one of the main subjects. Rejections of processes, systems, standards, and organizations that occur at the transition from the first to the second stage will be described in detail.

(2) Organizational obstacles characterizing the transition from the second to the third stage

When the organization successfully introduces the hierarchical structure and advance to the second stage, the authority to issue ad hoc interfaces is distributed to the whole hierarchical organization, and the efficiency increases greatly. However, some issues arise at the same time. Holding the authority of ad hoc interfaces to determine output contribution and resource allocation satisfies the instinctive greed for power, which continues to grow unlimitedly.[10]

[10] For example, governments have the authority to make decisions that are not explicitly described in laws or the authority to issue ad hoc interfaces arbitrarily. Such power grows easily and becomes a source of corruption.

In corrupt organizations where self-seeking activities are prioritized, greed for power is more significant than corporate profits. In this unhealthy circumstance, it is quite difficult to conduct even reasonable necessary innovations. Inflexibility, a disadvantage of fixed interfaces, dominates those organizations. Even though fixed interfaces become obsolete and no longer respond to the external and internal environments, the groups depending on them try to obstruct changes. Fundamentally changing such a strong existing power base requires huge organizational energies.

The obstacles inherent to the transition from the second to the third stage are explained by the negative characteristics of bureaucracy. That is, the organization grows, hierarchy as a collection of fixed interfaces becomes inflexible as described above, and the problem is likely to be neglected even though it seems objectively obvious. This issue can also be decomposed into three structural factors.

First, it is difficult to make judgments regarding to the timing of decentralization. The decentralization corresponds to delegation of powers. The delegatees must have developed decision-making skills by that time. However, the judgments of the timing often differ between the delegatees and the delegators. The delegatees are likely to judge that they are already prepared to make decisions, while the delegators deny it. As this is a matter of effectiveness, there exists no perfectly objective judgment. The fact that the capabilities of delegatees are developed through delegation leads to a hen-versus-egg type argument.

A second factor confuses the issue more. Any type of delegation deprives a group of people of benefits such as financial and human resources, privileges, and honors, which sometimes compose their lives. Therefore, objections to the deprivation of such benefits always become intense. As the power of headquarters may disappear greatly in the advancement from the second to the third stage, the objections become organizational and stronger than any expectations.

Third, there is an organizational inertia working in the reverse direction. The organization expended huge amounts of energy to concentrate powers on the bureaucrats who executed systemizations and organizations in order to complete the transition from the first to the second stage. Consequently, inertia has been created, as it was a very difficult feat. Reversion of the inertia requires more energy than the first challenge does. The inertia works against all challenges that destroy systems and organizations, even those that modify obsolete ones. Local motivations to modify problematic systems are extinguished, and unreasonable decisions due to malfunctions of organizations are ignored.

(3) Organizational obstacles characterizing the transition from the third to the fourth stage

Redundancies among distributed business units are obvious in the third stage, but the transition from the third stage to the fourth stage precipitates organizational pains again. The purpose of this transformation is economization by eliminating the wastes, which naturally leads to the deprivation of vested rights. This causes all kinds of obstacles to the transition.

First of all, there arise objections against standardization of functions among business units (e.g., accounting, finance, personnel, general affairs, legal, IT, R&D, sales, and production). Standardization streamlines tasks and enables introduction of IT and lower-wage labors. However, it requires each business unit to change processes and forces some departments to confront the possibility of fundamental decreases in values. All kinds of objections with various expressions such as logical designation of the disadvantages and emotional supplications will occur.

For an old example, in the USA, Electronic Data Systems, which had grown explosively with the new IT outsourcing business, utilized M&As actively. It had kept merging the IT departments of its clients. Although the engineers in the clients' IT departments were treated as second-class employees at that time, they acquired incentives to expand their business as profit centers after the M&As. The company grew at an average rate of 15 % per year for 20 years until 1984, when GM merged it.[11] Actually the company started the intercompany unification for the first time in the world. Later, many companies followed to separate their overhead departments (e.g., IT, personnel, and general affairs), and most of them have been merged with professional service providers by now. As the key success factor of modularity is increase of task volume, intercompany unification has an obvious advantage over intracompany unification in terms of the volume. And the former has been obtaining accelerated popularity worldwide. This is a good example of a successful transition from the third to the fourth stage by converting objections into positive cooperation.

Although the spread of the strategic business unit system began in the 1920s after the successes at DuPont and GM, nearly all attempts at making this transition from the third to the fourth stage had failed for more than half a century due to the difficulties described above. The first successful unification of IT departments in DuPont, Ericsson, the EU, the US Department of Defense, and so forth triggered a trend of the transition in Western countries. In contrast, when Panasonic, which is widely known as a pioneer of the strategic business unit system in Japan, was challenged to overcome the issues of the third stage, it deployed a solution to strengthen its headquarters—that is, it reverted to the second stage. Panasonic advanced to the third stage again and repeated transitions back and forth. This is a typical structural problem for most large-sized, Japanese companies. The transformation to the fourth stage is indispensable for globalization of businesses, even for start-up companies. This illustrates Japanese companies' deviation from global managerial innovations.

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[11] EDS became an independent company in 1996 and Hewlett-Packard Co. acquired the company in 2008. This merger of $14 billion is the world's largest in the IT industry so far.

A commonality of all the obstacles at the three transitions is that these are accompanied by (additional) introduction of fixed interfaces. As these certainly cause elimination or drastic decrease of vested rights and intensification of competition, which also leads to decreasing the vested rights, the strong negative reactions arise. However, the need to fix interfaces increases as organizations grow. The energy for the innovations continues, accumulating like magma, and the transitions occur corporate-wide, like volcanic eruptions. Small distributed energies are not enough to overcome the objections and to provoke the changes. It is a pitched battle between all the needs for the transition and all the objections to the transition. Many companies fail to win these civil wars, resulting in decline and collapse.

5.3 Synchronized Growth of IT Systems and Organizations

The IT system grows by stages in synchronization with organizational growth.

As shown at the bottom of Fig. 5.1, the staged growth process of the organization is exactly the same as that of the IT system. The history of IT systems began with mainframe computers operated and managed by centralized structures. After undergoing the decentralization that accompanied technological advances such as minicomputers, engineering workstations, supercomputers, and PCs, the IT system experienced unification, such as sharing by internal standardization and cloud computing by the Internet. This coincides exactly with the stages of *centralization*, *decentralization,* and *unification* that the organization follows. It also has similarities regarding large-scale destruction and innovation. IBM, for example, collapsed in the transition from mainframe computers to PCs, and new venture start-up companies (e.g., Yahoo, Google, and Facebook) emerged in the transition from discrete PCs to the Internet unification.

There are two factors causing these commonalities:

(1) Technological innovations as management tools

IT systems have been developed to facilitate the processing of managerial information. Therefore, they synchronize with organizations in origin. In the centralization stage of the organization, IT systems take the same centralized structure to assist the information processing properly. In the decentralization stage of the organization, the same decentralized structure is adopted. In the unification stage of the organization, technologies for sharing information by networks and databases are developed. However, it could be more plausible to argue that IT developers proposed the new structures of information processing after their contemplation and practice of ideal management and organizations. Not incidentally, outsourcings and network organizations were born and brought up in Silicon Valley in the USA and spread worldwide. As IT is the area with the biggest innovations, Silicon Valley attracts highly innovative people who enjoy creation and self-growth from all over the world. The management technologies of Google, Oracle, Sun Microsystems, HP, Microsoft, and IBM have obtained attention by necessity.

(2) Efficiencies in utilization of scarce resources

The scarcest resource in an organization is managers who make decisions and manage executions. The structures to maximize the efficiencies of CEO/presidents in the first stage and bureaucrats in the second stage are adopted. When those resources become abundant, those are distributed to the locales in the third stage and are allocated for managing total optimization in the fourth stage. Similarly, in IT systems, the centralized structure is first adopted in order to utilize the scarce resources such as CPUs, memories, and input/output devices efficiently. As the prices of those resources decrease, those are distributed to be used locally. Finally, in the fourth stage, those resources are also allocated to functions of networking and sharing resources.

5.4 Growth of the Market (Society)

The organization and the market coevolve sharing interfaces.

As described above, the organization's growth process proceeds with establishing fixed interfaces. In this section, the structure and process by which those fixed interfaces in the organization become shared in the market (society) to become assets of the society and another structure and process by which the organization deploys fixed interfaces existing in the market will be discussed. The organization and the market coevolve through the four stages synchronously.

(1) Organizational interfaces of the second stage shared in the market

It is impossible to share interfaces of the first stage, as there is no fixed interface at the stage (except the one that determines the authority of a leader). However, the interfaces of the hierarchy and the functional allocation in the second stage are shared in the market widely. The roles of managerial positions (e.g., directors and managers) and departments (e.g., sales, production, personnel, and accounting) are quite identical among companies worldwide. Only marketing departments vary in their roles according to industries, as marketing functions such as planning, development, and promotion of products differ by product (e.g., consumer goods/industrial goods and contract-based/self-development) and by customer segment (e.g., supply-oriented emerging/demand-oriented mature market). There are commonalities because the interfaces are reasonable enough to have been adopted and shared by all companies through their business interactions over many years.

These standardized interfaces regarding managerial positions and departments have defined occupational qualifications and established labor markets where transactions of managers are executed. For example, sales managers are able to change companies, and accounting personnel are even able to change countries due to International Financial Reporting Standards (IFRS).

As occupational qualification systems guarantee capabilities of individual professionals by standardized evaluation systems, transactions with the licensees are fairly easy. For example, as the light frame construction industry

in North America and Australia standardized its building materials and skills, carpenters are readily substituted.

(2) Organizational interfaces of the third stage shared in the market

Accounting is adopted to clarify the responsibility of each strategic business unit. Quasi-companies are formed within a company and evaluated by financial statements (i.e., profit-and-loss statements and balance sheets), like listed companies in stock markets. Responding to fierce competition, their profitability is monitored and evaluated severely.

Financial accounting was developed for information provision and quality assurance of products—in this case, companies (ownerships of companies) that are traded in stock markets. As investment activities become global, IFRS are standardized internationally. The establishment of those fixed interfaces promotes transactions of business units and companies. Investment activities in developing countries where the quality assurance systems are not yet credible are still risky.

(3) Organizational interfaces of the fourth stage shared in the market

In the fourth stage, redundant functions are unified both intra- and intercompany. As for intracompany unification, tasks such as IT, general affairs, personnel, finance, and accounting are standardized and integrated across business units to improve efficiencies. As for intercompany, those services are provided by professional firms that offer fixed specifications and transaction conditions to multiple clients.

Integrated information system packages are available these days to assist those outsource service providers, which are also standardized in the market. As a consequence of competition for the standardization among IT vendors, fixed interfaces have been established in the market. The standardizations are progressing with systems such as SCM, sales force automation (SFA), CRM, personnel management systems, accounting systems, ERPs, which integrate the systems above, PDM, and call center management systems. In addition, ISO9000 for quality assurance, PMBOK,[12] and CMMI or COBIT have also standardized the interfaces in the market.

It is important to note here that the interfaces by which not whole ownership but only use rights are transacted have been established for the outsourcing. Although ownerships should have been transacted to use external resources until the fourth stage,[13] companies in the fourth stage have established interfaces to transact only use rights of external resources, such as computers, networks, databases, cloud computing, and production facilities. For better readiness and efficiencies, interfaces for transacting those resources are being standardized as well.

[12] Project Management Body of Knowledge, which is the guide for project management proposed by the Project Management Institute for project management.

[13] Except for rental and leasing.

5.5 Coevolutions of Markets, Societies, Organizations, and Individuals

The establishment of fixed interfaces vitalizes the organization and the market and alters ways of developing individual capabilities.

As described in the previous chapter, interfaces in the organization become shared in the market; that is, they are standardized as assets of the society. It also means that interfaces in the market become deployed by the organization. The organization and the market have been advancing the stages synchronously, and the synchronization appears to be getting stronger.

Challenges to reducing transaction costs appear in the organization as well as in the market and the society. This implies that it is not correct to recognize only organizations reduce transaction costs. Human beings have always sought opportunities to reduce transaction costs, and technologies have been evolving everywhere in organizations and in markets. Because markets originated as platforms for transactions, they constitute nexuses of interfaces. As the society is considered to be a platform for relations (transactions) of people, the society is considered to be a nexus of interfaces. In addition to the reduction of transaction costs, fixed interfaces clarify people's rights (ownership and human rights). Because it matches with humanitarianism and justice, fixing interfaces has also been pursued throughout human history.

Interfaces in the organization are shared in the market and vice versa. While fixing and standardizing interfaces have always been pursued, the organization and the market are mutually utilizing and sharing interfaces consciously and unconsciously. It is interesting to notice that organizational interfaces are not a target of competitions and shared in the society peacefully despite companies competing fiercely for acquiring standards of product interfaces (specifications).

For example, recommendation reports from management consulting firms are usually properties of the consulting firms and repetitively reused for other clients. Therefore, there are some consulting firms that differentiate themselves by stating that they have only one client in one industry. Although a reuse of a recommendation for strategies seldom occurs, as it violates their professional ethics, recommendations regarding organizational structures are regularly reused. The strategic business unit system obtained its popularity under such circumstances. Information systems integrators usually assert property rights of custom-made systems for repetitive reuses, and in return they provide their first client a special discount. Contracts, descriptions of transaction interfaces, are also reused without any notice by law firms who created them or by clients who ordered them either legally or illegally. These facts, interestingly, show that fixed interfaces of organizations that have been analyzed as significant assets for competition throughout this book have not been acknowledged by companies at all.

Even proprietary interfaces of product specifications become standardized eventually. Commoditization means a shift of ownership of a product specification from private to public by sharing and standardizing the interface. The property is

protected by a patent at first, but the specification is spread to the public in various manners. All transacted resources, including software, technologies, engineers, managers, and companies, are commoditized eventually by standardization of specifications. Although the speed of commoditization varies according to the complexity and specificity of resources, it accelerates more and more in general. Establishment of interfaces for information sharing in the society promotes the spread of interfaces, which also facilitates development of personal capabilities to design and utilize interfaces. Those are in a synergistic relationship.

The more transaction interfaces that are established, the easier transactions become. Robot programs that automatically search, extract, and deliver information that users requested will possibly obtain popularity when a few more interfaces are established. Those will begin soon to negotiate, agree, and conclude contracts with each other. A new age of transactions will dawn soon in which social transactions are different from those of today. Capabilities required for each individual at that time must be quite different as well.

Methodologies for Designing and Managing Interfaces, Modules, Standards, and Processes

6

Interfaces, modules, standards, and processes are essentially identical and therefore are designed and managed by identical methodologies.

6.1 Common Requirements for Design Methodologies of Interfaces, Modules, Standards, and Processes

Counterbalancing the multiple factors is critical in designing interfaces.

Throughout this book, the essential commonalities among organizations—interfaces,[1] modules, and standards—have been explored. Module structure is determined by interfaces rather than the module body. A standard is defined as a condition under which interfaces are shared by the majority. Processes correspond to interfaces per se. For these managerial devices, which are essentially identical, common design methodologies should be applied. As discussed thus far in this book, transaction costs are reduced by the development of interfaces, but the results would be very different depending upon the technologies of the design and operation of interfaces.

The key factor in designing interfaces and standards is designing specifications that can be used many times (N) over a long period of time and sharing them by all related entities (M) to reduce development costs of the transaction interfaces by $1/N$ and $1/M$, to enhance operational efficiencies, and to reallocate the surplus resources to improve effectiveness as needed.

External interfaces and standards (with customers and suppliers) take the forms of product specifications and transaction conditions, which are described explicitly in contracts. Because those are also utilized as internal interfaces, the same concept can be applied to design methodologies. In contrast, internal interfaces (within organizations) take various forms such as business processes, institutions, systems,

[1] In this chapter, interfaces are only referred to as fixed interfaces, unless otherwise specified.

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
Springer Cham, https://doi.org/10.1007/978-3-319-06889-3_6

information exchange rules, conference rules, and IT; in addition, internal interfaces include implicit (such as trust and habits) and unfixed (i.e., ad hoc) ones. Therefore, internal interfaces are much more complicated to deal with.

In this chapter, the methodologies for designing internal interfaces, which could be also applied to external interfaces, will be discussed, referring to the specific cases of external interfaces if necessary.

(1) Counterbalancing fixing and creative destruction

Interfaces should be fixed and shared to economize both parties of transactions. However, fixing frequently leads to rigidity, which would obstruct changes, growth, and innovation. Therefore, achieving balance in this mutually colliding structure would be important. Extreme ideas like "systems (interfaces) should be avoided as much as possible because they will make people rigid," which is similar to the argument that "cars should be abolished since they kill people," can be observed often. It is not necessary to deny all automobile usage based on only one negative aspect. Rather than being trapped by negative considerations, positive actions to solve the structural issues should be sought.

However, situations in which only the disadvantages appear without improving efficiency and effectiveness are actually observed quite frequently. Two approaches should be applied to solve this problem: one is by improving methodologies of design, which will be discussed in this chapter, and the other is by enhancing the basic innovation capability of companies, which will be discussed in Chap. 10.

Although this is not limited to interface design, it is impossible to sustain growth without the basic capability of innovation, which facilitates continuous, creative destructions to respond to changes in the business environment. Successful experiences should be shared by everyone, but any innovation will certainly become obsolete someday, and changes in the present *fixed* procedures for the innovation will be required. Any organization, strategy, piece of production equipment, and so forth is implemented by *fixing*, and therefore, the innovation capability would be a prerequisite for continuous growth. The capability of innovation can be covered to some extent by the design capability, which is the object of this chapter. However, as innovation is also a collection of transactions, the transaction costs would obstruct the process of innovation. Improvement of those specific transactions is essential to promote innovation. This will also be discussed in detail in Chap. 10.

(2) Counterbalancing between proper design and enforcement of use

It is significant for fixed interfaces to be used by every related member. Transactions through a fixed interface would be impossible to execute if one party does not use it, and costs of ad hoc interfaces on top of the fixed cost are incurred at each transaction. An inefficient and troublesome situation in which fixed interfaces can be used sometimes or not used other times depending upon transaction partners would result in a vicious cycle in which the fixed interface would be used less and less. A proper design suitable for all users is indispensable for being used by all the users. Even if the design is proper, substitution

costs are incurred by the users; changing familiar operations and transaction procedures and getting accustomed to new, fixed interfaces also bring huge mental burdens in addition to physical costs, and this will easily cause resistance to change.

On the other hand, the designers of the fixed interfaces who believe their works to be the best, without considering that these may not be used by users, tend to be careless in promoting the uses of the interfaces. It is necessary to encourage the users to change by explaining the benefits and giving every possible support regarding the new operations and procedures. There is also an easier way to force the users by authority. However, it is also easy for the users to claim that the design is too poor to use, and it is quite difficult for the designers to refute such objection logically due to the fact that the effectiveness cannot be evaluated objectively.

The essential problem here is that there is a structure in which there is a conflict of interests between the designers and the users of interfaces. It is impossible for a fixed interface to satisfy 100 % of users, so a compromise must be found from the perspective of ROI, which is difficult to judge. Blame games arise when the introduction fails; the unclear location of the responsibility obstructs the modification and improvement. After repeated such failures, interfaces would be deemed useless and negated, as a whole even before consideration.

Designers may be tempted to abuse their authority to enforce the use of their interfaces through the users, but they should rather take sufficient time and cost to ensure the explanation, education, and training as much as the design. With a strong tendency of top-down management, global companies face fewer problems in the enforcement of learning and using interfaces in general. However, in the case of companies with democratic cultures, like Japanese companies, which tend to respect all employees' benefits too much, enormous amounts of time and cost must be expended. An information systems manager in a company that has utilized information systems unexceptionally well explained that he visits their users in all of their offices all over the country with several hundreds of PowerPoint slides whenever they introduce new systems. Interface design should not be started before understanding the structure of such conflicts of interest.

This concept is also applied to companies that intend to standardize their products in the market. The products with the best design do not always acquire the standard position. Mac OS was said to provide higher performance than Windows OS, but Microsoft's strategy for promoting the use of its OS was better. In the competition of VCR standardization, Sony's Betamax, which had technical superiority, was eventually defeated in the market, which also demonstrates the importance of product promotional campaigns. In addition to a good design, sufficient efforts to motivate users to use the product should be devoted in order to activate the positive feedback effects and to bring the product up to a standard. To do so, remarkable price cuts and user service enhancements are needed. Those marketing activities (explanation, persuasion,

and education, in the case of inside companies) are as crucial as the design for the establishment of interfaces and standards.

In the following sections, these methodologies of *proper design* (Sects. 6.2 and 6.3) and *marketing (promoting) of use* (Sect. 6.4) will be discussed.

6.2 Methodologies for Design

In the first place, the characteristics of interfaces should be essentially understood.

6.2.1 Return on Investment Analysis as Asset

Fixed interfaces correspond to assets.

In this section, four basic requirements for designing interfaces will be explained. First and most importantly, fixed interfaces should be acknowledged as assets. It may be difficult to recognize them as assets because they are intangible, not physical like a manufacturing facility. With designing interfaces in practice, the various problems caused by this lack of awareness occur frequently.

As interfaces are assets, their development means an investment; the more they are used, the higher the ROI becomes. As a matter of course, the ROI of an assets should be carefully examined. When facing a low return, the causes should be investigated and the problems solved, the result of which should also be applied to future investments. For physical assets such as manufacturing facilities, analyses like capacity utilization and evaluation and improvement of investment are typically executed. However, for interface designs and developments, those analyses are rarely practiced. Rather than scientific analyses, sentimental excuses and sophistries are more influential. In this chapter, scientific and quantitative methodologies of the ROI analyses will be proposed, but even evaluation on the basis of gut feeling alone would be much better than nothing. Just by conceiving of interfaces as assets, a huge difference in the ROI will easily be obtained (Fig. 6.1).

In the case of not fixing interfaces (shown in dark), transactions are executed by establishing ad hoc interfaces at every transaction, which incur large transaction costs. On the other hand, transaction costs would be reduced if a fixed interface was introduced (shown in white); however, a large initial cost of planning, designing, and developing is required instead. With a proper design and a certain number of uses, a sufficient ROI would be obtained; the ROI increases as the number of uses increases. Conversely, the initial investment would become a total loss if the interface is not used.

In short, to increase the ROI of fixing an interface, the interface must be designed to make the usage frequencies as high as possible and the use period as long as possible; users' needs must be analyzed and understood precisely. As users' needs are continuously changing every moment, the usage frequency will increase if changes in the future are well anticipated and prepared. In contrast, without

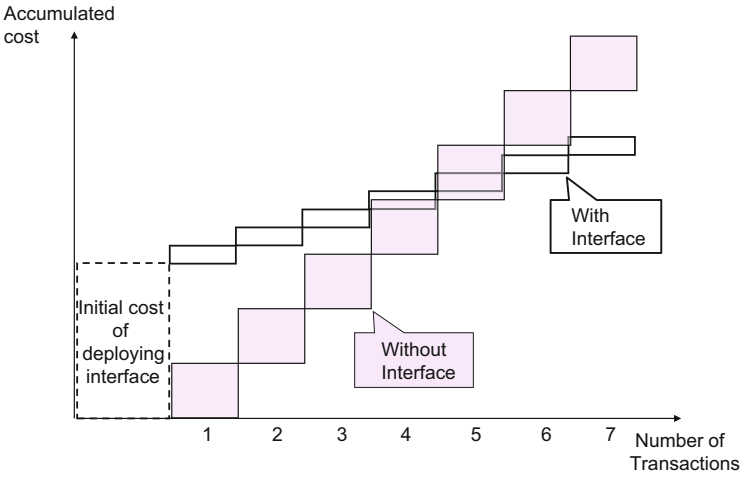

Fig. 6.1 Cost structure of transactions with and without fixed interfaces

forecasting the changes precisely, the interface would become useless earlier. It is an inevitable condition that is applied to any kind of asset. Without the awareness that interfaces are assets, the design requirement of increasing the usage frequency and period is easily neglected. And thus the only negative aspect is emphasized, despite the important requirements not being processed.

Meanwhile, obsessions like "interfaces should be fixed for any scene" or "fixed interfaces should be able to handle any case" are typical misunderstandings on the designer side. First of all, fixed interfaces should not be introduced when users' needs are uncertain or when the sufficient ROI is not expected. For example, when facing continuous trials and errors right after a product is launched into the market, all departments are cooperating and adjusting for enhancement of the product performances by all means. They do not have enough experience or information for fixing interfaces; even if they are fixed, they will be changed instantly with a high probability. Price and diversified product line are not important factors for early adopters in the market, the customer segment at this stage. Optimizing adjustments without modular structure would be most important in this situation. When the competition becomes fierce, however, lower prices, quick responses, and diversification of product lines to accommodate the various needs in the market become more important. For the first time in this situation, efficiency improvements of resources by fixing interfaces become valuable for competitiveness.

The timing of modularization or fixing interfaces has become harder to determine in the global markets these days. In the past, there was enough time from launching products to modularization, which allowed the costs of the development and adjustment for the new products to be recouped relatively easier. Companies with advanced technologies, such as Japanese companies, were able to accumulate profits before low-priced products were required. However, in emerging markets in recent years, such as China and India, customers require low prices while at the

same time having surprisingly diversified needs. To accommodate those needs, it is essential to diversify the product lines. The time to adopt modular structures for diversification and lower prices becomes shortened overwhelmingly. That is also because the technology of modularization has highly progressed, while Japanese companies have neglected the management methodology, and also because some companies have already started taking enormous risks at very early stages in the intensified global competition. In any case, there is no doubt that these practices have brought Japanese companies' continuous declines in the global markets.

6.2.2 Proper Design for Satisfying Users' Needs

Interfaces must satisfy users' needs anyway.

The design of fixed interfaces must satisfy users of interfaces (employees as well as customers). Fixing interfaces corresponds to the selection and the standardization of transaction activity patterns that users should comply with. There would be users whose needs match with the patterns as well as users whose needs do not. Minimizing the number of the latter is a major premise of *proper design*. However, as a perfect design is impossible, unfairness and inequality are structurally inevitable. Capabilities of consensus building and interest adjustment are required for companies. This is not limited to interfaces, and unfairness and transfers of vested interests occur with every decision and change. Capabilities to overcome the small conflicts of interest for achieving the major goal would result in the essential competitiveness of companies.

However, it is also true that there are many designers who justify the properness of their designs that actually deviate from needs by using sophistries and who easily depend on enforcement of use. It is significant for the designers to consider fully the actual situations including the conflicts of interest among users and to extract the greatest common factors in their needs.

6.2.3 Proper Selection of Objects to Be Fixed

For proper design, objects to be fixed are properly selected.

To perform the design that properly satisfies users' needs and does not bring any obstacles to their operations, it is important to select the right objects to be fixed properly, as follows:

(1) Selecting the transaction activities that will not change in the long term

For example, at the time of the writing of this book in 2013, no one would oppose the development of an e-commerce system based on the Web for the reason that the future of the Web is uncertain. However, the judgment could be different if it were in the early 1990s. For another example, the decision regarding whether to shift to HTML5 from HTML4, which has been the mainstream of Web commerce technology, still involves some risks: although

HTML5 is an expected technology for the future, the specifications are not yet standardized. Selecting technologies and products that have been used for a period of time in the society and established as a standard would decrease the possibility of changes and increase the ROI.

As forecasting the future of the market becomes increasingly difficult, the companies that take such risks and succeed in it are likely to overwhelm their competitors. Although a risky decision will result in failure with high possibility, it becomes more crucial for competitiveness enhancement to challenge risks in the intensified *winner-takes-all* competitions. Companies should be flexible enough to challenge new interfaces, and their adaptiveness can be developed by challenging changes in the current turbulent and uncertain environment. Also, the managerial effort to eliminate feelings of fear and rejection of change becomes more important than ever.

(2) Selecting *seemingly irrelevant* activities

A *seemingly irrelevant* transaction activity can be explained as follows: fixing of the particular activities would affect the whole very limitedly; the necessary cost is limited; the outcomes or effectiveness of this transaction will not be deteriorated by fixing; it is not defined as a source of differentiation of the company; and it has less added value. In short, these are the activities, the changes of which would incur little cost and not impair effectiveness. For example, although differences exist in conference reservation procedures, all of them share the same purpose, which is to manage the reservation of conference rooms, without making any substantial difference in effectiveness. The cost of changing the procedures is small. Also, with selections of e-mail software and file-sharing systems, no significant differences can be observed among all the candidates. Despite some of the features becoming unusable due to changes to standard products, there is little possibility of bringing a large detriment to the transaction activities. In a database for data-sharing, the formats or forms are not crucially significant when it is introduced for the first time. Any data entry can be handled fully if there is an input item named "miscellaneous."

What matters is that, by ignoring slight differences, transaction costs can be significantly reduced as a whole. But the perception of the magnitude of this *cost of change* is subjective and thus is different from person to person. For example, when fixing and sharing an interface like an interdepartmental information system, differences in code systems (such as product code and customer code) and definitions of terms among departments cause problems. Typically, those have been built historically and customarily by each department, which have already been familiarized with them. Therefore, the consequent costs of change will be incurred by all parties. Even after the unification of codes and terms, the standardization activities of each department incur significantly higher costs. A group of companies that are willing to challenge these changes by accepting large costs will eventually become accustomed to managing them. This further decreases the costs of change; the companies become more and more flexible. On the contrary, another group of companies

refusing changes will be burdened with the increasingly larger costs of change. Companies should encourage all their employees to adopt changes and innovations and streamline those *seemingly irrelevant* activities. The ability to respond flexibly to changes that correspond to the changes of interfaces would form the foundation of innovation capability.

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As discussed above, the objects to be selected and fixed include the following: the required change is relatively small both at present and in the future, the necessary cost is limited, the technologies are already matured, little value will be added, the effectiveness will not be deteriorated, and the efficiency is more significant. Conversely, the objects *not* to be selected and fixed include the following: technological innovation is proceeding vigorously, it is defined as a source of differentiation and value add of the company, and it is more significant to have flexibility and originality without any rigidification. When companies generate more innovations more quickly, more activities will need to be fixed. Surplus resources obtained from the fixings can be reallocated to value-added activities to create differentiation, a result of which would bring the whole companies into a virtuous cycle where innovation would accelerate further. In contrast, companies without innovation would fail in fixing as they fear becoming more rigid. Efficiency is not improved without fixing, which results in the lack of resources to execute new challenges. Fixing and innovation are inseparable in companies, and the competitive companies can find more *seemingly irrelevant* activities to be fixed.

6.2.4 Design as "Simple Is Best"

If an interface is simple, the transaction costs are reduced.

Simple structure and specification are most significant in the design of interfaces. As described in Chap. 2, although interfaces are supposed to have hierarchical structures, their complexity due to interrelation will increase when the entirety becomes larger, which makes understanding and using more difficult. This will cause a serious problem in promoting uses to users. If an interface is simpler, the costs of understating and using it (i.e., the transaction costs of the interface per se) will be smaller, and it becomes even easier to deal with the expansion.

In recent years, two concepts have been emphasized in the design arena of IT and software: product architectures and architects who are responsible for the architecture design. This is due to the increasing significance of total frameworks that enable concurrent and consistent activities among functions (e.g., design, development, operation, maintenance, and extension) under the situation that products and systems have increased their sizes and complexities. An architecture corresponds to a collection of interfaces. Inconsistent design of architectures will significantly increase confusion. Architectures with integrity can dramatically reduce the

transaction costs such as the costs of explanation, understanding, sharing, modification, and problem solving.

The term *architecture* involves multiple factors. The proper architecture should cover strategy and marketing plans in order to clarify the concept and purpose, and organization and business processes in order to ensure the execution. For example, to determine the platform/modular structure as the specifications of products, the issues on both the market side (priorities of the target segments and basic specifications of the products) and the technology side (a structure that configures a platform, core functional modules, and peripheral modules) must be resolved in advance. At the same time, future expansion of own technologies, motivation of engineers, and differentiation from competitors should also be considered. Architects should determine all the basic elements that serve as a foundation of all fixed interfaces. The concept generally known as "architecture" just covers a portion of them. Architectures cannot be designed properly if the designers are trapped with only a part of the whole idea, like "*architecture* means *components structure*."

Japanese companies in recent years have little perception of the significance of architecture and interface designs; their products increase in complexity, and consequently their organization structures increase in complexity as well. Thus, there is much room for improvement in their design methodologies. Their attitude of "products with high quality are marketable," which deprecates lower prices and higher cost performance, shows their lack of marketing sense even though this approach was a success factor in the past. Which market segment, providing what specification with how much price and how and where promoted—that is, the concept-makings of grand designs and underpinnings of a detailed implementation plan—should be prepared precisely.

Interfaces aggregate to structures such as organizations, processes, and modules. The overhead view of the whole structure should be conceived easily. Parts with the weakest relationships should be located separately, and parts with the strongest relationship should be located closely. By making everything from the whole to all the details in this simple manner, both a grand design and detailed descriptions can be understood easily. As a result, information regarding relationships and locations of each part in the whole can be transferred instantly; the transaction costs of implementing the interface will be reduced greatly.

6.3 Required Capabilities for the Designers

Logical thinking is indispensable for proper design.

Fixing interfaces improperly never contributes to efficiency improvement, and it even causes huge losses to all the users by forcing irrelevant activities. Biased opinions like "any fixed interface is valueless and should be avoided" could arise in this situation. In order to avoid this pitfall, the capability to complete proper design is required, of course.

Because interfaces must be used in as many occasions as possible to obtain the highest ROI, specifications that ensure the uses in more areas and in longer period are required. This is the thinking process to extract commonalities from countless events, which can be embodied by *inductive logical thinking* (a thinking process to extract commonalities) and *deductive logical thinking* (a thinking process to recall various possibilities of combinations).[2] *Inductive thinking* and *deductive thinking* are shown in Fig. 6.2. In short, the thinking process required here is recalling infinite matches of a specification and uses (by the *deductive thinking*), evaluating all the relations, and extracting the specification that the ratings of the relations amount to the highest (by the *inductive thinking*). In other words, it is the thinking process necessary to evaluate all the relations of ∞ versus ∞ and extract only one from them. The traditional thinking process of recalling a one-to-one pattern from memory, which is still popular in higher education, can hardly achieve these ends. Incidentally, *inductive logical thinking* and *deductive logical thinking* construct the core of logical thinking.

As a collection of interfaces, an architecture must be simple. In this regard, defining contexts (preconditions and premises of reasoning) objectively and explicitly plays a significant role. In logical thinking, *ensuring objectivity*,[3] that is, low transaction costs of transferring information due to the consistency in individual interpretations, is critical. It ensures accurate and effective transmittance of information. At that time, objectivity is embodied by decomposing (branching) and defining contexts. Misunderstanding occurs easily when recognitions of a context are different, which may not even be noticed in many cases.

Here are illustrative examples, including a popular case of a syllogism to explain the importance of objectivity in information transfer:

(1) In the case of the proposition "blue sky → no rain → do the action outside," there are two equivalence relations generated: "no cloud = no rain" and "one of the implementable activities while no rain = the action." There exists a large difference in logicality between "Let the space shuttle return because there is no cloud in the sky" and "I will go jogging since there is no cloud in the sky." Because a space shuttle is just a glider without a self-propulsion function, the definition of raining is restricted to scientific analysis of weather conditions. In contrast, the people who insist on accuracy in everyday conversations about weather related to activities like jogging or shopping are annoying, because they set contexts quite differently from the majority. In this case, the significance in the accuracy of the weather forecast is the context, the difference of which makes confusion and trouble in discussions despite the logical syllogism being appropriate. Those people who lack objectivity, who are simply

[2] Deductive logical thinking is often explained as to conclude a specific reasoning by applying general rules, but thought to recall various possibilities is required in order to match a general rule to a specific situation.

[3] Objectivity is an object of logical thinking as well as its means.

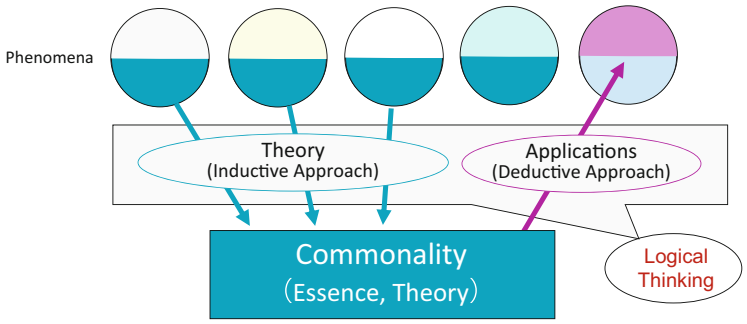

Fig. 6.2 Inductive thinking and deductive thinking

argumentative, have been mistakenly labeled as logical in Japan and have ruined the image of logicality in the society, even in businesses.

(2) The reason for the endless argument between one group of researchers who claim "tacit knowledge is the most important resource of an organization," another group of researchers who claim "tacit knowledge (as information) that cannot be recognized by the brain cannot exist," and yet a third group of researchers who claim "tacit knowledge (as know-how) that cannot be standardized cannot be shared" is because of different definitions of tacit knowledge as a context (or a premise). Even when the definitions are described explicitly, there are still more cases in which the definitions are not objectively conceived to construct contexts. For example, even if *tacit knowledge* is defined as knowledge that is difficult to transfer, the possibility of misunderstanding is not eliminated totally. There are still many different axes to decompose it. In addition to the one above, which is whether it is possible to transfer, there are whether it is possible to systematize, whether it is possible to verbalize, whether it is recognizable by the brain, and many more. As such discrepancies in understandings and communications pile up, the chances that complicated discussions will fall into chaos increase. At the same time, cases in which just reaching a consensus is prioritized by hiding the discrepancies, using ambiguous expressions, and concealing the issues are widely observed, a result of which is to collapse the discussions and even the relationships. Such incomplete transactions incur large ex post processing costs.

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To decompose the situation for defining the context and facilitating common interpretation, the concept of Mutually Exclusive Collectively Exhaustive (MECE) plays important roles. As shown in Fig. 6.3, MECE is a structure in which a situation is decomposed without an overlapping or a missing element, and it can be clearly understood by anyone with no misunderstanding (i.e., objectively). This structure can dramatically reduce the transaction costs in communication. For example, *man and woman, input and output, buyers and sellers, revenues and costs,*

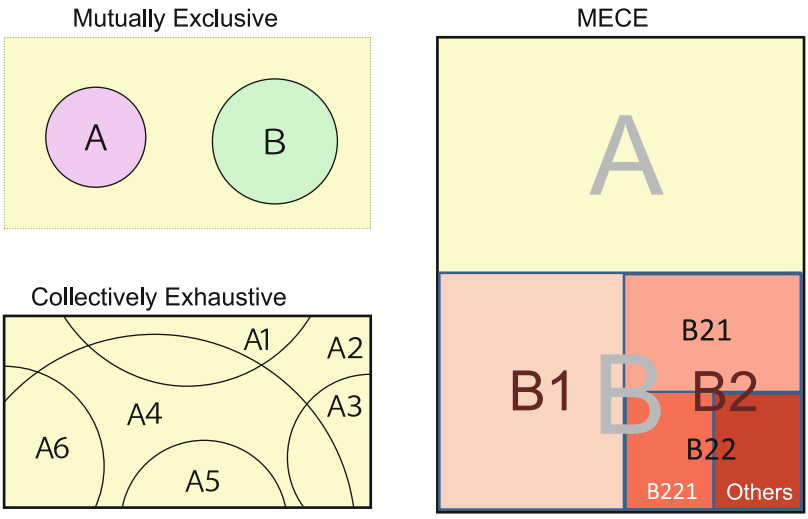

Fig. 6.3 Concept of MECE

internal and external, 20 or older and under 20 years of age, and *PDCA (Plan-Do-Check-Action)* are deemed as in the MECE structure. In contrast, *high-income people and elderly people, hot area and dry area, strategy and tactics,* and *data and information* are not in MECE because there are overlaps and missing areas in them. *Men and women* is in the MECE in most cases, but its traditional idea has brought great confusion to the discussion of gender identity disorder issues. Problems due to these ambiguous classifications causing confused discussions are seldom recognized in day-do-day operations.

It seems too strict to many people generally, but in order to avoid the confusions in practice, the strict decomposition and the configuration of the context are very significant.

Because organizations, processes, products, systems, and architectures are collections of interfaces, those should be designed as simply as possible. This is a typical case that MECE is applied to. By applying the MECE structure, the mutual independence is embodied, while the whole entirety is covered, and the objectivity is ensured. In other words, without misunderstanding, each participant can understand accurately and respond quickly, thus incurring much lower transaction costs. For example, as AC power module and PC body are clearly separated, it is easier to process all the activities in design and manufacturing organizationally. A PC body can be decomposed into hardware and software and then further into system software and application software. The processing unit of a PC can be subdivided further into the central processing unit, graphic processing unit, network/communication processing unit, and so forth. Setting such a MECE structure as the context, people can perform their work independently and smoothly without misunderstanding, mistakes, and confusion.

Although those examples above are just simple ones for an illustrative purpose, to construct the MECE framework in real, complicated situations actually requires considerably high capabilities (or rather capabilities that are difficult to obtain in general education systems.) Products, organizations, processes, systems, modules, architectures, concepts, and visions as collections of interfaces necessitate the high structuring capability that can be called genuine talent, as it is an extremely rare talent that is usually not required by a traditional sense of problems. Without this structuring, transaction costs will surely increase and competitiveness will decrease. It is not exaggeration to argue that this capability is deemed most basic to handling complexities. As will be described in Chap. 9 in detail, this is also applicable to exercising individual creativity and originality. As Bill Gates of Microsoft took the position of chief architect after CEO, the significance of architects who design architectures has been recognized, especially by leading-edge technology companies. The capability and the number of architects determine the competitiveness of a company. The reason for the drastic weakening of the competitiveness of Japanese electronics companies, such as in the mobile industries, is because they have ignored the development of such capable architects, prior to their council system.

This discussion can be applied not only to IT-related products but also to all the products that are increasing the complexity. Software becomes the key success factor for the differentiation of automotive and even pure mechanical parts, such as propeller blades and motors. It can be argued that software development competences and the development of architects increase the significance in any industry without exception. It is no longer possible to survive in the global competition without those capable architects.

Japan has been successful in memorizing technologies and information, putting its first priority on catching up with Western countries. In order to achieve that, it has mastered one-to-one pattern recognition capability, thoroughly depending on education by rote instead of logical thinking—that is, thinking capability to extract the most suitable pattern from ∞:∞ combinations by means of evaluation and comparison.

Meanwhile, education and self-learning of logical thinking, which includes inductive logical thinking to extract commonalities, deductive logical thinking to recall various possibilities of combinations, hypothesis and verification thinking, and objectivity, have boomed even in Japan these days. More than 300 logical thinking books with similar titles and contents have been published in the market. Companies have started screening candidates for their logical thinking capability at their employment examination, and students are eager to learn to prepare themselves for job interviews. Hopefully, they will quickly be able to overcome their lack of the capabilities.

6.4 Marketing Methodology for Promoting Uses

Both within companies and in the market, marketing activities are indispensable for promoting and encouraging uses of interfaces.

Assuming that a fixed interface is designed properly, its use should be promoted to members within companies as well as users outside companies (e.g., customers and suppliers). The more frequently it is used, the higher the ROI becomes; as it reaches a standard position, the number of users will increase by the positive feedback effects.

However, designers and developers of interfaces have a strong tendency to believe that all their work is completed when the interfaces are built and that the users have responsibility for the use, as frequently seen with information systems department people. In fact, users do not start using without such marketing activities by the developers and do not reach the number to activate the positive feedback effects.

Besides improvements of the design quality, methodologies to increase the usage frequency are basically the same as the measures for standardization described in Chap. 3, regardless of their being implemented within companies or in the market. This will be explained by classifying methodologies into enhancement of the awareness; reduction in the user fee; education, training, and support; and enforcement, management, and evaluation of the use.

(1) Enhancement of the awareness

Users of an interface must be aware of the existence, meaning, and significance of the interface before using it, as a matter of course. Great benefits gained from using the interface should be explained explicitly in advance. Although a limited number of companies can succeed in the maximum utilization of information systems, particularly in Japan, information system departments in all the exceptionally successful companies have paid persistent efforts to persuade users. As reluctance and anxiety to change are strong, steady activities to increase the number of users by answering every single question are required.

(2) Reduction in the user fee

As a lower price can promote the use, it is necessary to restrain the user fee, especially at the beginning. These days, most commercial software providers offer some features or time-limited uses free of charge. Even within companies, the same approach can be applied.

(3) Education, training, and support

When a new interface is introduced, the users will become confused because the ways of transactions are changed. In many cases, it is difficult to know even where and how to find the user instructions. In order to increase the usage frequency, it is necessary to eliminate any obstacle. To solve this problem, the appropriate support system is required for both internal users and external customers. Not only online manuals but also support desks to respond to questions by telephone or e-mail quickly should be provided.

(4) Enforcement, management, and evaluation of the use

To avoid the huge costs generated in (1), (2), and (3) above, it is possible for top management to depend on enforcement to use the interfaces. It is especially effective for the users who stick to self-interest and ignore the overall optimization. The top management commands the use of the interfaces, sets the responsibility of its managers to manage the use, and monitors and evaluates the level of usage in each department and team. Top-down enforcement works only when the top management has both strong leadership and an essential concept of an interface. For example, the probability of successful utilization of information system increases overwhelmingly if the top management understands the significance of introduction and the issues for utilization. If the top management acknowledges the necessity of the introduction, it must exert explicit and implicit pressure, which clearly enhances the usage. On the other hand, the "Don't think. Feel" type of top management, which is still the majority in most countries, may not be able to take the initiative due to lack of such understanding. The interface, as it can be recognized by logical thinking, cannot be understood essentially without this capability. The lack of leadership in the old-style management of Japan also poses a very serious problem for increasing the investment efficiency of interfaces. However, even in Japan, start-up and growing companies are demonstrating the appropriate utilization of interfaces under strong leadership. This exhibits one of the biggest differences between the conventional companies and the emerging companies there.

Products should be promoted in the market, as a matter of course. As the discussion here is about increasing the users of fixed interfaces, namely, standardization, the measures to take the majority for standardization in Chap. 3 are directly applied. The three positive feedback effects for standardization—*network externalities*, *bandwagon effect*, and *economies of scale*—should be utilized properly here as well.

6.5 Methodologies for Operation

Various measures in each transaction element must be implemented in the operation to enhance the effectiveness of interfaces.

6.5.1 Steady Implementation of the Effective Cycle

Running PDCA cycles by steady implementation of necessary steps is significant for effective utilization.

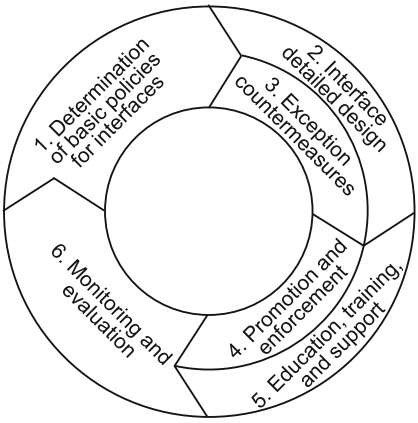

Fig. 6.4 Effective cycle for utilizing interfaces

The methodologies for utilizing interfaces mentioned in Sects. 6.2 and 6.3 will be redescribed using the framework of *effective cycle*, which puts emphasis on the operation as well as the design. Steady implementation of the *effective cycle* in Fig. 6.4 is indispensable to making interface function as designed.

(1) Determination of basic policies for interfaces

The basic policies (which correspond to the basic interface for the design), such as premise, philosophy, vision, objectives, targets, constraints, and scope of the application, should be determined for the detailed design. Users' requirements should be clearly understood, and the basic specifications and options that satisfy as many main targeted users as possible should be determined. The basic structure, consisting of a platform and modules, should be designed from the two viewpoints: users' needs and technologies. Unclear principles will confuse the developers and, consequently, the users. An aggregation of confused interfaces will be rejected by the users, making it impossible to achieve the goal of *uses by as many users as possible*. To what extent interfaces should be fixed and be left as exceptions (unfixed and determined ad hoc at the locales) also should be considered. These items can be conceived as the core portion of an *architecture*.

(2) Interface detailed design

Following the methodologies for design described in Sect. 6.2, interfaces should be designed in detail properly.

(3) Countermeasures for exceptions

While emphasizing the significance of fixing, it is impossible to fix all the activities without any exception, which would reduce the efficiency. Therefore, the structure in which the exceptional individual parts are clearly separated and handled by ad hoc interfaces should be designed.

A fixed interface is one in which the transactions with high frequencies are extracted and fixed as forms, such as systems, processes, and rules. Originally, it is not applied to 100 % of transactions; the exceptions should also be considered and prepared instead of just being ignored. Explicit and easily understandable countermeasures using ad hoc interfaces must be designed and provided for all exceptions. Users generally have the misunderstanding that fixed interfaces are designed to handle 100 % of their activities. Accordingly, when events to which fixed interfaces cannot be applied arise, they think those are incomplete, defective, and difficult to use, leading to mistrust and rejection of fixed interfaces without consideration. Therefore, countermeasures should be prepared so that every single exception can be handled by issuing ad hoc interfaces.

There are two types of ad hoc countermeasures for exceptions:

(a) Some interfaces are intentionally excluded from fixing.

As fixed interfaces become user-unfriendly due to increasing complexity associated with increased size, some interfaces should be left for ad hoc determination at the locales, which results in much simpler structures. The designers as well as users must understand that the fixed interfaces do not handle all events because it would complicate the interfaces unnecessarily. As for the countermeasures for those exceptions, the responsibility and authorities regarding who and how to set the ad hoc interfaces should be clarified.

(b) To some extent, it is allowed to overrule fixed interfaces.

Some fixed interfaces cannot respond to reality. If people attempt to handle all activities only by means of fixed interfaces, those possibly become rigidified and difficult to respond to all realities; fixed interfaces are likely to be criticized as rigidified or bureaucratic attitudes. Therefore, ad hoc interfaces should be set beyond fixed interfaces with explicit designation of the area and the extent to which they are allowed. Although the seriousness of this problem varies with the organization, the reconstruction of organizations should be considered. As this requires extensive solution, the countermeasures for bureaucracy and rigidification will be discussed in Sect. 6.7 separately.

(4) Promotion and enforcement

As described in the previous section, the countermeasures of enhancement of the awareness, reduction in the user fees, and enforcement, management, and evaluation of uses must be properly implemented.

(5) Education, training, and support

Based on the basic policies, education and training for users, including the countermeasures for exceptions, must be executed. Flexible and prompt support systems must also be established.

(6) Monitoring and evaluation

Currently, almost all interface development terminates somewhere between (1) and (5) above, without completing the *effective cycle*. This *monitoring and evaluation* step in particular is neglected quite commonly. Even though various

contingencies may have been considered, situations keep changing. Interfaces become obsolete and satisfaction decreases every day after the moment when those were implemented. Without improvement, interfaces become ineffective, which leads to low utilization and low efficiency. The problem solving of this step depends on companies' essential capabilities of innovation. Therefore, it is quite difficult for companies without innovation capabilities to complete this step and the effective cycle. CMMI also puts the capability of handling this step effectively and sustainably as the condition for the highest ranking.

6.5.2 Accomplishment and Continuation of the Cycle

The effective cycle should be kept running to avoid obsolescence of interfaces.

When issues and improvements are extracted from results of monitoring and evaluation, it is significant to go back to the first step of the effective cycle and start the new cycle; it functions as the PDCA cycle. As fixing interfaces may lead to rigidification, monitoring the deviation from the actual situation and solving the issues are necessary. However, confusion occurs if interfaces change frequently because these are also communication interfaces. It is important to maintain the balance between rigorous fixing and flexible changes. Changes should be implemented only after thorough planning and notices in sufficient advance. Extensive support systems are also indispensable.

The significance of the effective cycle, which spans basic design, detailed design, education and supports, and promotion and enforcement through monitoring and evaluation and back to the first basic design for improvement, is applicable to all kinds of interfaces such as strategies, organizational structures (roles, processes, systems, rules, IT, and so forth), and action plans at lower levels of organizations. First, visions and objectives are determined; then those are decomposed into strategies, further refined, and described in detail for implementation. The outcomes are monitored and evaluated for whether they are functioning as designed. After modifying or improving the interfaces as necessary, the next cycle starts. This PDCA cycle of interfaces is a universally essential concept for strategies, organizations, processes, systems, and plans.

6.5.3 Avoidance of Bureaucratic Rigidification: Reconstructing Organizations for Flexible Decision Making

The surplus resources obtained from efficiency improvements should be first allocated for enhancing effectiveness by avoiding bureaucratic rigidification.

Because fixed interfaces standardize activities, they will lead to increasing the outcome quality of low performers and, at the same time, to weakening the organizational processing capability for special or exceptional cases. That is, the quality

of the lowest level will be improved, but that of the highest level will be decreased; the decrease is usually criticized as too rigid and bureaucratic. In order to build flexible organizations, it is significant to foster individual moral under which each employee seeks for deliveries of quality higher than designation by fixed interfaces. At the same time, it is also necessary to equip an organizational function (another fixed interface) to allow individual countermeasures beyond fixed interfaces only for exceptional situations. Only in this way can the organization respond flexibly and promptly to the exceptional cases to which fixed interfaces cannot be applied.

When a system becomes too large and complex, organizations become basically decentralized, which is evidenced in delegation and distribution of authorities, such as division of businesses in companies and transfers of power from a central government to local governments in the society. This reduces the distance between the final decision maker and locales, consequently improving the flexibility and agility to respond to exceptional situations. Even the smallest innovation is impossible for the organizations in which managers stick to unreasonable and unrealistic interfaces, ignore constantly erroneous judgments, and try to evade their accountabilities by all means.

It is unavoidable that some kind of arbitrariness is introduced into organizations when overruling authorities are delegated to managers for assuring flexibility. However, because *the effectiveness of business activities cannot be evaluated*, it is impossible to judge objectively whether decisions are arbitrary or not. The only way to avoid arbitrary decisions that are not beneficial to organizations is evaluating and rewarding the business performances of final decision makers.

It is possible to instruct complex interfaces more easily by providing databases that archive the information regarding various cases in the past that were judged as exceptions with background information and logics of judgments. Many companies in Silicon Valley started exchanging such information among employees through their internal SNSs. As it is not anonymous, every contribution can be rewarded. Organizations can be flexible much more than before using databases and networks in this manner. The surplus resources obtained from efficiency improvements by fixed interfaces should be allocated to this kind of exception processing with a higher priority in order to increase effectiveness.

This structure can also prevent cunning employees from outmaneuvering the rules. If interfaces are widely separated from reality and common sense, employees who desperately think about the benefits of companies need to ignore the rules sometimes. Such *good* men who seriously work toward increasing others' benefits are expelled easily on charges of breach of rules by *bad* men who constantly try to snatch others' properties. The situation in which unrealistic interfaces are complied with rigidly is considered to be the biggest defect of fixed interfaces. This excellent capability of organizations to respond to exceptional situations is able to change the structure in which *good* men who breach rules are punished uniformly and *bad* men who backstab the *good* men batten, and to bring healthy vitality.

In the first place, innovation begins with destruction of rules. Innovators who destroy conventional rules have a characteristic of neglecting rules (or at least not

considering them seriously) which enables them to make innovations. From this viewpoint, the innovation-oriented talents are considered to include the anti-rule or even antisocial personalities. As the innovation-oriented talents who do not comply with unreasonable rules are expelled by the backstabbers during organizations' ordinary activities, they, the seeds of innovations, must be protected institutionally. Otherwise, the adverse effect of fixed interfaces outweighs the expected benefits.

Innovation is generally difficult for mature organizations because their structures have been rigidified historically. The maturity of organizations corresponds to the expansion of fixed interfaces, and there occur strong inertias that have been formed in the history of changing their value to better utilize the power of fixed interfaces. The symptom in which companies are too exhausted with changing value and diffusing fixed interfaces internally to encourage innovations is called "Big Company Disease" in Japan. In order to outgrow the vicious cycle of stagnation and decline, the value should be changed again. As discussed in Chap. 5, this change is extremely difficult, making it an essential differentiation factor for companies.

6.5.4 Appointment of Managers Responsible for the Effective Cycle

It is impossible to run the effective cycle without a manager responsible for the management.

The responsibilities and authorities have to be clearly appointed for not only countermeasures for exceptions but also the whole effective cycle. It is impossible to ensure the implementation of the steps and to accomplish the effective cycle without them. Designers and developers tend to believe that users are responsible, and the users think to the contrary. It is only final decision makers (i.e., CEOs of companies or division managers) who can be responsible for the complicated aggregation of those multiple functions.

The introduction and design of interfaces should be proposed by CEOs (final decision makers) and implemented under their responsibilities and authorities (the CEO should be accountable even if he/she delegates the authority to managers). Many of the effective cycles of IT development projects have not been implemented effectively due to the unclear responsibilities (which are even intentionally left unclear). Without the understanding of IT as an interface, many CEOs have started development projects just because salespersons informed them that their competitors deployed certain products. After launching the projects, the CEOs have no responsibility for or any interaction with the projects. It is impossible to make the IT systems function as desired in this manner. In contrast, the CEOs of companies that utilize IT systems successfully understand interfaces essentially and lead the projects practically by themselves. Not limited to IT, the successful utilization of interfaces strongly depends on the knowledge, project leadership, ownership, and commitment of the CEOs.

6.6 Background of Rejections of Interfaces and Countermeasures

Rejections of interfaces are not logical.

6.6.1 General Rationales for Rejecting Interfaces

All kinds of arguments against interfaces will be presented.

6.6.1.1 Exaggerating Disadvantages of Fixed Interfaces

The benefits of interfaces have been discussed mainly thus far; however, there are two sides to every coin, especially in management. Fixed interfaces also have some disadvantages, as described previously. The advantages are often ignored and the disadvantages tend to be exaggerated, especially by people who dislike change or suffer losses from the introduction of new interfaces. It is necessary to prepare counterarguments and countermeasures to the typical rejections by understanding the disadvantages and the background accurately.

There are six typical arguments supporting the rejection of the disadvantages of fixed interfaces. Those are totally identical with arguments for the rejection of systems, processes, IT, standards, modularity, and architecture (it is absolutely natural that the arguments are common, because all those are also interfaces).

(1) "Fixing interfaces accompanies risks."

Business corresponds to investment, and investment inevitably accompanies risks. Interfaces are assets, just the same as factories and equipment; the development costs equal investment. Business, or even life, is the competition to make the right selections and implementation. There are risks with even the selection of a greengrocer or fishery as a profession. A person's choice to study liberal arts or science, his/her choice of business school or law school, and his/her choice of which company to work for are also fixing activities. If fixing is regarded as too risky, it is impossible to continue business or even life. Business is strategy, and strategy is to concentrate resources on the spots where others neglect or ignore, taking risks. A key success factor for management is the capability to handle those risks. Ensured running of the effective cycle can improve fixed interfaces constantly and reduce risks greatly.

(2) "Fixing robotizes employees and freezes their brains."

Manuals (especially of the conventional type) are a typical example; many managers, especially CEOs of SMEs, often express concern that when interfaces are fixed, employees will become too dependent on them and cease thinking creatively. Most of the concerns seem to be caused by their own experiences in or with large-scale companies that suffer from "Big Company Disease." Their policy to educate and enforce employees to create everything by themselves without providing manuals is seemingly reasonable. In fact, it is a profound problem that people cannot find how to work without direction,

which is caused by rote memory study in the education system, which is prominent in Asian countries like Japan.

It was reported that there was no emergency operation manual (of safety venting) at the Fukushima nuclear plant disaster. The emergency procedure was designed ad hoc based on the blueprints found in the pile of mess right after the earthquake. It illustrates the current situation in which the processing capabilities at lower levels of management are quite high, while their value is not placed on manuals. This is the typical style of operation in Japanese companies.

"What can the manuals do?" "Only we know the situation!" "I don't want to teach my knowledge to others!" It is quite natural for employees at lower levels of operation to respond this way, but it is problematic if top management compromises them and leaves the issues unsolved. Top management is likely to ignore the fact that they have no manual, the manual is useless, or employees cannot respond to emergencies even with an excellent manual because they are not familiar with it. They complain about the insufficient results, even though it is mainly because of their lack of understanding about the value of manuals.

As to the countermeasure for the robotization problem, the *seemingly irrelevant activities* described previously should be the first target to be fixed. That is, the most basic activities are fixed and, at the same time, employees are requested to increase the value added.

Despite the fact that the manual-driven operation of McDonald's is criticized anywhere in the world, it has established outstanding manuals that assure the most basic quality of the operation by juvenile part-timers. Its hierarchical management and education system are also well organized, corresponding to the manuals. It might be easier to convince the managers who reject manuals by illustrating manuals as the basic standard for beginners and low-wage workers while more flexible operations are expected and trained for skilled workers.

It is important to note that the essential countermeasures for this issue are fostering the culture of innovation as well as designing properly. The effects of manuals are achieved only when fixed interfaces and innovation-oriented cultures work together. Otherwise, organizations become rigidified and start adhering to past experiences. It is highly possible for employees to be robotized and for organizations to be rigidified without the base of an innovation culture.

However, this problem has existed regardless of fixed interfaces. Separated from the disadvantages of interfaces, fostering the culture for challenge and innovation is always important. This is the universal management issue common to all the stagnated companies, including Japanese conglomerates; the rejection of fixed interfaces is just the tip of the iceberg. This subject will be discussed in detail later in this chapter.

(3) "Inappropriate fixing will be counterproductive."

There is no need to say that inappropriate fixing results in a worse situation in which ineffective and inefficient activities repeat. The problem of interfaces becoming obsolete as time passes despite functioning appropriately right after their development can also be included in this argument. First of all, *activities that are anticipated to remain unchanged in a sufficiently long term* and

seemingly irrelevant activities—in other words, *activities of which fixing will not deteriorate the effectiveness*—should be selected assuredly as the first target to be fixed. However, in the reality of development of processes, systems, and so forth, the activities that are most difficult to fix (e.g., high-level managerial judgments) are likely to be selected or included. This is caused by the developers' general characteristic of challenging unrealistic feats to satisfy their professional interests. The basic investigation regarding the ROI from comprehensive and managerial perspectives is neglected here.

Kao Corporation, an equivalent of P&G and the leader in IT utilization in Japan, has a policy called "the 80 % rule for systemization," meaning only 80 % of activities should be selected for systemization. In fact, 20 % of activities may be enough for companies who are beginners in systemization.

It is important to monitor whether interfaces function properly and modify them when necessary. This is the most basic management for assets such as machinery and equipment. As interfaces cannot satisfy 100 % of cases universally and are deeply influenced by their contexts, the effectiveness diminishes day by day. It is necessary to monitor constantly how interfaces are used and what benefits are being obtained, to evaluate the effect and take improvement actions. In companies like Japanese companies that depend on customs and tacit knowledge, organizational mechanisms to make the PDCA cycle function appropriately are generally weak, as the PDCA cycle does not function or rather is avoided in customs and tacit knowledge. That becomes the serious limitation for implementing fixed interfaces.

(4) "Fixed information will be leaked to the outside."

As fixed interfaces are described by documents that are usually stored in the servers, the information may be leaked at any time. The influence of this security problem will be much more serious than others if interfaces consist of the core competences of companies. However, many companies, like Japanese companies, are too sensitive about the concern that standardization leads to leakage of expertise and reduction in competitiveness. There seem to be some lack of understanding as follows:

(a) Inappropriate selection of activities to fix

The security issue can also be solved by fixing *seemingly irrelevant activities*. It will not damage companies, no matter how much information that is irrelevant is leaked. The basic objective of fixing interfaces is to pursue the efficiency, not to develop the most advanced technology. The surplus resources that have been obtained are reallocated to more effective and complicated activities. Furthermore, fixed interfaces function among departments and companies as *interfaces* that are originally opened and shared by as many as possible. Therefore, fixing interfaces does not relate to information leakage problems if it is properly managed.

(b) Underdevelopment of information security

Japanese companies generally deem themselves as big families based on mutual trust and are less conscious about internal information leakages, which has been pointed out by the Japanese governmental report regarding

information security issues. All the data and knowledge have to be managed effectively using IT systems; permission should be requested for information download, and access rights and session log records should be strictly controlled. Business has already entered the era in which all the data are stored in databases and accessed by all employees through networks. If someone rejects to fix information, it is impossible to utilize IT systems and networks. As frequently mentioned throughout this book, the development and utilization of databases and networks have been accelerating in the global open economy. However, Japanese companies are still hampered by conventional ways of closed communication, such as face-to-face meetings and tacit knowledge interactions. Those should be modernized as soon as possible to adjust to global open transactions before the development of information security.

(c) Overvaluation of the transferrable value of interfaces

Interfaces are business processes. It is difficult to transfer their real value to others, including competitors.[4] It takes time for others to understand, modify if necessary, and become accustomed to them. It is even easier for a company to develop its own interfaces instead of transferring, implementing, and standardizing ones developed specifically for others. If a company is capable of copying and implementing others' interfaces properly, there is absolutely no need for it to steal from others because it must have the capability to design, develop, and utilize interfaces efficiently and effectively. Companies that are excessively conscious about leakages are inferred to lack expertise in interface technologies. The most significant thing is not the interface per se but the capability of designing, developing, and utilizing it—the expertise of the effective cycle. The companies that have utilized interfaces successfully are challenging developments and advancements of their interfaces continuously, not the security systems to protect their obsolete interfaces. Fixed interfaces provide value only with the culture of challenging innovations. That is, the information leakages do not become a serious problem because the companies have already innovated their interfaces at that moment. The companies with no innovation culture depend on others' interfaces, which would not bring any change to them. The culture to challenge advancements, improvements, and innovations is the most essential core competence of companies. Therefore, the companies with utilization capabilities do not need to be excessively conscious about this problem. It rather deprives their competitors of opportunities to develop the capabilities.

(5) "Fixed interfaces decrease my value by transferring know-how to others."

The biggest obstacle to the fixing, which does not frequently appear in arguments, is the rejection from employees who will lose their value and

[4] Manufacturing processes, which usually involve high-level confidential information to be protected by patents, are also included in interfaces. They are not included in the discussion here.

competitiveness in their companies. When their know-how becomes exposed to others and decreases the value of individual differentiation, they will lose their authorities. Some managers apprehend that they can no longer control their staffs. This is a quite reasonable response from employees.

Top management is also responsible for this issue. The employees who are capable of developing new expertise constantly after the know-how is shared with others should be valued. Developments of new know-how are vibrant without such rejections in the creative and competitive organizations where know-how is actively shared. In contrast, organizations cannot develop their competitiveness where self-interest takes precedence over the organizations' benefit. If people take actions to protect their value and current status naturally, managers in charge of the entire company's benefit should be responsible for overcoming the rejections and leading the projects for describing, fixing, and standardizing interfaces. From this viewpoint, fixed interfaces or standardization cannot be implemented by the bottom-up approach, which Japanese companies prefer.

(6) "The standardization is important, but it is impossible to apply to our tasks that are so special."

There is an objection: "I agree with the standardization in general, but our task is too complicated to standardize or routinize." The correct way to say this is, "I am not able to standardize this" instead of "it is not possible to standardize my task." As described previously, standardization and interface design are extremely difficult challenges that need high-level thought capabilities and essential understanding of the organization. Even the standardization of the simplest task will still be difficult for those with insufficient capabilities.

There seem to be too many people in Japanese companies who object to standardization for these reasons. Although nearly all the people showed this attitude against standardization or IT projects, hardly any task is unable to be standardized, according to the author's experience.

The background of these rejections will be examined further in the following sections. There are several significant points to be noted.

6.6.1.2 Disrespect for Systems

*System*s here include rules, processes, regulations, manuals, procedures, IT, structures, and plans—namely, the fixed interfaces discussed in this book. All the intuitive rejections of *systems* have a common mechanism. They argue that only on-site workers understand the realities, while systems employ a desk theory, which is unrealistic and valueless. The typical examples are tacit knowledge and the integral model or the denial of modularity, which are undermining Japanese companies where disrespect for systems and plans is deeply rooted. It surely obstructs utilization of fixed interfaces. To utilize systems and interfaces, various types of technologies and capabilities need to be equipped; falling into the entire denial without executing the musts frequently occurs.

6.6.1.3 Disrespect for Indirect Costs

It has been pointed out that the Japanese companies' design engineering departments have the problem that the "Design" in Computer-Aided Design (CAD) has been turned to "Drawing." The original purpose of the CAD system was to improve design efficiency by reusing components of designs that were archived with the expectation of being frequently used (i.e., it is an application of the module concept by IT systems). However, engineers do not utilize the reuse function of CAD system but use it as a simple drawing tool.

Furthermore, they still adhere to 2D CAD systems, and the craftsmen who are skilled in 3D configuration using 2D CAD systems are admired. It is a complete contrast to Chinese companies, which started their CAD operation in 3D. Literally, 3D CAD systems provide an additional dimension of functions such as interference computation, structural calculation, and operation verification simulation. This could be a possible cause for the decline of their mechanical manufacturing industries.

One of the reasons for this problematic situation is that their design departments, like their other departments, have run into an extreme policy that all indirect costs should be eliminated completely, while they have been trying to reduce costs by all means. If parts designs are reused frequently in the future, it will reduce time and effort. However, the costs for the future reduction are deemed as just waste costs for current products; the expenditure of such indirect costs became prohibited.

Japanese manufacturing companies, which are quite influential to all other industries, tend to deem their *indirect departments*: administrative departments with supporting functions (e.g., personnel, general affairs, and accounting), as necessary evils. One of the main functions of the *indirect departments* is to extract commonalities from all of their direct departments and to develop and promote systems, processes, procedures, platforms, and modules. Therefore, the disrespect for *indirect departments* corresponds to the disrespect for systems, processes, and modules essentially.

Because all systems and fixed interfaces incur only indirect costs, it is significant for companies to utilize the indirect costs in indirect departments effectively. In particular, Japanese companies should grow out of the extreme policy that denies all indirect costs and develop the technologies to better utilize indirect costs—that is, fixed interfaces.

6.6.2 Mechanism of Rejection and Exclusion of Modularization

Industry-level rejection and exclusion work against modularization.

6.6.2.1 Reversal of Vested Right Structure Caused by Modularization Occurring in Product Life Cycle

Universal Implications from Cases of Modularization

Modularization strategy has been deemed almost as a national disgrace with a nationalistic reaction in Japan: "If you are Japanese, you can't accept modularity."

This fact provides many universal implications regarding the difficulties in implementation of modularity. There are several background factors:

– It is difficult to understand.
– It is difficult to utilize.
– It is difficult especially in Japanese culture.
– Innovation is difficult in Japan.
– The public opinion has been developed politically to protect vested rights.

Most of these are essentially identical with the rejection arguments for systems, fixed interfaces, and standards. In this section, the structure of political rejection and exclusion against modularization will be examined to extract universal implications.

Progress of Modularization in Product Life Cycle

The inevitable generation and expansion of modularization in product life cycle is shown in Fig. 6.5. Four stages of the progress will be examined from the viewpoint of the relationship between end product assembly manufacturers and parts manufacturers.

(1) Stage 1: Introduction of a product by an end product assembly manufacturer (1:1)

This is the stage in which a new product is introduced into the market. An end product assembly manufacturer plans and designs the new product and procures the parts from parts manufacturers according to the product specification that is an intellectual property of the end product manufacturer. The parts manufacturers have no right to supply the parts to any other companies. Therefore, the relationship between the end product manufacturer and the parts manufacturers becomes inevitably closed; as a result, business groups become formed (the end product assembly manufacturer has more than one parts manufacturer, but the relationship is expressed here as 1:1 for illustrative purpose). Only the parts manufacturers that are capable of complying with the interfaces (the specification, delivery schedule, and other transaction conditions) of the finished product manufacturer are adopted. Thus, the finished product manufacturer comes to have an overwhelming price bargaining power and the parts manufacturers become settled in a subcontractor position.

(2) Stage 2: Competition between end product manufacturers (1:N)

Other end product manufacturers launch similar products, and the price competition becomes fierce, especially when commoditization starts. At this stage, the end product manufacturers with strong price bargaining power exert cost reduction pressure on the parts manufacturers to a level that are, in Toyota's case, expressed by a metaphor: "squeeze a dry towel." The weakest end product manufacturer that suffers from the price competition comes to the point at which it must procure parts from suppliers in its competitors' business groups to reduce its costs. The price competition continues, and the number of end product manufacturers that follow the decision increases. At this time, the relationship between the finished product manufacturer and the parts manufacturers becomes 1:N.

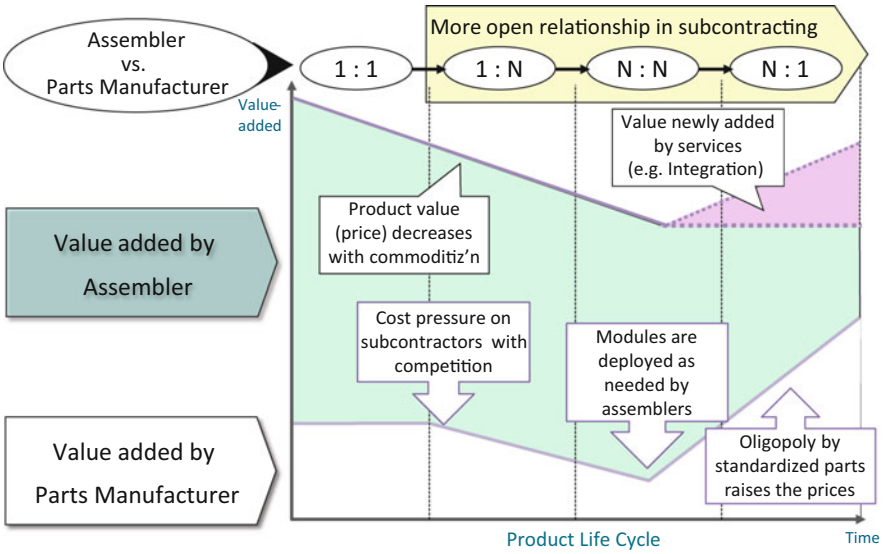

Fig. 6.5 Progress of modularization in the product life cycle

(3) Stage 3: Introduction of modules by parts manufacturers (N:N)

When the relationship turns into 1:N from 1:1, it means one parts manufacturer starts supplying more than one end product manufacturer. That is, the relationship will change from 1:N to N:N naturally; the business relationship goes beyond groups to become a free competition. At this point, since orders from multiple customers concentrate on the most competitive parts manufacturer, the suppliers start negotiating with their customers to purchase parts with their own fixed specifications in return for better transaction conditions. Some end product manufacturers have to accept this offer to reduce their costs. Consequently, parts from the parts manufacturers come to be used commonly by many end product manufacturers; this marks the start of modularization.

(4) Stage 4: Standardization by parts manufacturers

The parts manufacturers that started supplying modules enhance cost reduction and performance improvement with their increasing competitiveness. This accelerates the concentration of orders and further strengthens the cost competitiveness of the suppliers. This will lead them into *the positive feedbacks of standardization*; the parts become indispensable for the end product—that is, they become standards in the market. The relationships have turned to N:1 from the original 1:N. By this time, the parts manufacturers dominate the market with the bargaining power on various transaction conditions such as prices. In other words, the end product manufacturers can no longer control their profitability but are controlled by the parts manufacturers, contrary to the relationship at Stage 1. If the same structural changes occur with every part of the finished product, the end product assembly will no longer create value. The

assembly is a manufacturing process that can easily be replaced, even by manufacturers in the emerging countries. The value of the end product assembly manufacturers in developed countries has inevitably been decreasing. The end product assembly manufacturers start looking for new sources for value added, such as consumer finance, customized services, and consulting, in addition to brand marketing.

A Case of the Computer Industry

The case of the computer industry illustrates the structural change described above very well. IBM used to dominate the industry until the early 1980s. It was widely known as a manufacturer that produced all parts in-house, including OSs, CPUs, printers, disk drives, and application software. Other computer manufacturers also never considered another option besides their in-house products. However, when IBM entered into the PC market in the 1980s, the company made a strategic decision to outsource the key components, an OS and a CPU, in order to reduce the time and cost of the development. The suppliers were the famous Microsoft and Intel. This corresponds to the transition from Stage 1 to Stage 2.

Those two companies supplied their products, modules with their own specifications, to all the end product companies, not only to IBM. As a result, they became the dominant companies, even overwhelming IBM. In the early 1990s, IBM had fallen from its crowning point into a bankruptcy crisis in just a few years, thus reaching Stage 3. In order to advance to Stage 4, IBM invited Louis V. Gerstner, Jr. to be the new CEO. He drastically changed the company into an excellent service company that has become prominent all over the world. The "service science" advocated by IBM to enhance the awareness of the value in services, their services in particular, has even strongly affected the universities and the government of Japan. IBM's PC manufacturing business was sold to a Chinese company, Lenovo, and its HDD business, one of the key parts, to Hitachi.[5]

A Case of the Semiconductor Industry

By now, the horizontal division and specialization of functions has spread in all PC-related industries. The miniaturization of semiconductors such as CPUs has advanced dramatically; the number of transistors mounted has increased one million times more than the number 40 years ago. Many special production technologies and functions must be integrated to realize the ultraminiaturized manufacturing. The semiconductor manufacturers outsourced semiconductor production to subcontractors (foundries) instead of producing them by themselves. The most successful company among them is TSMC of Taiwan, which was the role model for Taiwan's national strategy. GLOBALFOUNDRIES of the USA, UMC of Taiwan, and SMIC of China have all grown rapidly. There is also a strong trend for semiconductor manufacturers to outsource even their semiconductor designs to technology companies called *design houses*.

[5] It was resold to Western Digital, a US company, in 2010.

MediaTek of Taiwan, which once monopolized the markets[6] of almost all kinds of baseband IC[7] in mobile phones, concentrates its resources on the design function by outsourcing production to TSMC. MediaTek started its business with Chinese manufacturers of "Shanzhai," the mobile phones with imitation and pirated brands, providing the chip set (an integrated chip with functions of CPU, graphics, memory, and GPS signal processing) that enabled Chinese start-up companies with no technologies to launch every kind of mobile phone. Since then, the company has become a top-notch global company conducting joint research with the world's top universities and hiring a large number of Ph.D. holders.

MediaTek outsources not only its production but also chip layout designs, semiconductor intellectual property core modules, to companies such as Qualcomm and TI, which have numerous technology patents for mobile phones. These companies also supply the modules to the countless design houses.

ARM of the UK has gained attention as a fabless semiconductor manufacturing company recently. The company supplies CPUs for embedded systems in mobile products like smartphones, mobile devices (e.g., the iPad), digital cameras, game machines, and automobiles, excluding PCs. Those products have strict constraints of power, time, and memory in common that make the CPU specifications totally different from ordinary ones for PCs. ARM has already become a dominant company with 90 % market share.

ARM is an *IP core vendor*, a type of company that only licenses chip layout designs to customers. ARM partners with TSMC and SMIC, which provide the business system and interfaces to enable their customers to produce products with high-level miniaturization requirements just by executing a simple transaction. Thus, they have been increasing their customers all over the world.

As described thus far, a very advanced distribution structure of modular functions among companies has been established in the semiconductor industry; semiconductor manufacturers do not any more either produce or design internally but purchase the licenses for the chip layout designs. Furthermore, even in the design activities, Electronic Design Automation (EDA) plays a significant role, and the vendors of the systems have established the position of indispensable module suppliers in the manufacturing process. There are also companies that specialize only in testing finished semiconductors. The efficiencies of designing, manufacturing, and selling CPUs and semiconductors have been improved to the utmost limits by such a refined modular structure.

[6] MediaTek established a dominant market share in 2G and 2.5G, but after 3G in which the smartphones took the central role, new players such as Apple, nVidia, and Android-related companies came in and changed the industry structure. MediaTek is struggling to get back by its cost competitiveness and strong distribution channels, competing with companies like Qualcomm, Intel, and TI.

[7] A baseband IC is one of the core semiconductors of mobile phones, which provides all the major functions required for mobile phones. Another core semiconductor is an application IC, which provides functions for added value.

In contrast, the Japanese semiconductor industry has been falling behind in the modularization. All the companies, such as Renesas Electronics (the SoC[8] manufacturing company that merged the semiconductor businesses of NEC, Mitsubishi Electric, and Hitachi), Sony, Toshiba, Fujitsu, and Panasonic, and all the national projects, such as Selete, STARC, ASUKA, ASPLA, HALCA, and MIRAI, have been in trouble. It is getting harder and harder for companies to survive in the global market without adapting themselves to the new global competition rules.

A Case of the Mobile Phone Industry

The Japanese electronics companies executed large-scale investments in the Chinese mobile phone market with their common missions to rank in the top three suppliers of this strategically significant market with no room for failure. The number of the products in China is 20 to 50 times larger than in Japan, and at the same time, the life cycles are much shorter. It has been absolutely important to keep developing an abundant variety of low-priced products to meet the market needs.

However, they wasted time and the cost of developments, which were reportedly a few dozen times more than those of Chinese domestic competitors, due to their over-specification orientation and lack of modular structure. As a result, all their projects and even businesses collapsed.

From the global perspective, the diversity of the Chinese market is just the tip of the iceberg. The US and European markets had been their only targeted customers for a very long time; however, the markets of BRIC (Brazil, Russia, India, and China), VISTA (Vietnam, Indonesia, South Africa, Turkey, and Argentina), MIKT (Mexico, Indonesia, Korea, and Turkey), and Next-11 (Iran, Indonesia, Egypt, Korea, Turkey, Nigeria, Pakistan, Bangladesh, the Philippines, Vietnam, and Mexico) have been increasing their significance. Benefited from the global economy, many other countries like Thailand, Malaysia, Australia, and the Eastern European countries are following. The diversification of the global markets is growing rapidly. It is impossible for Japanese companies to survive in the global competition with their anti-modular structure. This is not just about the mobile phone industry but all other industries, including the automotive industry.

A Case of the Automotive Industry

Modularization is advancing even in the automotive industry. It was considered the industry in which it would be most difficult to deploy modularity despite its maturity in the product life cycle. It is well known that the relationship between the end product manufacturers and their suppliers had been 1:1 for a long time. Long-term, trust-based relationships in business groups work effectively as long as the expectation of the sustainability of high economic growth goes on. However, in the turbulence of intensified global competition, the business groups began to dismantle in quest of lower costs, which started from the weakest European groups.

[8] SoC (System on a Chip) is an IC that integrates multiple functions into one chip.

It is difficult for the suppliers to pursue economies of scale only in the closed market of a business group. Sharing of the parts by modularization is proceeding beyond the business groups to reduce the costs. The major parts manufacturers declared their sales goals of more than 50 % from outside of their groups and became independent from the groups, as was the case with Delphi of GM and Visteon of Ford (after their bankruptcies). Those companies, including Bosch of Germany and Valeo of France, are expanding their scales rapidly, mainly by acquiring their competitors; the presence of parts manufacturers is increasing remarkably. It may be no exaggeration to argue that the parts manufacturers are going to overwhelm the automotive manufacturers. Without question, this trend will become even stronger when the new era of electric vehicles begins.

The automotive manufacturers in Japan are also beginning parts standardization and sharing under the direction of the Ministry of Economy, Trade and Industry (METI). Because the Japanese companies had been boasting the strongest competitiveness in the world market, they could have been able to oppose the wave of modularization to the last, which would possibly reverse the power relationship with the parts manufacturers. The activities to obstruct the wave have been reasonable; they might have been trying to form the public opinion against the modularization directing and supporting domestic academia and media. However, hunger had no law for some of the automotive manufacturers, which were almost ejected from the competition. They adopted the new structure of modularity to come back. This is the structural reason why the European companies led the modularization and the Japanese companies were preceded by the US companies.

If the automotive industry should have already entered into Stage 4 (the automotive manufacturer N : the parts manufacturer 1), the automotive manufacturers should start searching for the next source of value added. In the computer industry, the service markets, such as system integration, system consulting, and business process consulting, have been great opportunities for the computer manufacturers. In contrast, the automotive manufacturers have successfully developed only the consumer finance businesses thus far.

They may be able to explore more possibilities that increase their values, such as functions corresponding to IT system integrators. For example, the manufacturers may customize the design and development of cars specifically satisfying a certain customer. Car designs have been too unified from the era of the Ford T Model. There is a possibility that an abundant variety of vehicles specifically designed for taxies, delivery trucks, shuttle buses, cars for sharing, cars for carrying babies/kids, and so forth will be provided at much lower prices. Development of the next-generation intelligent transportation systems collaborating with governments of emerging countries is also considered. In emerging countries that have been suffering from intense traffic congestion, there are very strong needs for the development of total infrastructure. It will integrate new transportation systems, car sharing, and navigation systems with controlling capabilities of distances not just between cars but also between cars and roads. These technologies should be completed before Google provides Google-branded self-driving cars, which are

produced by contract automotive manufacturers located somewhere in South East Asia.

6.6.2.2 Lessons from Negative Examples of Declining Japanese Companies

The Innovator's Dilemma

The remarkable economic growth of Japan from the 1970s to 1980s had heavily depended on manufacturing, especially the consumer electronics industry and the automotive industry. Their technologies of handling lathe machines and fabricating their molds with extremely high accuracy were so competitive that the global market was dominated by Japanese companies that manufactured super-compact, high-quality products. One of their biggest sources of competitiveness was the capability of *polishing and adjusting* mold parts during the process of assembling them to a finished mold. Since the phrase *polish and adjust* ("Suriawase" in Japanese) was used to refer to anti-modular structure (the "polish and adjust model") by some researchers and Japanese media, using modules—thus undermining the national strength—came to be seen as unpatriotic.

In English, the term "integral" is widely used to emphasize the whole instead of only parts. *Modules* certainly correspond to parts, which leads to the widely accepted understanding that the modular methodology adheres to only details, neglecting the whole. However, when interfaces are focused, it is apparent that the whole is more importantly considered as the *architecture*. Therefore, the understanding that the modular methodology does not consider the whole, which is represented by the expression of the contrary concept as "integral," is totally wrong.

The essential difference does not reside in emphasis on the whole or the detail, but on the design—whether the interface will be used once or frequently, whether it will be used locally/short term or comprehensively/long term, and whether it will avoid risks unconsciously or manage risks intentionally.

Designing interfaces with a comprehensive and long-term perspective increases the usage frequencies, the consequence of which increases ROI and decreases risks. Therefore, the more integral perspective becomes indispensable for the modular methodology. As the modular methodology involves multiple products, multiple businesses, and future modifications, it rather considers the larger scope than the ordinary or non-modular methodologies.

The phrase, "mono-dukuri," meaning "production" in Japanese, has been repeatedly reconfirmed as the strength of Japan that should be pursued continuously. The term "mono" in "mono-dukuri" refers to tangible products/parts. That is, it is intended to emphasize the significance of physical production over software, intellectual properties, and services, which have been pointed out as the weakness of Japan. It is understandable that "mono-dukuri" has been well accepted and supported by all of the Japanese people who played very important roles in the past.

However, it is obvious that software, intellectual properties, and services have become much more important for adding value to products than they were in the past. In addition to the digitization of products, the digitization of product design,

production equipment, sales force automation, online distribution, and R&D activities is progressing. As described throughout this book, those reductions of transaction costs further decrease other transaction costs.

The denial of changes and the rejection of the necessary innovations are typically symptomatic of "the innovator's dilemma" syndrome, in which the most successful person in the past is most likely to fail in innovations. It is true anytime and anywhere that changes cause pain. It is surely unfortunate that their past success factors had lost value drastically only in 20 years, but the escape from reality only works like morphine, which will not solve the problems.

Exceptions in Japan: The Module-Oriented Companies of Kyoto

Despite the fact that few companies pursue modularization in Japan, there are a dozen unique companies in Kyoto with business performances three to eight times better than ordinary Japanese companies in terms of profitability and growth rate due to the adoption of the modular strategy. The examples include the following:

- Kyocera: electronic components and electronic equipment
- Nidec: precision motors
- Murata Manufacturing: electronic components
- Nitto Denko: high-performance films and adhesive tapes
- Keyence: integration and manufacturing of FA equipment
- Omron: electronic components and electronic equipment
- Nichicon: capacitors
- Horiba: measuring equipment
- Tose: game software development

These companies have the following features, which are commonly observed with globalized companies:

(1) Specialization of technologies and products
(2) Acquisition of de facto standard products (parts)
(3) Focus on open global markets (not *Keiretsu* group businesses)

Furthermore, there are some more common features as the consequences of the features above:

(4) No intention to move their headquarters outside of Kyoto

Successful companies that are located not in Tokyo tend to move their headquarters to Tokyo after they reach a certain size, spending much more for office rental. However, none of those Kyoto companies moved to Tokyo. Their head offices do not need to be in Tokyo because personal networks, supports, or businesses from the central government are not strategically important to them, unlike ordinary Japanese companies. Their focus is the global market. Kyoto also offers a higher quality of life and authentic Japanese culture, allowing companies to better entertain their global customers.

(5) Competitive governance structure

Different from the community-type governance of ordinary Japanese companies, their decision makers' responsibilities are clear so that their performances are strictly evaluated. Their unique performance evaluation and

management systems, including the Amoeba Management of Kyocera and the 3D matrix organization of Murata Manufacturing, have obtained attention.

(6) Utilization of M&A as their engines of growth

Despite M&As still being emotionally denied in Japan's society, those companies are well known for utilizing M&As actively.

Among those, the following companies have particularly unique characteristics:

- Nidec is strictly focusing on precision motors and has realized the high market shares in fields like electronics products, automotive parts, and industrial and home appliances.
- Murata Manufacturing and Nichicon also have a modular organizational structure, which is commonly applied by their domestic competitors such as TDK and Alps Electric. This is because all electronic components are modularly structure more or less.
- Keyence and Nitto Denko have implemented modular structure in product development, technology development, and application service integration. Modules of technology are integrated into products, which are also integrated to customized applications efficiently.
- Horiba is the most cited example of a successful venture start-up company in Japan. All those companies have commonly strong innovation-oriented entrepreneurship, critical thinking, and independency culture.
- Tose has built multiple partnerships with game makers, not subcontracting relationships, in which it provides them development and planning functions, clearly declaring that they will never compete with their customers by directly selling games to consumers with their own brand. The company has dominated the game software outsourcing market of Japan.

The features described above may not be worth pointing out because they are common to all the globally growing companies. However, the innovation culture, the entrepreneurship, the critical thinking, the independence, and the leadership/governance that enabled their achievements in the adverse environment of Japan should be reconfirmed as universal key success factors in the global open economy.

6.6.3 Difference of Benefits and Attitudes by Stakeholders

Destruction of fixed interfaces by vested rights groups is possibly avoided.

6.6.3.1 Stakeholders Who Desire Fixed Interfaces

In this section, the stakeholders who desire fixed interfaces and those who reject them will be clarified. First, stakeholder groups that advocate fixed interfaces include the following:

(1) Business owners and statesmen

Organizations, markets, and societies flourish economically when transactions are promoted by the establishment of fixed interfaces. Therefore, business owners and statesmen must establish interfaces to benefit

organizations and societies as a whole. Nations with statesmen who put the first priority on the establishment of interfaces such as infrastructures are likely to improve prosperity. However, once those people acquire monopoly positions, they may reject the introduction of new fixed interfaces such as deregulation. To avoid this, governments in developing countries should utilize private activities including private finance initiatives (PFIs) and public-private partnerships (PPPs) for railways, postal services, highways, electric power, and telecommunication, thus maintaining their small size.

(2) Customers (consumers and buyers)

All customers are positive about fixing interfaces, which increase the quality of products/services and decrease prices by intensified competition, with exception of those who do not appreciate standardized products/services without knowing their values.

(3) Competition-driven and growth-driven companies (suppliers)

Companies that have higher-quality and lower-cost products and expect expansion of their businesses are likely to desire the establishment of fixed interfaces so that they can enter into competition. Examples are venture start-up and foreign-affiliated companies.

(4) Competition-driven and growth-driven managers and workers

Individuals who have higher capabilities with self-growth motivation welcome competition, which increases opportunities. Therefore, they are positive about fixing interfaces.

(5) Some managers and workers with creativity

Creative individuals want to outsource their valueless tasks by introducing fixed interfaces (e.g., manuals) so as to focus on more creative work. Therefore, they are likely to be positive about fixed interfaces. In contrast, uncreative individuals reject them to avoid the competition.

(6) NPO activists with philosophies of sharing resources and unification

NPO activists who support sharing resources such as Free Software, Open Source, Creative Commons, and the Internet-related NPOs regard a society free of transaction costs as ideal. None of them are communists, but they are in quest of the society in which people are interconnected. They conduct those activities expansively in the world to achieve the ideal.

6.6.3.2 Groups of Stakeholders Who Reject Fixed Interfaces

The positive feedbacks regarding standardization described in Chap. 3 occur because consumers, companies, and markets desire them. Consumers purchase products that are expected to meet standards, resulting in supporting the companies that intend to acquire standard positions. As fixed interfaces construct layered structures, new standards are built on existing standards, the structure of which easily generates vested rights. When those standards become obsolete, they are supposed to be replaced by an innovation, but the groups with the vested interests of existing standards frequently obstruct it.

The substitution of existing interfaces by new interfaces is perceived as a threat by those who benefit from the vested rights of the established system. That is,

people who oppose the introduction of fixed interfaces generally are those whose benefits are decreased by competition. They enjoy making profits easily with their lower-quality and higher-priced products. Therefore, they reject and obstruct such substitutions by any available means. Introductions of fixed interfaces will likely be denied before competition is promoted and substitutions are enforced. Even though their present vested interests were gained by their hard efforts of self-innovation in the past, they adhere to and protect their present positions. This stance is particularly noticeable in the following groups:

(1) Managers and workers who avoid self-improvement activities

Individuals who are reluctant to streamline their own tasks and improve their performances may reject fixed interfaces. An example is tacit knowledge workers who lose their jobs when their individual know-how is described explicitly as fixed interfaces such as manuals and rules and shared by young workers.

(2) Companies that avoid self-improvement activities

Companies that do not implement innovations for lower prices and higher quality may reject fixed interfaces in their organizations. Examples are companies that cannot control the mentality of their employees who avoid self-improvement.

(3) Corrupt politicians

Politics are likely to be influenced or controlled by political funds from vested rights holders with abundant resources and select policies to protect vested rights prior to social benefits. They are likely to obstruct the introduction of fixed interfaces.

As described above, the introduction of fixed interfaces promotes competition and substitution of resources, and therefore, it contributes to majorities such as consumers and buyers. However, the vested rights of small groups are inevitably compromised. As they have enormous political power commensurate with their size, majorities are not able to deal with the minor groups' unreasonable obstructions. This problem is serious but not unsolvable if the structure is recognized by all members of an organization and the countermeasures that were described in this chapter are well prepared.

6.7 Essential Issues Behind the Rejections

Difference in value and preference on competition is most essential.

6.7.1 Differences in Raison d'etre of Organizations

Transformation from a *village community* to a *competing organization* is required for companies.

In this chapter, requirements and interferences for designing interfaces, including modules, standards, and systems, have been discussed from various points of view. The introduction and improvement of interfaces correspond to innovation, and the success largely depends on the organizational capability of executing innovation. To discuss the organizational capability of innovation, the six factors for executing innovation shown in Fig. 6.6 will be discussed. For explanation, organizations are divided into two groups by the value for raison d'etre (purposes for existence), applying the concept of community versus organization[9] that was proposed by Peter F. Drucker. How those factors are implemented properly in those two groups, respectively, will be examined.

The left side of the two in the comparison is the group aiming at peaceful lives of all members, which will be referred to as *village communities* hereafter. The right side is the group with goals and willingness to sacrifice to win competitions, which will be symbolically referred to as *competing organizations* hereafter. How the two types handle the factors for executing innovations will be described below.

(1) Allocation of profit as an incentive for innovation

Innovation is executed with an aim to create benefits to communities or organizations. At that time, the proper allocation of the benefit is important for encouraging innovation internally. As achievements of innovation are fundamentally difficult, strong incentive must be provided. In *village communities*, equality and absence of sacrifice to any member are deemed right. Thus, degradation of even one individual's life is disliked. If profits brought by innovators are allocated to them unequally, it will result in relative degradation, deterioration, and even demotion of life and status of the others. This problem does not surface as long as the communities are growing, but the antipathy toward the weighted allocation of profits to the contributors increases during their aggravation. This would add enormous cost and risk to potential innovations, which takes away the motivation and inhibits the emergence of innovators.

In contrast, *competing organizations* believe that the larger the weighted allocation to those who achieved innovation, the more innovation is promoted. Having achieved numerous internal changes (individual self-improvement) and external changes (innovation leadership in organizations), the innovators may also be referred to as high performers. As the disparity favors high performers and disfavors low performers, to eliminate it would be equal to favoring low performers and disfavoring high performers (by transferring profits earned by high performers to low performers). However, excessive preferential treatment toward high performers would result in the accumulation and the explosion of social discontents; thus, the disparity leads to political instability.

(2) Rigorous and accurate evaluation of innovations

The second factor that promotes innovations is evaluation. Evaluation of results is indispensable for modifications and improvements of innovations,

[9] Drucker, P. F., *Post-capitalist Society*, 1993, HarperBusiness.

Village Community : Peaceful life for all members	**Competing Organization:** Achievement of goals
Change = Drop off = Degradation = Loss	**Change = Growth = Innovation = Gain**
Distribution of power (Bottom-up) .Everybody has a right to veto ➔Vested rights maintained/Rejection of changes .Denies weighted allocation of resources (strategy)	Concentration of power (Top-down) .Decisions based on logical rationality .Concentration of resources with risk .Backed by governance structure
Avoiding assessment of colleagues' initiative .Denying assessment/ selection/ promotion	Searching for perfect evaluation/selection .Strengthening empowerment/monitoring
Aid for low performers .Avoiding the gap ("Inappropriate Equality")	Favorable treatment for high performers .Incentive due to the gap
Excluding Outsiders .Dependence on internal resources .Avoiding mobilization of human resources	Aggressive deployment of outsiders .Utilization of external resources .Promoting mobilization
Pursuit of homogeneity .Excluding heterogeneity .Education focusing on obedience	Acceptance and utilization of diversity .Heterogeneity as the origin of change .Education focus on change/independence
Denying competition ("The law of the jungle")	Promoting "Competition Principle"

Fig. 6.6 Differences in raison d'etre of organizations

which make innovations more efficient and effective. The more detailed and elaborative the evaluation is, the more accurate the management of innovation becomes. If *monitoring and evaluation* in the effective cycle for usage of interface is executed properly, the possibility of success can be greatly increased.

In *village communities*, occurrence of disparity by changes of remuneration and promotion or demotion through the result of evaluation is disliked. In addition, more basically, ranking of colleagues by evaluation tends to be disliked. Actually, as *evaluation* means to evaluate the effectiveness, it is impossible to be executed objectively. However, *competing organizations* spare no effort on developing and improving the methodologies and the capabilities required for evaluation. Being typical *village communities*, Japanese companies have been indifferent to internal evaluation; there existed a history of introducing performance-based evaluation systems by copying Western companies. With the common negative attitude toward evaluation, the introduction failed, not being able to overcome the aforementioned difficulties, and resulted in a reconfirmation of an entire negation of evaluation.

(3) Promotion of competitions

It is not an exaggeration to argue that innovation exists only in competitive environments. This is because earning various rewards and benefits by winning competitions is the biggest incentive to lead changes that are accompanied by huge individual risks and costs. A motto such as "innovations for our society" is significant idealistically, but the realistic driving force is rather instinctive and materialistic. Thus, it is necessary to explicitly praise and reward the innovators

according to the results of the competition, but this would create a relative loser, which *village communities* dislike. Impassioned argument that asserts competition as inhuman, saying "the competition principle corresponds to the law of the jungle," is widely repeated there.

On the other hand, in *competing organizations*, the competition principle is positioned as an important philosophy that enables growth, wealth, and revitalization of the society. Furthermore, competition encourages and revitalizes individual growth, which brings people satisfaction and a sense of accomplishment.

(4) Utilizing entrants from outside

In many cases, outsiders that try to enter communities or organizations have high abilities and seek for opportunities for growth and success in the new environments. It causes internal competition, which further brings weighted reallocation of resources and profit. For example, if a venture start-up company thrives or a foreign-affiliated company enters *village communities*, losers may be generated. Therefore, mobilization of human resources that causes new competition is disliked; various practices and protocols that can only be understood internally and path-dependent systems are created to obstruct new entrants, both intentionally and unconsciously.

In contrast, in *competing organizations*, new, high-caliber entrants who will strengthen their competitiveness only at low cost are highly welcomed. In the Internet society, where mobilization of human resources has increased dramatically, *competing organizations* that are capable of accepting and utilizing outsiders and entrants possess huge advantages in any competition.

(5) Promotion of diversity

Along with the exclusion of new entrants, another important policy for *village communities* is elimination of diversity. If heterogeneous values and behaviors existed in the communities, they would cause various conflicts with the preexisting robust conventional practices, resulting in confusion and chaos. Then the peace and calm life would collapse. It is significant to transfer preexisting values to all members, automatically leading to the introduction of an education system and spontaneously generated disciplines that emphasize obedience and homogeneity. The psychological mechanism that denies heterogeneous thoughts is embedded there.

On the other hand, in *competing organizations*, the concept of diversity cannot be overemphasized for enhancement of competitiveness from a long-term perspective. Introduction and acceptance of diversity is also an extremely difficult challenge. If discrimination issues are included, it can be argued that it is the biggest challenge to mankind. However, rather than abandoning or denying diversity as a whole before consideration, *competing organizations* endlessly attempt to build societies and organizations that can accept and utilize diversity.

Generally speaking, Japanese companies have relied on tacit knowledge and customs as interfaces until now. These were generated spontaneously in the homogeneous society, rather than being developed artificially, not like processes and systems that were designed to manage diversity. As customs and

tacit knowledge take a long time to become established, these cannot respond promptly to the increasing and accelerating changes in today's environments. Interfaces must be in easily manageable forms such as systems and processes to design, develop, monitor, evaluate, and modify.

Designing interfaces necessitates two basic capabilities: logical thinking and leadership, the development of which is closely related to diversified environments.

In the first place, patterns in which interfaces are used frequently and in the longer term should be extracted from among various phenomena. In this process, the capability for induction and deduction is required. For designing interfaces, risk evaluation is also important. This is not a blind, risk-taking action but a scenario prediction based on logical processing of past experiences and information analysis, the accuracy of which must be much higher than that of the competitors. Innovation is achieved by convincing others who possess various values, experiences, preferences, and logical thinking capability to accept the offered scenario and making them conquer the fear of taking risks and moving forward. Leadership is another key to make it occur.

As conceptually shown in Fig. 6.7, there is a different characteristic in the distribution of human resources[10] in every field of Japan, including business, arts, sports, music, and so forth. Under the values of *village communities*, the strong homogenization pressure raises the capability level of the bottom and at the same time drags down the top. It is true not only in a comparison with the USA; the distribution widths spread further in India and China. In the globalizing world, such distribution is growing wider in all areas and regions

Organizations with strong homogeneity probably win the competition of human resources in the left side of the figure, namely, the competition in the lower level, and lose in the right side, the competition among high-caliber people

The weakness of the organizations with such concentrating distribution of human resources includes the absence of leadership, strategy planning, and innovation, as described previously. On the other hand, their strength is the higher operation capacity. That is, such distribution of human resources would exhibit extremely high competitiveness in environments where the direction and strategy are clearly set and shared without question and all members are highly motivated. The high-growth period of Japan after World War II corresponds to this kind of environment where the homogeneous society exhibited an overwhelming competitiveness to the confused societies struggling with diversity. The homogeneous society will be surpassed by a diversified society when various techniques that can dramatically reduce the transaction costs among diversified entities have been developed

[10] Means and standard deviations of the two countries will be different in various fields such as business, politics, arts, sports, and so forth. However, in this figure, the average is set the same just for illustrating the conceptual idea clearly.

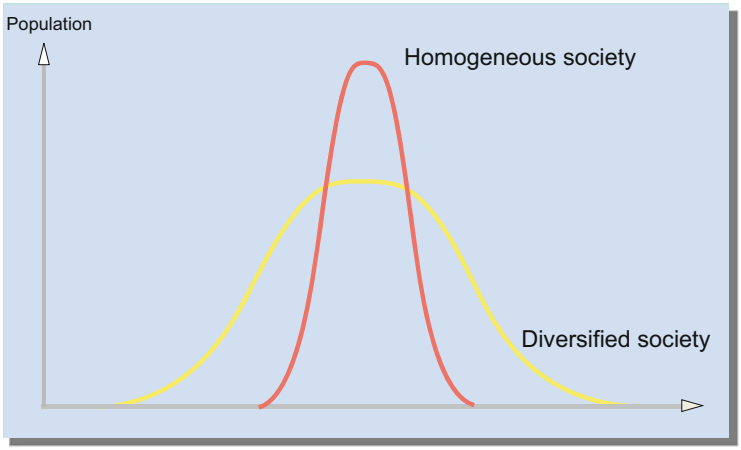

Fig. 6.7 Difference in the distribution of human resources

Design capabilities for interfaces are basically identical with capabilities of handling diversities; therefore, they are more developed in diversified environments. As Japanese society and companies have had a tendency to ignore their weaknesses, the enhancement of diversity has almost never been discussed, developed, or taught. For companies that are competing on the right side of the distribution, the development of this capability should be recognized as a critically urgent issue.

(6) Concentration of decision-making power and acceptance of risks

In *village communities*, where the aim is the peaceful and sustainable life of every member, all of them are entitled to participate in decision making. Every decision is made unanimously. No matter how small the change is, there is invariably an individual who will be faced with loss. For example, if a narrow road is constructed, the majority can gain a great benefit. However, there are still disadvantages such as destruction of lands due to the construction or increase in street noise caused by pedestrians. Veto power is exercised and accepted; any small change is very difficult to be embodied. This leaves room for unsolvable emotional arguments. In Japan, headmen of villages, fixers, used to play active roles in coordination of conflicting interests in the past, but due to the rise of individualism in recent years, their functions have greatly diminished.

In contrast, in *competing organizations*, the necessity of the concentration of power, especially in emergencies such as wartime, is conceived as a common recognition. The current competitive environment requires continuous innovation, which makes it no exaggeration to say that every day is like an emergency. For example, the role of Chief Technology Officers (CTOs), in whom all decision-making authority related to research and development is concentrated, has been increasing in significance. By concentrating research resources strategically, surpassing larger competitors in terms of resource

volume in a targeted area becomes possible. Venture start-up companies usually utilize this mechanism to compete with behemoth companies. In large, *village community*-type companies, all researchers in their research and development departments are like feudal lords; resistance occurs when reducing resources of the individual researchers or consolidating research projects. It is impossible to win the globally intensified competitions in research and development with such dispersed resources.

CEOs formulate corporate strategies and shift resources from unpromising businesses to promising businesses to win the competition, as is the case with CTOs in the research and development efforts discussed above. This concept, the concentration of resources, is basic in all strategies, throughout all times and places. Such shifts of resources that inevitably accompany sacrifices are executed in the field of every sport, even in the high schools of Japan, where the critical purpose is to win the competition, and needless to say in the increasing global competition of the business world. The Internet has integrated the global market drastically and has been intensifying the competition further; companies have to increase product quality while decreasing prices to zero in order to win market shares. In such an extreme competitive environment, concentrating decision-making rights to one person and encouraging actively taking risks becomes essential.

However, in *village communities*, anyone—even new employees—can veto. Even a slight change in operation requires enormous time and cost spent on informal consensus. Most innovations and changes disintegrate in mid-air, being unable to withstand those demands. Vetoes of every individual are respected; vested authorities that have already become social evils are also protected. Vested rights holders would resist any shift of resources without hesitation, no matter how trifling it is, and would even gain sympathy.

Execution of a strategy (i.e., selection of an area and concentration of resources) accompanies great risks. An improper anticipation may lead to critical loss, not to mention loss of the peaceful life. However, not taking any risk—not executing any selection or concentration—would also result in loss or collapse in the current severe global competition. Taking risks does not invariably result in winning the competition, but taking no risk would result in losing the competition with higher probability. While it necessitates that companies concentrate power and authority to leaders such as CEOs, CTOs, and business managers, the decision-making system that gives all members a veto is likely to converge on the most risk-averse decisions.

Dependence on a leader corresponds to *selection and concentration*, the structure of which is identical to modularization, standardization, and establishment of interfaces that involve risks. Without capabilities, the defects would surpass the benefits. The leader's capability is absolutely critical.

Innovation is to move forward in a totally unprecedented direction, dealing with various inexperienced situations instantly, which is highly similar to a crisis response. As for the Fukushima nuclear disaster, many questions were raised about the responses of the leaders. It seems not essential to blame only

the leaders, as it is a problem of the social structure, which shares the same root with the social background that innovations do not emerge. Emergency-response manuals were poor, and even the decisions in such emergencies were made in the council system. Accurate judgment capabilities for leadership were not developed institutionally, or high-caliber assistive teams were not provided. Incentives have been too small for such high-risk missions.

Excessive concentration of power increases the possibility of resulting in incorrect dictatorship; this massive potential cost complicates the matter. The mechanism prepared for this problem is the governance, which is a safety device of democracy to monitor and check the misuse of power. In terms of companies, it would be the distribution of decision-making authority such as a board of directors (including outside directors). The cost for the democracy is large, which has been recognized as an integral cost in order to avoid a runaway dictatorship. However, due to the aforementioned drastic changes in the market competition, successful cases in which decision-making authorities are concentrated and these costs are avoided have become noticeable.

(7) Active utilization of systems

V*illage communities* assume basically that people act for and contribute to the societies voluntarily, respecting self-initiative and disrespecting controlling. This assumption typically leads to inadequacy and ignorance of manuals, systems, and processes. In contrast, *competing organizations* make efforts to manage and control people depending upon the efficiency of the system. With the assumption that people are originally reluctant to innovate or change, they should be managed and motivated through a top-down approach in the hierarchical structure. Conceit and arrogance also depend on mental laziness; thus, management and education of habits are also important in encouraging innovation.

6.7.2 Examples of the Two Groups in Comparison

The difference in competitiveness between the two groups becomes larger in the global economy.

6.7.2.1 Examples of Competing Organizations

One of the most prominent success cases of the transformation from a *village community* into a *competing organization* would be South Korea. The breakthroughs of Korean companies including Samsung, LG, and Hyundai KIA Motors have been beating Japanese counterparts, one right after the other; the rank of the GDP per capita of Japan, which can be deemed as an indicator of international competitiveness, has been going down greatly from 4 to 19 (National Diet Library survey) among OECD countries in the past 20 years. Specifically, the global market share of Japanese companies in the strategic products, such as memory semiconductors, LCD panels, DVD players, solar panels, and car navigation systems,

has diminished from near 100 % to almost 0 %. The same phenomena are also occurring in other industries like mobile phones, lithium ion batteries, TVs, semiconductor manufacturing equipment, and game software. In the automotive industry, which is believed to be the last stronghold of Japan, Hyundai KIA Motors ranked as the No. 1 customer satisfaction brand in retaining buyers in 2011 (J. D. Power Customer Retention Study) for the first time and already hold a bigger share than Toyota in the Chinese and EU markets.

After the financial crisis in 1997, South Korea acquired the support of the International Monetary Fund (IMF). With a shared sense of crisis among its people, various reforms were executed, including the following:

- Enhancements of international competitiveness by merging companies such as Samsung and Hyundai KIA Motors for efficiency improvements
- Preferential treatments toward large companies such as taxation and foreign exchange rate policies (to weaken the Korean Won)
- Flexible applications of the Labor Standards Act (enhancement of product development capabilities through longer working hours)
- Active use of the FTA to strengthen export industries, with the sacrifice of domestic industries
- Concentrations of decision-making authorities in companies (e.g., CEOs, CTOs) and governments (e.g., the "national CTO" position in the Ministry of Knowledge Economy) and aggressive investments with high risk for enhancing product competitiveness by economies of scale such as semiconductors
- Aggressive developments of emerging markets (India, Middle East, Africa, and so forth)
- Active utilization of external human resources such as lifting the ban on Asian elite immigration and appointing an American to be the head of their sovereign wealth fund
- Clarification of responsibilities, active delegation of power, and rigorous monitoring and evaluation in companies

Under the direct and indirect effects of IMF, the construction of infrastructures for promoting innovations—a social innovation—was executed. In addition, the personal influence of Lee Kun-Hee, the Chairman of Samsung Electronics, which changed its raison d'etre and drove the entire nation to an innovation-oriented country, is also not negligible.

However, the phenomenon of swingback that occurred in the UK, which will be discussed later in this section, can also be observed in South Korea currently. Political pressure for profit distribution to vulnerable groups from significantly exposed disparities intensified, and the government has been increasing the number of policies to respond to it. This may weaken the international competitiveness of rapidly growing behemoths such as Samsung, LG Electronics, and Hyundai.

Singapore is well known for being a country advocating *competing organizations* with its leadership from the powerful bureaucracy, even stronger than that of South Korea. In fact, a similar tendency can also be observed in Taiwan. In China, although a gap may exist between ideal and reality, the movement toward

a *competing organization* under the Communist leadership is steep, at least in the economy.

The UK used to emphasize equality of all members, just like the *village communities*, until the 1970s. The concept of *competing organizations* was introduced in the 1980s by former Prime Minister Margaret Thatcher to break the "British disease." However, it has been in a swingback period, and The Third Way has been pursued. As for the USA, the basic policy of President Barack Obama, who used to be a lawyer for civil rights activists, focuses on the relief of weak and declining industries, which is deemed the position of a *village community*. On the other hand, there arises the tea-party movement against the policy in grass roots by the classic group on the right side.

The most successful example of the transformation must be the establishment of the EU. The markets became open to each other by reducing all kinds of transaction costs, and competitions have been promoted. The challenge is still progressing. The bubble once burst due to the excessive expectations, which always accompany remarkable successes, and the influence still remains at present. However, their long-term fundamentals are considered to be very strong.

The *competing organizations* utilize disparity as an incentive, but there is also an obvious drawback, as previously described. As the number of people who do not gain any benefits from the incentive system takes up the majority usually, dissatisfaction is likely to be accumulated, which may lead to social and political instability. Policies for the majority are likely to be adopted politically, which responds to the dislike of *competing organizations*. However, circumstances are essentially different within a company. By having proper countermeasures against people who express dissatisfaction, the introduction of the incentive system becomes possible. Specifically, consolation systems, support, education and training for re-challengers, career change systems within a company, and various systems for promoting challenges (e.g., internal competitions for process improvements with rewards) can be considered.

Many global companies have succeeded remarkably in raising morale and awareness of competition among ordinary employees, which coexist with their already-established, outstanding leaders. Competitions among companies seem to have expanded to among ordinary employees beyond corporate leaders. The growing companies have successfully appealed to and recruited high-caliber and qualified employees more and more, resulting in a larger difference in the competitiveness between companies.

Global companies that have been decoupled from countries accelerate the changes to become *competing organizations*. Support from governments or even understanding by governments will revitalize the economy, but not a policy that impedes the transformation.

6.7.2.2 An Example of a *Village Community*

The expression "the law of the jungle" is often used to ridicule the *competing organizations* in Japan. Expected responses to changes from a *village community*, which can be learned from an example of Japan, will be discussed in this section.

"Follow precedent," "go with the flow," and "you can't fight city hall" represent the characteristics of Japanese's decision-making behavior. The trend becomes stronger in organizations that are closer to the foundations of the state, such as the bureaucracy, state-owned companies, corporate giants, and national universities. As long as people follow previous examples and the crowd, it is obviously impossible to realize any change. Also, "city hall" is usually the vested power holders; as long as the existing system is obediently followed, the vested power will be maintained inevitably. That means the concept of accepting changes is not established in Japan's society or companies. Although regulations and regulatory authorities are often criticized as impediments to social innovations, the regulations merely appear as the tip of the iceberg that is the sense of value and the system, the raison d'etre. The criticism with an expectation for solution seems to be very irrelevant.

Generally speaking, the heads of not only large companies, but also medium-sized companies and even venture start-up companies, do not possess the power to enforce a change. In *village communities*, not to mention the power of dismissal, even the exercise of the right of determining remuneration is shunned as a threat to the equality. Pushing the limits further in such environment may result in a backlash, and the leader may be ostracized from his village. The ostracism in *village communities* is a fatal and enormous risk to any individual. Even when having been succeeded in forcing everyone to accept a change, the profit to oneself is extremely small in the current reward system. The personal ROI of exercising leadership is close to zero or even negative. Especially nowadays, there is a tendency of organizational size reduction in each company; thus, once a failure, which can be observed publicly, is committed, one would immediately become the victim of the purge. Taking no action may be the safest way to cling to the current position for elderly and high-ranked people. Although a leader could make a well-prepared risk aversion by pressing all accountabilities to his/her subordinates as a scapegoat, the potential change agents themselves are vanishing.

Accordingly, the opportunity of exercising a change is very limited; the opportunity to learn leadership skills on the job is also limited. Furthermore, the opportunities to acquire and learn leadership skills, which are very important in *competing organizations*, are unavailable from internal or external educational institutions. This is a vicious cycle in which the probability of successful innovation achievement is significantly reduced. Pointing out the lack of leadership of a leader as a factor of innovation stagnation would be very cruel to that person.

It is significant to be noted that although all the facts above are specific and special, it is highly possible for any single organization that any of those paralyzing factors may arise if not cautiously directed, organized, and managed.

Transaction Cost in Economics

7

Transaction cost economics does not deal with transaction costs per se. There is a need for a field of economics that deals with transaction costs.

7.1 What Is Transaction Cost Economics?

Transaction cost economics deals with only governance issues.

This chapter will set out to explain how economists use the concept a transaction cost. Central to the concept is the field of study that is called transaction cost economics (TCE). It is important to recognize, however, that TCE treats transaction costs in a different manner than this book does. From the title of the study, one might think that TCE is all about measuring and minimizing transaction costs, but this would be quite misleading. TCE does not even deal with transaction and transaction costs per se, as this book has been proposing, but instead addresses the purely economics-oriented question of how governance structures are selected to counter opportunistic behavior. Here governance structures refer to whether a company manufactures internally, manufactures within its family group, vertically integrates, or buys from the market. The most accepted explanation about TCE is "a comprehensive model of governance choice between market and hierarchical (organization) regarding how to minimize the threat that exchange partners will be unfairly exploited in an exchange and to do so at the lowest cost possible."[1] TCE centers on the question of how these forms of governance are selected.

To answer the question of why TCE is not addressing the issues of transaction costs, it is first necessary to understand the context of how and why TCE emerged within the larger field and history of economics. The aim of this chapter is to

[1] Barney, J. B. (1997), *Gaining and Sustaining Competitive Advantage*, Addison-Wesley Publishing Company.

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
Springer Cham, https://doi.org/10.1007/978-3-319-06889-3_7

describe how TCE has emerged, to discuss the issues involved, and finally to propose some options to further develop the field.

The concept of a transaction cost was first proposed by Ronald Coase in 1937. The classical economics up to that point presumed complete markets, meaning that the market is frictionless, requiring no transaction costs, where resources are reallocated from ineffective organizations to more effective organizations by the "invisible hand" of the market. Reproaching this argument, Coase asked the simple question of why, if the market place is such a perfect mechanism, firms exist at all. He proposed that, actually, there are costs arising during transaction and organizations exist in order to reduce these costs, implementing internal mechanisms by the "visible hands" of managers. He was later awarded the Nobel Prize in 1991 for this and other lasting contributions to economics.

However, Coase only proposed the theory, simply calling attention to the existence of transaction costs. The economist Oliver Williamson was the one who worked out the details of why transaction costs arise in the first place and how the transaction costs should be reduced. He popularized the term, making it widely known in economics. His theory has not only made an impact on the field of economics, but has also summoned a lot of followers who helped spread the concept to other fields. Thus, today, TCE mostly refers to the theory formulated by Williamson, for which he also earned a Nobel Prize in 2009.

7.2 Williamson's Theory of Transaction Cost Economics

Williamson's TCE is complex and difficult to understand.

Before delving into the demanding explanation of Williamson's theory, it is useful to provide some basic knowledge by defining some of the key notions: opportunistic behavior, bounded rationality, and asset specificity.

(1) Opportunistic behavior

Opportunistic behavior refers to behavior that involves persons or organizations deceiving others or breaking rules for personal gain. The existence of such behavior also implies that the complete market of classical economics is not functioning properly. Conventional economics presumes perfect rationality, which would make it possible to know everything about a potential business partner ruling out deception and opportunism. In fact, if we probe the idea of pursuing profits, which lies at the heart of utility maximization, another core premise of conventional economics, we also end up with potentially opportunistic behavior. The concept of opportunistic behavior was proposed to criticize the ideal concept of profit seeking governed by invisible market mechanisms. And while the concept of opportunistic behavior has existed in economics, it was Williamson who raised it to prominence in his main work.[2]

[2] Williamson, O. E. (1985), *The Economic Institutions of Capitalism*, New York: The Free Press.

(2) Bounded rationality

Human beings have a limited capacity for absorbing information and making decisions. This contradicts the assumption made by conventional economics regarding complete rationality of individuals in the market. Conventional rational-choice theory made the assumptions that individuals have complete information gathering, processing, and transferring capabilities and thus are capable of acting rationally. In 1947, Herbert Simon criticized this stance and proposed the concept of "bounded rationality," emphasizing the limitations to human rationality. Williamson, later, utilized the concept in his framework. Please note that the expression, "complete rationality"—the counterpart of bounded rationality—is not even used in economics, because it was such a major presumption of all conventional economic theories.

(3) Asset specificity

Literally, a specific asset is an asset that is difficult to trade in the market. However, it is quite a challenge to provide an exact definition. Even Williamson avoided defining the term in his books. Instead, in his main work cited in (1) above, he only pointed out that specific assets are assets that cannot be described as "transferable," "fungible," "redeployable," "replaceable," or "salvageable." He described four "dimensions" of asset specificity: site specificity, physical asset specificity, human asset specificity, and dedicated asset specificity. Some scholars add brand asset specificity and temporal asset specificity to this list.

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The next section introduces Williamson's main theory, which deals with the problem of asset specificity arising from opportunistic behavior and bounded rationality.[3]

I Opportunism and Bounded Rationality Exist Opportunistic behavior is possible because human rationality is limited. While *opportunism* and *bounded rationality* have been overlooked previously, it is necessary to incorporate them in future theories. These two concepts cast doubt on the central tenets of neoclassical economics, namely, the *complete market* and *(complete) rationality*.

II Opportunistic Behavior Arises (Only) When Asset Specific Transaction Is Involved Opportunistic behavior arises when a transaction involves specific assets. This means that a company sourcing a product that can only be supplied by one specific firm may find that its partner betrays promises and acts for its own benefit. Williamson, however, did not discuss any other types of *opportunistic*

[3] Williamson has also defined along with "asset specificity" two other dimensions, "uncertainty" and "frequency," but these were merely supplementary. Adding these to this current discussion would make things more complex, so these will be dealt with in Sect. 7.4.2.

behavior, implying that he considered transaction involving specific assets significant enough not to consider another source of *opportunism*.

III Transaction Costs Arise as a Mechanism to Avoid Opportunism Bounded rationality (i.e., the limited information-processing ability of the human mind) makes opportunistic behavior possible, and a huge cost is required to protect firms against this opportunism.

IV Asset Specificity Leads to the Holdup Problem Resulting in Exploitation The *holdup problem* arises when a partner exploits its weaknesses and gains control over a firm, creating a situation where the partner can set all the conditions. Unreasonably large amount of profits might be squeezed out of the firm in such a dependent position.

V A Huge Amount of Transaction Costs Are Required to Protect Against or to Get Out of Such a Situation Constant monitoring is required to avoid *holdup*. Monitoring cost (part of transaction costs) can become very high even by itself, but should a firm be caught up in a holdup, extremely large costs can be incurred while escaping the holdup, looking for a new partner, negotiating a contract, and making further adjustments for the new transaction.[4]

VI A Proper Governance Structure Is Needed to Avoid Holdup To avoid such a destructive situation, it is necessary to carefully select a proper organizational form (or *governance structure*). Although there may be many such derivative forms, the two that are considered by Williamson are whether a firm buys a product from the market or manufactures the product internally.

VI-1 Market transaction occurs frequently and thus information about bad conduct spreads quickly, protecting against opportunistic behavior. That is why market transaction is preferable.

VI-2 Asset specificity leads to opportunistic behavior; therefore, it is preferable to produce within an organization, where such behavior is easy to monitor and manage.

7.3 Unrealistic Presumptions in TCE Theory

TCE theory assumes situations that have no realistic foundations, and thus many of the hypotheses are unfounded.

In this section, each proposition will be dealt with in the same order as presented above, pointing out its unrealistic scenario.

[4] The former type of transaction costs is related to product transaction during ordinary operations, while the latter type is related to finding and establishing new relationships. It is significant to note that the two are of very different character.

I Opportunism and Bounded Rationality Exist It is unnecessary to debate this point, as both concepts have a strong basis in reality. It is clear that opportunistic behavior is a real concern in the human society. One may even say that self-interestedness is encoded in the DNA of living things[5], for preserving and transmitting one's own DNA, while sacrificing others' very easily. The existence of limitations in human rationality is so obvious that it can also be accepted without any further discussion.

II Opportunistic Behavior Arises (Only) When Asset Specific Transaction Is Involved According to Williamson, the setting where opportunistic behavior is most likely to arise is when asset-specific goods are involved and the transaction partner has a choice of acting opportunistically. This setting is chosen in order to highlight the fact that these kinds of opportunistic betrayals can happen. However, as will be explained in full detail below, this is very unlikely to occur in real life.

Although human beings possess their self-interested DNA, there are social mechanisms that suppress such destructive behavior. Yet lack of vigilance against opportunism can make firms victims of opportunistic behavior. This is why, in reality, business people consider *trust* one of the most important values.

Before the spread of the Internet, where information about opportunistic behavior spreads in an instant, people relied more on personal and family relationships instead of the quality of goods and technologies. This kind of business convention still hinders Japanese venture start-up companies from easily establishing transactional relationships with large companies. People involved in business spend time to draw out detailed contracts for new transactional relationships (i.e., "complete contracts") and rely on the authority of the state to protect their interests from opportunistic behavior. Consequently, one of the major roles of the state is to facilitate and enhance transaction by restricting opportunism.

Another protection mechanism is to second source parts to other manufacturing companies in order not to depend solely on one source. This intended redundancy also has a role of defending against shortages caused by natural disasters and other emergency situations, but actually its main function is to protect against opportunistic behavior. Firms also involve third parties actively to swiftly resolve disputes and avoid the high cost required by the enforcing mechanisms of the state. In this context, unskilled managers abated by opportunism in an asset-specific transactional relationship become uncompetitive and subject themselves to the forces of natural selection. It is quite unlikely for opportunistic behavior to actually arise in an asset-specific transaction in which all firms and individuals without exception have developed their predicting mechanisms against opportunism in modern societies.

[5] Hamilton, W. D. (1964), "The Genetical Evolution of Social Behavior," *Journal of Theoretical Biology*, 7, pp. 1–16.

Dawkins, R. (1976), *The Selfish Gene*, Oxford University Press.

III Transaction Costs Arise as a Mechanism to Avoid Opportunism It is quite reasonable to accept the ideas of bounded rationality, opportunistic behavior, and transaction costs as the results of bounded rationality and opportunistic behavior. However, TCE focuses only on transaction costs required for handling the opportunistic behavior of existing partners, such as costs from monitoring, negotiating, enforcing, and problem solving, and it fails to address many other types of costs arising during transaction.

Williamson, in other words, equates transaction costs with costs for handling opportunism. Yet, for one thing, there are huge costs incurred by preliminary information gathering, even before starting a new transaction.[6] During a transaction, there are substantial costs involved with handling mistakes in communication and operations, adapting to changing environments, and preparing for possible mistakes and unavoidable changes of circumstances. In each case, it is necessary to gather information, monitor partner activities, and shape and execute solution plans. These are much more significant activities in the ordinary operations of a firm, and transaction costs associated with actions taken against opportunism can be conceived to be simply embedded in these activities.

These various other types of transaction costs must be addressed, instead of merely focusing on the ones arising from action taken against opportunism. These and their transactional elements are measured, analyzed, and managed in reality.

IV Asset Specificity Leads to the Holdup Problem Resulting in Exploitation The best example of a holdup involving a specific asset, arguably, is the Windows operating system by Microsoft. However, the actions of Microsoft led to the verdict that the company was against market competition and breached the US antitrust laws. The U.S. Department of Justice decided that Microsoft overcharged products and that its practice of bundling its Internet Explorer software with the Windows operating system was illegal.

As mentioned in Chap. 3, these days it is quite difficult to use a firm's own platform (or standard) to gain an unfair advantage over its competitors. Firms that try to do so often fail to earn credibility for their standards, and they end up running into antitrust laws and potential litigation. Even Microsoft, which once conquered markets all around the globe, found its power waning after the antitrust case. Put simply, it is illegal to abuse partners or customers for opportunistic means, and opportunistic behavior comes with a huge risk that can even lead to the breakup of the company.

The USA has relatively well-functioning antitrust laws. In the past, there were many precedents of ordering violating conglomerates, such as Standard Oil, AT&T, and IBM, to break up, with some even driven to near-bankruptcy by the verdicts. There are cases where the illegal activity was sanctioned by penalties and imprisonment. The European Union antitrust law has similarly strict regulations.

[6] This also includes information gathering costs for avoiding opportunism.

Laws are in place against the abuse of superior positions if a company finds itself in a holdup. This "superior position" does refer not only to monopolistic superiority but also to regular relative superiority in business relations. Unless a country is in a state of anarchy, it is too much of an exaggeration to regard the main function of organizations to be a mechanism to counter illegal activities. At least, in reality it is not like the theory.

In fact, many parts manufacturing firms with highly differentiated products could easily manufacture and sell end products, yet have strong company policies against interfering with customer business. Parts manufacturing firms understand that if they yield to the temptation of a short-term gain, they would lose trust and ultimately wither and fall. These parts manufactures are very keen on gaining the trust of their customers (i.e., the end product manufacturers). High trust means that they can take market share from second source manufacturers, because the redundancy becomes unnecessary. It is not an exaggeration to say that showing even the slightest sign of opportunism might almost equal suicide for these firms.

Nevertheless, there are some ambiguous cases that seem to contradict the above. For example, there are the cases of the developments by Google, the developer of the Android operating system, of tablets (manufactured by ASUS) and smartphones (manufactured by LG). However, as mentioned earlier, it is an open source platform with a nearly completely open license, so Android user firms can never be locked in to a holdup.

Apart from standard products, how many products (or technologies, transactions) are there, or are there any that would make buyers locked in to suppliers, even though the buyers expend enough costs for switching? Williamson, at least, has not provided exact examples that would answer this question, so it is not quite clear what he assumed. He actually gave four examples for asset-specific transaction in his forecited book:

(1) Site Specificity: Supplier facilities located near the site of the buyer
(2) Physical Asset Specificity: Specifically manufactured molds and dies
(3) Human Asset Specificity: Engineers with firm-specific knowledge
(4) Dedicated Assets Specificity: Customized equipment investment at customers' firms

However, all of these examples are either cases of suppliers locked into buyers (Cases 1, 2, 4) or bilateral lock-ins (Case 3), instead of buyers locked in to suppliers, as assumed by TCE theory. He provided no example for his theory.

The most widely discussed problem related to opportunism and holdup in economics textbooks is the acquisition of Fisher Body (a General Motors supplier) by General Motors.[7] This is clearly a case of a supplier (Fisher Body) getting locked into the buyer, General Motors (Case 1). In reality, most of the cases have to do with small- and medium-sized companies (suppliers or subcontractors) being locked into

[7] GM proposed Fisher Body to build a factory near GM's site, but Fisher Body declined the proposal, fearing a holdup. To overcome the situation, eventually GM acquired Fisher Body.

large companies (buyers or original contractors). Yet this is exactly the opposite of what TCE theory assumes.

In addition to this, it is also a well-known fact that for a long time buyers had been exploiting suppliers in Japan, and this was treated as Japanese practice. For example, it was customary to send the order documents after the delivery had been made, a practice that clearly favored the buyer. However, as societies matured, these malpractices have been acknowledged as serious problems and proper regulations have been drafted. Today, there is the subcontract act, which prohibits delaying proceeds and beating down the price by taking advantage of the supplier's weak position. In the USA, there is no particular subcontract act, but there are specific reports, such as Dun & Bradstreet (D&B) reports, similar to consumer reports (often called Dun Reports for short). These reports make it possible to identify and avoid future transaction with large companies that fail to conform to decent transactional practices.

Another well-discussed example of holdup is when railway companies build railroad tracks to a particular factory. In this case, railway companies can get locked into the factory (i.e., the buyer) because the railroad tracks can only be used for one purpose. This corresponds to Case 1 above. However, this again is the case of a supplier (a railway company) being locked into a buyer (the factory).

The problem is that all of these are opposites of what TCE theory assumes, and therefore, these are not only inappropriate cases for explaining the central issues of TCE, but might potentially lead to misunderstanding. Most researchers, and especially the graduate students of the author, often mistakenly think that TCE is about suppliers (subcontractors) being locked into buyers (original contractors). Although all of these examples create a vivid mental image about the holdup problem, these are the opposites of what TCE should be explaining (it should explain the cases about buyers locked into their suppliers).

Let us examine other possibilities. For example, there are some examples from the 1980s where a particular supplier offered a specific product catalog platform or electronic ordering system. When these became standards, buyers found themselves locked into their suppliers. American Airlines and Misumi Corporation are examples of this. However, lately, the trend toward open systems made these standards disappear.

Looking back in history, there are actually many cases of buyers being locked into suppliers, but there is no asset specificity involved in these cases. For example, in developing countries the supply of certain goods is quite limited, and there may be no alternative options for buyers. The modernization of manufacturing and the growth of manufacturing companies are likely to occur simultaneously, as a result of which end product manufacturing companies could grow faster than retail companies (the reason is automation is easier with processes in production than in transaction). Therefore, retailers usually grow as subsidiaries of large manufacturing companies—or in other words, suppliers (i.e., manufacturers) controlled buyers (i.e., retail companies). This structure still remains in industries of Japan, such as household appliances, automobiles, commodities, and steel industries. Resale price maintenance has been noted as an issue that can be the

object of antitrust litigation. In addition, there is also the case when a retailer intends to procure from other manufacturing firms, but the manufacturing company stops supplying goods in order to negotiate various conditions advantageously and to hinder retail firms from growing independently. Historically, however, there appeared entrepreneurial leaders in retail companies who have torn up the long-established inferior position of buyers and changed the industry structure. In fact, the first clause of the Japanese antitrust laws is about prohibiting the rejection of supply, and the Japanese society in general has been supporting the attempts to mend these situations. These kinds of lock-ins are in the same direction as TCE theory suggests; however, they have nothing to do with asset specificity because there is already competition. These are simply cases of free transaction being obstructed by the power relationships or combines of suppliers.

Patents are basically specific assets that are difficult to substitute in other firms. However, because these days there might be fierce fighting for gaining essential patents, most patent wars end in cross-licensing agreements. The patent on the blue light emitting diode (LED) owned by Nichia Corporation of Japan is often given as an example of a non-substitutable asset, but actually there are other substitute technologies to achieve blue LEDs, and there are a multitude of patented manufacturing methods that also produce a blue LED. Many competitors of Nichia Corporation, including Taiwanese and South Korean companies, are indeed manufacturing and selling blue LEDs based on different patented technologies. Patents are not only insufficient to lock in customers, but setting above-market prices can lead to giving an opportunity for competitors to enter the market and develop alternative technologies. The more significant and widely accepted strategy these days is for a company to standardize its technologies with lower prices or even zero-price and to challenge the various utilization of the standard position for earning profits.

For another example, state-run company products are non-substitutable, as is often the case with developing countries, simply because of regulations, which are not asset specific in the above sense. Therefore, they should be excluded from the discussion.

Source code without any accompanying manual may qualify as a specific asset as assumed by TCE theory because it can only be understood by the programmer who made it. In Japan, this specificity is fueled by organizational systems that do not necessitate manual writing and the *village community mentality* that is outright against any kind of manual making. In old-style Japanese firms, this was true not only for the software programmers but for almost all employees. The employees are likely to refrain from externalizing their work procedures in order to avoid substitution and to increase their own value in organizations. Although it is an omnipresent problem, there exist no cases for holdups that would utilize this ambiguity, as they are controlled in the villages.

Different historical backgrounds may partly be the cause of the presumptions seeming so estranged from reality. The period when Williamson created TCE still lacked the same strong antitrust regulations and value systems that exist today, and he might have thought of TCE as a mechanism against monopoly. In monopolies,

assets are non-substitutable, regardless of whether they are specific or not. Although monopolies are caused not only by asset specificity, it is true that asset-specific products can lead to monopolistic relationships.

Williamson's abovementioned book emphasized that by not considering asset specificity, one can easily find himself in the monopolistic reality of the past. As we know Williamson to be a researcher with a strong critical approach, then it might be possible to see that his work has provoked the antitheses against monopoly.

V A Huge Amount of Transaction Costs Are Required to Protect Against or to Get Out of a Holdup Lock-in refers to a relational situation where it is impossible to change existing partners because of the high switching costs involved. In Chap. 4, where there has been a discussion on the level of modularization, lock-in is a key perspective for analyzing the level of modularization, because it is the exact opposite of ease of substitutability and independent decision making.

TCE holds that it is not possible to switch partners in lock-in situations, but it could be argued at least that some of these are not real lock-ins because if the profit from switching is expected to be above the switching cost, then there is an incentive to switch, no matter how high the costs are. This idea will be further discussed as an issue regarding the levels of modularization here.

Switching costs can be classified into costs *related to production* and costs *related to transaction*: switching costs *related to production* entail costs incurred while replacing manufacturing equipment. In a similar vein, switching costs *related to transaction* to set up the relationship with new transaction partners include search costs; presentation costs for exchanging information regarding credit, capability, and potentiality about the prospects; and negotiation/contracting costs.

In the following, those will be explained respectively. It is especially essential to analyze by further segmenting the switching costs *related to transaction* into each transactional element. In addition, it is important to note that switching costs only include costs that are incurred during the process of switching transactors, and it is completely different from the transaction costs incurred during ordinary transaction, as discussed previously in ***III*** *Transaction costs arise as a mechanism to avoid opportunism*.

(1) Switching costs related to production

On the customers' side, even if their equipment is developed that is specialized for a product of a supplier, it is possible to procure the product with the same specification from another supplier, so there occurs nearly no switching cost. In the case of specific assets, there would be higher switching costs; however, as discussed previously, there are hardly any cases for such specific assets.[8]

[8] It is not possible to prove that there are none, so instead it should be restated that there are not enough cases to allow for the general theorization.

On the other suppliers' side, if some equipment is specifically designed for a particular customer, then switching partners can lead to incurring a huge amount of switching costs for deploying new equipment (e.g., design and development) and dealing with the new suppliers.

It is clear that lock-ins related to production can only occur in the supplier-to-buyer direction (this is a lock-in from supplier to buyer, which is contrary to TCE theory). In order to avoid the lock-ins, suppliers need to take the risk of owning the product specification and rights related to production. If the rights for product specification do not belong to the supplier, then switching can become very problematic due to high switching costs.

(2) Switching costs related to transaction

Lock-in can happen in respect to each individual transaction element. Switching costs are incurred by switching interfaces owned by the partner. An example for this is EDIs. Originally, large buyer firms had their own firm-specific EDIs and required suppliers to buy expensive terminals to access them. Switching costs related to EDI terminals made it almost impossible to switch customers. Even today, there are buyer companies that refuse to transact with companies who do not participate in their online marketplaces (buyer-specific commerce sites can be thought of as the extension of firm-specific EDIs).

Similar costs can be incurred by presentation, negotiation, and monitoring. If interfaces are owned by buyers and suppliers need to adjust their internal interfaces to them, it can lead to huge switching costs.

The above describes a case of suppliers locked into a buyer, but customs and tacit rules can lead to a bilateral lock-in, where buyers can also get locked in.

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In this manner, if switching cost is divided into production-related and transaction-related costs, it becomes clear that there are no switching costs associated with the buyer-to-supplier direction. In other words, there is no lock-in only in the direction from buyer to supplier. If the only possible lock-in direction is suppliers being locked into buyers (which is the opposite of TCE theory), then a solution will be much different than selecting proper governance structures, as proposed by TCE. Supplier firms used to get locked in because they could not afford the high switching costs. However, based on the discussions in the previous chapters, it should be obvious thus far that the increasing reduction in transaction costs (because of the spread of the Internet and other standards) led to a dramatic decrease in the switching costs.

Currently, the biggest two problems faced by developed countries are (1) how to make SMEs independent from their original contractors and allow them to grow into global firms and (2) how to make them spearhead innovations, raise employment, and revitalize local economies. Even South Korea, where large companies have a huge influence under the governmental protection, is trying to generate policies to encourage SMEs to become more independent and global. In order to

revitalize societies and enable innovations, it is vital to help SMEs become independent from large firms.

Four essential solutions have been proposed in Chap. 4, namely, increasing the applicability of products by modular design, adapting to multiple customers with lowest costs, decreasing dependence on main customers, and enhancing sales and marketing capabilities. Even if a SME depends on contracted business, with the rise in the number of users, it can extract fixed interfaces as its own standard and deploy modular design to create its own standard product lines applicable to various customers' needs.

Promoting this transformation has become a critical, general management issue. The main focus of research on strategies for avoiding opportunistic behavior should not be the buyer-to-supplier direction, but the more general supplier-to-buyer direction.

VI A Proper Governance Structure Is Needed to Avoid Holdups

VI-1 Market transaction occurs frequently and thus information about bad conduct spreads fast, protecting against opportunistic behavior. That is why market transaction is preferable.

VI-2 Asset specificity leads to opportunistic behavior; therefore, it is preferable to produce within an organization, where such behavior is easy to monitor and manage.

The presumption here is that the ill reputation following opportunistic behavior during transactions outside the market is difficult to transmit. Yet historically in the Western world, firms have expended huge costs involved in obtaining references and information on the creditworthiness and trustworthiness of potential partners. For example, tenants often sublet their apartments to complete strangers during the summer when they are away, but they do carefully check the character and background of the person through friends. New company hires are also prudently checked before employment by acquiring information about past conduct from professional firms specialized in these checks, which obtain references from multiple concerned persons. In Japan, it is also common to approach involved parties and go-betweens to acquire information about future partners before any transaction takes place in order to avoid opportunistic behavior. Obtaining information on creditworthiness and trustworthiness has been an indispensable part of business transaction.

Does the next presumption, internalizing a specific asset in order to dissolve holdup situations, assume M&A in particular? A company that has such a competitive product that can lock in others cannot be acquired easily or its product produced internally. In developing countries, it is quite common to acquire confidential know-how through employing engineers or retired employees from competitors, but this unethical behavior is certainly not what internalizing a specific asset has meant.

This kind of decision about internalizing specific assets is not applicable for modern core-competence-oriented management. These days, firms need to concentrate their valuable resources in a select area in order to avoid decreasing efficiencies by overspreading their resources among highly dispersed areas. This is how even venture start-up companies, by concentrating their resources in core areas, have chances to beat behemoths. Competitive technologies that could lead to holdups require a huge amount of investment and costs for developing, marketing, maintaining, and improving products. In today's highly competitive markets, it is inefficient to internalize different technologies that require additional huge investments and costs.

Furthermore, it is not only opportunism that must be taken into account when selecting a governance structure; there are a myriad of other factors. For example, there is the policy regarding company size. Larger companies have greater social reputation, have access to better labor, have more political influence, can create synergy among business areas and among products, can satisfy a desire for power, and can receive capital gains from revenue growth due to in-house transaction. For these reasons, especially in developing countries, company growth by internalizing transaction may be preferred in societies where growth is ordinarily of value. In Japan, the companies' goal has been to enclose transaction within *Keiretsu* groups, for which the social respect had been extensive. Nowadays, however, there is a change in sentiment calling for firm size reduction, core competencies, and higher profitability. Strategic significance of the technology/product, consequent synergetic effects, future potential, accordance with own corporate mission and strategy, and environmental factors are also important issues for the decision about internalization.

Apart from these, there are also many other factors that influence the decision about the internalization, such as the potential for existing employees and technologies at the company to be merged, past relationship with the company, the market potential for the technology/product to be internalized, and one's own excess resources at the moment. It is absolutely not true that the choice of governance mechanism would be decided only based on arguments about protecting against opportunistic behavior. It may even be said that in today's reality, it is only opportunistic behavior that is not really taken into account when deciding about governance structure.

On the background of this assertion, Williamson has replaced the *production* function, which corresponded to the company by conventional economics, with the *governance* function. In order to exaggerate this pass-breaking argument, the larger question of "corporate governance" was converted into the issue of the "make or buy" problem of a single product. This possibility will be delved into more deeply in the following section.

7.4 Historical Background of the Emergence of TCE

Today, decision making of firms proceeds in the direction opposite to what TCE assumes.

7.4.1 TCE, Which Proposed Existence of Governance Function of Firms

The assertion that firms have decision-making functions became revolutionary in economics.

For argument's sake, let us assume that there are indeed asset-specific products for buyers, and therefore, as a countermeasure to difficulties in market transaction, it is appropriate to manufacture them internally. In this situation, TCE is perceived as the simple problem of choosing between internalizing and outsourcing (the "make or buy" choice). This makes sense to some extent. In fact, many scholars interpret TCE in this way.[9]

However, the question of "make or buy" is a decision about a single product. TCE deals with selecting a corporate-wide governance structure, such as vertical integration or building *Keiretsu*-style relationships. A whole company's governance structure is simply not decided on the basis of the "make or buy" decision of a single product. Besides, if there are multiple products, then different decisions would be made for each product anyway.

Even if TCE is perceived as "make or buy," the direction of discussion should be different. The managerial choice of "make or buy" is usually made from the following perspectives:

- Comparison of sourcing costs: self-manufacture or outsourcing? As a matter of course, transaction costs should be taken into account (including cost of searching for partners, checking credits, conducting product examinations, communicating specifications, transporting, customization, monitoring, problem solving, taxation, and so forth).
- ROI: Are there sufficient returns to be expected in the future from the internalization?
- Accordance with company strategy: Is the internalization of certain products within the domain of *selection and concentration*?
- Growth policy: Is it consistent with the whole company's growth policy? The choice of product sourcing should be complied with the whole company's policy (e.g., expansion of scale, focus on a domain), as explained above.
- Others: Regulatory and political factors, potential information leakage to other firms, personnel management issues such as treatment of a director in charge,

[9] There are numerous papers applying a TCE framework that deal with the problem of "make or buy."

and so forth should be considered for the shift from self-manufacture to outsourcing.

Williamson has only used terminologies such as "governance structure," "vertical integration," and "hybrid forms" without explicitly referring to outsourcing strategies or "make or buy." Hence, it is quite problematic to interpret Williamson's TCE as a problem of the "make or buy" type.

In fact, the starting point of Williamson's research was to provide an antithesis to the widely held belief of economics that describes only the behavior of the market, looking at firms as mere dots. He argued that these dots actually are agencies in the form of governance functions and make their own decisions. The "make or buy" problem is nothing more than a decision within a dot (namely, one product in one company); it is not likely to have been of interest to Williamson and it should have not been so. While firms were considered as a mere dot in the complete market without any decision-making capabilities, Williamson conceived that firms were equipped with the capability of making *outsourcing through the market or in-house production* decisions, which he represented by the term "governance." It can also be perceived as firm's capability to stand apart from the market mechanism and to establish its own governing mechanism. He must have seen the very first function of firm as a decision about whether to leave the market or not.

However, as discussed in Chap. 5, organizations and the market are basically identical, and the only differences are:

– An organization has fixed interfaces to determine ad hoc interfaces easily.
– An organization is physically collocated (a fixed interface as collocation).

The raison d'etre of the organization is related to the above two advantages, but these features exist in the market as well. There is only a difference in degree. It is exactly this identicalness that firms increasingly use to create internal markets within them (internal market transaction). That is, the reality is now reaching to the conventional assumptions of economics.

Regardless of whether TCE is about the problem of governance or the problem of "make or buy," opportunism plays only a minor role in decisions on these. Therefore, although Williamson can be highly evaluated for calling attention to the existence of opportunism and the governance function of firms, it must be said that it is much exaggerated to claim that the most significant function of firms besides production is selecting proper governance structures to guard against opportunism.

7.4.2 Factors Contributing to the Increase in Transaction Costs that Were Neglected by Williamson

The variance of transaction entities overlooked by Williamson has a significant impact.

Williamson has proposed "uncertainty of transaction" and "frequency of transaction" as analytical dimensions of transaction costs, alongside "asset specificity." He uses the term "dimension" instead of axis, but if we interpret these as factors causing an increase in costs, then it is obvious that the most important factors are well covered. The real research purposes of Williamson will be examined below by

comparing the three dimensions with the transaction cost elements that were proposed in Chap. 1 (Fig. 1.4).

First, the factors that are not covered due to the difference of the definition should be excluded. Williamson places *contracting activities* at the center of a transaction, so it is quite likely that he has disregarded physical costs such as transportation costs, installation costs, and training costs, although he did not state it clearly whether he excluded these (to facilitate the objectivity of research, it would have been quite important to clearly delineate the boundaries of the research object).

The exclusion of the physical costs (that is, inclusion in a *production cost*) results in a serious problem that those costs incurred on the buyers' side become neglected (because buyers never produce). Excluding these costs, however, the comparisons with Fig. 1.4 are described below:

(1) Asset-specificity dimension: If a product is difficult to be procured on the market, then the supplier is also specific. This means that it costs more to search for and gather information about the specific product and the specific supplier. These can be also applied to monitoring and problem-solving costs; however, the substantial point here is the low frequency of transaction which leads to increased costs due to dependence on ad hoc interfaces, instead of asset specificity.
(2) Uncertainty dimension: In order to minimize future costs and risk related to uncertain transaction, it is necessary to collect information with maximum prudence. More agreements and contracts must be prepared for any possible contingency. And then, to exclude further uncertainty, it is necessary to circumstantially monitor and inspect existing operations. All of these result in increased transaction costs.
(3) Frequency dimension: It is less likely that fixed interfaces are installed when frequency of transaction is low. If there are fewer fixed interfaces in place, then there is a natural increase in costs because there is a need of ad hoc information gathering, negotiation, adjustment, monitoring, and problem solving.

This shows that Williamson could cover most of the important factors causing an increase in transaction costs. However, it can be pointed out that there are some factors missing.

(1) The physical, institutional, and conventional distance between transaction entities (the number of interfaces necessary to bridge it):

After the second half of the 1990s, transaction costs have been on the decline, boosting the transactions all over the world, even with originally unconnected countries, firms, and individuals. Missing factors can be examined from a perspective of the causes of the massive transaction costs of the past.

The transaction cost reduction was brought about by the spread of the Internet and various applications that were built on top of it. At that time, transaction costs that had been proportional to distance were reduced not just in the sense of physical distance but also in that of institutional and conventional distance. Distance between heterogeneous entities (e.g., firms and individuals) incurs the costs associated with establishments and maintenance of interfaces. This concept of "distance" was overlooked by TCE theory, which looked at

transaction entities as uniform. In fact, depending on the transaction partners, transaction costs differ. This was a factor that TCE did not take into consideration.

(2) The interface-building capability and intent of the transaction entities:

In order to reduce these distances, heterogeneity was reduced by finding and fixing common interfaces. Differences in location, language, information exchange methods, ordering and delivery systems, payment and remittance methods, monitoring and assessment customs, and so forth, most of which necessitated high transaction costs, have been bridged by interfaces, fixed interfaces in particular.

Communication has been first fixed and standardized through the postal service reducing worldwide costs of delivery, and then later digitalization brought about a further ease of information exchange. Even before the Internet, there were different attempts for fixing transaction interfaces. Firms designed and introduced their own EDI systems, which led to fixed interfaces even locally. There were also OSIs that had been pioneered by national governments just before the spread of the Internet. Similarly to networks, databases fix interfaces for sharing and increase efficiency. The accumulation of these efforts led to the present world of global transaction, which is still being and will be expanded as prospects for further declining transaction costs are promising.

Conventional economics perceived not only individuals but even firms as mere dots in its models, so it comes with no surprise that the capabilities of participants have not been dealt with in the economics. Even in management science, tacit knowledge issues must be more influenced by individuals who deal with the knowledge (their capabilities and intents) than the knowledge per se, but it has been neglected. In fact, the externalization of tacit knowledge undermines the competitiveness of individuals who could before rely on his advantage gained from leveraging tacit and, thus, specific knowledge. Therefore, a major obstacle to externalizing tacit knowledge, which corresponds to fixed interfaces in general, is a lack of intent to do so, not the awkward characteristics of the knowledge per se.

When the analysis of economic activity comes to transaction, a minimal unit of economic activity, it is unavoidable to consider the difference of individual entities. It is indisputable that the individual capabilities of modularization, standardization, and process design that were described in Chap. 6 have a large influence on the determination of transaction costs. It is simply no longer tenable to disregard these issues. If the differences both in transaction entities (capabilities and intent) and in the distances between transaction entities are not taken into consideration, the discussion cannot be sufficiently accurate.

In order to deal with these issues, measurement and analysis including benchmarking of transaction costs with precise operational definitions and methodologies for designing and managing interfaces are required as proposed throughout this book.

7.4.3 The Historical Background Behind Williamson's Radical Contributions

Williamson made various radical contributions at the time.

Although the theory, considerably removed from reality, was created in the past based on a different historical background, Williamson did provide creative new explanations for his time. His goals with TCE theory were considered to be the following:

(1) Opportunism and bounded rationality exist (therefore, the market is not complete).
   - Opportunism exists because of bounded rationality.
   - Opportunism manifests itself in the holdup problem most clearly (however, as seen above, it is important to understand that real-life holdup happens in the direction of supplier to buyer and not buyer to supplier as assumed by TCE).

(2) Transaction costs exist (therefore, the market is not complete).
   - Firms exist as means of reducing transaction costs.
   - Firms reduce transaction costs by selecting proper governance structures.

(3) The function of firms is not only to produce but to select proper governance structures (therefore, the market is not complete and agency of firms has value).

(4) There are some products that are not standardized and specific assets, which are difficult to substitute, and those are untradeable on the market (therefore, the market is not complete).

(5) Firms and the society should utilize these arguments in their decision-making processes (economics has a relevant use in real life).

In that time, there were only a couple of scholars who had criticized the assumptions of the complete market, such as Herbert Simon and Thorstein Veblen. Williamson, however, tried to prove that the market was not complete. He intentionally dealt with all five radical propositions. The confusion that has been described in this chapter has probably been caused by the fact that he mixed up *holdups as the easiest examples of opportunism* with *holdups as the most frequent examples (or the only example) of opportunism* and the *make or buy problem* with the *governance structure selection problem*. It was not easy to disentangle the complex theory and find the contradiction through the careful study of the direction of holdups. Eventually, the economics community at the time welcomed the theory for its groundbreaking ideas of (1), (2), and (3). While (4) is somewhat supplementary, (5) was also quite revolutionary as well at the time.

Williamson's TCE pointed out that the market was incomplete, where opportunism and transaction costs existed and firms were not simply dots but entities with significant agency. To develop this radical view, he then turned to the empirical research on opportunism and transaction costs in asset-specific transaction. And to increase the relevance of his research, he proposed that firms had the choice of determining their governance structure in asset-specific relationships in order to reduce transaction costs. His revolutionary idea has given birth to many research

areas, such as contract theory, new institutional economics, property rights theory, and principal-agent theory,[10] none of which deals with transaction *costs* per se. While this thinking was a great contribution to conventional economics, it is quite unfortunate that it robbed research completely from its main focus on transaction costs.

7.5 Comparing TCE and Modularization Theory

TCE and modularization theory provide exact opposite answers for the identical problems.

The asset specificity concept central to Williamson's TCE theory is actually identical to the idea of ease of substitutability embodied by modular products. This section discusses modularity from the perspective of Williamson's theory.

As described previously, Williamson defined the properties of non-asset-specific assets as "transferable," "fungible," "redeployable," "replaceable," and "salvageable." "Substitutability"[11] generally represents these, which happen to be the very same properties of modular products. Of course, there is a strong connection between the lock-in problem and the level of modularity issue of this book (which is determined by ease of substitutability and independence of decision making, as explained in Sect. 4.1.6). Although this was not reflected in the previous literature on modularity, in fact Williamson had already been unconsciously investigating the question of modularity. The areas covered by research on modularity and TCE are identical, dealing with problems such as the borderline between the market and organizations and the borderline between commodities that should be outsourced to external partners and products that should be insoursed.

However, Williamson's conclusion is the opposite of the answers that the modularity studies provide. In other words, while the modular strategy is *external oriented*, exploring an open social structure by establishing collaboration between modules that have the competitiveness with asset specificity features, the strategy underlying TCE is *internal oriented*, encapsulating a wide range of asset-specific products and technologies within the boundaries of firms. These two types of completely opposite strategies also reflect the difference in historical backgrounds. This question will be investigated further by carefully looking at Table 7.1, which compares TCE with modularity theory.

The *first main difference* between historical backgrounds is the recent dramatic decrease in transaction costs due to the spread of the Internet. This has led to horizontal division of functions and business processes globally, and the modular strategy adapted to the rapidly developing emerging markets. In the past, high transaction costs limited the size of the accessible market and led to limited

[10] Those research areas are sometimes included in TCE or called "transaction cost approach."

[11] E.g., Brousseau, E. and B. Quelin (1996), "Asset Specificity and Organizational Arrangements: the Case of the New Telecommunications Services Market," *Oxford Journals, Industrial and Corporate Change*, Volume 5, Issue 4, pp. 1205–1230.

Table 7.1 Comparing TCE with modularity

	Transaction cost economics	Modularity theory
Commonalities	Arguments about the boundaries of the market and organizations	
	Arguments about the boundaries of the products that should be handled internally and sourced from the market	
Different historical background	Transaction costs drastically reduced with the spread of the Internet –Greater returns on investments with modular strategy –More competition, more risk-taking A shift in political focus from large companies to SMEs for innovation A shift in corporate philosophy from opportunism/exploitation to trust/collaboration	
Differences in conclusions	Large firms' competitive strategy –Control over SMEs –Lock-in of SMEs by large companies Internalizing external resources Control and governance Closed vertical integration	SME growth strategy –Escaping from large companies' control –Lock-in of large companies by SMEs Externalizing internal resources Independence and collaboration Open horizontal collaborations

potential for modular deployment investments, but these days it is possible to reap the benefits of modular design and standardization strategies. Strategies with excess risk have intensified competition, and more competition in turn has led to accepting even more risk. The modularization strategy has adapted to this environment very well. It goes without saying that as customers it also becomes necessary to select and utilize those modular products with such values.

Onto the global standard of the Internet, further layers of standards are being added continuously. This is a characteristic of globalization; however, firm strategy differs greatly based on their belief: whether external sources are increasingly utilized by acknowledging change as permanent or internalized processes are preserved by disregarding change as only temporary. This difference has been creating considerable differences in performances of firms. In the past, it might have been a clever strategy for large companies to adopt the vertically integrated (or internalized) governance structure in particular as a response to asset specificity, but in the end the modularized structure gained higher competitiveness from the effective use of resources. Today, the trend is to move in this latter direction. The Internet is merely one cause underlying this change.

The *second difference* in historical backgrounds is the shift in resource from large companies toward SMEs and venture start-up companies in order to escape stagnation and promote innovation (at least in developed countries).

Nowadays, a key research interest is finding out how to facilitate social and technological innovation by independent SMEs and venture start-ups, instead of enhancing the competitiveness of large companies. TCE approaches the problem from the perspective of control and integration by large companies, discussing strategies for avoiding lock-ins by SME suppliers. In contrast to this, the modularity

theory looks at the situation from the subcontractor perspective and; it deals with strategies for advancing independence from large, final-assembly manufacturers in order to avoid lock-ins by these large companies.

The former is against modularity that would benefit small companies and proposes that large companies should internalize processes to gain competitive advantage. The latter accepts modularity and presumes independence, emphasizing a market structure that is built upon groups of independent companies. Depending on the perspectives, the end result is quite different.

These days, it is a widely held view that revolutionary ideas from SMEs and venture start-ups are necessary to innovate the market and the society. From the 1980s onward, the US government, by pro-patent policies, fueled the shift of power from large companies, such as IBM, to swifter and leaner companies, such as Microsoft, Intel, and various other small venture start-ups in favor of innovation.

This ended the era of large companies with diverse product portfolios and led to the rapid proliferation of SMEs that have embraced modular designs. Modularity means that there is no need to worry about lock-ins by suppliers because products and their suppliers are fungible, replaceable, and substitutable. In order to resist this, suppliers attempt to increase their market share by standardizing their modules. In an age when modular products can be easily substituted, it is critical to profoundly differentiate to gain competitive advantage. Suppliers need to surpass competitors on every point of technology, quality, cost, delivery time, and so forth. If these goals can be achieved, then companies enter a positive feedback loop where increased market share leads to even stronger differentiation.

This also means that orders (purchases from customers) concentrate on a specific supplier as it supplies the best module product, leading to a situation that is similar to a lock-in. Buyers counter this by building a second source relationship. In other words, by maintaining potential substitutable suppliers, they increase their negotiation power and stop any holdups and opportunistic behavior before it could happen.

Yet, in reality there are many cases of quasi-monopolistic markets with more than a world market share of 80%, where opportunistic behavior might arise due to the lock-in situations. For example, there are numerous products holding quasi-monopoly market shares, such as Fujifilm's TAC film, ARM'S embedded processor, Mitsubishi Chemical's red LEDs, Nidec's HDD spindle motor, Advantest's DRAM testing device, Dainippon Screen's silicon wafer cleaning device, Japan Vilene's nonwoven fabrics, ASML's semiconductor stepper equipment, Tokyo Electron's semiconductor resist coating equipment, DISCO's laser dicing saws, Ushio's digital cinema projector lamps, NSG's glass panels for thin-film PVs, Nidec Copal's shutters for compact digital cameras, JSW Muroran's various parts of power generators for nuclear power plants, Toppan's LCD anti-reflection films, Okamoto Glass' digital light mirrors for dentists, Shimano's bicycle components, and possible many others.

These quasi-lock-in situations arise because of the swiftly changing technological landscape and the desperate effort made by the supplier-side management. This is the result of suppliers earning the absolute trust of their customers by providing complete and prompt response to the buyers who have been trying to secure second

source relationships in order to avoid lock-ins and opportunism. For example, Foxconn, the main manufacturer of Apple products, is famously keen on satisfying every need of Apple, no matter how difficult it is, in order to build trust and convince its customer that there is absolutely no threat of opportunism. In some relationships, both parties jointly decide prices by openly sharing the cost information.

If buyers are able to trust their suppliers and concentrate on only one company, then both companies can attain scales of economies greatly. However, even these seemingly stable relationships are subject to potential substitution, due to the drastic reduction of the transaction costs and technology innovation enabled by that.

The *third difference* in historical backgrounds is the progress of globalization and openization (i.e., open intellectual properties, open relationships, and open innovations), which are caused by and promotes the shift from opportunism and exploitation toward trust and sharing. In the previous chapter, there was discussion about coevolving organizations and the market. This coevolution can be described as the history of continuously increasing and expanding interfaces. The establishment of the interface decreases transaction costs and makes sharing fundamentally easier as well as substitution.

The advent of the Internet has been facilitated by the philosophy of open intellectual properties and sharing, and its spread has been accelerated due to its trust-building mechanisms. Trust building made remarkable progress by methodologies that visualize, depict, and monitor it. Of course, this is exactly the methodology of fixing interfaces. Without this methodology, trust building would require a huge amount of time, making large-scale governance structure indispensable for organizational expansion. In the era of TCE, before the advent of the Internet, these ideas of globalizations and openization did not exist.

In today's societies, information is so easily transferred and shared that even one product extracting unjust profits would lose trust, leading to eventual substitution. The supplier would lose even the future opportunities of businesses. Although opportunistic behavior is part of human nature, it has been increasingly banished from healthy and competitive societies. It is impossible to objectively judge whether our society is based on trust or opportunism, but from the experience of the author, it can be safely said that the world is moving faster toward trust-based societies. Without trust, globalization and openization would not be possible in the first place. And also the move toward a world with human rights as a core value can clearly be seen from the trends in world history, which also supports the above claim.

7.6 Possibilities for Further Development of TCE Theory

There are limitless possibilities for further developing TCE by measuring transaction costs.

Thus far, three main issues with Williamson's TCE for further development of the theory have been shown:

– It does not deal with transaction costs per se.
– It does not provide effective solutions applicable to real-world situations.
– It does not address the structure of transaction.

Now there is a call for an advancement of the theory by tackling these issues.

One advocator of this research stream is a group of scholars gathered around Ronald Coase, the originator of the concept of *transaction costs* before the concept had been appropriated by Williamson. Although indeed transaction cost economics is mostly associated with Williamson's research, these researchers affiliated with the Ronald Coase Research Institute in St. Louis, USA, are now searching for a new direction. Lee. K. Benham, the director and secretary of the institute, and Alexandra Benham are calling for research to quantify and measure transaction costs, and they warn that without such moves TCE would reach its limits.[12] They also point out that the definition of a transaction *cost* and its taxonomy are very confusing and ambiguous.[13] There are multiple definitions of a transaction *cost*, which adds to the confusion. The below is the partial list.

(1) Coase's definitions
   – "the costs of using the price mechanism, which includes the costs of discovering relevant prices, and negotiating and concluding contracts" (Coase, 1937)[14]
   – "the costs of resources utilized for the creation, maintenance, use, and change of institutions and organizations" (Coase, 1960)[15]

(2) Broad definitions
   – "all the costs which do not exist in a Robinson Crusoe economy" (Cheung 1988)[16]
   – "the costs of running the economic system" (Arrow, 1969)[17]

[12] Benham A. and L. Benham (2000), "Measuring the costs of exchange," in Ménard, C. (ed.), *Institutions, Contracts and Organizations: Perspectives from New Institutional Economics*, Edward Elgar, pp. 367–375.

There is also a paper with the same opinion: Dahlstrom R. and A. Nygaard (2005), "Measurement of Transaction Costs and Falsification Criteria: Toward Future Directions in Empirical Research on Transaction Costs Theory," in James, Jr. F. S. (ed.), *New Ideas in Contracting and Organizational Economics Research*, Nova Science Publishers, pp. 89–103.

[13] There are many other researchers who made the same kind of consideration. For example, A. Rindfleisch and J.B. Heide examined 45 previous papers in TCE in "Transaction Cost Analysis: Past, Present, and Future Applications," *Journal of Marketing*, Vol. 61(October 1997), pp. 30–54.

[14] Coase, R. H. (1937), "The Nature of the Firm," *Economica*, 2(1), pp. 386-405.

[15] Coase, R. (1960), "The Problem of Social Cost," *Journal of Law and Economics*, 3, pp. 1–44.

[16] Cheung, S.N.S. (1988), "The Transaction Costs Paradigm: 1998 Presidential Address Western Economic Association," *Economic Inquiry*, Vol. 46, No. 4, pp. 514–521.

[17] Arrow, K. J. (1969), "The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Non-Market Allocation," in *The Analysis and Evaluation of Public Expenditures: The PBB-System, Joint Economic Committee*, 91st Congress, 1st session, vol. 1, Washington, DC: Government Printing Office.

- "the costs of processing and conveying information, coordinating, purchasing, marketing, advertising, selling, handling legal matters, shipping, and managing and supervising" (Wallis and North 1986)[18]
- "the sum of the costs associated with engaging in exchange and contracting activities, which are distinct from the costs of production" (Polski 2001)[19]
- "the costs that arise when individuals exchange ownership rights to economic assets and enforce their exclusive rights" (Eggertsson 1990)[20]

(3) More narrow definitions
- "the cost of arranging a contract ex ante and monitoring it ex post, as opposed to production costs, which are the costs of executing a contract" (Matthews 1986)[21]
- "those [the costs] involved in the transfer of goods and services from one operating unit to another. . .they usually involve the transfer of property rights and are defined in contractual terms." (Chandler and Hikino 1990)[22]
- "the costs associated with the transfer, capture, and protection of rights." (Barzel 1989)[23]
- "the costs of acquiring and handling the information about the quality of inputs, the relevant prices, the supplier's reputation, and so on" (Vannoni 2002)[24]

(4) Middle-range definitions
- "those costs associated with "greasing markets," including the costs of obtaining information, monitoring behavior, compensating intermediaries, and enforcing contracts" (Davis 1986)[25]
- "the costs of running the systems: the costs of coordinating and of motivating" (Milgrom and Roberts 1992)[26]

[18] Wallis, J. J. and D. C. North (1986), "Measuring the Transaction Sector in the American Economy, 1870-1970," in Engerman S.L. and R.E. Gallman (1986), *Long-Term Factors in American Economic Growth, Studies in Income and Wealth*, 51, University of Chicago Press. pp. 95–161.

[19] Polski, M. (2001), "Measuring Transaction Costs and Institutional Change in the U.S. Commercial Banking Industry." *Institute for Development Strategies Discussion Paper*, ISSN 01-3. January.

[20] Eggertsson, T (1990), *Economic Behavior and Institutions*, Cambridge University Press.

[21] Matthews, R. C. O. (1986), "The Economics of Institutions and the Sources of Growth," *Economic Journal*, 96, pp. 903–918.

[22] Chandler, A. D. with the assistance of T. Hikino (1990), *Scale and Scope*, The Belknap Press of Harvard University Press.

[23] Barzel, Y. (1989), *Economic Analysis of Property Rights*, Cambridge University Press.

[24] Vannoni D. (2002), "Empirical Studies of Vertical Integration: The Transaction Cost Orthodoxy," RISEC, *International Review of Economics and Business*, 2(1), pp. 113–141.

[25] Davis, L. (1986), "Comment" in Engerman S. L. and R. E. Gallman, (eds.), *Long-Term Factors in American Economic Growth, Studies in Income and Wealth*, 51, University of Chicago Press.

[26] Milgrom, P. and J. Roberts (1992), *Economics, Organization and Management*, Prentice Hall, p. 29.

– "the costs of defining and measuring resources or claims, plus the costs of utilizing and enforcing the rights specified" when considered in relation to existing property and contract rights, and, quoting Coase (1960)[27], the definition includes "costs of information, negotiation, and enforcement when applied to the transfer of existing property rights and the establishment or transfer of contract rights between individuals (or legal entities)" (Furubotn and Richter 1997)[28]

As it can be seen from the above definitions, there are very broad sense of transaction costs such as "all the costs which do not exist in a Robinson Crusoe economy" by Steve Cheung and the definition including all the costs of the firms that deal with transaction costs of the society, such as distribution and logistics by the 1993 Nobel Prize-winning Douglas North (Wallis and North 1986). There is yet another set of definitions that specify transaction costs as all costs other than production-related costs, although the definition of a *production cost* is not given, so it is still not clear what exactly is a *transaction cost*.

In a narrow sense, transaction costs can also mean those costs that are related to only ownership right transfer based on contract theory.

The transaction cost concept used in this book is nearly corresponding to the definition that Coase proposed in 1960 (i.e., "the costs of resources utilized for the creation, maintenance, use, and change of institutions and organizations"). But to give a definition of a transaction cost that emphasizes interfaces, transaction costs might be defined as "the costs of resources utilized for the creation, maintenance, use, and change of *interfaces in* institutions and organizations." However, in this book institutions and organizations are used with a similar meaning as interfaces, so there is not much difference between this and Coase's definition (although the costs utilized for the creation, maintenance, use, and change of institutions and organizations only apply to fixed interfaces, while ad hoc interfaces are not clearly included).

TCE proposes that transaction costs are being reduced by avoiding lock-ins, but as it has been discussed thus far, lock-ins do not occur in real life, and therefore, if at all, transaction costs related to lock-ins are only a very, very small part of the whole cost incurred. It has been also pointed out many times throughout this book that it becomes much more significant to focus on managing transaction costs, compared with production costs. The traditional production cost-oriented mindset needs to be changed. If one realizes the significance of transaction costs, then it is obvious to assent to their advocate's position that transaction cost economics still have a great mission to fulfill—that is, transaction costs need to be measured and analyzed. Such an analysis would most certainly yield a great amount of insight.

However, in order to succeed in real cost reduction, each cause giving rise to transaction costs needs to be handled respectively. Every company makes great

[27] Coase, R. (1960), "The Problem of Social Cost," *Journal of Law and Economics*, 3, pp. 1–44.

[28] Furubotn, E. G. and R. Richter (1997), *Institutions and Economic Theory: The Contribution of the New Institutional Economics*, The University of Michigan Press.

efforts in reducing these costs in their day-to-day operations, and most of the difference in the level of competitiveness between companies can be accounted for by looking at how good these companies are at this reduction process. In this book, it was argued that this difference in the level of the competitiveness is actually determined by the difference in the level of individual processing skills.

Transaction costs must be decomposed into its parts; each part, then, must be measured and analyzed in order to understand its underlying causes. Only then can potential countermeasures be extracted. Understanding the circumstances of when and where transaction costs arise is of utmost importance, but it has been not yet touched. It is time to answer the calls of the scholars at the Ronald Coase Institute, that measuring and analyzing transaction costs are what should be the real focus of transaction cost economics.

Application Examples of Transaction Cost Measurement and Analysis to Management

8

Numerous findings and new perspectives can be identified by measuring transaction costs, achieving innovative management.

8.1 Transaction Cost Management as a New Management Methodology

Activities that cannot be measured cannot be managed.

8.1.1 Introduction of Quantitative Analysis into Organizational Value-Added Activities

Numerous opportunities can be extracted for improvement of efficiency and effectiveness with a new perspective: the transaction cost.

Activities that cannot be measured cannot be managed. This common sense has not been applied to the activities of employees in companies despite the fact that this is a fundamental management issue. In reality, this information is not present in corporate financial statements, and in most companies this is neither measured nor correctly grasped. In attendance management, only the work start time and end time are taken into account, and the rest is basically a black box. Companies that offer legal, accounting, consulting, and engineering services bill their customers on an hourly basis. Therefore, most of these companies maintain activity log details. These data are based on the classification for customer billing; they are not used for activity analysis, even though the data are entered with effort. To begin with, the data accuracy per se is too low to support analysis.

Conventionally, the whole cost is tracked focusing on production costs. However, the problem in considering the activities of employees as only production related is that organizational activities such as communication and interactions

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cannot be grasped. Therefore, the efficiency and effectiveness of organizational activities cannot be measured or analyzed.

In many cases, an activity monitoring is emotionally rejected with the reason that this leads to scrutiny of individual expertise, privacy, creativity, originality, and autonomy. However, these are not scrutinized during measurement and analysis of transactions. The interactions between individuals are never related to individual expertise or privacy. This is about how an organization works, which has to be explicitly clarified to establish consensus, standardized, and shared. The black box obstructs the clarification, standardization, and sharing. Therefore, the room for improvement is enormous; the management methodology to track and analyze becomes crucial today when transaction continues to increase in volume and significance.

Enormous opportunities can be identified to improve not only efficiency but also effectiveness by perceiving inside the box with a new perspective: the transaction cost.

8.1.2 Standardized and Systematic Approach Is Possible

Transaction can be standardized across industries, business types, and functions.

Transaction has a common pattern across industries, business types, and functions, as described previously. Therefore, a standardized and systematic approach is possible with the measurement and analysis. This standardized approach is considered to be extremely important because the absolute parameters are not available for evaluating effectiveness and the relative comparisons are indispensable for making managerial decisions about reducing transaction costs. The useful methodology possible is to explore improvements by benchmarking against other companies, other departments, other groups, other individuals, and one's own past.

Even if the standardization and systematic approach are theoretically possible, there are many practical issues involved in dealing with all business activities as transaction, such as:

- Classifying the transactions and the participating entities in the case of information sharing through databases
- Allocating *production costs* and *transaction costs* to activities of writing e-mails
- Dealing with all information exchanges that take place during meetings which correspond to transaction
- Describing the transactions that occur when corporate assets such as IT systems are developed (these are formally delivered to company owners)
- Dealing with the transactions in which corporate assets are used

It is necessary to define all of these by a simple and uniform system. Rules for the classification are required to be established for transaction costs, which is identical to the vast and detailed rules provided for classifying costs of physical goods in the accounting regulations. Analysis with the accuracy level of accounting is possible if detailed and thorough rules are established. In the existing state where transaction is never analyzed, however, it can be argued that only very simple rules can contribute

significantly. The methodology just needs to become more sophisticated once the outcomes from the analysis increase.

Several points are to be noted regarding the systematization of a methodology that realizes transaction analysis universally applicable to any kind of activity performed in all industries, all business types, all functions, and all individuals, both between and inside companies. These include:

- Avoiding generation of omission and duplication: Obviously, the actual cost has to be dealt with exhaustively without any omission or duplication.
- Simplicity: The rules have to be as simple as possible such that the new concepts can be easily grasped by everyone.
- Generality: The rules must be applicable to any activity in any kind of situation. Therefore, the generality that captures the essence of the transaction is required.
- Standardization: This is an expression that comprises generality and utilization of the generality effectively in practice. In other words, the standardized definitions and processes for measurements, analyses, and evaluations and the mutual comparison of activities are required.

While the research group of the author is at the stage where such required refinements have been undertaken, the framework will be briefly described in the next section. However, to repeat, such highly detailed discussions are not required at present because numerous improvement items have been identified easily with very simple measurement, analysis, and evaluation. The effectiveness has been confirmed in various domains. A part of this will be described later in this chapter.

8.2 Transaction Cost Configuration Elements

Transaction cost measurement eventually corresponds to the measurement of activity time.

The current accounting deals with physical objects accurately, but transaction activities are grasped together as a set as *sales and general administrative expenses* or a part of *cost of goods manufactured*. Data required for the analysis and evaluation of these activities are practically not collected. Transaction corresponds to the activities between employees and the quantities are expressed as the form of a transaction cost.

A transaction cost is the cost incurred for exchanging or trading activities and can be decomposed into the following elements:

(1) Fixed costs of infrastructure for executing transaction
    Communication costs such as Internet and telephone and rental costs of meeting rooms and offices
(2) Variable costs incurred for each transaction
    Media used for each transaction (e.g., paper, electronic media), general consumables (e.g., stationeries), and traveling cost
(3) Transport costs

Expenses incurred for the delivery of exchanged goods (this can be also subdivided into fixed cost and variable cost)

(4) Employment costs for the activity time of transaction

Employment costs per employee (welfare costs are included) incurred for the time spent in transaction activities

Of these, (1) and (2) are usually recorded not at each transaction but as a lump sum. Even if these costs are monitored accurately so as to identify which transaction they are associated with, the value of the information compared to the cost of the measurement and allocation is quite small. Consumables and communication expenses are more or less the same. It is sufficient to allocate the costs using the general allocation methodology of the existing accounting. It also provides enough data and the methodology for the transport cost of (3).

The most difficult and significant of these elements is the activity time of (4). If this is grasped, it will be possible not only to analyze, evaluate, and improve the activities, but to obtain the basic data for the allocation of costs (1) and (2) mentioned above. Although sufficient accuracy can be achieved with the allocations just using head count or revenue, the allocation of the transaction activity time of (4) is preferable for reflecting the reality, which is the primary focus of this book.

The employment cost for each transaction of (4) can be calculated with employment cost per hour multiplied by the activity time, while employment costs per hour can be easily calculated from the total of salaries and welfare costs and the total work time.

If all the related costs are managed in this manner, the transaction cost issue eventually adds up to activity time measurement. The remaining issue is the simple allocation of cost, the skills of which are already well developed in managerial accounting. Contrarily, activity time has not at all been measured or, if it is measured, the accuracy of the data is extremely low.

It may be understood that activity time can be measured even in the present situation, but it has not been measured in practice because it is difficult due to the following two reasons:

- Employees whose activity time is measured still have to enter the data by themselves with existing technologies.
- Measurement (data entry) has to comply with a standardized classification, which is costly.

As to the first reason, although the trend of tracking operational activities has become stronger, even though this is being recorded as business performance, the data accuracy is far from the reality. Data entered by consultants, accounting firms, or engineering companies are not accurate since the objective is just billing. However, in the future, there is no doubt that measuring the number of transaction and the activity time will become easier with the spread of IT infrastructure and technological innovations. Already, various activity data are stored in different forms in databases, and most of this information can be used as transaction data. Supplementing data along with information on time has become simpler. For now,

however, data entry by humans is still required; the resistance to the data-entry task is very high at the workplaces.

For the standardized classification criteria, the second reason, there is no point in measuring blindly, and it is necessary to input according to an accurate as well as unified classification. Conventionally, work classification criteria are prepared by each department of each company, and there is no standardization to speak of. Mutual comparison is impossible if the classification criteria is not standardized. Standardization will provide great values to companies and should be achieved throughout the entire society if possible.

In this chapter, how to solve these problems and how to take advantage of transaction cost data will be discussed.

8.3 Transactions Have a Multilevel Structure

Transaction costs will be different depending upon the level of the entities involved.

For analyzing transaction costs in practice, the first and most important cutoff is to separate the analysis by taking into consideration the level in a multilevel structure of transaction. With this perspective, it becomes organized and easy to understand.

Consider the case of a transaction in which Company B, a customer company (or a consumer), ordered a product and Company A, a supplier company, accepted it as shown in Fig. 8.1. The sales department accepts the order from the customer and transmits this order information to the production department within the supplier company. The production instructions will be transmitted through each process within the production department. The procurement section will place orders for required components to subcontractors. Even within the sales department, an order will be placed to some supplier when the sales promotional materials become out of stock. It is important to note that there are many levels of transaction; the transaction costs will be completely different depending on the level of the transaction considered. In order to organize the analysis, it is necessary to consider transaction based on a three-level classification: *transaction between companies (organizations)*, *transaction between departments*, and *transaction between individuals*. Perception of a transaction (as well as transaction costs) should be distinguished based on the setting of the hierarchy level (entities) of the transaction. The three levels are satisfactory for practical effective measurement.

(1) Company-to-company level: transaction and transaction costs between companies (organizations)

The transaction entities are companies in this level; the transaction is executed between companies. This transaction is positioned on the highest level. If the transaction of an order placed by Company B (customer) to Company A (supplier) is considered, Company A produces the product (or information or service) and delivers it to Company B (the arrow in Fig. 8.1 shows the direction in which the product is delivered). In this case,

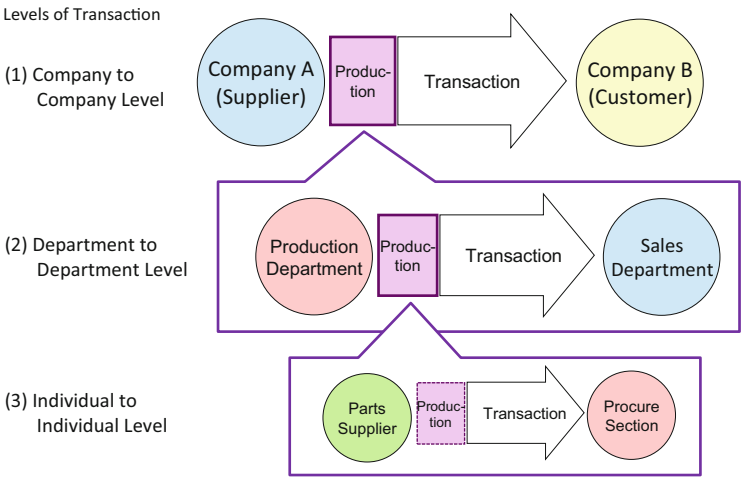

Fig. 8.1 Multilevel structure of a transaction

the business activities that are classified as *transaction* include sales activities, negotiation of transaction conditions such as specifications, handling of contracts, ordering, delivery of goods, installation, monitoring, and problem solving; the remaining activities after excluding these activities are classified as *production*. The activities involved in the transaction on this company-to-company level incur *transaction costs on the company-to-company level*.

It should be noted that the transaction (communication) within Company A (supplier) for manufacturing the product is classified as *production*. In other words, all the *transaction costs* incurred between the departments and the individuals within Company A are included in *the company-to-company level production costs*. Incidentally, Company B, which is the customer, incurs transaction costs but no production costs, of course. Analysis focusing on the company-to-company level is for the purpose of comparing and evaluating the efficiency and effectiveness of transaction between companies.

As an illustrative example in manufacturing to distinguish production costs and transaction costs at the company-to-company level, the dividing point is located in the design activity. The design activities associated with the company's own specifications are considered to be *production*, and the customized design activities that are executed to meet the requirements of a particular customer are *transaction*. In addition, creation of drawings that are used for confirmation with the customer is included in *transaction*, while preparation of drawings required for manufacturing is included in *production*. According to this definition, market research activity (including information gathering from customers) for development of their own specifications is an activity that should be classified as *production*.

Because the costs of overhead departments (e.g., personnel and general affairs) are associated with both production and transaction, those are proportionally allocated to them.

(2) Department-to-department level: transaction and transaction costs between departments

The *production* on the company-to-company level discussed above can be decomposed into *production* and *transaction* between departments within Company A (supplier). In other words, when Company A delivers a product to Company B (customer), the order received from Company B becomes a transaction wherein the sales department places the order to the production department and the production department delivers the product to the sales department within Company A. In addition to the information transmission cost regarding product specifications and delivery schedule, the costs of adjustment and negotiation between the departments are incurred. When the product is consigned from the production department to the sales department, exchanges of various documents also occur. The *production costs at the department-to-department level* will be incurred only at the production department that manufactures the product; almost the entire cost at the production department is production costs except interaction with the sales department, which is considered *transaction costs*. The production costs also include transaction (communication) within the production department, and these communications are recognized as *transaction* at the next lower level (among individuals). Analysis focusing on the department-to-department level is for the purpose of comparing and evaluating the efficiency and effectiveness between department[1] within a company or across companies.

(3) Individual-to-individual level: transaction and transaction costs between individuals

In the same manner as above, the *production* in the production department on the department-to-department level can be subdivided into *production* and *transaction* among teams or individuals. In other words, it is recognized and classified as the *transaction* between the individual engaged in *production* and the individual who ordered the *production*. For example, an order to supply parts in one of the production processes is transmitted to an employee in charge of the *production* or controlling parts inventory or a parts supplier, which forms another *transaction*. This structure can be also applied to all other departments to recognize activities between groups and individuals as transaction. Analysis focusing on the individual-to-individual level is for the purpose of comparing

[1] This transaction within Company A could be recognized as two separate transactions: the first transaction between the sales department and the top management of the company and the second transaction between the top management and the production department. This is because the outcomes from the departments and the evaluations (i.e., rewards) by the top management are exchanged as transaction. However, it is described as one transaction between the departments of sales and production in order to simplify the explanation and analyses. Our practical analysis confirms that there will be no issues even if the analyses are carried out in this simplified form.

and evaluating the efficiency and effectiveness of intra-departmental transaction (i.e., between groups and between individuals).

It is also possible to analyze the transactions between teams in the production department at the same time as the analysis of the transactions between individuals. As there are usually data available to identify which team individuals belong to, transaction costs between teams can be determined by simply replacing the individual with the appropriate team (a summation of individuals), as long as the transactions between individuals are tracked. Likewise, this summation approach is applicable to transaction cost measurement on the department-to-department level and the company-to-company level, as there are also data to identify which department and company individuals belong to. In short, it is possible to grasp transaction costs on any level above just by the measurement of activity time of individuals.

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Thus, a transaction is subdivided or aggregated in the multilevel and nested structure. In the case above, a manufacturing operation has been used as an example since manufacturing is a convenient activity for understanding and allows the structure in which the elements of a transaction are delegated successively to be shown. The nested structure appears not only in production departments but everywhere. Even production of sales promotion materials in sales departments has a multilevel structure, such as a transaction between a manager and an assistant manager and between the assistant manager and employees or suppliers. Designing and printing (production) of sales promotion materials are also delegated in the same manner as the parts of *production in the company-to-company level*. It is significant to note that if the hierarchical level of a transaction as an object of an analysis is not explicitly identified, the constituent activities cannot be determined either as production or transaction. As a result, the value of the production costs and transaction costs will become totally different, the consequence of which is to make an apples-to-apples comparison impossible. The level of an analysis should therefore be set clearly as far as transaction cost measurement and analysis are concerned.

Transactions have been linked one to the next across the levels, and the aggregation constructs corporate activities and social activities. This complex chain structure with enormous transactions is the main reason that makes comprehension of transaction and a transaction cost very difficult. Therefore, this biggest barrier should be overcome to comprehend *transaction*.

The points that may cause problems when analyzing transaction costs are summarized below:

(1) Transactions have a multilevel and nested structure. Production and transaction as well as their costs vary depending on the level considered. In other words, an activity that is classified as a *production cost* on a higher level may be classified

as a *transaction cost* on a lower level. During analysis, the analysis level must be determined clearly.

(2) Not only *production* described above but also any element of transaction *on the company-to-company level* can be subdivided and classified at the department-to-department level, such as sales brochures in sales and transportation in logistics. However, if the subdivided activities are outsourced to a supplier company, they then turn out to be company-to-company transaction. Thus, the outsourcing transaction could be classified at both the department-to-department and the company-to-company level, but comparison conditions can be better unified by classifying them at the company-to-company level when comparison analyses are performed.

(3) There is usually information about which individuals belong to which teams, departments, and companies available. Therefore, if the transactions on the individual-to-individual level are tracked, the transactions on the department-to-department level as well as the transactions on the company-to-company level can be also obtained by simple summation.

The multilevel structure of transaction is the most basic along with the transaction elements for classifying transaction. When comparison analyses are performed, the transactions in the same conditions, namely, the levels of company to company, department to department, and individual to individual, as well as industries and business types, should be selected in the first place. That enables apples-to-apples comparisons. However, as valuable implications can be obtained through contrasts with different practices, transactions in different conditions should be compared in later analyses.

The multilayers of transaction appear seemingly complex and complicated at first glance, but it is simple enough as one becomes skilled at the actual analytical work. Recognizing the position of transactions on the layers clearly is the only significant issue.

8.4 Transaction Cost Analysis and Applications

Application domains that can leverage transaction cost analysis for management are enormous.

8.4.1 Basic Concept of Analysis and Applications

First focus will be on the elements that generate the maximum transaction costs.

Considering organization, strategy, and operation as an aggregation of transactions, there are enormous application domains to which the methodology of managing transactions and transaction costs can be applied.

Any activity can be classified into the elements of production or transactions. The employees and departments are separated according to the elements in most

cases since each transaction element has a different type of task. For example, responsibilities can be divided into tasks such as exploring the first access with business contacts, making appointments, preparing and providing routine presentations, preparing and providing customized presentations, determining specifications, negotiating prices and delivery schedules, accepting and processing orders, executing production, assisting acceptance inspections, providing implementation support, handling of problems, and so forth. Each task can be executed efficiently and effectively by division since these operations are fundamentally different. Even when IT is introduced, the IT functions are usually divided into these transaction elements.

If efficiency is disregarded, and more time and cost are expended for each transaction element, better outcomes will be obtained. Since time and cost are limited, of course, the management issue associated with transaction costs is the problem of allocating resources such as human resources, time, and cost optimally among the transaction elements. The costs of physical resources are managed at a relatively much higher accuracy, while activities (transaction in particular) and cost of activities are handled intuitively and there are almost no systematic approaches to analyze. This book has been proposing a management methodology focusing on this systematic approach.

In other words, the time allocated for each transaction element should be measured and checked as to where the maximum cost is incurred. The activities that can be reduced without deteriorating the effectiveness and the activities required to ensure effectiveness are measured, analyzed, and verified to check if such activities are being performed properly and modified if necessary. Normally, the examination to check the possibility of reducing activities without compromising effectiveness is much more significant; transactional activity items (between departments, between groups, and between individuals) that are repeated without contributing value should be extracted. The analysis is in the order starting with transaction elements to which time is expended the most. The possibilities of standardizing, converting into routine work, and introducing IT have to be validated. For instance, in the case of presentation, each salesperson need not individually prepare all the portions of the presentation that are common, such as company introduction and standard product explanation. The efficiency will increase greatly if a dedicated team prepares the materials and provides related training on the critical presentation points for other teams, and the surplus time generated as result of this rearrangement can be used to increase the value added to their customers. Even in the complicated proposals by top-management consulting firms, many common parts can be extracted easily without reducing their effectiveness.

On the other hand, there are many cases where indispensable transaction elements are neglected and all other transaction costs associated with this transaction element are wasted. For example, innumerable cases where activities that have to be executed but are not can be easily identified in companies, such as requesting and comparing estimates from two or more suppliers, confirming agreed terms and assigning the persons responsible in a meeting, confirming explicitly between

managers and subordinates on each action, evaluating and improving activity results, and improving all activities about which customers complained. The effectiveness of the related transactions will certainly be decreased by such negligence.

Actually, when activities were measured and visualized in our research, numerous improvement points have been easily identified even without decomposing to the transaction elements. A part of our current research outcomes will be introduced in the following section.

8.4.2 Example of Business Visualization Based on Transaction Costs

The value obtained by visualizing business activities results is huge.

Given below are actual examples[2] for which our research group performed visualization and extracted the issues and improvement measures.

(1) Case 1: Sales productivity improvement

Figure 8.2 is one of our analysis results[3] of the sales activities (by time measurement) and the performance of each salesperson of Company C. Gross profit, a KPI of Company C, was taken along the vertical axis, and the time expended for the sales activities (as one of the transaction elements) was taken along the horizontal axis and plotted for each customer.

When this graph was illustrated, analyzed, and discussed by all concerned employees, attentions were first drawn to the point that the plots can be divided into the high-efficiency customer group (group that has given the higher gross margin with fewer activity hours) and the low-efficiency customer group. This resulted in segmentation of the customers—namely, grouping the customers separately and distinguishing the sales efforts by the groups, which the start-up young company had not done before. This graph initiated active discussion on what customer segment indicates high efficiency. More than ten segmentation axes (axes of grouping customers) were proposed; eventually it was found that all these axes converged to only one single axis (although this was extremely unusual). Thereafter, during the first contacts with the prospects, the customers were distinguished using the extracted axes, and the activities of each salesperson were corrected so that the time was allocated preferentially to the customers belonging to the "high-efficiency customer group." As a result, higher operating profits were achieved.

[2] Though the numerical values have been altered, the descriptions are provided without a significant change in the essential messages.

[3] Suematsu, C., S. Sengoku, and Y. Matsubara (2008), "Assistance of venture start-up management through visualization of activities (measuring and analyzing transactions): a case study," *Proceedings of the 2008 Autumn National Conference on the Japan Society for Management Information*, 2008.

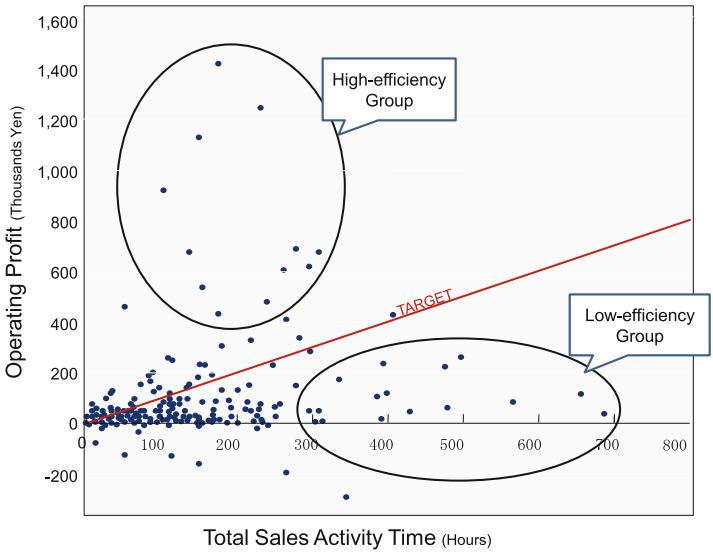

Fig. 8.2 Distribution of productivity: the sales activities of Company C

From the discussions of the graph, it was also noticed that there were combinations of particular salespersons and the customers on whom significant time was spent without making any profit (they had almost a one-to-one pairing of the customers and the salespersons). It was estimated that those salespersons were visiting those customers only to chat privately. Although the individual names of each plot (salesperson) were disguised intentionally to protect the participants' privacy, it seemed that everyone could perceive easily whose plot indicated those abnormal values. Thereafter, this led to the voluntary behavior correction of the salespersons.

This is an example of analyses based on a single graph with only basic data that led nevertheless to a significant improvement in the operating profits. The only barriers to these useful analyses have been the costs of the measurement that the conventional un-standardized methodologies have necessitated.

(2) Case 2: Sales strategy modification

There are numerous examples where such obvious problems have been neglected. The vertical and horizontal axes of Fig. 8.3 are both the same case as those of Fig. 8.2, which is an example where the trend is more pronounced. For this product, there is a clear difference in performance between the customer group to which selling the product is not possible irrespective of the time spent and the customer group to which the product can be sold spending very little time. The reason for this is that a leading-edge technology has been applied to this product; the groups to which this product was sold included laboratories of universities and research institutions, and the products were purchased due to their experimental interest in the technology of this product.

Fig. 8.3 Productivity distribution of the sales activities of Company D

On the other hand, the customer group to which the product could not be sold was R&D departments in business companies, which could not take the risk of adopting the brand-new experimental technology. The company had an urgent need to establish the product as a pillar of its business; such aspiration kept its focus on the unpromising prospects and left its business activities inefficient, but the graph convinced the top management that a major change in the strategy was urgently required. This is a typical example where the problem is difficult to acknowledge objectively if the daily activities are not visualized explicitly, such as in the form of a graph.

(3) Case 3: R&D activity efficiency improvement

Figure 8.4 shows the details of activities for an R&D department of Company E. Transactions of reporting account for a major part overwhelmingly, and it is noteworthy that meetings in particular took up around 40 % of the total activity time. In practice, meetings account for 30 % to 50 % of the time in most companies, and naturally this percentage tends to increase as it goes up the hierarchy of organizations. The results of surveys showed that "more than 50 % of the official office hours of the administrators"[4] and "25 % to 75 % of the office hours of the business leaders"[5] are spent in meetings. Actually, everyone in Company E was aware of "too many meetings," but they did not recognize the astonishing fact that their meetings accounted for as much as 40 % of the total time. If the consensus on the introduction of measures to improve the

[4] Tropman, J.E. and G. Morningstar (1985), *Meetings: how to make them work for you*, Van Nostrand Reinhold Company.

[5] Sheridan, J.H. [1989] " $37 billion waste," *Industry Week*, Vol. 238, No. 17, September 4.

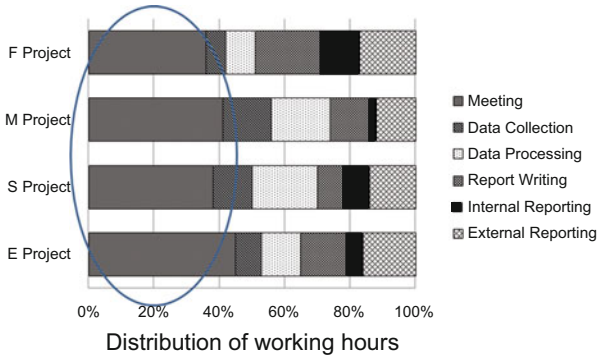

Fig. 8.4 Activity time allocation (%) of the R&D department of Company E

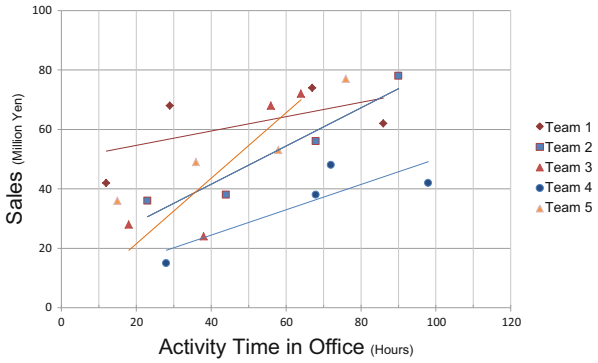

Fig. 8.5 Correlation of the internal activities and the performance at Company F

efficiency is obtained by fostering the recognition, then numerous remedial measures can be usually proposed easily for economizing meetings. Designing these measures is not all that difficult. However, since there are no standards or comparisons with other companies, the recognition has not been fostered. In the case of Company E, it actually started undertaking various desperate initiatives to improve the productivity of meetings after their recognition was established.

(4) Case 4: Sales activity major modification

For Company F, the correlations of all activities with KPI (sales in the case of this company) were investigated after decomposing the activities of the sales department. The result regarding one of the activities is shown in Fig. 8.5. The point to be noted is that there is a correlation between the volume of the internal activities and the performance (sales) as shown in the figure, and there is no correlation between the volume of the external activities and the performance. This company, which manufactures and sells commodity goods, encouraged the salesperson to make frequent courtesy visits ("do not warm your seat").

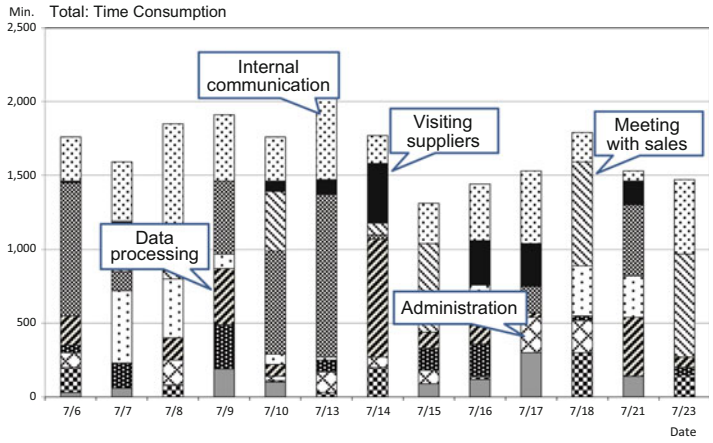

Fig. 8.6 Transaction distribution for the parts procurement department of Company G

However, the salespersons who actually performed well were those who worked more in the office and not those who worked outside the office. With further analysis regarding the better performers' activities in office, it was found that they were preparing PowerPoint slides for their resellers (customers) in which store management and sales promotion are advised. That is, the salespersons who were providing advice based on the market analysis of the region and their competitor information rather than just making courtesy visits were able to increase their sales. This was a startling fact for Company F, and it realized that major strategic changes were required. When businesses are analyzed by visualization, often such major findings are obtained.

(5) Case 5: Finding of neglected activities

Figure 8.6 shows the time distribution for transactions of the parts procurement department of a small-scale manufacturing firm, Company G. When this company's president saw the analysis of this graph, the color of his face changed. He observed that the critical transactions for which he had high expectations were not present. Development of new parts suppliers with a promising technology was their mission with top priority for this department. However, this graph showed that such kind of a transaction activity had never been executed (time was not expended). The president, after having a look at the graph, left the meeting room immediately for the development of the suppliers by himself.

As described previously, the fixed interface has two functions: efficiency improvements of transactions with high frequency and enforcing necessary transactions. While the focus of the examples explained previously were on efficiency improvements of transaction, this example shows the other one, finding that necessary transaction is not being executed. To monitor to what degree the required transactions are executed is also one of the possible analyses.

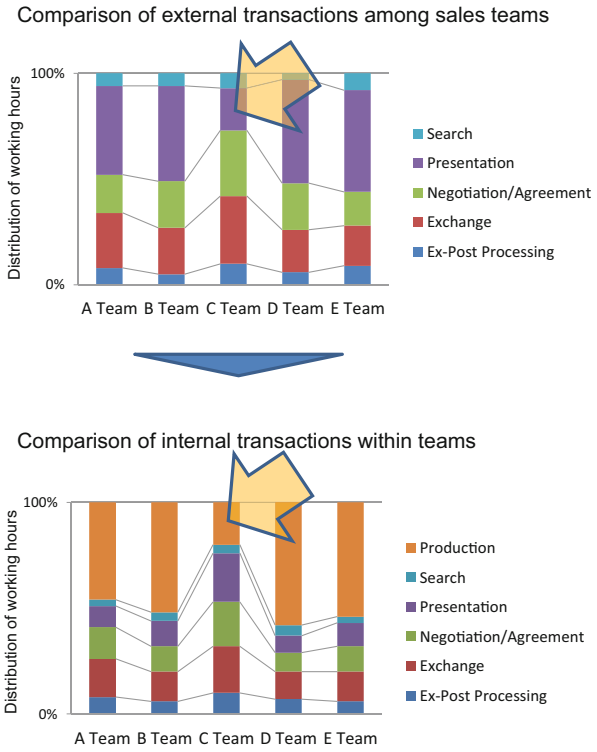

Fig. 8.7 Activity breakdown by transaction element and comparison at Company H

(6) Case 6: Decomposing activities and finding an unknown key success factor

Figure 8.7 shows the activity time comparison among the sales teams of a manufacturing company, Company H, applying the transaction element classification. Regarding transactions with entities outside the company, while the performance of team C was fairly high, their time spent on *presentation* was significantly less compared to other teams. When their time spent on *presentation* was further decomposed and analyzed, a marked difference was specifically discovered in the distribution of their activity time for internal transactions within sales teams. That is, the time for production (preparation of the materials, in this case) was extremely less, as shown in Fig. 8.7. No significant difference in the quality of their presentation compared to other teams was confirmed; only the efficiency was significantly higher. After the reason was qualitatively investigated, it was found that the team had a database of the documents for sharing in the team. This excellent data management approach was recommended to and shared with the other teams immediately.

8.4.3 Example of Visualizing Communication in a Meeting

> Meetings represent the efficiency and effectiveness of all transactions across a company, and the company performance is significantly correlated with the meeting management skills.

A meeting is a place where formal transactions of important information occur. However, meetings are not cautiously well managed almost everywhere. The responsibility for the meeting management is left to voluntary leadership, without institutional supports. Our research team is continuing the research to assess and score the management skills in order to evaluate and improve the efficiency and effectiveness of meetings from the viewpoint of transaction.

Numerous problems are usually observed in meetings, and the following wastages are being routinely recognized without any action taken:

- There are too many meaningless meetings that do not have clear objectives.
- There are too many attendees whose participation is not necessary.
- Meetings do not start and end as planned.
- Proceedings of meetings are not well managed.
- Documents are distributed on the spot, and participants do not prepare for contributions.
- Explanations are inefficient.
- No framework is prepared for discussions.
- Reporting is not well prepared or pointless. Therefore, statuses are difficult to understand.
- Decisions and agreements made are ambiguous. The executions are not thorough because the responsible persons, tasks, or schedules are not explicitly confirmed.
- Agreements reached in the previous meetings are easily ignored.
- Statements regarding problems and issues are not well organized. Action plans are not prepared.
- There is a tendency to avoid argument because major chaos occurs if argument starts.
- Meetings are ritualized meaninglessly.

Those above are observed typically in Japan but are quite common among low-performance companies all over the world.[6]

The futility of meetings not only includes the transactions at such meetings but also significantly impacts the loss in the participants' day-to-day operations. Even if an individual completes the task that has been agreed, the completed task ends up useless, since other related individuals did not complete the related task. The contents determined were not clearly confirmed, and hence the wrong tasks were executed. These also lead to significant opportunity losses. As a further result, the overall motivation decreases. If these obvious wastages are eliminated and

[6] Thus far, more than 200 meetings in 78 companies/organizations of 18 countries have been researched.

Table 8.1 Types of communication

	Communication type	Characteristics	Applications
Decision making	Leader innovation	Leadership-oriented communication (information gathering, discussion, decision, ordering). Risk of dictatorship	Emergency, innovation, build-up, uncertain environment
	Consensus	Everybody's involvement in decision making. Motivation oriented. Risk-averse and slow decision making	Operational improvements
	Brainstorming	Free communication for idea generation	Idea creation
Execution mgt.	PDCA mgt.	Reporting activities, diversion from plan, problem extraction and solution. Discussion and ordering	Processed management control
	Face-to-face communication	Leader's communication	Order, notice, and enforcement
	Commitment	Members' declaration of commitment in front of peers	Declaration of commitment
EI	Free communication	Mutual understanding and friendship to improve relationship and work environment	Friday evening party, birthday party
	Personal introduction	Introduction of each activities, Q&A and discussion for mutual understandings	Luncheon seminar, morning speech
Education/training		Education, training, and instruction	

EI Emotional Intelligence

reallocated to tasks considered to be effective, the overall productivity will certainly improve.

First, in our research, discussions were classified based on the type of communication as shown in Table 8.1. Communication types should be appropriately adopted depending on the objectives to be achieved. However, the multiple types of discussion become mixed unconsciously, quite often resulting in confusion. For example, if a decision-making discussion is mixed with a brainstorming or free communication, making decisions is severely obstructed. If a leadership meeting is combined with a consensus meeting, the extent to which it is desirable for the participants to be involved in making the decision cannot be understood commonly, which will lead to misunderstanding and mutual distrust between the leader and participants. Decision-making meetings are often mixed with education/training meetings, which reduces the effectiveness of the meetings due to confusion over the objectives.

Meetings with the objectives of decision making and execution management are of special importance and interest to our research team. Therefore, the meetings of those two types have been scored using the scoring sheet in Fig. 8.8, which assists in evaluating the efficiency and the effectiveness of the meetings in a standardized manner.

No.	evaluation item				score
	Efficiency: Scoring of Designing and Managing Transactions in Meetings (Management Basics)				
1	Appropriateness of designs	process / procedures of meeting management		meeting positioned in process	
2				meeting management general rules of the organization	
3				meeting management rules for the specific meeting	
4				responsibility and authority of participants	
5		selecting a meeting type		selection of meeting type	
6				selection of meeting sub-type	
7		defining mission, objectives and goals		goals of a set of meetings and milestone of meeting	
8				objectives/goals of meeting	
9		selecting participants, place and means		selection of participants	
10				selection of place/ means (web meeting, etc.)	
11				preparation for absentees	
12		meeting management plan	assignments of roles	decision maker of meeting	
13				chairperson	
14				time keeper	
15				facilitator	
16			management plan	agenda and proceedings	
17				time allocation plan for agenda and proceedings	
18				time allocation plan for materials preparation activities	
19				frameworks for discussions	
20	Execution management of meeting plans above	meeting type		managing meeting types	
21				managing meeting sub-type	
22		meeting management plan		control of discussions toward a goal	
23				control of progress (agenda and proceedings)	
24				punctuality: starting time of meeting	
25				punctuality: ending time of meeting	
26				punctuality: control of time keeping	
27				control of discussion by prepared frameworks for discussions	
28		meeting management procedures and rules		general meeting rules of the organization	
29				general meeting rules for the specific meeting	
	Efficiency Average				
	Effectiveness: Scoring of Secure Executions of Transactions (Transaction Culture / Discipline Basics)				
30	Presentation	efficiency of presentation	preparation for meeting	distribution of materials prior to the meeting	
31				easiness to understand materials	
32				participants' preparation prior to the meeting	
33				utilization of file servers for material distribution	
34			access control	rules of access control	
35			presentation	efficiency of presentation (oral presentation, materials)	
36		individual problem definition and solution		structuring (frameworking) of problems	
37				presentation of own solution plans	
38		emotional intelligence	motivating & encouraging comments	encouraging participants' comments	
39				de-motivating participants' comments	
40	Adjustment Agreement	institutional capabilities of problem solving	discussion structuring skills	facilitation by facilitators	
41				facilitation by participants	
42			collaboration skills	collaboration	
43				problem solving by collaboration	
44	Exchange	confirmation level of agreements		confirmation of agreed direction	
45				assignment of responsibilities and tasks	
46				scheduling	
47				making minutes and confirmation	
48				number of postponed issues	
49				number of agreed outcomes	
50		business process oriented action (feasibility, development, proposal, agreement, execution) -long term perspectives -innovation driven		business process development; feasibility discussion	
51				business process development; development, instruction and execution	
52				business process monitoring for possible problems	
53				business process improvement (proposal and agreement)	
54		emotional intelligence	leadership, guidance, enforcement	leadership, guidance, enforcement by a leader	
55			motivating actions	confirming each member's motivation for execution of tasks	
56				encouraging each member's motivation for execution of tasks	
57	Ex-post Processing	confirmation, evaluation and modification of outcomes agreed in the previous meetings		confirming and modifying minutes	
58				confirming, evaluating and modifying outcomes	
	Effectiveness Average				
	Evaluation and Improvements of Meeting				
59	Overall	evaluation and actions for improvements of the meeting (design, execution, etc.)			
	OVERALL AVERAGE				

Fig. 8.8 Meeting scoring sheet

(1) Efficiency: Scoring of Designing and Managing Transactions in Meetings (Management Basics)

The upper portion of the sheet is for evaluation of fixed interfaces for routine communications—in other words, how adequately meetings are designed in advance and managed so. It is obvious that things proceed smoothly and efficiently when they have been designed, planned, and prepared well in advance, whether it is an elementary school play or the Olympics ceremony. For example, if types of communication, types of discussion, objectives, goals, agenda, discussion frameworks, and final responsibility of decisions are not fixed, the discussion will be diffused, repetitive, and redundant, leading to confusion. Owners (organizers) of meetings must make the participants share them as interfaces in advance. If time allocation plans and valuable discussion frameworks are provided properly, timekeepers can control the progress easily. In most cases of the companies that have grown globally, this level of management is likely to be well embodied. Naturally, meeting facilitation is enhanced when a facilitator is appointed. These items are assessed and scored regarding how they are designed and managed as per designed plans.

(2) Effectiveness: Scoring of Secure Executions of Transactions (Transaction Culture and Discipline Basics)

The effectiveness of meetings as described in the lower portion of the scoring sheet, how sufficiently the transactions are accomplished, which is influenced by transaction culture and discipline, is scored. If these items are not executed infallibly, the transactions will not be completed effectively, and subsequent outcomes from the meetings cannot be obtained satisfactorily.

- Presentation: Documents must be prepared such that they are easy to understand for discussion and decision making and be distributed sufficiently in advance. Participants must read the documents beforehand and prepare for discussions. Presentations must be prepared and executed adequately. Well-structured solution plans must be proposed instead of just presenting subjective descriptions regarding situations.
- Adjustment (negotiation) and agreement: Adequate facilitation and efficient/effective management must be provided for discussions. Consensus must be built up cooperatively.
- Exchange: Contents of the agreements must be confirmed explicitly. Individual task assignments with goals and schedules must be specifically included.
- Post processing: It must be monitored if proper actions have been executed for the contents that were agreed upon. Evaluation and improvement measures must be discussed.

These effectiveness items are conceived as culture and disciplines that should be encouraged routinely and for which adequate leadership, rules, corporate culture, and so forth may be required.

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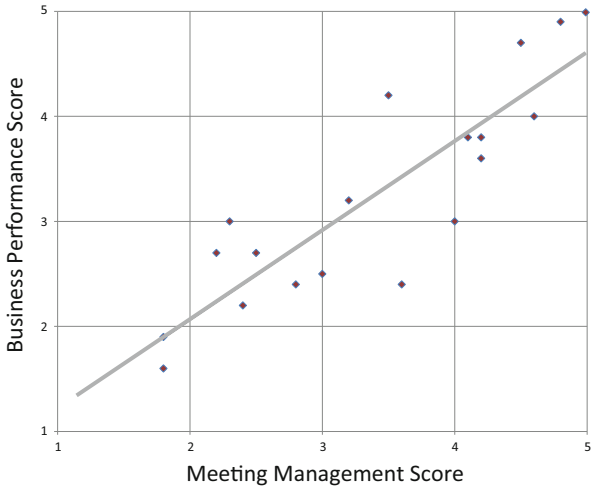

Fig. 8.9 Correlation of meeting management and business performance

From our research results of the scoring, as shown in Fig. 8.9, a strong correlation between the score of meetings and their business performance score[7] is observed. Specifically, global companies achieved high scores for nearly all the scoring items. In our initial hypothesis, the degree of correlation was low due to market turbulence even for companies with higher efficiency, including meeting management. However, those companies with the higher performance scores made high scores both in efficiency and effectiveness. Therefore, it was speculated that those companies that are capable of managing meetings can also prepare for the changes in the market and technology adequately and manage to ensure necessary innovations.

A comprehensive analysis will be reported in the near future after sufficient data are collected.

8.5 Organizational Problems that Obstruct Business Activity Visualization

Companies that reject visualization do not have their future.

Our research team has been researching business activity visualization from the viewpoint of transaction, and various organizational issues have been revealed well through the analyses of visualization data. Although this fact seems to be easily

[7] The business performance score is calculated from number of employees, 5 years average profit rate, and 5 years average revenue growth rate, which correspond to the performance in the past, in the present, and in the future, respectively.

recognized by companies, in many cases the measurement and visualization are not welcomed, particularly in the case of Japanese companies. Generally, CEOs show their strong interest, but they face strong objections, either explicit or implicit, from employees.

Our inference is that the desire to improve business correlates to the interest in visualization of activities and business performance. Japanese companies, especially, seem to have lost their zeal. Incidentally, our visualization data are planned to be positioned as the foundation to foster awareness of issues and encourage discussions prior to voluntary solution actions by employees, the style of which is suitable for the bottom-up decision making in Japanese companies. However, the number of employees who showed willingness to participate was very limited. Their most significant success factor from the 1960s to the 1980s, a period when the Japanese companies dominated the world market, was their steady and continuous improvement activities on their shop floors. Some companies collected several hundred thousand suggestions for improvement in a year from their employees at that time. A Japanese word, "Kaizen," which means improvement activities by bottom-up, became known all over the world. This created the source of a competitive edge for Japanese companies.

However, these days, their Japanese firms' passion and perseverance for improvement seem to have critically reduced, especially outside their shop floors. Even if the senior management has it, the thorough corporate-wide execution seems extremely difficult due to their weak governance. The problems of their *village community* management style and culture are the largest cause, but all companies, regardless of their nationality, without appropriate leadership to encourage improvements tend to present the identical symptom. Those companies also have the commonality that the term "innovation" is likely to appear frequently just as an excuse not to change themselves. Companies that reject visualization are deemed not to have their future.

Logical Thinking/Creative Thinking

9

In both organizational and individual thinking processes, transaction costs impede information transfer.

9.1 What Is Creativity?

Fixed interfaces can be extracted even from activities with high novelty—that is, with high diversity and complexity—in order to improve efficiency and effectiveness.

In this chapter, *creativity* will be examined and structured from the perspective of transaction. Just as in the previous chapters, the enhancement of the *creative thinking* process and activity will be studied by applying the methodology of managing transaction costs. It is obvious that the methodology of integration of modules based on interfaces also has significant value in creativity, which is widely conceived as integration of knowledge. In addition, the development and enhancement of individual *creative thinking* will be analyzed from a perspective that it is also conceived as diversified communication within an individual's intellectual activity.

There are also various definitions of *creativity*, among which the following are widely accepted:

(1) Novelty
(2) Usefulness or effectiveness
(3) Business applicability and feasibility

Novelty is obviously the minimal condition of creativity, and some people argue that novelty is the only condition to define creativity. If so, however, it implies that eccentricity-driven ideas and being bizarre are good enough to be considered as creative. This criterion is not appropriate in terms of social responsibility and business management. On the other hand, the claim that any idea is valueless without *business applicability and feasibility* is indispensable, but it is too general as long as discussions are in the field of business management and is not limited to creativity. Thus, it should be excluded from the discussion. That is, the meaningful

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
Springer Cham, https://doi.org/10.1007/978-3-319-06889-3_9

discussion in this context is how to enhance both *novelty* and *usefulness or effectiveness* with high efficiency.

Regarding *novelty*, promotions of new challenges, avoidance of negative attitudes, and elimination of thinking restrictions that leads to new challenges are necessary in production and transaction. These will be realized through setting shared values, behavioral principles, and supporting systems, such as evaluation and rewarding, as interfaces.

As for *usefulness or effectiveness*, the methodology of this book, which, by fixing interfaces of redundant and repetitive activities with little or no value, reduces transaction costs and improves efficiency and consequently effectiveness, is adhered to. It is impossible to objectively evaluate effectiveness; it is impossible to evaluate effectiveness of information because the information that is regarded as valueless for increase of sales in a short term may contribute to enhancement of customer loyalty and consequent increase of sales in the future.

Basic R&D that requires the most creativity in companies is a typical example. Honorary Dr. Koichi Tanaka was inspired by his failure in an experiment to obtain the basic idea that resulted in his winning the Nobel Prize in Chemistry. Likewise, it is difficult to decide what leads to innovation. However, this generates an atmosphere that justifies unmanaged and unrestricted research activities, causing confusion, disorder, and indolence in the basic research organizations.

Even in activities with high novelty, repetitive activities with relatively low novelty and low value exist. The attitude, discipline, capability, and rules to pursue fixed interfaces, which improve efficiency without deteriorating effectiveness, are indispensable. When repetitive activities are eliminated and excess time is obtained, the volume of not only effective but also novel activities increases. That is, the management of transaction costs also enhances creative thinking with high *novelty* and *effectiveness*.

Many argue that only effectiveness is important in the discussion of productivity improvement of creativity, ignoring efficiency. In such arguments, the tendency of considering only revolutionary products and breakthrough technologies which are almost worthy of the Nobel Prize can be observed. However, the proposition that it is impossible to objectively evaluate effectiveness becomes more significant here. The possibility of hitting a home run intentionally is extremely low, and it can result in an attitude that commonly denies the value of a series of single hits. Rather, the sufficient and abundant capability of repeating single hits or small innovations will create doubles and triples. In reality, such arguments are frequently excused for justifying one's own laziness and incapability by asserting the significance of home-run-type innovations, which almost never arise.

As previously described in the discussion regarding the meetings, formal decisions made in R&D meetings frequently remain unexecuted. Decisions that are not operational but *innovative*, requiring changes and challenges, are even more likely to be neglected. Even a small innovation will never be achieved without immediate confirmation of commitments, explicit description of the responsibilities and schedules, and monitoring of the progresses. The accumulation of such small efforts leads to creativity.

In this procedure, the methodology in which repetitive and redundant activities with no or little value are extracted and eliminated should be emphasized. However, it is obviously much more difficult *than the application in ordinary operations*, as diversity and complexity increase by far in activities with higher novelty. Hereinafter, the subject moves to the main issue of this chapter, which is the reduction of transaction costs in the activities with strong diversity and complexity, assuming that the novelty in *creativity* differs only in diversity and complexity from ordinary activities.[1]

As aforementioned, the methodologies of reducing transaction costs proposed in this book already possess the characteristics of enhancing the *effectiveness* and *novelty* in activities, a result of which enhances creativity. In this chapter, the discussions will be summarized from a perspective of creativity.

The methodologies to process activities with diversity and complexity will be discussed from two aspects: interindividual (Sect. 9.2) and intraindividual (Sect. 9.3). Intraindividual issues will be positioned as derivatives of the interindividual issues.

9.2 Interindividual Transactions of Information

Fixing interfaces increases the efficiency and effectiveness of transactions of information as well.

9.2.1 Knowledge Management as Transactions

The foundation of knowledge management is the elimination of repetitive and redundant waste.

Knowledge management aims at increases in the efficiency and effectiveness of interindividual transfer of information, dealing with transfer and exchange of information. As transfer of information corresponds to exchange, the methodology of managing transactions can be directly applied, which is, in this context, composed of "increase of efficiency by fixing interfaces (e.g., database and network) of information exchanges with high commonality and repetitiveness, but with little or no value" and "increase of effectiveness by utilizing obtained surplus resources (e.g., time and human resources) to create effective information." Some assume that "information sharing" is distinguished from information exchange. However, "information sharing" is just another term of information exchange; for example, information sharing in meetings and through media such as databases should be simply deemed as derivative forms of information exchange, namely, transactions.

[1] *Novelty* can also be defined as unaccustomed activities or activities that are yet to be processed for fixing interfaces. As for the former, it looks unreasonable to define unaccustomed activities as creative. As for the latter, it is enough to define unfixed (i.e., un-simplified) activities as complex.

One of the largest causes that obstruct improvements of efficiency of interindividual information exchange is the belief that efficiency obstructs effectiveness. Based on such an idea, inefficient activities or laziness are disregarded. The common notion that efficiency management of discussion restricts free and creative thinking and leads to lower possibility of valuable idea creation is often based on the misunderstanding (or sophism) and laziness (in addition to inappropriate management).

Another typical misunderstanding (or sophism) is that more creative and effective ideas will be generated through less restricted communication. In other words, this means that all kinds of management should be abandoned or denied, asserting that freewheeling communication without any control will exchange implicit knowledge and ideas that lead to creativity. This idea is especially observed in Japanese companies, and one may argue that it is an established vested right of researchers, which makes the basic research activity and all kinds of meetings in Japanese companies chaotic. However, according to our research results as described in Chap. 8, the effectiveness improvements caused by the efficiency improvements are verified, while effectiveness improvement caused by disregarding efficiency has never been observed. For reconfirmation, no interfaces should be fixed but for the ones with little or no value.

In the first place, the diversity of information exchanged in day-to-day operations is not as wide as self judged, but rather quite limited. This misunderstanding is also caused by the same cause as the denial of fixing interfaces in which people perceive themselves as special. In ordinary conditions of businesses, it is impossible to deal with all issues, from the arts to politics, stem cells, tea ceremonies, and boxing training. In the ordinary *creative* communication of businesses, the variety of information is very limited. Our observation of more than 100 meetings in R&D departments showed that all their communication exhibited limited patterns. Sometimes it is very significant to encourage freewheeling discussions with a larger scope of information to create new ideas, such as brainstorming sessions. However, except for such special occasions, most of the portions could be or should be managed and controlled by introducing fixed interfaces. Divergent thinking should be artificially and systematically controlled even in brainstorming sessions that are currently haphazard and improvisational. Without management, they would become just idle conversation or breaks. When these are merged and confused with decision making, the objectives will never be accomplished.

The predetermined sequence of basic management of communication, which is description of status, extraction of structural problems, listing of solution options, listing and selecting evaluation axis, and selection and prioritization of actions, is the minimum requirement. However, it is rarely met. Although "autonomy and self-initiative should be emphasized for creativity," there are many communications that should be and can be controlled, and the management capabilities are developed and enhanced through the practice. Lack of comprehension regarding the management of information (in addition, a strong belief in implicit knowledge for Japan) is

an underlying cause, which leaves chaos, laziness, vested interest, and vicious habit disregarded and untreated.

This does not rob the significance of socialization activities in companies—that is, free communication aiming at trust formation, deep mutual understanding, and collaboration-oriented corporate culture. Most of the innovative global companies with high efficiency are likely to separate and promote opportunities for free communication, such as Friday evening beer parties or birthday parties. At brown bag lunch seminars, individuals make presentations introducing their activities and ideas and discuss freely to enhance mutual understanding. Some Japanese companies equipped Japanese tatami-mat rooms for discussions in a relaxing atmosphere. Isolation from day-to-day operation consequently improves effectiveness and creativity.

The attitude of eliminating inefficiency without deteriorating effectiveness is always significant, even in the cases where high diversity and complexity are concerned.

9.2.2 Introduction of Frameworks in Information Transfer and Discussion: Extraction of Commonalities

There are infinite opportunities of efficiency improvement in information transfer without deteriorating effectiveness.

The methodologies to improve efficiency of free discussion without deteriorating effectiveness and creativity in practice will be examined here, which were extracted during our research.

For example, using common frameworks such as "introduction, body, and conclusion," and "background, purpose, facts, and conclusion" are types of efficient communication that never compromise the effectiveness of the information. Distinguishing "facts and opinions" is a must in any kind of report. Sharing such frameworks improves communication and, as a consequence, transactions such as order and information exchange are executed effectively without errors. This is a typical example of increasing effectiveness by increasing efficiency from adopting adequate frameworks.

A sales meeting at a certain company, where our research team investigated, obtained great improvement of efficiency by simply introducing the BSC framework. They utilized the four dimensions of the framework with some modification: "sales," "customer satisfaction," "information sharing," and "human resource development" during their regular reporting of each activity at sales meetings. Presentations and discussions in the meetings, which were chaotic before, became greatly organized and efficient. At the same time, effectiveness increased from the increased time for valuable information exchanges. Such a framework functions as an interface to organize the flow of information and the order of discussions and improve the efficiency of the transactions.

As this example shows, the extraction and fixing of the patterns from information exchanges that appear repetitively and making them into frameworks do not regulate or restrict the information itself but fix only the transaction interfaces. The following advantages are expected:

– It eliminates misunderstandings in information exchanges.
– It reduces the time of information exchanges.
– It embodies easier and more effective decision makings.
– It increases the output by proper and agile processing.
– It increases the speed of the thinking process when accustomed to the fixed frameworks.

Although frameworking or fixing of thinking processes may lead to rigidification of thinking if it is not designed or managed properly (as a framework is one kind of interface, it has the identical disadvantages), it certainly increases the effectiveness if it is designed and managed such that:

– It enables shifting of resources (time and staff) spent to more valuable thinking processes.
– It eliminates the possibility of slipping or neglecting important issues.
– It assures the minimum quality of outputs.

The following is a partial list of frameworks that smooth the flow of information as transaction interfaces, including the aforementioned for reconfirmation:

(1) Filing index and directory

Filing indexes and directories, as explained in Chap. 2, are also illustrative framework examples that organize and restrict the flows of information for efficient transactions.

(2) Database (e.g., CRM, SCM, ERP, PDM)

Databases are for accumulating and sharing information, and the input and output should comply with frameworks restricted by rules in order to do so. The frameworks of classifying information should be designed properly. If not, the operation becomes unfriendly and inefficient, which will hinder regular usage by users. In addition, if the understanding of frameworks is not shared among users, those will not function as platforms of communication. For example, a customer information database will contribute greatly if the possibility of a customer's order is shared between sales and production departments; however, a salesperson may input the possibility data of "more than 90 %" subjectively and optimistically, despite the fact that the reality is "less than 50 %." Thus, it is necessary to make detail regulations that specify each condition for higher accuracy of the information exchange.

(3) Meeting

Meetings are typical occasions for information transactions within companies. Missions, goals, meeting types (decision making, execution management, brainstorming, education, and so forth), agendas, and frameworks of discussion become important interfaces for convergence of each thought, expectation, and direction for collaboration and increase of the outcomes. Basic meeting rules (e.g., being punctual; reading materials before the meetings; making sure to confirm the agreements, tasks, schedule, and each

responsibility) function as interfaces in all meetings universally. None of these rules obstruct effectiveness. Although it is commonly understood that an organization should be artificially designed, it is unreasonable that meetings are seldom designed or planned, in the sense that meetings are also information-processing devices, like organizations. This fact leads to huge opportunities for improvement. The ratio of meetings in total activity time is extremely large. The universal rules above can be applied to all meetings, and the design of frameworks at each meeting, such as missions, goals, and types of discussion frameworks, does not consume much time. The more the staffs become accustomed to it, the less time it consumes. It should be deemed as serious as corporate culture or employee discipline. The management of meetings is likely to depend on the managers in charge, rather than the institution and the organizations; the managers who organize meetings strictly with deep comprehension of the significance tend to show much greater performances.

(4) Sales reporting form

This may be one of the most popular frameworks in information transfer. The great improvement of the efficiency is easily conceived. The common problem is that the accumulated information is not fully utilized or analyzed, so it does not contribute to the effectiveness. This is an illustrative example that no value is created without the information-processing capability, namely, logical thinking, despite the fact that the volume of information is increased efficiently.

(5) PMBOK

Project management methodology is applied to various kinds of projects, such as plant construction and software developments. A very complicated flow of information is processed, but the basic pattern of the information flow is quite universal there. The managing methodology from extracted common patterns in the communication is the PMBOK. Its main purpose is to regulate, economize, and secure the information flows for more accurate controls of resources, schedules, and quality. It regulates the flow of information regarding the project management to increase the efficiency of information exchanges, as described in this chapter. If the regulation is strictly applied, the deployment of IT becomes possible, which increases the improvement further.

PMBOK only assists in the execution of the project management plans or the interfaces that are already determined. Therefore, its contribution to the improvement of effectiveness is limited except for avoiding the collapse of the project, which contributes to an improvement of effectiveness.

(6) Pro Forma (business action plan)

In R&D and product development activities, potential market size, penetration, planned market share, planned revenue, expected costs, and expected profits are designated to prescribe in the form of the pro forma framework. If necessary, these items are further decomposed and analyzed more precisely to manage the projects. In addition to the improvement of

communication between the project owner and the project manager, it encourages the attitude of each project members toward the business profitability. This framework is for enhancing effectiveness, not deteriorating, by establishing the performance measures, which are likely to be neglected by researchers.

(7) KPI

KPI embodies the accurate and efficient managerial communication regarding activity direction and targets, as well as quantified progresses and outcomes. Activity targets such as the time to respond to customer claims, the number of meetings with customer decision makers, the time spent for educating staff, and so forth are designated and reported.

(8) Business modeling tool

Modeling methodologies to describe business workflows in a unified manner, which are useful for designing IT systems or merging tasks at M&As, are gaining popularity (e.g., DEMO[2], UML[3], and IDEF[4]). Although the real situation is too complicated to be described completely, the efficiency in understanding the flow with flowcharts is greater, compared to those explained in words. Such tools are utilized for both external and internal communication to visualize and explain the tasks.

(9) Protocol

We can enjoy e-mails and the Web because all the data are created, transferred, and exchanged under various protocols including TCP/IP, HTML, and SMTP. The term *protocol* originates from diplomatic protocol but recently is used to mean work processes and manuals, all of which function as interfaces. In the first place, connection corresponds to compliance with protocols or interfaces. We may think that we are communicating completely freely, but we consciously and unconsciously are complying with many restrictions and constraints, such as languages, laws, customs, cultures, common sense, and manners. Just a few additions of interfaces will not cause a large difference, leaving no need to be so nervous.

(10) Open source

Thousands of open source software development projects are developed by programmers from all over the world who have never met each other in person. Such projects are possible because of the rigid infrastructures on which thousands of programmers can collaborate without confusion. The target of the infrastructures focuses directly on the efficiency, but it is obvious that it increases the effectiveness as well.

(11) Object-oriented software development

As the reproduction costs of software are close to zero, the reuse of programs increases the efficiency easily. When enhancing the advantage, it

[2] Design and Engineering Methodology for Organizations.

[3] Unified Modeling Language.

[4] Integration DEFinition.

is necessary to develop programs complying with the interfaces so that other programmers can understand and reuse them to integrate into their works in process with minimum costs and effort. It also assists the original developer of the program when he/she reuses it in the future. The module of program is called an "object." In software development, where the competition is becoming intensified, precise management of objects becomes important. Some argue that the compliance with interfaces may deteriorate the effectiveness. In the case of software development, however, the increase of processing capabilities by technological innovation of semiconductors is overcoming such disadvantage. Given the restriction of the compliance, programmers are expected to enhance their development skills to utilize objects without deteriorating the performance. The technologies to design the interfaces that do not deteriorate the performance and the architects who possess such capabilities also become significant, as previously described. Incidentally, the interfaces of programs are applied not only to the interindividual development activities but also to the intraindividual ones (individual development processes), and this perspective is also going to be a key factor when dealing with efficiency in intraindividual thinking processes in the next section.

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It is necessary to design specific frameworks for each case ad hoc in addition to utilizing these general frameworks. The deployment of interfaces is indispensable for the assurance of minimum quality, efficiency, and agility. In order to increase them, it is necessary to improve the quality of the design.

9.2.3 Practical Examples in Discussions

There are an infinite number of frameworks that organize discussion and improve efficiency and at the same time effectiveness. It is necessary to utilize them.

In discussions, managing transactions of information by decomposing into simple contents and determining the constructive order is valuable for avoiding redundant and repetitive exchanges of information (i.e., the efficiency issues) and the neglect of important subjects (i.e., the effective issues). In addition, due to lack of shared understanding of contexts and assumptions, even the same assertions frequently collide without being able to distinguish agreeable points. As a result, personal attacks and avoidance of argument occur. Frameworks contribute to structure and designate the contexts of discussion.

Some argue that the decomposing destructs a holistic perspective. In that case, however, a framework to decompose the issue into the whole and the parts will help with strengthening the holistic perspective. There are infinite numbers of well-known frameworks; those that frequently appear are described below, although it is also important to design specific frameworks appropriate to each issue by yourself.

(1) Understanding the problem → extraction of possible solutions → listing of evaluation axes → selection and weighting of axes → shaping solution plan

Without the comprehension of this flow, the discussion is likely to become redundant and repetitive, resulting in wasted time and costs. This is commonly observed in companies with lower performance.

(2) Hypothesis setting → collecting facts for the verification → discussion based on the verified assumption

Just like distinguishing between facts and opinions, discussion of problem solving without distinguishing between hypotheses and verified facts easily becomes inefficient and emotionally confusing. By using this framework, the following can be understood when establishing shared acknowledgment of a problem (1) the acknowledgement of a problem is only a hypothesis, (2) it should be verified by facts (data in particular), and (3) new hypotheses should be openly accepted because verified facts may be denied by newly found facts in arguments.

(3) 3C

This framework of three axes—*customer*, *company*, and *competitor*—is widely utilized when discussing strategy from the perspectives of players. This assists engineers who forget their customers and competitors as well as marketers who neglect their own company's situation to properly widen their scope of perspectives.

(4) SWOT

This framework is also widely used for analyses of businesses, products, and technologies by four axes: *strengths*, *weaknesses*, *opportunities*, and *threats*. If the strengths and threats are discussed at the same time, members with fundamentally the same strategies may feel as if they have significant differences in opinions once the real problem is simplified by the order of the discussion.

(5) QCD

Decomposing discussion subjects by means of the *quality*, *cost*, and *delivery* framework would help to organize discussion on product development, procurement, and so forth.

(6) AIDMA

This is a classical framework for marketing promotion issues, in which customer purchasing activity is decomposed into five processes: *attention*, *interest*, *desire*, *memory*, and *action*.

(7) Work process

Decomposing activities into processes such as AIDMA increases the efficiency of communication. For example, discussion on sales activity becomes more efficient by subcategorizing it into processes of listing of prospects, making appointments, making first contacts, making presentations, gaining access to decision makers, negotiation, delivery, follow-up, and complaints handling.

(8) Customer segmentation

Issues regarding customers should be discussed by decomposing them into segments based on demography, key buying factors, and company efficiency.

The appropriateness of the segmentation will make large differences in efficiency and effectiveness.

(9) Tree structure

Issues are structured and decomposed into tree-shaped hierarchy to illustrate the relationship of the issues and to enhance the independence of each issue. It becomes easier to organize the discussion in order of priority and sequence. It is significant to decompose it without overlaps or slips.

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There are infinite numbers of such frameworks. There also exist numerous opportunities, where efficiency and effectiveness will be greatly improved by applying such frameworks appropriately in chaotic discussions.

9.2.4 The Significant Role of Facilitators in Meetings

Facilitators' strategic role in meetings increases its significance.

It is not easy for everyone to stand up in a chaotic meeting and propose a framework to organize the discussion in some cultures, such as Japan. Such action can be hated for being self-assertive and some may hesitate from the fear of proposing a wrong framework resulting in further confusion. Facing this kind of situation, leading global companies like high-tech companies in Silicon Valley started designating *facilitators* besides chairpersons. The facilitators standing on a neutral position are responsible for organizing discussions by structuring them; vitalizing discussions through excluding emotions and egoism; balancing, controlling, and promoting the remarks; and explicitly confirming the consensus, tasks, and schedules. Incidentally, many companies also assign timekeepers separately for strict time management.

The reason that chairpersons do not play the role of the facilitator is, first, to make the facilitator focus on the hard role; second, to make the participants recognize the significance of the independently designated role; and last and most importantly, to give opportunities to train the structuring capability to as many members as possible. As described repeatedly in this book, the structuring capability and technology can only be realized through the proper designing of fixed interfaces on the interface/module structure and the modularization of product and organization. If the structuring is improper, organizations and modules result in zero or negative value. The development of such skills is, however, extremely difficult. The facilitation in meetings provides perfect opportunities for the training. It is highly valuable to assign the facilitator role to all members, executives in particular, by rotation in order to develop their structuring skills.

9.3 Intraindividual Transactions of Information (Thinking Methodology)

Thinking is activated by reducing transaction costs between the past and the future.

9.3.1 Information-Processing Structure in the Thinking Process

Transaction structures of information in organizations and in individual thinking process are identical.

The largest difference between organizational (interindividual) activity and individual (intraindividual) activity is whether transactions occur or not. The well-known definition of a transaction cost by Steven Cheung, "all the costs which do not exist in a Robinson Crusoe economy," implies that no transaction costs exist if there is no transaction partner.

However, as long as information processing is concerned, it is not true that there arise no transaction costs in the thinking process. If so, intraindividual information processing would not include any transaction cost, implying it is perfectly frictionless to acquire any necessary information during processing or thinking. In reality, however, human memory functions so poorly that the past data are seldom utilized. The data stored in the brain as memories are usually limited, and the rest are converted and archived in external memories such as notes, files, and personal databases. In particular, the spread of smartphones and cloud computing technology promoted the popularity of personal knowledge management systems by cloud computing,[5] which enables users to easily access their own knowledge data from anywhere in the world with network access. The dependency on the networked external memories is increasing at a high speed, replacing the human brain.

Personal data archiving corresponds to the transactions between the self in the past, the self in the present, and the self in the future, which also incur transaction costs. The reduction of the transaction costs enhances intraindividual transmission of information and effectiveness including creativity, the consequence of which improves the capability of intraindividual information processing.

The subsequent question is how intraindividual transaction costs are reduced.

There is no reason not to apply the *interindividual* methodologies to the intraindividual transactions of information, which are actually identical. That is, if the information is recorded and archived so that it is clear to others, it will be efficiently delivered to oneself in the future. Examples include databases and filings. There are no significant differences in function and efficiency between interindividual and intraindividual usages.

[5] By this service, users can store and edit their notes in the cloud computing servers. Users access their archives from their multiple PCs and mobile devices, in which the data are automatically synchronized. Examples include Evernote, Apple's Quick Note, and Google Keep.

Nowadays, when IT is ubiquitous, the technology of knowledge management contributes to not only organizations. All members of organizations access databases through network to utilize the accumulated data for organizational and individual usage. Usage does not distinguish between interindividual and intraindividual purposes. In this manner, all the methodologies for organizational or interindividual reduction of transaction costs and enhancement of communication are applicable to intraindividual or personal usage. The usage frequency of interfaces is higher with interindividual communication, resulting in higher ROI, but intraindividual investment will also gain enough ROI as the personal design capability improves to decrease the design cost and increase the quality. The repetitive challenges to design the value-added interfaces would contribute to enhancing the capability.

It was described in previous section that the establishment of interfaces enhances effectiveness of interindividual communication drastically. On such occasions, it is clear that the commonalities in interindividual and intraindividual processing of information increase the usage frequency and the ROI.

The only difference between the interindividual and intraindividual methodologies is as follows:

(1) As transaction costs in intraindividual communication are lower, the reduction effect is less visible. The mutual understanding between a sender and a receiver who is the same as the sender (i.e., intraindividual) is stronger. If there remain data in brain memory, it does not incur transaction costs.
(2) While there is a manager who advises or orders the usage of interindividual interfaces, intraindividual interfaces depend solely upon personal free will. If an individual is indulgent, the introduction and management are more difficult.
(3) As intraindividual information processing is a personal competitiveness factor, it is more difficult to share the technologies.
(4) Interindividual information sharing has been rapidly enhanced, which could be applied to intraindividual information sharing. For example, Wikipedia covers a great range of information, and all types of information and know-how can be obtained from one of many Q&A Web sites promptly and free of charge. As information accumulated by individuals has been more and more open to the public, the incentives to start an individual archive are decreasing.

Therefore, the establishment of intraindividual interfaces has been becoming more difficult. However, in this very situation, there lies a high possibility that the disparity between individuals' capabilities is widened. One group of people continues to develop their information-processing capability with discipline by opening their thoughts, accumulating data, and sharing information with the public. The other group totally depends on the information from the previous group without their own efforts. The polarization seems to have emerged already.

While the latter group cannot understand the behaviors and motivation of the former group who disclose valuable information to the public, the open information policy has obtained popularity among the intellectual elite. The active distribution of valuable information creates communication opportunities with a huge number of receivers, a result of which makes all information concentrate on the sender,

providing him/her with great opportunities to process, analyze, and organize the enormous volume of information. The design capabilities of interfaces are required, and the opportunity to develop it is given. The geniuses called *architects* must have obtained their astonishing capabilities because they have been through such processes from the young age. We should look at the fact that the opportunities to grow capabilities have been concentrated on a limited number of people. And the benefit from the transaction cost reduction correlates to the information-processing capability.

9.3.2 Methodology to Enhance Capabilities in the Thinking Process

Creativity is embodied by the *division* and *interconnection* of knowledge modules.

Knowledge management and creation in the intraindividual thinking process is achieved through infinite repetition of the *division* and *interconnection* which were described in Chap. 4. Knowledge and information is divided into modules by various axes, and, through various integrations of the modules, creativity or novel knowledge and information are born. The widely accepted definition of *creativity* designates that it is not the creation of entirely novel information from scratch but the new integration of pieces (modules) of information. It is clearly much more efficient to search and reuse former and others' outcomes.

The question is what the methodology to design such interfaces of intra-individual information transmission is. When considering this, the following issues are significant:

(1) High accessibility to valuable information using frameworks: Assuming that one's own self in the future accesses the information for the first time (meaning one would have forgotten everything), objective and easy accessibility should be provided when archiving information. All the frameworks introduced in the previous section such as 3C and QCD are effective for the archiving.
(2) High accessibility to valuable information using identification information: A search function is indispensable for efficient and prompt access to the information. And at the same time, tagging systems that have become popular for identification such as date, time, name, category, process are useful; designing a frequently used tagging system is required. The standardization of such system is usually established for organizational databases, but it is also significant with personal databases. Personal knowledge management will advance greatly if a tagging system that creates value over time is successfully designed.
(3) Utilizing appropriate management tools: Use management tools that can be used whenever, wherever, and even in the future. Especially, as for cloud computing databases that can be accessed over a long period of time, the usage frequency increases, resulting in higher ROI.

Some may argue that such effort and cost are meaningless and that that cost should be spent for creation activity itself. However, the cost will decrease drastically due to acquirement of the expertise after repetitive challenges.

This kind of objection is likely to seen in *village community*-type organizations described in Chap. 6, as the background has the same root as the psychology of community. Implicitly oriented attitudes in village community-type organizations, based on their homogeneity and exclusiveness, deprives their members of opportunities to develop, which leads to many failures of interface functions and consequently ends up with the total denial. In addition, the absence of management on fixing interfaces by the leaders would make it worse.

These are crucial obstacles toward knowledge management and creative thinking, which requires processing of complex and vast volume of information in efficient and effective ways. Without the opportunities to develop capabilities of interface designing, knowledge management is strongly restricted. It should also be emphasized that this is a serious problem concerning one's competitiveness development perspective.

Innovation and Transaction Cost

10

Innovation corresponds to the reduction of transaction costs.

10.1 What Is Innovation?

The reduction of transaction costs is a measure as well as a goal of innovation.

Innovation is indispensable to increase sales through matching new market needs and new technologies, in order to revitalize the saturated economy. This is a significant issue shared among the developed countries. However, it is difficult to define *innovation* because its meaning tends to be taken widely due to its versatile importance. The classic definition of *innovation* advocated by Joseph A. Schumpeter back in 1934 is used in almost every study on the topic. *Innovation*, according to Schumpeter, is "a new combination of means of production—that is, as a change in the factors of production (inputs) to produce products (outputs)."[1] Although *production* is the main concept here, too, due to the aforementioned background in Chap. 7. it is clear that no change occurs from production per se, and in order to raise a social impact, the sales (usage) of the product are indispensable. In other words, new transactions in large quantity bring a significant change to the society, and the volume of the new transactions determines whether it can be called an innovation or not.

However, the significance of transactions for *innovation* is more than that. In this chapter, summarizing this book, *innovation* will be examined through applying the aforementioned concepts. It will come up with the conclusion that promotion of innovation corresponds to the reduction of transaction costs.

There are only two ways to create new transactions for innovation. One is to develop a new product or a new technology that has not been supplied before. And the other is to enable new transactions of existing goods that were not transacted

[1] Schumpeter, J.A. (1934), *The Theory of Economic Development: An inquiry into profits, capital, credit, interest and the business cycle*, Harvard University Press.

C. Suematsu, *Transaction Cost Management*, Management for Professionals,
Springer Cham, https://doi.org/10.1007/978-3-319-06889-3_10

due to high transaction costs despite the fact that the demand and supply have existed.

In Japan, especially where *innovation* was interpreted as *technological innovation*, the idea that innovation should be led by new technologies has dominated, which further led to the idea that innovation is the development of new products from new technologies, the former of the two ways above. However, as explained through this book, the core of the globally progressive innovations is the latter, namely, *technologies, products, and services that have led to the reduction of transaction costs*.

The innovation by the reduction of transaction costs is literally focusing on the reduction of transaction costs per se. As the reduction of transaction costs and the introduction of fixed interfaces have an enormous impact on the society and organizations, huge obstacles are also being raised. During the establishment of interfaces, including social standards, modules, and systems and processes in organizations, vested rights shift, leading to political mechanisms that reject such innovations. As an illustrative example, this explains the failure of the B2B marketplace in conservative industries as well as the rejection of modules in the automotive industry. In other words, achieving innovations is in the double-layered structure, where organizational and/or social innovations are necessary first before creating business innovations. Ultimately, this makes innovation more difficult.

As for the former one, developments of new products and new technologies also correspond to the reduction of transaction costs per se as further explained below.

Metaphors like "Devils River," "Valleys of Death," and "Darwinian Seas" are often used to express the difficulties of the process of creating a new business from a new technology—that is, how difficult innovation is. "Devils River" refers to the difficulty of the processes between research and product development. "Valleys of Death" refers to the difficulty of the processes between product development and business development. "Darwinian Seas" refers to the difficulty of the processes between business development and business success.

The common obstacle in the river, valleys, and seas is that ideas leading to innovation are not easily conveyed or disseminated. In order to achieve an innovation success (e.g., great profit from commercialization), an idea needs to be understood by other people who decide that exchanges (transactions) of their resources (investment, effort, and/or introducing personal connections) for the idea (which is expected to lead to compensation or fame in the future) must occur. Furthermore, it has to occur in a sequential manner among all the related parties with different backgrounds, knowledge, and interests. The transaction here consists of each of the transaction elements, such as searching for such parties, presenting/collecting information regarding the idea, collecting information on the parties, negotiating and adjusting for mutual agreement, clearly stating the conditions of the exchange as a contract, carrying out education and support for execution, and monitoring the progress. As for ideas that were judged as unpromising, the transactions will be screened out.

As one's own resource is to be invested on an idea that will not bring any profit in the short term, this transaction is hardly realized. Since no one knows the future for

sure, people do not like to take risk for the sake of new, unknown matters. In addition, as current transactions need to be replaced by the new one in many circumstances, opportunity costs are incurred. During commercialization, the cost of replacing existing fixed interfaces in organizations is added, the result of which increases risks and strengthens oppositions. Even the realization of ordinary transactions is not easy; the transactions for innovation have the difficulty of having to invest on something with uncertain value and further need to be repeated through numerous people. Even if any single transaction among a huge number of such difficult and sequential transactions is missing, one small idea will not constitute a business innovation.

In the first place, most of the ideas claiming to be innovative are valueless. If by any chance there exists a seed of innovation that can actually be realized (thus should be realized), it is important to implement it before the competitors do; then the issue becomes whether the transactions of acquiring necessary resources (including human resources) can possibly be executed or not.

In this way, the reduction of transaction costs is not just the core goal of innovations in the global economy today but also the measure to realize innovations.

10.2 Promotion of Innovation Through Reduction of Transaction Costs

Reasons behind the difficulties of transactions for realizing an innovation are the low frequency and the shift of vested rights.

10.2.1 Difficulties of Innovations from Transaction Perspectives

The difficulties in innovation transactions are due to their low frequency and the shift of vested rights.

Examples of open innovation in which aforementioned transactions are executed successfully and sequentially were given in Chap. 1. The examples show that if transaction costs are small enough, an individual's information is easily conveyed to others. Then it is spread further to many more with value added. During these processes, one path may reach innovation; the lower the transaction costs are, the higher the probability becomes. On the other hand, if the transaction costs are larger, the probability of the success becomes smaller.

The following two characteristics make the transactions of innovation more difficult than ordinary ones:

(1) Frequency of the transactions is low.

From the definition of *innovation*, it is characterized by novelty, which corresponds to nothing but low frequency of the occurrence. If the frequency is low, it is difficult to introduce a fixed interface to reduce transaction costs.

(2) It replaces existing resources (existing products or related human resources).

Innovation is explained to create new markets, but in today's saturated markets, it actually means a replacement of some sort of existing resources. At customers, existing products are excluded, and at companies, the human resources who were in charge of the existing products may become displaced. This comes to the shift of vested rights, political refusal, and oppositions. It is understood as the "dilemma of innovation" especially when the vested rights of a former successful man are enormous in particular; however, in reality, every micro innovation results in refusal and oppositions.

If all the sequential transactions from ideas to commercialization are executed smoothly and efficiently, the probability of innovation increases. However, all the transactions are difficult with frictions due to the reasons above and become even more difficult than the individual transactions explained in Chap. 9. Thus, precise interface designing is indispensable.

Two cases—social transactions with a focus on promoting venture start-up companies: organizational transactions within a company developing new products and new business—will be discussed below.

10.2.2 Improvement of Transactions: Venture-Related Innovation in the Society

Venture start-up companies will be developed with the improvement of the related transactions.

10.2.2.1 Transactions of Financing

Funds are indispensable prior to commercialization. Most of the necessary resources can be acquired if a company has enough funds. If the transaction interfaces of financing commercialization are prepared, the probability of successful venture-related innovation increases significantly.

The establishment of financing systems of risk money (venture capitalists, angel networks, project finance, and diversified financing methods) is important among companies. As for fixed interfaces to reduce the transaction costs of the finance, matching platforms between the investors and the start-up companies and information transmission on each transaction element should be standardized (e.g., standardized presentation of business plans).

10.2.2.2 Transactions of Resources Procurement

Although most of the necessary resources can be procured with enough funds, funds are extremely limited in most cases. In order to appeal to expensive skilled employees when launching a business, in particular, establishing a transaction interface of trust as an emotional solicitation method such as enthusiasm and dreams becomes necessary.

However, many fixed interfaces that assist in the procurement have been appearing on the Internet. For example, LinkedIn standardized human resources' database/network and has increased its popularity worldwide. Whether they know each other in advance or not, various job offers and job-hunting information are widely shared. Because the information is accurate and abundant, it has contributed greatly to human resources procurement.

Also, transactions of procuring business support functions such as lawyers, patent attorneys, certified tax accountants, overhead operations (e.g., accounting, general affairs, and IT), and various consultants became easier through various online matching websites. AnnaLee Saxenian asserted in her previously cited book *Regional Advantage* (Saxenian 1994) that networking was the key success factor of Silicon Valley companies in the 1990s. Interfaces have become stratified on the network and have advanced significantly from that time.

10.2.3 Transactions for Business Innovation Within a Company

Innovations within a company may be promoted by improvements of the related transactions.

Seeds of technological innovation in a company are usually developed by an R&D department. The significant issue here is how to manage the balance between freedoms in inspiration (allowing any subject one desires) versus limits from marketability and feasibility in order to facilitate innovations. Thus far, there exists a general tendency of ignoring the marketability and feasibility due to the difficulty to evaluate them (effectiveness). However, the number of valueless researches has increased excessively from such lack of management and interference, while the freedom of such researchers has become a part of vested rights. The decision on objectively screening off projects that have lower possibility of innovation becomes important for promoting successful innovations. As for marketability and feasibility, an information-sharing interface between each researcher and the director based on the viewpoints of potential market size, expected penetration, expected own market share, and cost prediction can be useful, namely, Pro Forma. In addition, fixed interfaces of project management that monitor and manage the progress of technology development should be shared (e.g., the phase gate model).

Also, as resource efficiency in commercialization increases when the seeds of innovation from R&D match the needs of business divisions, the establishment of matching interfaces between R&D and business divisions is effective. For example, business divisions may fund seed projects in R&D that match their market needs and, in return, R&D accepts their requests derived from their business development.

Recently, in addition to seed development in R&D, companies have increasingly introduced business development systems focusing on marketing ideas-driven innovations such as new business plan contests and intrapreneurship systems. When the cost expenditure on these trials increases, the probability of innovation occurrence also increases obviously. However, it does not imply simple increase in

amount, of course; rather, it is a significant managerial decision for the investment trade-off between current operations and innovation.

The interfaces of the cross-functional team, introduced in Chap. 1, cover most of the transactions that occur during the process of commercializing the seeds of innovation, which include "how to propose an idea of innovation," "who should evaluate it and how," "how to organize the team in charge," and "who authorizes the implementation and how." If a company puts emphasis on innovation rather than current operations and fixes these interfaces properly, then the numerous transactions in the commercialization process become smooth and efficient, resulting in significant increases in the success probability.

10.3 Structure of Innovation Breakdown

> Innovation is doomed to breakdown. Without the capabilities to solve the structure, it is impossible to overcome it.

In spite of the significance of innovation, most of it does not lead to expected results. In order to realize it, numerous transactions need to be completed within the long process of taking an idea to commercialization. Those are the aforementioned sequential transactions, each of which is by far more difficult to execute than ordinary.

First of all, if the quality of the idea (i.e., the expected value in the future) at the beginning is unpromising, the transaction is hardly executed (should not be executed). Also, the planning capability, execution capability, enthusiasm, physical and mental strength, problem-solving capability, and the learning ability of the person who claims his idea will lead to a successful innovation are scrutinized. In reality, most of the proposed transactions will be unqualified to this point; a diamond in the rough must be searched for among enormous piles of sand.

Current businesses may have resulted from the success of an innovation in the past, but luck and coincidence must also account for a large share of the cause. It is hard to say that a company will be as lucky as it was in the past when it achieved a successful innovation to create its current business. It is quite possible that although the total amount of available resources may have increased by far, things that have been lost are more influential than the increased resources. Namely, organizations have lost enthusiasm, desire, self-motivation, critical thinking, and a problem-solving capability, which are indispensable for the innovation needed for growth and expansion and were possessed by the founders. This is because of the organizations' history; people who followed fixed interfaces have been selected; people who questioned or proposed new methods were excluded because they interfered with efficiency during the process of growing in scale. It had been necessary for the companies to invest in artificially fostering the culture where the employees were conscious about creating innovations even in their day-do-day operations and challenging to development of necessary capabilities.

Assuming that a person with high capabilities and desire made the proposal of promising seeds for innovation, this is the point where the real difficulties of innovation start.

As for the seeds with a high possibility of success, the allocation of resources (capital, competent human resources, channels, and so forth) is necessary. However, this leads to depriving resources that belong to current vested right holders. It is hard to earn the compliance of the current vested right holders, who had succeeded in their innovations in the past. It is easy for them to assert that the seeming diamond in the rough is a grain of sand because effectiveness cannot be evaluated objectively; someone should deal with unreasonable interference from them. Without very powerful leadership, it is impossible to raise the seeds of uncertain innovation when considering these power political relationships.

Interest oppositions that are hard to solve logically occur invariably with innovation. Interest oppositions within organizations are solved smoothly if there is strong leadership (even though it accompanies risk of dictatorship), and it is basically impossible to solve under unanimous solution system. In Chap. 6, it was explained that predominating leaders are unfavorable in *village* communities and changes are rejected, as it leads to heterogeneousness. This is one of the biggest reasons why Japanese society is weak at innovation. The issue which has been preexisting from the past has just been manifested under the growing global competition. The decline of the Japanese economy is synchronously proceeding with the phenomenon, which includes globalization by digitalization, intensified competition by globalization, and increased significance of innovation for intensified competition.

The forte of the Japanese *village* community was the gradual improvement, which functioned in an environment where everyone could agree on the direction, such as when catching runners up front and the only necessary consensus building is fine adjustments. When nobody raised an objection, changes on a small scale could be processed quickly, which functioned extremely well in simple transactions of production such as production cost management, quality control, and inventory control, even without IT utilization. However, on the other side, it is safe to say that the organizational techniques for handling major changes on a large scale that accompanied shifts of resources from vested rights holders to emerging forces have never been developed. As for such complicated and large-scale transactions, customs and tacit knowledge that have managed fixed interfaces spontaneously are no longer enough.

In *village* communities, the capability of managing fixed interfaces is very limited. Too much time must be expended for the new developments or modifications to reduce transaction costs, the consequence of which makes it impossible to process innovations, which require the most difficult transactions in sequence. These days, Japan seems to prostrate not just revolutionary innovation but also even extremely small changes along with loss of vitality.

The growing tone of nationalistic argument in the media and academia, such as "what we need is only encouragement," "make greater use of our strength," or "current situation is nothing wrong," may contribute to short-term escape from the

reality, forgetting about the currently accumulated problems. However, following the global movements, understanding indispensable changes, and flexibly complying with them are essentially required.

Substitutionability of transaction partners was included in the definition of *degree of modularity* in Chap. 4; one of the major functions of interfaces is facilitating transactions of substitutes. When interfaces are established, people try to earn their positions, and people try not to be deprived of their power. In other words, competition is promoted; efforts, growth, change, and innovation are revitalized.

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Epilogue

The reduction of transaction costs as a goal of innovation was introduced in Chap. 1, with examples of various business models that spread from the late 1990s. The reduction of transaction costs has been globalizing the competition, which has been overly heated up.

There are more than two billion poverty-stricken people who are living on less than 2 US dollars a day in developing countries, and transactions involving all these people as production workers will become possible in the near future. It results in lower production costs and further decline in prices along with the reduction of the transaction costs.

Google's drive navigation software on mobile phones has brought down the value of on-board navigation systems, originally priced at several hundred thousand dollars, to practically zero. Their self-driving cars will replace taxi drivers soon. It is just around the corner when the value of Microsoft's software, priced at a few hundred dollars, becomes zero too. Various services with amazing convenience can be obtained on smartphones, for free or less than a few dollars. Tablets, which are the platform for content sales, are sold under cost and expected to be free soon. Amazon has been decreasing a physical delivery fee and 3G telecommunication fee. Extending this strategy, a business model providing cars under cost or free in order to monopolize the content platform on-board to show drivers restaurants and shops is also possible.

The intensified competition for standardization has a significant impact on competitions in general. In a "winner-takes-all" economy, companies gain "all or nothing"; in order to dominate market shares, companies increasingly provide products and services at zero prices. It started with software programs or services on networks that incur nearly zero variable costs and is now spread to physical business products. In the Chinese online commerce market, competition became so intensified that various products were sold under cost, and this will certainly affect other markets such as India and other developing countries. In India, 900 million people already possessed cell phones before the spread of fixed phones, and mobile commerce is expected to be in use before the establishment of physical distribution systems. As for the Indian mobile business industry, where rapid growth is regarded as being certain, Amazon, Softbank, companies with Indian business leaders who have returned from Silicon Valley, and India's IT behemoths (e.g., Tata and Infosys) have already entered the market and the competition is intensifying. It

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has been reported that even Wal-Mart is planning the entry. China has a market size of 1.35 billion people, and India has 1.2 billion people. The outcome must be enormous when the standard position is acquired. When even a few companies with the same goal and intention enter the market, it will result in great impact on price competition. Even physical goods have been obtained free of charge these days since numerous design diagrams with open source license are distributed, which make extremely low-cost production at home possible by 3D printers.

In the spring of 2012, one of my students graduated and left for Silicon Valley to start up a company. Being called a genius software programmer, with a sleeping bag and a dream of developing his software business to the size of Google, he lives and works in a free small space that his acquaintances offered in their office. The business can be continued for a few years only by dozens of thousands of dollars funding from an angel. For him, the few years cannot be a big risk, and if it turns out great, his dream will come true and make him a great fortune. Such young generation is gathered at Silicon Valley and other places. They, of course, are to start from zero-price models.

Many of those must aim at business models of reducing transaction costs, where infinite business opportunities still await. Some of them will successfully reduce transaction costs and furthermore production costs, which enlarges the application range of zero-price models. This could be more than inflation through increasing the monetary base or even deflation, requiring radical conversions in the economy, financial policies, and the way economic activities should be.

The philosophy of sharing or zero prices is born in the USA, especially from antiauthoritarianism. It has a strong root among innovators and accompanies resistance characteristics against vested rights that destroy innovations. It started off with Internet-related activities and businesses and developed through synchronization of sharing and exchanging services on consumers' idle resources at home (e.g., automobiles, houses, rooms, fallow farmland, used clothing, and other discarded articles). Their counterstrategy against the destruction of innovation is the zero-price model; it must become a great threat to the vested right holders. Conservative companies that fail at innovation in the market or within organizations are faced with the higher possibility of becoming victim to the zero-price model challenged by incomparably smaller-sized companies.

The reduction of transaction costs has been progressing gradually and latently ever since the history of human beings started and is now reaching the level where the fundamentals of economic activities may be changed. By having unconventional viewpoints, the existence of enormous transaction costs—that is latent everywhere—becomes clear. As long as there are human activities in the market or within organizations, there lie infinite opportunities to reduce transaction costs. If transaction costs are reduced, transactions that were practically impossible in the past become possible, and new transactions occur, the costs of which consequently become new targeted objects for reduction. All the reduced costs can be recycled as resources. That is, the new competition on developing these new enormous resources begins now.

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