Certified CPP Procurement Professional

Procurement Professional Study Guide

Management Guide

JMA JAPAN MANAGEMENT ASSOCIATION

Introduction

1 Toward Developing Procurement Professionals

The position and role of procurement has been changing in recent years.

In the manufacturing industry, cost reduction (CR) efforts focused on continuous CR activity at the mass production stage until the mid 1990s. The CR efforts were made during the continuous development of the Japanese economy after the war and the trend of increasing production due to high growth. The goal of these efforts was generally up to around a CR of 10% per year, and in many cases it was possible to reach these goals by negotiating and engaging in annual CR activities. With the bursting of the economic bubble, the business climate became difficult and there were concerns over how to increase sales. In order to maintain and improve economic results, it was inevitable that the relative importance of CR as a business challenge would increase. At the same time, in order to increase sales, it became increasingly important to find suppliers who were competitive or had unique technologies in order to realize short-cycle development with product appeal.

Even in industries other than manufacturing—in which sales management formed the core—there is an increasingly strong tendency to stress profit, and the importance of CR continues to grow. Procurement reform continues to advance in a range of industries and companies, including construction, communications, transportation, and energy.

In order to respond to these changes in the environment, each company has undertaken its own unique efforts and schemes. A diverse array of reform methods have been developed and implemented in production, sales and marketing to improve productivity and expand sales. However, such reform methods have yet to be systemized for procurement, and few success cases have been released. It is a fact of reality that a standard has yet to be created in Japan.

"Procurement" requires skills from a wide range of areas of knowledge (scholarship). Unfortunately, these skills have yet to be systemized in Japan. It is for this reason that top management and other departments mistakenly believe that "procurement has no unique skills"—or even that "procurement requires no special skills at all". In reality, "procurement" is supported by knowledge both wide and deep. Without "procurement skills", it would be difficult to work with other departments or suppliers, and to contribute to management.

Until now, "procurement skills" tended to be thought of as personal skills based mostly on negotiation and expertise that stresses negotiation ability. This has created a warped perception that dismisses how specialized procurement skills are.

However, with information able to be fully exploited nowadays, "procurement" is considered a specialized field of work that must offer exceedingly quantitative persuasion based on more logical information, be systemized, and recognized as procurement engineering.

2 The Creation of the Procurement Certification System

In 2007, the Japan Management Association (JMA) created Japan's first "procurement certification system". This system certifies those who have obtained the skills required of a procurement professional as Certified Procurement Professionals (CPP). The goal of the certification system is to help standardize Japanese procurement skills and help establish even more advanced procurement skills. This should help to improve the status of procurement within companies.

3 Structure of the Procurement Professional Study Guide

The Study Guide is composed of three parts/five books: the "Management Guide", "Skill Standard", and the "Study Guide".

"Management Guide"

The "Management Guide" summarizes information on the concept of how procurement contributes to management on a high level, and how to make procurement more competitive. This guide book should be read by anyone involved in procurement.

"Skill Standard"

In order to improve procurement skills, it is important to "first clarify what skills are required and then gain and put those skills into practice". "Skill Standard" define "expected roles", "skills requirements", and "skill levels" for each work topic, in a systematic format. This allows readers to score themselves in each skill.

"Study Guide "

The "Study Guide" organizes knowledge by work category required to perform work as a procurement professional.

The "Study Guide" is based on the "Skill Standard". After scoring yourself using the "Skill Standard", if you find that your skills are lacking in some area, you can refer to the related item in the "Study Guide" for study.

4 Contents of the Management Guide

This guide book consists of two parts. Part 1 provides an overall image of how procurement should be performed, while Part 2 describes "procurement infrastructures" covered in the last chapter of Part 1.

4-1 Contents of Part 1

Chapter 1 provides an overview of environment changes surrounding business and examines the background behind increasing expectations of the role of procurement in contributing to management. It also takes a look at the changing role of procurement, and organizes how

procurement should function and what roles it must play.

Chapter 2 organizes issues that procurement is currently facing, and describes how to improve procurement competitiveness. This chapter presents the core concept of this guide book, in the form of the "framework for strengthening procurement competitiveness". The framework for strengthening procurement competitiveness classifies points that must be reformed to strengthen procurement competitiveness into two categories ("procurement strategies" and "procurement infrastructures"), and provides details.

4-2 Contents of Part 2

Chapters 1 through 6 describe individual topics on procurement infrastructures ("strengthening procurement planning functions", "establishing procurement organizations/systems", "enforcing management processes", "standardization of procurement processes", "building procurement information management framework", and "building framework to improve procurement skills").

This guide book was created based on the Japanese business environment.

Management Guide

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Part 1 Direction to Strengthen Procurement Competitiveness

Chapter 1

Aiming for Procurement that Contributes to Management

1 Aiming for Procurement that Contributes to Management

1 The Changes in Surrounding Business Environment

As shown in Figure 1-1-1, this section organizes recent business environment changes from four perspectives: global market changes, changes of risks and increasing demand for CSR, diversification of competitive axes, and structural changes in Japan.

●Figure 1-1-1 Recent Business Climate Changes

[a. Global market changes]
(1) Expansion of emerging markets
(2) Expansion of free-trade agreements

[c. Diversification of competitive axes]
(5) Shifting perspective from physical things to non-physical things
(6) Development of new materials/technologies
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(8) Progress of decreasing and aging population
(9) Continuous rise of overseas production ratio, and unchanging overseas production pressure
(10) Changes in industrial structures and low competitiveness of the service industry

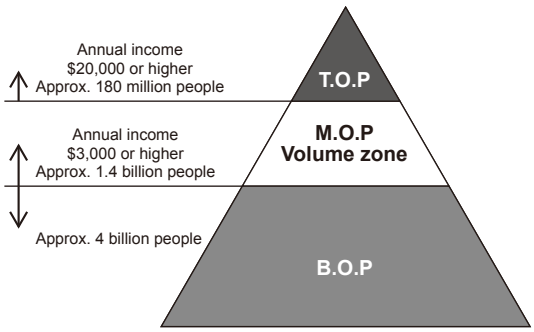
■ a. Global Market Changes

(1) Expansion of emerging markets

The global market may be thought of as a market pyramid that is classified by annual income. Until now, companies in advanced nations (including Japan) have focused on expanding their businesses within a global market of approximately 180 million people—this is the section of the pyramid called the top of pyramid (TOP), and it is defined as having an annual income of at least 20,000 USD. TOP is made up of mainly of advanced nations. However, there is some degree of difference from country to country, they tend to experience falling birthrate and aging populations, and their markets are tending to shrink. Meanwhile, income—and buying power—is increasing in markets in the parts of the pyramid other than TOP (especially the middle of pyramid [MOP]). This massive market is expected to become a volume zone.

Japanese companies have specialized in providing high quality products for comparatively inexpensive prices. Even so, these prices are still too high for consumers in the volume zone, and

●Figure 1-1-2 Market Pyramid



further price competitiveness is required. Further, there is little appeal in merely providing bargain versions of products, so it is required to provide products that fit the consumer needs.

(2) Expansion of free-trade agreements

Various countries throughout the world are entering into trade agreements, in which partner countries receive preferential duties. The purpose of a free-trade agreement (FTA) is to liberalize the trade of goods and services. Japan is said to have a low FTA ratio (ratio of amount of trade between FTA partner countries versus the total trade amount) when compared with the rest of Asia. TPP[*1] has reached to an agreement in 2015 and sighed in 2016 with 12 nations. But the agreement become unclear whether to come to effect due to the declaration of withdrawal of US. Japan-EU EPA[*2] has just announced its reaching of agreement in 2017. Negotiation is underway for RCEP[*3]. Although it will likely take some time for each country to ratify the treaty and for it to come into effect, action has begun in various circles under the assumption that the treaty will ultimately come into effect.

Along with market growth, trade agreement trends in each country must be considered when placing production sites and configuring production. At the same time, the flow of logistics could also change, so procurement must also keep an eye on these trends.

*1: TPP=Trans-Pacific Strategic Economic Partnership Agreement

*2: EU-EPA=Japan-EU Economic Partnership Agreement

*3: RCEP=Regional Comprehensive Economic Partnership

■ b. Changes of Risks and Increasing Demand for CSR

(3) Diversification/increase in risk following globalization

Risk elements increase as a business undergoes globalization. This is especially true in recent years, with the increase in such problems as political instability, unseasonable/abnormal weather, epidemics, market condition/exchange rate fluctuation, and technology/information leak. The

scope and frequency of risk continues to increase.

The example of political instability are the coup in Thailand, the annexation of Crimea by Russia, democratization demonstrations in Hong Kong, and coups in North African nations. These incidents affects procurement from blockages to changes in national policy.

As for the risk of terrorism, there are troubling trends in the influence of radical Islam, especially in the Middle East. Until now it has been enough to merely be careful in certain countries. Now, repercussions are spilling out across the globe.

There are weather risks as well. In addition to large-scale disasters such as earthquakes and tsunamis, regions all over the world are experiencing increased typhoons, heavy rain, and blizzards due to abnormal weather. In Japan, business continuity plans (BCP) have tended to focus mostly earthquake countermeasures. However, more companies are expanding their BCP scope to include typhoons, heavy rain, and blizzards.

There is also an increasing risk of epidemics. In addition to avian influenza, dengue fever is fresh in the minds of many in Japan. In 2014, there was an outbreak of Ebola hemorrhagic fever in West Africa, which soon became a global issue. Although the infectious capacity varies from infectious disease, if there is an outbreak of such a disease in a country that is ill-equipped to handle it, the disease could quickly spread across the globe. The risk of infection spreading continues to increase.

Fluctuation in market conditions and exchange rates continues to grow more violent. Although influx finance money into procurement is a major factor behind this, conditions are now fluctuating widely over a comparatively short period of time. In addition to futures trading and exchange contracts, it is now necessary to adjust export/import balances and settlement currencies.

A final risk worth considering is the leaking of technology and information. In addition to highly illegal cases of hacking and industrial espionage, cases of technology outflow due to headhunting or caused by retired employees have begun appearing.

(4) Increasing demand for corporate social responsibility (CSR)

CSR stands for corporate social responsibility. Until recently, each company and industry engaged in CSR in different ways. However, with the release of ISO26000 in 2010, the approach is standardizing. ISO26000 lists seven items as core subjects for social responsibility: organizational governance, human rights, labor practices, the environment, fair operating practices, consumer issues, and community involvement and development.

More specifically, trends include the widening scope of controlled substances from an environmental regulation perspective and the spread of regulations to prevent minerals from politically unstable countries/regions from being converted into a source of funds for anti-government forces (i.e. conflict minerals) in certain regions and industries. Companies are being urged to comply.

CSR trends tend to be spearheaded by overseas non-profit organizations (NPO) and non-governmental organizations (NGO). The human rights issues that these organizations see as a problem are not much of an issue in Japan, and there is likely a difference in the CSR perspective of Japanese companies and of organizations overseas. Companies will need to keep this in mind for future globalization.

■ c. Diversification of Competitive Axes

(5) Shifting perspective from physical things to non-physical things

There has been a recent shift from physical to non-physical things. Physical things refer to products that can be seen and that have a physical value. Non-physical things refer to value that cannot be seen. Some examples include a customer's experiences using a product, thoughts, or knowledge.

In other words, physical things refer to things that undergo innovation. These would be materials, parts, and products in the manufacturing industry. The attributes of these things are described as QCD (quality, cost, delivery). Non-physical things refer to effects that change physical things or their level. Some examples include processes (procedures and standards), people (human resource development/motivation), organizations/systems (collaborative atmosphere), and technology. An example showing the relationship between physical and non-physical things would be as follows. "In order to change an existing product (physical) into a new product (physical), the technology level (non-physical) must be improved to XX".

It is becoming increasingly difficult for companies to differentiate themselves with physical things alone, and there is a significant number of cases where companies go into price competition. However, merely lowering prices without increasing volume will lead to a vicious circle. It is becoming increasingly important to propose meaningful experiences to customers and present them with a "story".

(6) Development of new materials/technologies

On the other hand, a range of technological innovations are occurring in physical things as well. The speed of innovation varies by industry. However, new forms of energy have begun appearing and spreading, while remarkable advances are being made in new material development and technologies such as microfabrication. Furthermore, with 3D printing now a reality, industries are seeking the future shape of new manufacturing. Functions that could only be realized mechanically are also increasingly able to be handled in software.

An example of a new manufacturing trend that is gaining attention is Industry 4.0, which uses ICT and is spearheaded by Germany. Industry 4.0 aims to realize production where manufacturing is connected with society around it for production that is more optimized and that offers a greater

degree of freedom. In addition to improving product performance and reducing costs, it is expected to greatly increase value provided to customers (including service). It has even been called the fourth industrial revolution. It will be necessary to keep an eye on how new ideas and technologies will develop in the future.

With all of this in the background, the structure of market players is changing dramatically. Although there are cases where the introduction of new technology can lower barriers to entry, there are also cases where technology requires massive investment. There are even industries where M&A are resulting in oligopolization. Alliance strategies with competitive manufacturers and M&A strategies to acquire venture firms with promising technologies are becoming even more important than developing proprietary technology. For procurement, it will be important to keep a close eye on the merits and future prospects of each technology, and to consider their affinity with the technology and product strategies of your own company.

(7) Supply chain competitiveness

Many companies are engaged in supply chain management (SCM). In order to maximize sales, it is important that competitive products are supplied reliably, without going out of stock. As mentioned in the section of risks, elements that could get in the way of the stable supply of products continue to increase. Companies will need to build stable supply systems that conduct solid procurement activities. Market trends and customer needs fluctuate. Establishing a method to accurately forecast this demand fluctuation is very difficult. It is also important to strengthen cooperation with operations, increase supply flexibility, and avoid maintaining excessive inventory. On the other hand, there are also cases where companies target the utilization of low cost countries (LCCs) from a perspective of business globalization or cost reduction (CR). These companies are forced to extend procurement lead times or set large procurement lot sizes. It can be difficult to accomplish this while reducing inventory, making it difficult to build a strategy.

As described in the previous section, companies are increasingly seeing alliance and M&A strategies as important, and rather than the company itself, the competitiveness of the entire supply chain is being called into question. Until now, SCM tended to focus largely on inventory and logistics. Not enough attention was paid to the impact on mid-long-term results, so further development/advancement is required.

■ d. Structural Changes in Japan

(8) Progress of decreasing and aging population

According to the Ministry of Internal Affairs and Communications, the population in Japan has been on a decreasing trend since 2007. This trend is expected to continue until 2050. Further, the ratio of people 65 years old or older has sharply increased from 1990, and in 2005 exceeded 20%

of the total population. This is the fastest pace of all advanced nations.

As the population continues to decline in regional areas of Japan, there is the real risk of municipalities vanishing. Demand will change dramatically as the population ages. In response, new products and services will be developed, and the market structure will change.

(9) Continuous rise of overseas production ratio, and unchanging pressure for overseas production

According to statistics from the Ministry of Economy, Trade and Industry, the overseas production ratio of the Japanese manufacturing industry exceeded 20% of the total in 2012. Although this varies by industry, the ratio of overseas production is likely to continue to increase. The Japanese business environment was described as "plagued by six difficulties" for a period of time. The majority of these factors (such as high corporation tax, energy crunches, labor regulations, and high targets for eliminating greenhouse gas emissions) continue today. These factors also serve to push production outside of Japan.

(10) Changes in industrial structures and low competitiveness of the service industry

Although Japan tends to be thought as being particularly competitive at manufacturing, the service industry (the so-called third industry) already had account for 70% of Japan's gross domestic product (GDP) a decade ago. Furthermore, demand for services will increase in response to changes in social structures (such as the decreasing birthrate and aging population), outsourcing will expand due to continuing modularization of work (focusing on the manufacturing industry), and new service markets will be created and expand as a result of regulatory reform or the opening of public markets to private citizens. These factors and more will serve to increase the importance of the service industry and further expand markets.

On the other hand, increases in productivity in the service industry are still low when compared to those in the manufacturing industry. According to a report from the Japan Productivity Center, when growth in labor productivity from 2005 to 2012 was compared, the manufacturing industry had a score of 1.17, while other industries (electricity/gas, construction, retail, transportation, finance/real estate, and service industries) had scores from 0.72 to 1.07. Under the simple arithmetic average (0.95) this is a negative growth rate (Japan Productivity Center Productivity Multidisciplinary Research Center, "Japan Productivity Trends 2014"). Further, when productivity is compared between Japan and the US, many service work industries were found lacking (Ministry of Economy, Trade and Industry, "Seminar on Bringing High Added Value to the Service Industry", 2014).

The fact that the service industry was not exposed to global competition is one reason why productivity has not increased. However, global competition is rapidly increasing with recent developments in ICT. Increasing the competitiveness of the service industry will become a very

important issue.

In Japan, "procurement" generally refers to procuring thing in the manufacturing industry—the exception being "capital procurement" (i.e. fundraising). There are many cases, especially in the service industry, where companies simply do not have a procurement department. There is still much room for procurement to be strengthened in the service industry.

Companies are attempting to react to such environment changes by increasing their management, technology, and management standards. Procurement is increasingly expected by management to play a role in these activities. Trends such as these are spreading throughout the world, from the manufacturing industry, to the construction, power/gas, and railroad/airline industries. This is due mainly to the two reasons below.

- First, more companies are focusing their attention on costs in order to increase revenue, and expenses paid outside the company account for a large portion of costs.
- Second, procurement departments play an important role in reforming SCM in order to realize the timely supply of products and goods (products pass through a company's internal manufacturing process, while goods are procurement sales items that do not pass through a company's internal manufacturing process) and reduce inventory.

However, these environment changes can often create an adverse conditions for procurement. The degree to which these changes can be responded to appropriately and quickly is becoming apparent in the large difference in company competitiveness (such as product appeal or earning capacity), and the role of procurement is extremely important.

2 Responding to Procurement Environment Changes

There are three aspects seen in trends for procurement to respond to the environment changes described previously. They are...

(1) Increasing the sophistication of efforts in the direct material area

(2) Expanding management scope to the indirect material area

(3) Increasing awareness of CSR

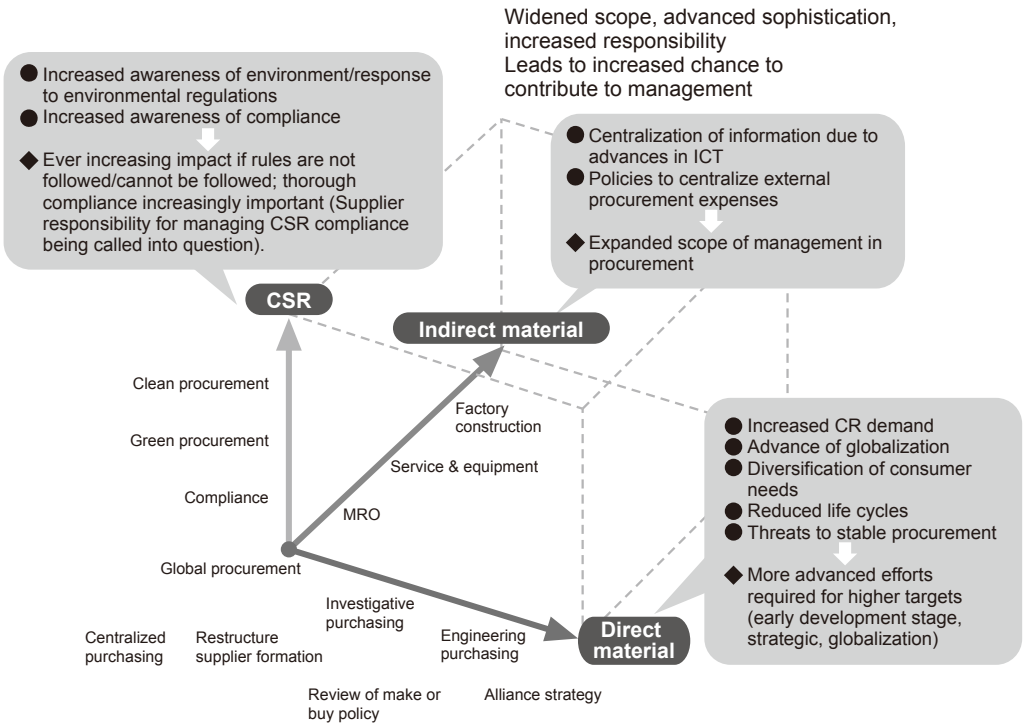
Figure 1-1-3 illustrates environment changes in each of these three aspects, as well as major trends for handling them.

Note that the content below applies mostly to efforts in the manufacturing industry. This is because procurement efforts in the manufacturing industry have made more progress than those in other industries. However, this should serve as reference for other industries as well.

(1) Increasing the sophistication of efforts in the direct material area

First is increasing the sophistication of efforts in direct materials. Direct materials refer to items

●**Figure 1–1–3 Procurement Support Trends in Responding to Environment Changes**



such as raw materials, for which expenses can be directly billed to individual products. The ratio of direct material expenses continues to increase each year. According to statistics from the Ministry of Economy, Trade and Industry, this has increased on average across all industries 2% from 2009 to 2012 (this figure varies by industry). In the manufacturing industry, the ratio of external procurement expenses for materials and parts that procurement is generally responsible for managing is significantly high. This has a major impact on management results. Expectations for CR therefore continue to grow.

On the other hand, there also exist environment changes that could be said to create an adverse conditions for CR, such as diversifying consumer needs, shorter life cycles for products and goods, and increasing threats to stable procurement. In other words, it is becoming increasingly difficult to achieve CR targets while providing stable procurement in the direct material area. In order to achieve CR targets, it is becoming important to make even more sophisticated efforts and measures. The figure includes some important key phrases, such as centralization, global optimization, supplier reorganization, investigative purchasing, revision of make or buy policy, Sourcing for Development, and alliance strategy. Details will be covered later. The important point for now is that it will be important to expand approaches for CR and to take even more sophisticated efforts.

(2) Expanding management scope to the indirect material area

The second aspect is for procurement to take responsibility and help expand efforts from direct material to indirect material procurement, as a means to engage in CR in all directions.

Indirect materials are expenses paid outside the company that exclude direct materials. Traditionally, Japanese companies tended to focus more on managing direct materials. In European and US companies, however, procurement is generally responsible for managing both direct materials and external procurement expenses that include indirect materials.

In Japanese companies, expenses classified as so-called indirect materials (such as office supplies, manufacturing equipment, and service) were generally procured directly by the department that will use (budget) said materials. For this reason, this area was not often subject to company-wide management. Recently, however, large companies (mostly in the manufacturing industry) have placed this area and also construction expenses within the scope of responsibility of procurement.

In addition to attempting to centralize information in indirect material areas (in which there has traditionally been a strong tendency to procure individually by the consuming department) and optimize both procurement work and procurement costs, this trend of centralization is also desirable from a compliance perspective. Many companies in Europe and the US monitor the ratio of expenses managed by procurement versus all external paid expenses, as an indicator to show the degree of contribution of procurement to management.

In this way, the scope of indirect materials has expanded from familiar office supplies such as stationary and appliances, to procured items and services of a completely different nature, such as repairs, services such as cleaning or security, and even equipment procurement and factory construction. It will be necessary for procurement to gather technologies, approaches, and information that will be required in these areas. Note that indirect material procurement may also be referred to as maintenance, repair & operation (MRO) procurement.

(3) Increasing awareness of CSR

The third aspect involves efforts toward CSR, risk management, and business continuity plans (BCPs). Procurement faces a wide range of risks. However, these risks can be classified into the three major categories below.

[1] Compliance risks related to complying with environmental regulations, business transaction laws, and laws/regulations concerning human rights and procurement ethics.

[2] Supply risks such as earthquakes and other disasters, accidents, or insolvency.

[3] Transaction risks that get in the way of daily QCD (quality, cost, delivery).

As environmental awareness increases across the globe, governments around the world (especially in the EU) are setting regulations on products that contain substances of concern and regulations on emission matter. Procurement must therefore remain aware of materials contained

within procured items. Compliance (which also includes matters related to human rights) is also being stressed. More companies—especially large companies—now see "CSR violations by suppliers as the responsibility of the buyer company". There have even been cases where human rights issues or legal violations that have occurred in suppliers have shook the roots of management in buyer companies. A particularly recent phenomenon is the deliberate and malicious mixing of foreign substances or even poison into products—so much so that we have seen terms such as "food defense" in the food industry and "part time worker terrorism" in the restaurant industry. Inappropriate actions by part time workers have even resulted in stores being shut down. Companies therefore must improve how they select suppliers, continuously manage manufacturing processes, and handle the procurement of human resources.

In procurement, CSR means acting as a socially responsible company and bringing legal/regulation compliance to many suppliers. Although few incidents end up shaking the roots of management, previous cases indicate that even a single illegal act by one supplier among many could develop into a major issue.

For this reason, CSR and procurement risk management takes a great deal of time and effort. The major issue here is to what degree a policy can be clarified and then efficiently managed. In order to reduce CSR and supply risks, it is important to select competent suppliers. In order to guarantee the effective management of suppliers, it will become important to reduce the number of suppliers, or to simplify the hierarchy of the supply chain.

The CSR axis in Figure 1-1-3 lists compliance, green procurement, and clean procurement. It also describes efforts by companies in these areas. First are legal efforts. Procurement activities that are environmentally aware are already becoming common sense. Further, even if not written in law, companies are working in a more active and concrete way toward realizing procurement activities aware of business practices and procurement ethics.

In this way, procurement functions are expanding in three dimensions. Depending on whether changes can be responded to appropriately and quickly has become apparent in the large difference in company competitiveness (such as product appeal or earning capacity). Procurement plays a very big role. Although it will be difficult for procurement to respond to these changes, the more that procurement's responsibility expands, the more that it can contribute to management. It is important to continue to reform procurement and strengthen its functions.

3 Expected Roles of Procurement

The function of procurement is to "In order to increase product competitiveness and contribute to results, realize a high level of QCD and sustainable stable procurement through fair, clean, and transparent trade".

"Fair, clean, and transparent" refers to one's stance for processes when deciding suppliers and procurement prices. Fair means equal opportunities for suppliers. Clean means transacting in accordance with laws and business ethics. Transparent means maintaining transparency while selecting suppliers and setting procurement prices and during subsequent trade.

As mentioned previously, companies are required to fulfill their social responsibilities. It is important for buyers to maintain self-discipline so that they are not talked about behind their backs. At the same time, a company must not rely only on individuals' senses of ethics. It is important to set frameworks and rules to prevent illegal actions from occurring.

QCD is the act of ensuring appropriate quality for products and services, at a competitive price, at the needed time, in the needed quantity. High level QCD goes beyond merely keeping the level of QCD at the timing of its procurement.. Its goal is to keep a close eye on the impact of procured items over the entire manufacturing process and on the entire product life cycle, in order to arrive at optimal solutions.

Sustainable Stable procurement goes beyond ensuring supply, and refers to the importance of continuously realizing a high level of QCD. For example, let us assume that you have received a competitive quotation from a new supplier. If you accept that quotation without carefully examining the basis of the quotation, and the price increases after mass production, then that means you have not realized sustainable stable procurement.

Traditionally, the focus of the procurement function tended to be on creating profit by making continuous improvements after a product has launched (improvement profit). Therefore...

- Q (quality): Maintain quality of procured items (parts, materials, and services) set in product planning and development
- C (cost): Maintain CR by optimizing buying and manufacturing method
- D (delivery): Optimize delivery lots and frequency to improve productivity of internal production processes

... were required. These are efforts for when what to procure itself has been decided.

In the manufacturing industry, companies are questioning how to incorporate competitive QCD during the product development stage, due to recent changes in the business climate and shortening product life cycles. CR following mass production often follows mold changes or product specification changes. It is often overlooked unless a substantial effect is expected, and thus companies miss an opportunity to make improvements.

In order to avoid missing these opportunities, involvement is required from higher up in the process. This is particularly true in the mass production type manufacturing industry, where CE (cost engineering or concurrent engineering; cost engineering is used more often recently) and Sourcing for Development performed in parallel with development. Those activities were conducted after development. For engineer to order businesses (such as in the engineer to order manufacturing or construction industries), procurement's involvement is required prior to

receiving the order from customer. Also, as information and logistics accelerate, procurement and sales will globalize and supply will need to be optimized on a global scale.

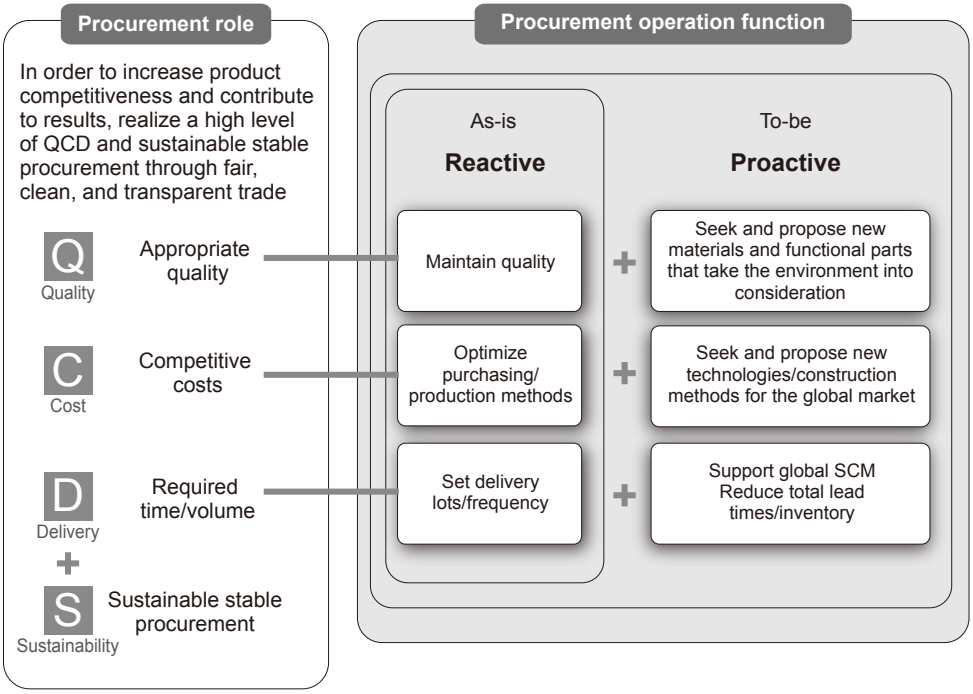
These changes will require the following (additional) functions of procurement:

- Q (quality): Find and propose new materials and functional parts that take the environment into consideration
- C (cost): Seek new technologies, new manufacturing methods, and suppliers that are competitive in the global market
- D (delivery): Support global SCM capable of realizing shorter total lead times (LT) and reduced inventory

In other words, work processes related to procurement functions are changing dramatically.

Figure 1-1-4 summarizes these changes. In this figure, traditional procurement functions are described as "reactive". Meanwhile, functions that will become more deeply involved at the development stage are described as "proactive". "Reactive" refers to a reactive stance in which certain defined tasks are performed according to decisions made during processes prior to procurement, or a stance of reacting to problematic events after they have occurred. "Proactive" refers to a stance where procurement is involved earlier and more actively, in order to demonstrate the functions required of procurement at an even higher level. With this stance, procurement attempts to prevent issues from happening, rather than reacting to them as they occur.

●Figure 1-1-4 Changes to Procurement Functions



4 Position of Procurement in Corporate Activities

Figure 1-1-5 uses the manufacturing industry as an example to show where the procurement function is positioned in manufacturing. There are two major processes in manufacturing industry activities.

- The first process is the supply chain, which provides products and services in response to orders received from customers, and then provides after-sales service, repair, and recovery of discarded items.
- The second process is the engineering chain, which develops products and services to provide to customers.

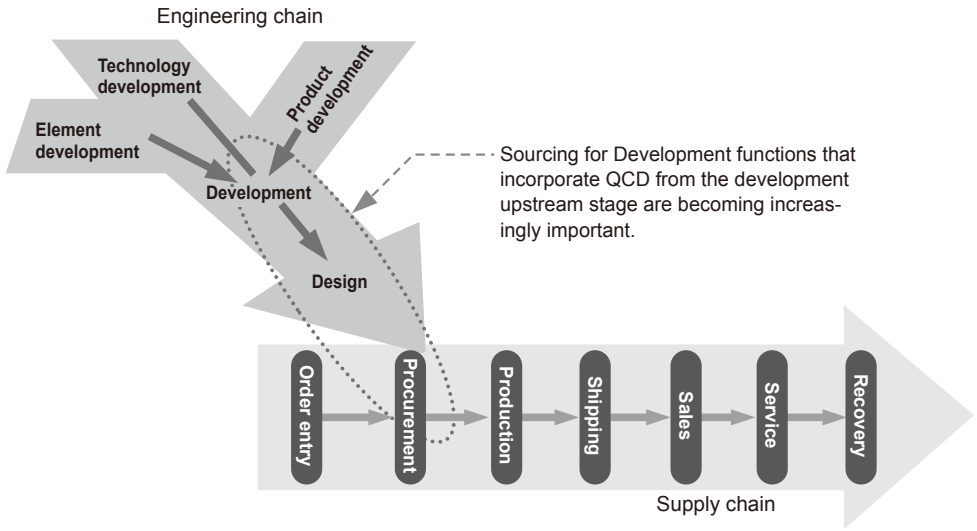
Generally, procurement is positioned within the supply chain on the horizontal axis, where it is required to procure items (with specifications decided from the development/design department) from suppliers without delay. However, the role required of the procurement function is changing in response to changes in business climate—it is becoming increasingly important for procurement to be involved in the engineering chain, which is higher up in the development process. This function is called "Sourcing for Development". Some companies separate their procurement functions between the supply chain and engineering chain.

In Figure 1-1-5, the engineering and supply chains cross at procurement. The engineering and supply chains are generally often thought to cross as production. However, as described earlier, it is becoming increasingly important for procurement to become involved in the engineering chain. In this figure, the two chains cross at procurement to clarify that this is the case.

The most important part of this figure is to what degree procurement is involved in determining specifications for procured items. Procurement is positioned like this especially in the mass production type manufacturing industry. For the engineer to order manufacturing, construction, and service industries, procurement should be thought of as becoming involved at a stage prior to where specifications for procured items or services are finalized. This is prior to the stage where the order is received, and even prior to the sales and marketing stages. In other words, think of it as though the engineering chain is replaced with that process.

For example, there are cases in the wholesale industry where sales personnel indicate procured items based on what their customers request. As a result, the types of procured items continue to grow, and there have been a number of cases where companies are unable to ensure volume for each type of item, and unable to procure items at competitive prices. If sales can cooperate with procurement to focus sales on items that can be procured at a competitive price, it should become easier to ensure profit.

●**Figure 1-1-5 Role of Procurement in Manufacturing**



5 Scope of Procurement

■ 5-1 Scope of Procurement and Work

Companies procure a wide range of things externally. Some examples include raw materials and parts used in products, dispatch workers, sub-contract (such as outsourced processing), manufacturing equipment or installation/repair work of the equipment, energy, promotional materials for sales, goods that does not go through the internal manufacturing process, office supplies and travel expenses for work, cleaning and security for offices and plants, and intangibles such as rights. Also, depending on the business, company products may be installed or built on the customer's site. Figure 1-1-6 lists some major procured items. Note that this excludes donations and M&A expenses.

Very few companies in Japan put their procurement departments (which may be called "material" or "purchasing" departments in some companies) in charge of all of these items. However, a good number of companies in Europe and the US stipulate that their "procurement departments have authority to place orders for all expenses paid externally".

They do this because centralizing payment information, supplier contracts, compliance, and environmental issues is desirable from the perspective of centrally handling supplier management. Some companies in Japan have even begun shifting their thinking in this way.

This Management Guide focuses mainly on direct material procurement. However, the procurement function does not change even if procured items do change, so from a standpoint of realizing competitive QCD, there are many points in common. Therefore, this should serve as reference even in cases outside of direct materials. ⇱Chapter 9 "Procurement for Specialized

●Figure 1-1-6 Scope of Procured Item

Procured item		Definition	(Reference) Common procurement departments				
			Material/ purchasing/ procurement	Production engineering/ engineering	Construction	General affairs	Sales/ marketing
[1]	Direct material	Raw materials, sub-contract processing /assembled parts used in direct products (contract manufacturing service [CMS]). Includes original design manufacturing (ODM; products where specifications are set by the buyer company, while detailed design, parts procurement, and manufacturing functions are outsourced).	○	○	○		
[2]	Goods purchased	Products and devices that do not go through the internal manufacturing process. Includes original equipment manufacturing (OEM; manufacturing products sold under the other company's brand).		○	○		○
[3]	Supply parts	After-service parts or supply parts.					○
[4]	Software	Software installed in products.	○				
[5]	Equipment	Production equipment and systems.		○			
[6]	Construction	Construction and installation.		○	○		
[7]	Indirect item	Sub-materials (packaging, etc.), maintenance parts, repair parts, office supplies, etc.	○	○		○	
[8]	Energy	Utilities such as electric power, gas, and water.				○	
[9]	Service	Service and intangible asset (service, travel, etc.).				○	
[10]	Sales promotion articles	Sale promotion samples (sample containers, bonus items, etc.) and sales promotion tools (signboards, hand bills, etc.).					○

* Handling of OEM items may vary depending on whether or not there is responsibility for QA.

Fields" contains details on equipment procurement, software procurement, and indirect material/ service procurement.

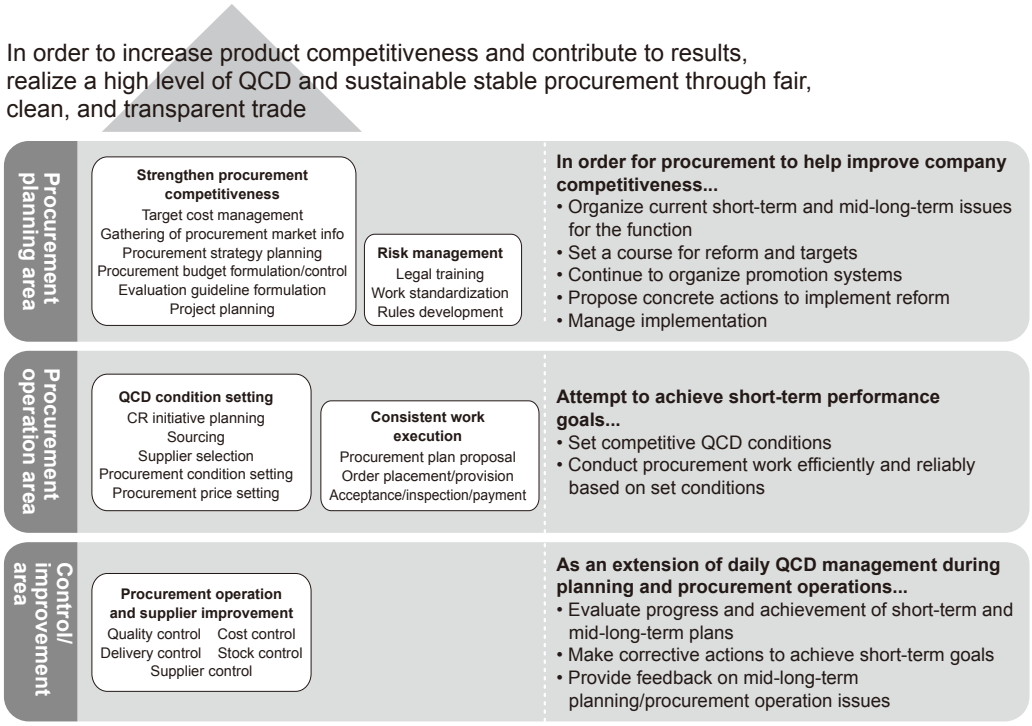
In this Guide, "procurement" refers to the work listed below. "Procurement" is used as a umbrella term that covers all of these processes.

- Participating in deciding what items to procure
- Sourcing (finding/evaluating/selecting suppliers)
- Determining procurement prices
- Arranging procured items (placing orders, managing delivery, receiving, inspecting)

■ 5-2 Procurement Functions

Procurement work functions can be categorized into three major areas: "procurement planning", "procurement operation", and "control/improvement". Figure 1-1-7 summarizes the definitions and work items in each area.

●**Figure 1-1-7 Procurement Function Organization**



(1) Procurement planning area

This refers to "organizing current short-term and mid-long-term issues for the function, setting a course for reform and targets, continually organizing promotion systems, proposing concrete actions to implement reform, and managing implementation in order for procurement to help improve company competitiveness". Stated more clearly, this refers to attempting to realize a high level of QCD competitiveness, proposing strategy, and then standardizing work and conducting risk management in order to realize fair, clean, and transparent trade, as well as sustainable stable procurement.

(2) Procurement operation area

This refers to "attempting to achieve short-term performance goals, setting competitive QCD conditions, and then conducting procurement work efficiently and reliably based on set conditions". "Short-term performance goals" is basically another way of saying "annual budget". "Setting competitive QCD conditions" refers to sourcing and actually determining procurement conditions/prices with suppliers. This also includes reliably following up on daily orders and deliveries according to procurement conditions.

(3) Control/improvement area

This refers to "conducting work during procurement operations in order to evaluate progress

and achievement of short-term and mid-long-term plans as an extension of daily QCD management during planning and procurement operations, making corrective actions to achieve short-term goals, and then providing feedback on mid-long-term planning/procurement operation issues". This includes such work as quality control, cost control, delivery control, stock control, and supplier control.

Figure 1-1-8 adds these three areas to Figure 1-1-4.

The "procurement operation area" involves direct work conducted to implement the "role of procurement", while work conducted to maintain set standards falls within the "control/improvement area". The procurement planning function is responsible for planning in order to improve procurement operations and control/improvement standards.

In order to respond to changes in the procurement environment, it is important to strengthen both the "control/improvement area" and the "procurement planning area". For example, in the "control/improvement area", there are many cases where evaluation results are not necessarily reflected to procurement policies, even if a company tracks transaction results with suppliers. Companies must not just continue to use the same suppliers. Instead, they must take evaluations into account and act accordingly.

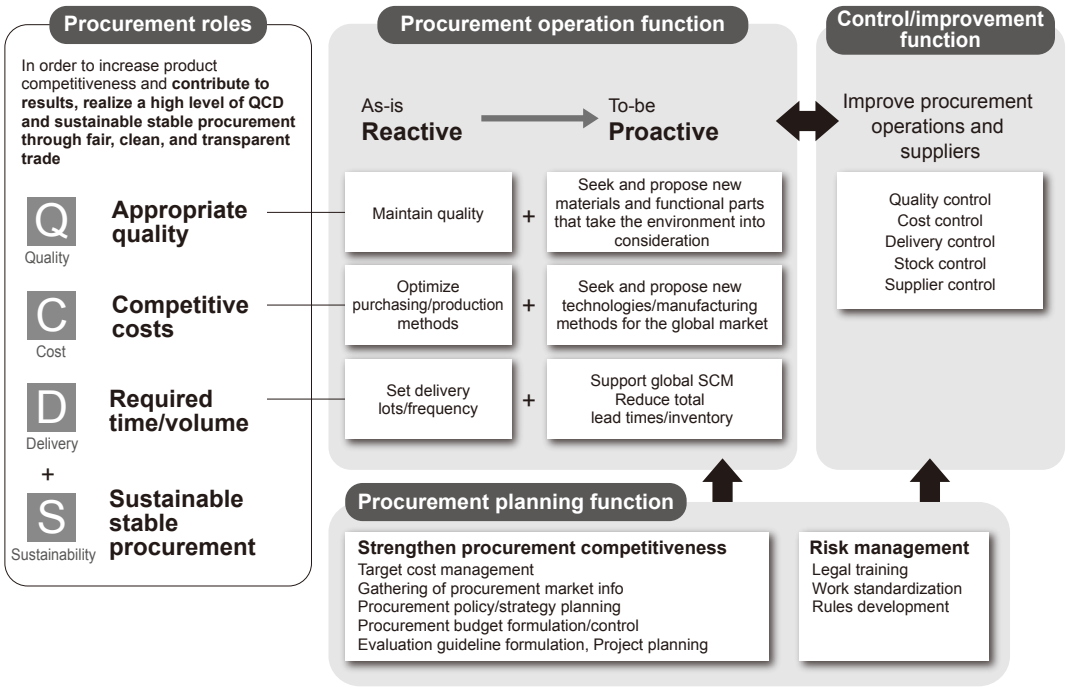
In the "procurement planning area", it is becoming increasingly important to follow changes to procurement market characteristics or to act in anticipation of these changing characteristics. Some examples include how required technology is changing along with changes to the technology fields of procured items, or how it is becoming increasingly important to strengthen risk management.

However, much higher goals are now set for procurement, and there have been many cases where procurement became stuck because work methods were not changed.

Although buyer ability is crucial to respond to these changes, the individual abilities of buyers will not be enough to perform the increasingly difficult roles required of procurement. It is therefore important to increase the "procurement ability of the entire organization". Further sections describe elements for improving the procurement ability of an organization.

Note that, although this Management Guide focuses on describing CR, it assumes that "Q and D are satisfied". The intention is not to sacrifice Q and D conditions for CR.

●**Figure 1-1-8 Roles of Procurement and Procurement Function Connections**



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Procurement Professional Study Guide

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JMA JAPAN MANAGEMENT ASSOCIATION

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Chapter 1

Strategy and Management

1 Strategy and Procurement

This guide describes the details of the strategy of the procurement area as one of the procurement planning functions. This section overviews management strategy and examines the procurement strategy as a part of the management strategy.

1 What Is the Strategy?

Strategy is initially a military jargon indicating a method to comprehensively manage the course of a war, by definition.

In turn, it has come to be called "management strategy" or simply "strategy" to establish an edge in a competitive environment in company management.

Strategy is defined in various ways in business management. The frequently used definition is "plan or measure to fill the gap between the ideal and current situation in a competitive environment." More specifically speaking, "ideal" is called "strategic target" or simply "goal." Strategy is a measure to achieve the goal. Strategy requires the factors: "competitive environment," "target," and "measure."

Part 2-Chapter 1 "1 Procurement Planning Roles" defines procurement strategy as "package of actions to achieve a business target." Procurement requires formulation of necessary actions to achieve the strategic targets and implementation of the measures.

Whether it be a whole company, business department, or functional department such as a procurement organization, it requires a strategy, which is a package of actions, to fill the gap between the ideal and current situation.

By the way, the word "tactics" is used as frequently as "strategy." The difference between them is said to be that strategy specifies what to do and tactics specifies how to do it.

In short, strategy is "What" and tactics is "How."

2 Strategy and Organization

This section sorts out the position of the strategy in the company organization.

Firstly, a company has a corporate philosophy which does not vary across the ages, and is the objective of a company its running business. In corporate philosophy, some companies express the basic value and mission in performance of business.

There is a vision under a corporate philosophy. Vision is a target like "what we will be and want to be in a certain future." While a corporate philosophy is the ultimate objective, a vision is an interim target to realize the corporate philosophy. Some companies do not clarify its vision but

shows the ideal direction as a philosophy, or vice versa. A corporate philosophy is the ultimate objective and the measures to realize it is inevitably rough, but a vision as an interim target expresses the future ideal in words and the measures to achieve the future ideal are a "corporate strategy."

The important point to be clarified by a company strategy is a domain, in other words a definition of an area where a company focuses, and allocation of in-house resources such as capital and human resources.

When considering a domain, it is necessary to make a definition from the following factors: market, which means which customers to target at, and product, which means what kind of technology to be used, furthermore, viewpoints, which means what kinds of functions to fulfill for customers. In the famous marketing case of American railroad companies, it is said that the companies lost in competition with trucks and airplanes because the companies regarded their business as "railroad" but did not define the function as "carry."

On the other hand, appropriate allocation of resources such as capital and human resources to each business and function is important to win the current competition and secure future growth.

Under the corporate strategy, the strategy of each business department in the company is "business strategy."

A business strategy is a measure to achieve the goal in the business area more specific than the corporate strategy. As with a corporate strategy, the point of a business strategy is allocation of resources and establishment of a competitive edge in the business area.

Moreover, under a business strategy, a strategy is formulated for each function such as technology, marketing, production, and finance. These are called "functional strategy."

Normally, a functional strategy is considered to support a business strategy. However, today, companies with a certain or larger scale rarely runs only one area of business and normally run multiple areas of businesses. In such cases, normally, there are not only functional strategies under a business strategy but also company-wide functional strategies.

In this case, each company struggles to establish a harmonious relationship between a business strategy and functional strategy.

3 Procurement Strategy

On a company-wide basis, a procurement strategy is positioned as a functional strategy but most of the modern companies position a procurement strategy in a business strategy as well as regard it as a company-wide functional strategy.

Actually, many companies have a centralized company-wide procurement function across the boundary of business. In this case, there is a relationship so-called matrix between each business strategy and company-wide procurement strategy and it might be difficult to adjust them.

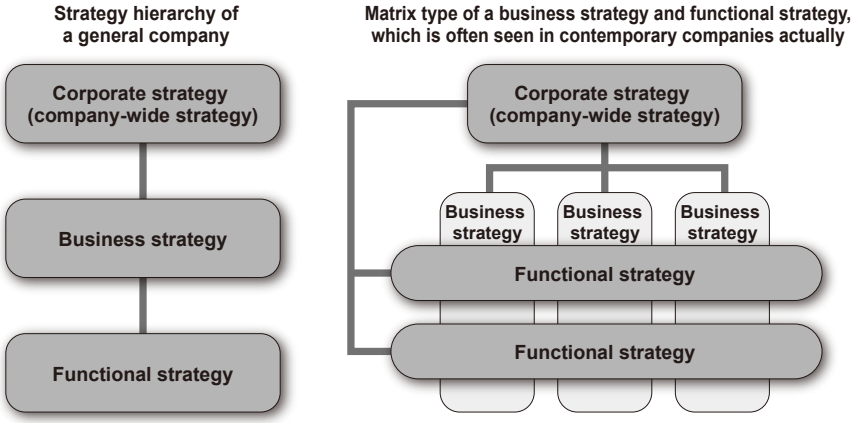
Typical examples are centralized purchasing and decentralized purchasing regarding the procurement system. In procurement, the merit of scale is widely recognized and actually effective. Therefore, it is often discussed in many companies to centralize the procurement functions company-wide or by group and realize CR (cost reduction) on a larger scale.

On the other hand, centralization also has negative aspects such as inability to make fine-tuned responses to each entity and deterioration of speed. In such a case, each entity will strongly desire a decentralized procurement function. In other words, the company will be faced with the choice of overall optimization or individual optimization in the procurement activity.

In addition, it is also necessary to make adjustments with other functional strategies such as a production strategy and technology strategy.

If a production strategy proceeds with overseas production, procurement will also need a procurement strategy with a global procurement system corresponding to it. In an area focused in a technology strategy, it is necessary to incorporate securing of the appropriate suppliers to support the necessary technologies in a procurement strategy.

●Figure 1-1 Strategy in a Company



●Figure 1-2 Actions Related to Procurement in a Company

Types of actions	Details and examples of actions
CR (cost reduction) strategy	Strategy regarding cost reduction which is a main mission of the procurement function Example) Centralized procurement, standardization, promotion of joint procurement, etc.
Supplier strategy	Strategy to optimize the relationships with suppliers Example) Promotion of narrowing down of suppliers
Global procurement strategy	Strategy to realize optimized global procurement Example) Setup of an international procurement office
Stable procurement strategy	Strategy on capabilities of suppliers and measures against surrounded risks Example) Conclusion of a long-term contract and adoption of multiple suppliers
Procurement IT strategy	Strategy for applying informational technology and its utilization in the procurement area Example) Setup of a portal for suppliers and submission of electronic data such as the certificate of non-use of environmental control substance
Procurement CSR strategy	Strategy of CSR regarding procurement Example) Promotion of environment friendly procurement

As explained so far, the optimal procurement strategy of each company is derived from the business environment, competition environment, and in-house system as well as the company-wide strategy, business strategies, and other function strategies (Figure 1-1).

Also, a procurement strategy contains specific actions as well from the viewpoint of regarding a strategy as a package of procurement actions. As examples, Figure 1-2 shows major actions under a procurement strategy.

This guide book illustrates each action as strategy because specific actions are also often called "XXX strategy" in practice.

4 Planning a Strategy

This section overviews a planning method of general strategy.

Firstly, it is assumed that the future ideal is clarified from the vision based on the corporate philosophy. Based on it, a strategy is formulated in the flow of [1] Analyze the environment, [2] Set a goal, [3] Plan strategy options, [4] Select the strategy to adopt, and [5] Development actions.

■ 4-1 Environment Analysis

(1) External and internal environments

Planning a strategy to fill the gap between the ideal at a certain future point and the current situation starts from an accurate grasp of the current situation and recognition of the issues.

The first step is to have a grasp of the situation around the company, that is a grasp of the environment. This is divided into:

- External environment analysis to analyze the environment outside the company
- Internal environment analysis to analyze the situation inside the company.

To grasp the external and internal environments, it is necessary to look at the situation of the necessary area so that there will be no omission or redundancy in consideration. There are various frameworks and methods for it and you should use them effectively as needed.

(2) Frameworks of environment analysis

The following introduces the typical frameworks:

[1] PEST analysis

To grasp the external environment from a macro viewpoint, overview from the points of politics (P), economy (E), society (S), and technology (T) (Figure 1-3).

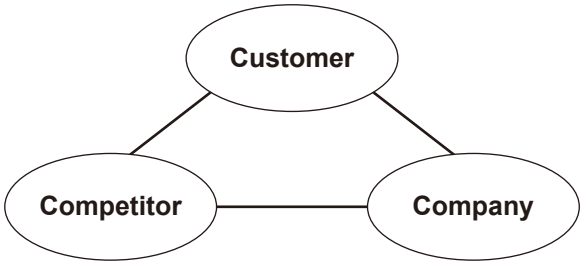
[2] 3C analysis

Consider the surrounding environment divided into customer, competitor, and company. This is often used for planning a marketing strategy (Figure 1-4).

●**Figure 1-3 Framework of External Environment Analysis and PEST Analysis**

Area	Specific contents
P - Politics	Trends of laws, regulations, governments, public corporations, foreign governments, trade agreements, etc.
E - Economy	Trends of economy, inflation / deflation, currency exchange, interests, etc.
S - Society	Situations of demographic change, religion, value, ethics, societal norms, public opinion, custom, lifestyle, disease, natural disaster, etc.
T - Technology	Trends of technology innovation, patent, production technology, etc.

●**Figure 1-4 Framework of 3C Analysis**



Considering that these three contents are the macro environment, industry and market environment, and in-house, this framework is highly versatile for looking down at the environment.

[3] SWOT analysis

Grasp the current position of the company dividing the surrounding environment into a total of four quadrants with the two axes <External environment / Internal environment> and <Opportunity / Threat>.

For details, see ⓈChapter 4-7 "2-2 SWOT Analysis."

[4] Five forces analysis

This is a framework of industry analysis advocated by Michael E. Porter. It will be explained in detail in the next section. It extracts five factors which determine the long-term profitability and grasp the industry structure about it.

[5] Value chain

This is also an analysis framework advocated by Michael E. Porter for grasp of the sources of the values generated by a company. It will also be explained in detail in the next section.

There are many other frameworks to grasp the current situation without omissions and construct a foothold of planning a strategy. It is important to utilize frameworks and keep a flexible attitude to consider without sticking to the frameworks as needed not to make creation an end in itself.

This is because it is important in planning a strategy to clarify the real issues based on an understanding of the current situation.

■ 4-2 Setting of the Goal and Direction

Next, set a more specific strategic goal based on the "ideal" at a certain point indicated in the vision. Set the basic concept, quantitative goal qualitative goal, etc.

After setting the strategic goal, structure the issues recognized towards the achievement of strategic goal and formulate an overall strategy scenario. When examining the recognized issues thoroughly into the root cause, you will find that many issues which appeared to be different phenomena are the same issue with the same root. Clarify the root cause and set the overall direction of the strategy.

■ 4-3 Creation and Selection of Strategy Options

When developing a strategy, it is necessary not to bundle together but development about three strategy options for possible future cases. The developed strategy options shall be evaluated from various viewpoints and the best option shall be extracted as the strategy to implement.

■ 4-4 Planning Actions

After determining the strategy, clarify it into specific actions to implement it. It is important to deploy the strategy to the point of policy enforcement so the strategy can be put into actual actions.

After that, deploy it to the annual plan, budget, etc. and construct a system to follow up on the actual progress.

Consult "Procurement Professional Management Guide" for specific descriptions on how to plan a strategy when building a procurement strategy (See Ⓜ Part 2–Chapter 1 "4 Key Points for Developing Procurement Strategies").

5 Management Strategy Examination Framework and Procurement

This section examines a strategy from a viewpoint of procurement using typical management strategy examination frameworks.

Among strategy frameworks, this section picks up "Five Forces" and "Value Chain" from the competitive strategy, which is representative strategic management in 1980s, advocated by Michael E. Porter, Professor at Harvard Business School, mentioned above, and "Balanced Scorecard" advocated by Robert S. Kaplan and David P. Norton, representing 1990s.

5-1 Procurement Strategy in "Five Forces"

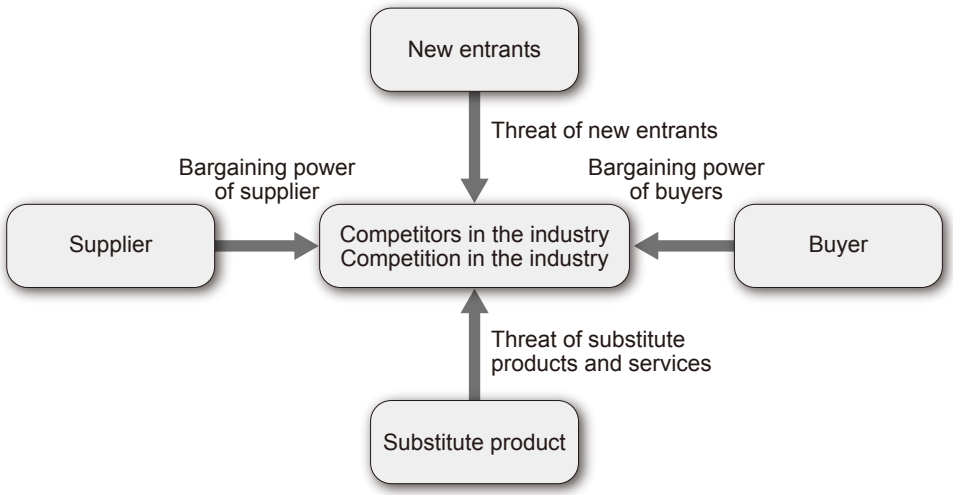
Porter advocated the concept of the framework to grasp the industry structure, "Five Forces", as a method to analyze the external environment in his representative book "Competitive Strategy" (Figure 1-5). He argues that as shown in Figure 1-6, the five forces are "competition in an industry," "threat of new entrants," "threat of substitute products or services," "bargaining power of buyers," and "bargaining power of suppliers" and it is important to recognize the industry structure analyzing these forces.

This section examines the viewpoint of procurement for "bargaining power of suppliers." In an industry where this part is significant, a procurement strategy has an important position in a corporate strategy. Specifically speaking, the following cases are possible:

●Figure 1-5 Framework of "Five Forces"

Five forces	Definition
Competitive rivalry	The severer the competition in the existing industry is, the severer competition in terms of price, product development, etc. becomes. This leads to decrease in the profitability of the industry
Threats of new entrants	If new entry is easy, competition will be severer and profitability will decrease
Threats of substitute products and services	The decreased profitability in the industry due to competition between the existing products and substitute products from other industries
Bargaining power of buyers	The decreased profitability through price reduction and cost increase due to requests from buyers such as discount, quality improvement, and service improvements
Bargaining power of suppliers	The decreased profitability due to the strong bargaining power of suppliers such as increase in the price of raw materials, etc.

●Figure 1-6 Structure of Five Forces



[1] The corresponding industry is occupied by a monopolistic supplier or oligopolistic suppliers

[2] There is no substitute product

[3] Buyers are not important customers for suppliers

[4] The products of suppliers are important for the business of buyers

[5] The cost to switch the products of suppliers with those of competitors is high

[6] Suppliers are expected to integrate the downstream processes by acquiring buyers, etc.

In these cases, the power of the supplier companies who fulfill the procurement function is strong and the relationship with the supplier companies has a significant impact on the overall corporate strategy.

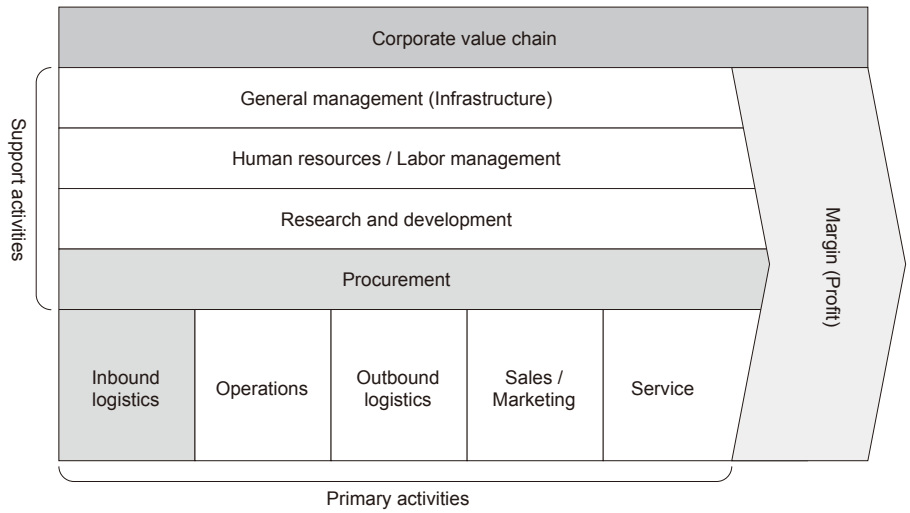
5-2 Value Chain

Value chain is the analysis framework to identify the source of a competitive edge. It was also established by Porter in his book "Competitive Advantage" (Figure 1-7).

The products and services purchased by customers are cumulative values generated by a company and Porter divided the process of generation of values in a company into five primary activities and four support activities. The value chain contains the primary activity "inbound logistics" and support activity "procurement" as procurement-related activities.

In the figure, inbound logistics is the process of carrying raw materials to a plant. Specifically speaking, it seems that in inbound logistics in Japan, it contributes to improvements through reduction of procurement lead-time, on-time delivery ratio (OTD), etc. in the procurement supply chain by the collaboration between suppliers and buyers such as VMI. It, Vendor Managed Inventory, is a method for a supplier to manage the inventory of procured goods

●Figure 1-7 Value Chain



In Japan, this is handled by suppliers so it is difficult to recognize as a value creation area of buyers. However, generally, buyers in charge of import are responsible for logistics in import operations, so they can understand this naturally.

The support activity "procurement" indicates procurement activities such as determination of clients and prices, order, delivery date management, and acceptance for procurement of goods and services from outside.

In some industries, the procurement function is the most critical point in value creation of a competitive edge. In such industries, enhancement of procurement is equivalent to the source of a competitive edge of a company.

5-3 Balanced Scorecard

Balanced Scorecard is a framework to examine a strategy, as well as the performance evaluation system advocated by Robert S. Kaplan, Professor at Harvard Business School, and David P. Norton, consultant, in 1990s.

You can recognize the process to create company values by making a strategy map associated with the business strategy using the concept of balanced scorecard.

For balanced scorecard, four perspectives are advocated as the standard forms.

They are "financial," "customer," "internal process," and "learning and growth."

Firstly, the word "Balanced" in its name indicates that a company has to keep balance in several meanings. The following show the major ones:

[1] Financial and non-financial

Do not stick to only the numeric values on the financial statements but keep balance in the non-financial perspectives: "customer," "internal process," and "learning and growth."

[2] Past, present, and future

Keep balance among "financial," which is the result of company activities, "customer " and "internal process," which are current issues, and "learning and growth," which is a future issue.

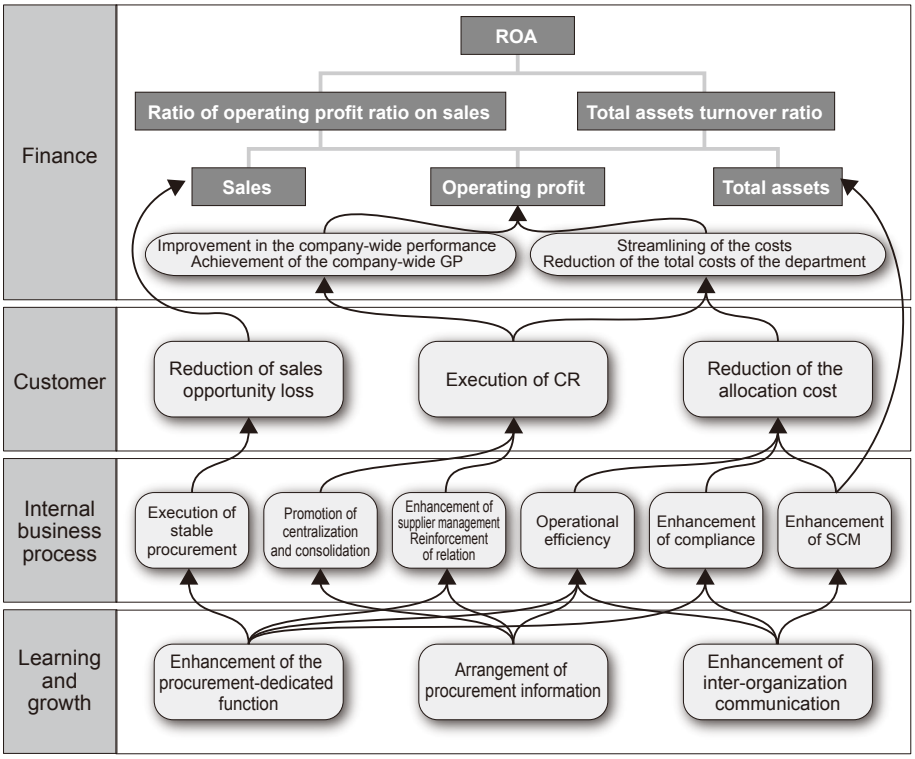
[3] Short-term, mid-term, and long-term

Keep balance among "financial," which is the recent performance result, "customer " and "internal process," which are a little longer perspective, and "learning and growth," which is a long-term issue of an organization and people.

The background of generation of this concept would be the short-term oriented attitude of American companies to pursue improvement only in the most recent performance at that time. It was thought that this viewpoint alone could not necessarily secure long-term development of a company.

It is also understood that a company will diminish someday if "learning and growth" such as training of people and organization, which tends to be neglected when busy, is weak.

●**Figure 1-8 Balanced Scorecard in the Procurement Organization**



For the procurement department, you can also consider what is the value creation activity balanced as a procurement function using balanced scorecard.

Figure 1-8 shows an example of balanced scorecard in the procurement department.

This indicates that the procurement department also has to not only pursue short-term numeric values but also improve customer support and business processes, moreover, train people and organization from a long-term viewpoint.

2 Procurement Organization

When implementing procurement activities, it is important for determination of the procurement power to have what kind of a procurement organization. Firstly, this section examines the organization for procurement after overviewing the form of the organization and considerations of the organization in a company.

When designing a procurement organization, it is necessary to consider from the following viewpoints:

[1] Position in the whole company and roles with the related departments

[2] Organization design in the procurement function

[3] Organization capabilities of the procurement organization

1 Organization in a Company

Alfred Chandler, a well-known management scholar, said "Organization follows strategy."

This means that a company strategy prior to the organization: you should formulate a strategy first and then construct an organization according to the strategy.

On the other hand, Igor Ansoff presented an opposite argument "Strategy follows organization." Opposite to the opinion of Chandler, Ansoff indicates that a company strategy should follow the organization.

Neither of these is absolutely correct or wrong. You should rather recognize that a strategy is so closely related to the organization.

This guide is based on the philosophy that "an organization is one of the important factors to realize a strategy." However, the available strategy level is limited depending on the organization capabilities. Reinforcement of the procurement infrastructure can be said to be loosening or elimination of such constraints.

■ 1-1 Concept of a Company Organization

(1) Line and staff

Generally, a company organization is divided into line and staff.

- Line is an organization directly related to execution of business and is responsible for profits.
- Staff is an organization to support the business of line and provides support based on expertise for line.

Generally, in a large company, manufacturing and sales departments are line and accounting, personnel affairs, and legal departments are staff. An organization composed of line and staff is

called a line-and-staff organization. Procurement may be in line in some companies or in staff in other companies, depending on the case from company to company:

(2) Profit center and cost center

In a company organization, organizations might be classified into a profit center, which is responsible for profits, and a cost center, which is responsible for costs only.

A profit center is responsible for profits, so it is considered to be an independent business unit, which is responsible for both sales and cost. On the other hand, a cost center is responsible for only cost reduction within its function and scope.

Generally, a procurement organization is positioned as a cost center.

■ 1-2 Type of a Company Organization

Typically, the overall corporate organization is consisted of the following organizational forms:

- **Organization by functions**: Organization structure constructed by functions such as sales, manufacturing, personnel affairs, accounting, and procurement, classifying company functions by function.
- **Organization by business units**: Organization constructed by product, customer, or region to be responsible for profits and execute the business. It is composed of organizations which deploy self-contained business activities, that is a group of business units.
- **Matrix organization**: Organization system to report to both functions and business units integrating an organization by functions and organization by business units.
- **Special organization/Committee**: Organization to consider an in-house specific issue by a cross-functional member composition.
- **Special organization/Project team**: Organization constructed for a series of non-repetitive work with a deadline for a specific theme.
- **Company organization**: Company organized by more independent companies than divisions. It is considered to be a developed form of a divisionalized company.
- **Intrapreneurship**: Organization specially constructed independently from the existing in-house rules, procedures, systems, and organization for business which is risky and likely to be rejected as of now.

2 Position of a Procurement Organization in the Whole Company and Scope of Roles with the Related Departments

The position of a procurement organization in a company is different largely depending on the degree of affecting the business of the items procured from outside.

Simply put, the larger the proportion of the items procured from outside in the costs is, the more

people belong to the procurement organization. On the contrary, if the proportion is small, the procurement organization may be included in another organization such as the general affairs organization.

If many people belong to the procurement organization, there are several forms of the organization. The following describe the position of a procurement organization in the whole company and roles with the related departments.

■ 2-1 Department Which Handles Procured Items

Procured items in a company are wide-ranging including not only direct materials such as materials and parts of products but also equipment, indirect items, services, etc. Quite a lot of companies which procure and process primary products as raw materials organize a raw material department as a department to procure raw materials. As such, a procurement organization is called by various names such as procurement department, purchasing department, material department, and raw material department, in each company. However, the department does not necessarily cover all items procured from outside. It is often the case that another department is also in charge of procurement in a way that an engineering department procures equipment, and general affairs department purchases office supplies out of indirect items.

It is an important point to note when considering a procurement organization that not all procured items are procured by the procurement department and you should grasp which department is in charge if the procurement department is not in charge.

Recently, companies, mainly European and American companies, increase the system in which the procurement departments cover resources not available in-house but from outside, in other words all of the cash outflow.

■ 2-2 Position of a Procurement Organization

A procurement organization is positioned in the following three types in relation with the whole company and business-line organization:

[1] Business-cross type procurement organization

Set up in staff as a company-wide organization and provides the procurement service across multiple entities.

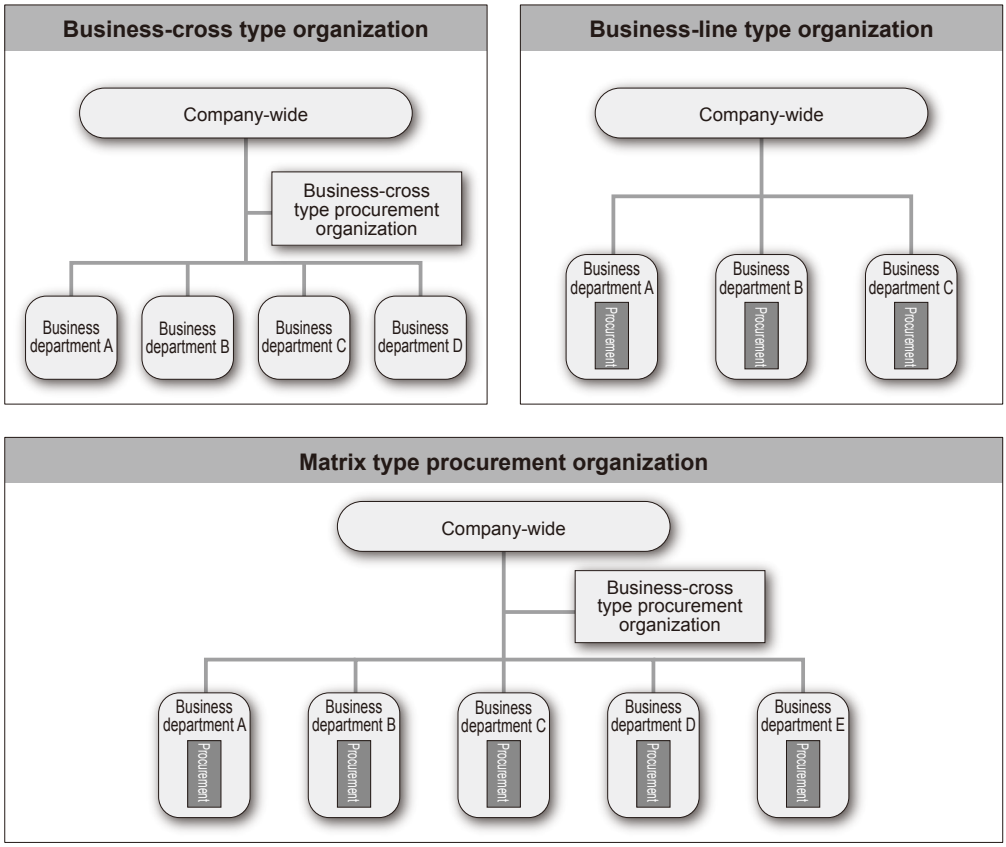
[2] Business-line type procurement organization

Belongs to each business-line organization or plant, is positioned as a department of a business-line organization, and provides the procurement services only to the business line or plant.

[3] Mixed type procurement organization

Mixture of the business-cross type procurement organization and business-line type

●**Figure 1-9 Three Types of the Position of a Procurement Organization**



procurement organization. For example, an organization is divided by functions and then procurement IT system management, global procurement, etc. belong to the business-cross type procurement organization for specialty and the other procurement functions belong to the business-line type procurement organization.

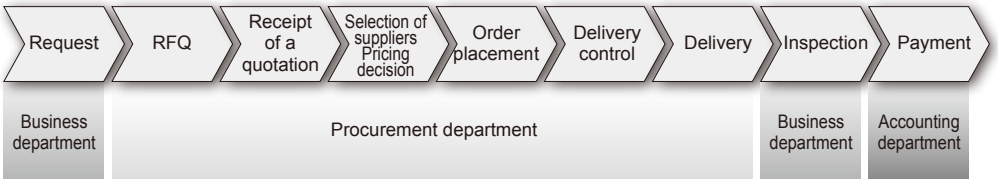
Or an organization is divided by procured items and then the items purchased in common company-wide are procured by a business-cross type procurement organization and the other items are purchased by business-line type procurement organization. In reality, many companies have more complex mixed type procurement organizations from various viewpoints.

A company should flexibly adopt the optimal system of a procurement organization from business-cross type, business-line type, or mixed type based on its industry circumstances, internal system, etc. (Figure 1-9).

■ 2-3 Roles on Business Process

On the other hand, from the viewpoint of the in-house business process, the procurement function as a whole can be completed by making any department execute the business related to

●Figure 1-10 Example of Roles on Business Process



procurement on the process.

Generally, upstream requests are issued from departments, including business department, which use procured items. After downstream delivery acceptance, the procurement department accepts delivery and sends it to the requesting department, and then the department in charge in the requesting organization inspects whether the items meet the purchase requirements. If the items pass this inspection and/or confirmation, they are accepted and payment is settled. Finally, the accounting or finance department handles payment.

There are several forms of response to delivery. In some cases, the purchased items are transferred to the requesting business departments immediately. In other cases, the procurement department manages the inventory of purchased items and gives them to the business department when using them.

It is important for organization design to clarify the definitions of roles: which organization will execute which operation in the process like this (Figure 1-10). Especially, as for the rights in a procurement organization, the supplier determination right and purchasing price determination right should attribute to the procurement department. In addition, it is also important for organization design to divide roles among multiple organizations in order to keep a check and balance function to prevent inappropriate processing from the viewpoint of internal control as well.

■ 2-4 Roles on Product Life Cycle

The roles of procurement are expected to expand in product life cycle, that is, the flow from creation to usage of a product: planning -> development and design -> production -> sales -> after-sales service.

In the past, the roles were limited to acquisition of the necessary items for production. However, as recently the importance of Sourcing for Development has been recognized, expectation for value creation in selection of materials in upstream development and design has been increasing. For some products and business, expectation for roles of procurement in more upstream planning stages is increasing.

On the other hand, in some cases, external resources are used for downstream installation, maintenance, etc. from the viewpoint of the whole product life cycle. For such areas, the procurement department is expected to be involved more and improve the management capabilities.

3 Organization Design in the Procurement Function

The preceding sections clarified the position in the company-wide organization and roles in the process, and product life cycle. This section examines the organization design in more detail.

One viewpoint is division of roles by functions. In a procurement organization, a line function to actually purchase procured items and services and a staff function for budget management, compliance, development and management of IT tools, etc. are required. A line functions are further divided from various viewpoints.

The following show cases of division.

[1] "Purchase," which is to purchase items based on the catalogs of suppliers, and "contract manufacturing," which is to consign manufacturing based on the specifications of the buyer company

[2] "Organization dedicated to the prototyping stage" before launch of a product and "organization dedicated to the mass production stage" after launch of a product

[3] "Procurement of direct materials," which is directly used for manufacturing, and "procurement of indirect materials" which is used in a plant or office

[4] "In charge of domestic suppliers" and "in charge of overseas suppliers"

The division should be selected flexibly considering the situation of the procured item market

●Figure 1-11 Centralized Procurement and Decentralized Procurement

Key points of design of centralized and decentralized procurement

- ●Ability to flexibly set the range of centralized procurement including inside the group
- ●Flexible relationships between requesters and the procurement department

Direction of centralization (Recognition of the merits of centralization)

- ●Arrangement of procured items: Make arrangement for a lump-sum purchase in case the same item is purchased from different locations
- ●Arrangements of similar items: Make arrangement for a lump-sum purchase of similar items
- ●Arrangement of suppliers: Narrow down the suppliers to purchase items from
- ●Utilization of expertise: Make arrangement for a lump-sum purchase which require expertise
- ●Centralization in the design stage: Promotion of standardization

Flexible selection between centralized procurement and decentralized procurement

- ●Recognize the strengths and weaknesses of each of centralized procurement and decentralized procurement and create an effect by optimal utilization

	Strength	Weakness
Centralized	Utilization of the volume	Difficulty to make fine-tuned responses Slow speed
Decentralized	Fine-tuned responses Quick speed	Inability to make good use of the volume

corresponding to procurement of the company, characteristics of the procured items, etc.

Regardless of the company-wide strategy, "centralization" and "decentralization" have to be considered to some extent in the procurement function. Figure 1-11 shows the points of consideration of an organization of centralized procurement or decentralized procurement.

Especially, the point to centralize depends on how to reinforce the procurement capabilities. It is important to clarify this point in organization design.

4 International Procurement Office

International procurement (purchasing) office, so-called IPO, is one of the organizations run mainly by the procurement department.

The very first IPO was established by an American computer manufacturer to convey the intention of the buyer company to suppliers more effectively and achieve the objective of procurement along with an increase in procurement from Asia. Now, quite a lot of Japanese manufacturers also have such IPO.

The following shows the missions of an IPO:

- Minimize the total cost of locally procured items using the local expertise in the territory, etc., in overseas procurement
- Build a good relation with supplier, being located near the head office of the supplier and reinforcing the connection with the executives of the supplier
- Try to find the optimal procured items through sourcing activities
- Provide information on suppliers, market conditions, etc. of the assigned region

The following points are considered to be functions:

[1] Function + SCM management function (contract management, procurement management, supplier management, and logistics management)

[2] Sourcing (researches of procured items and suppliers, procurement supply chain design, and market research)

IPO is expected to greatly contribute to the business by working effectively in these missions and functions.

However, the problem is about the method to collect costs for setup and management of IPO.

In some cases, basically, an IPO is financially independent by collecting the costs through commissions and consignment expenses for procured items. In other cases, it is positioned like a representative office called IPLO (international procurement liaison office) and managed by remittance from the head office.

In any cases, such an organization has to consider its setup and management carefully examining its degree of contribution and cost effectiveness in procurement.

5 Organization Capabilities of the Procurement Organization

A procurement organization creates values by making use of expertise in the procurement area and supporting the business. To do so, the important points are the position and composition of the organization as well as how to improve the power of the organization itself, that is the organization capabilities as a procurement organization.

To improve the organization capabilities, it is essential to establish a mechanism to improve the skills of individual members of the organization and the organization capabilities. The following examine the points to improve the skills of individuals and organization capabilities.

■ 5-1 Human Resources Development in a Procurement Organization

Skills of individuals in a procurement organization are considered to be knowledge and execution capabilities in the following three areas:

[1] Procurement knowledge

Knowledge for execution of procurement business is necessary regardless of the industry such as pricing, supplier management, and contract management.

[2] Knowledge on procured items, business category, and industry

This also includes knowledge on procured items themselves, business category to which the company belongs and products using the procured items are introduced, knowledge unique to the business category, market to which the supplier belongs, etc. It is desirable for procurement professionals to be more familiar with knowledge on what they purchase than any other persons in the company.

[3] Basic knowledge on business

Basic knowledge on business such as financial knowledge, business legal knowledge, Corporate Social Responsibility (CSR), etc.

Especially, procurement knowledge tended to be confused with knowledge on procured items, business category, and industry, moreover, the basic knowledge on business. A procurement organization has to get procurement knowledge in a systematic, deep, and professional manner in order to use expertise of the in-house procurement area. It is necessary to actually use it to drive actions to achieve the objective.

Therefore, it is important to take the following human resource cultivation actions for individuals who belong to the procurement organization and incorporate a mechanism to improve the organization capability in the organization.

[1] Requirements for individual skills

Determine the skill requirements which clarify the roles and responsibilities which procurement

professional should fulfill and clarify the skills of each individual for the skill requirements The skill requirements and the skills of each individual for them shall be important factors for determination of their wages and positions, etc.

[2] Training for individuals

Arrange a training system to educate individuals on the necessary knowledge for procurement professionals. For the training, set the required subjects to meet the above-mentioned skill requirements, etc.

[3] Career roadmap for individuals

Create a guideline for the future of individual career and disclose it to members as a career roadmap. This guideline shows what kind of skill requirements should be fulfilled within years and what kinds of training should be required in order to meet the ideals. The above mentioned skill requirements and training are also included in this guideline.

5-2 Mechanism How to Connect Individual Skills to the Organization Capabilities

A procurement organization should build a mechanism to connect individual skills to the organization capabilities as mentioned above. The following show the points:

(1) Allocation of personnel

It is often said in all kinds of organizations that it is necessary to assign the most appropriate human resources to the appropriate positions in order to improve the organization capabilities. This also applies to the procurement area.

However, if the best human resources at a certain time are assigned to certain positions for a long time, they lose their drive for motivation, know-how depends on them too much and it may become an obstacle to transfer, and the organization capabilities may diminish drastically when the human resources leave the organization for some reasons. It is not necessarily good to continue the same work for a long time.

Therefore, it is necessary to rotate the persons in charge of procurement in order for the skills of each individual to improve the organization capabilities from a mid- and long-term viewpoint.

Also, you should consider acquiring human resources from outside the procurement department to activate the organization by transferring developers and designers from outside the procurement organization and recruiting experienced persons in charge of procurement from other companies.

(2) Compilation of a database of skills

It is effective in consideration of personnel assignment to compile a database of what kind of skills they have based on the past work experiences and self-help efforts of each individual.

It is necessary to put right people in right places in procurement based on the database as well

as confirm excess and deficiency of the necessary skills for the organization, reinforce the deficiency areas by training, etc., and then reinforce the organization capabilities.

(3) Accumulation of procurement-related information

Another example of a mechanism to improve the organization capabilities is knowledge management to use the knowledge of the organization. In a procurement-dedicated organization, each member has various knowledge on procurement based on their experiences, etc. If all of them can share and use the knowledge, it will be a great power for the organization.

However, in actual management, it is not as simple as just registering knowledge to a database in a computer. It is necessary to build and manage an effective mechanism to constantly maintain and manage registration of new and correct information of the appropriate area to the database.

Therefore, for example, such measures are possible as recognizing members who register knowledge quoted many times or highly appraised and associating knowledge registration with performance evaluation.

For details of knowledge management, see Chapter 10 "3 Knowledge Management and Skill Management."

3 Supplier Relationship Management

1 Relationships with Suppliers

■ 1-1 Importance of Management of Relationships with Suppliers

In the past, Ford Motor Company, which left its mark on the industry history by mass production, mass-produced the famous car model, Ford Model T, at the River Rouge plant. The River Rouge plant is a self-contained vertical integration plant which even had an iron mill and glass plant to produce the necessary iron and glass for cars.

Now, only few of such vertical integration plants remain and instead it is general to procure materials from suppliers.

Procurement from specialized manufacturers is better than the principle of self-sufficiency thanks to the edges in cost and technology and the better ability to respond to fluctuation. However, external procurement of materials leads to dependence of procurement of the necessary items on outside the range of in-house control and the risk increases.

It is important to appropriately manage the relationships with suppliers which supply procured items for the issues of securing of an advantage of external procurement and how to reduce risks associated with procurement.

■ 1-2 Relationships Between Supplier and Buyer Companies

Let's consider relationships between supplier and buyer companies.

The edge of the "purchasing" side is often emphasized in procurement business. A buyer company can select suppliers and is relatively advantageous in its position. However, many buyers would be feeling that the situation is not so simple anymore.

For example, in the personal computer industry, the business deployment method varies depending on whether a microprocessor of an American semiconductor manufacturer or OS of an American software company is implemented. In this case, the suppliers control the root of the business of the buyer companies and the procuring side, buyer, has to take a low profile.

Even in other cases than these typical examples, it is procured items such as procured materials and parts that support the product competitiveness of a buyer company and the attractiveness, product price, on-time delivery, quality, etc. of its products may depend on the suppliers which supply the items. In some cases, the attractiveness of the products of a buyer company depends on the items procured from suppliers so it is not necessarily superior to them. The relationship

between suppliers and buyer companies are becoming more and more influenced by procured items or timing.

Also note that suppliers are not simply suppliers but also sources of supply to provide the necessary resources to a buyer company. A buyer company has to build more long-term stable relationship based on the trust relationships with suppliers which supply important resources for execution of business.

However, if the existing suppliers cannot make responses at the expected level or meet new requirements of a buyer company, it may be necessary to find new suppliers and build a new relationship.

"Roles" which procurement is expected to fulfill is to be able to procure the necessary resources from outside for the company at anytime in need with appropriate conditions from outside. Therefore, it is very important for procurement to execute the company strategy from the viewpoint of what kind of relationships to build and maintain with the existing suppliers and how to find new suppliers and build relationships with them.

Here is the necessity for a strategy to establish appropriate relationships with suppliers. In other words, in order to increase buyer company value, maintenance and development of appropriate relationships with suppliers means establishment of relationships with supplier where supplier can perform to lead its improvement in values

The following section examines the relationships with suppliers from a strategic viewpoint.

2 Business Relationships with Suppliers

This guide defines a supplier as "supplier of a procured item" at the beginning of the management guide.

Procured items are diverse including raw materials, electric parts, office supplies, sheet metal processing, assembly of equipment, development of software, and installation of equipment.

There is a concept to divide the business relationship with a supplier depending on procured items.

2-1 Purchasing and Outsourcing

In some cases, purchasing of procured items, that is, a business relationship with a supplier, has been divided into: "purchasing" and "outsourcing."

Purchasing is a function for a buyer company to procure an item planned, developed, and manufactured by a supplier. Simply put, it is to purchase what is sold outside. Procurement of raw materials, electric parts, and office suppliers means purchasing.

Outsourcing initially means consignment of work which has been done in-house to outside.

In the manufacturing industries, companies have often consigned manufacturing to a supplier in order to complement for lack of the in-house manufacturing capabilities or to reduce the manufacturing costs. In terms of procurement, outsourcing often indicates contract manufacturing. However, outsourcing is consignment of work which has been done in-house to outside, so consignment of business such as repair, development of software, cleaning, and security is also called "outsourcing."

In outsourcing, a buyer company presents the contents of consignment such as specifications and drawings, and then a supplier manufactures or repair items based on them.

It is considered that management is different between purchasing and outsourcing whether a buyer company makes instructions. In the case of outsourcing, the buyer company sometimes has to be involved in issues with management of the supplier and make instructions for management of the schedule, quality, process, etc.

■ 2-2 Sales Contract and Subcontract Agreement

Legally speaking, the types of procurement are a transaction by a sales contract and that by a subcontract agreement.

Sales is a contract prescribed by Article 555 of the Civil Code for one of the Parties (supplier) to transfer the property right of the object to the other Party (buyer) and for the other Party (buyer) to pay for it.

Subcontracting is a contract prescribed by Article 632 of the Civil Code for one of the Parties (contractor) to promise to complete work for the other Party and for the other Party (orderer) to promise to pay compensation for completion of the work. The most typical form of outsourcing is based on this subcontracting agreement.

The Subcontract Act, which requires secure management in purchasing in Japan, stipulates that it is not a subcontracting transaction if any procured items listed in a catalog considered to be a sales contract are purchased.

3 Actions to Build a Desirable Relationship with a Supplier

In procurement activities, the expression "Manage a supplier" is used. The expression appears to mean that a buyer company manages suppliers themselves, but in reality, it would be appropriate to recognize that what is managed is the relationship with the suppliers.

In the sales side, it is called CRM (Customer Relationship Management): management of relationships with customers. This is an action of management focusing on building and developing a relationship with customers to improve customer satisfaction. After appearance of this concept, the concept of SRM (Supplier Relationship Management) also appeared in the

●**Figure 1–12 Descriptions Related to Suppliers in This Guide**

Theme	Reference destination	Definition
Key points for developing procurement strategies	Ⓜ Part 2–Chapter 1 "4 Key Points for Developing Procurement Strategies"	Describes the planning process of a supplier strategy as the core of a procurement strategy.
Selection procedure in supplier decision (forth decision)	Ⓜ Part 2–Chapter 4 "3 Key Procurement Process Points Determining Suppliers (Fourth Decision)"	Describes the selection procedure in supplier appointment (fourth decision).
Supplier evaluation, maintenance, and management	Ⓢ Chapter 4 "1 Supplier Evaluation, Maintenance, and Management"	Describes the supplier evaluation method, etc. recognizing that realize a high level of QCD and sustainable stable procurement requires building and maintaining a more robust supplier group.
New supplier sourcing	Ⓢ Chapter 4 "2 New Supplier Sourcing"	Describes how to find new suppliers in order to maintain a robust supplier group and find suppliers of new procured items.
Procurement management including development and design consignment	Ⓢ Chapter 3 "5 Procurement Management Including Development and Design Consignment"	Describes the procurement activities of development itself.

procurement side as well. This is recognized as strategic management of the relationship with a supplier by a buyer company to increase contribution to the business departments through CR and efficient execution of business for procurement from outside.

The procurement department of each company formulates strategies to manage and develop the relationships with suppliers and executes various actions.

This guide also contains various descriptions focusing on the relationship with a supplier.

The following describes how to manage the relationship with a supplier based on the above descriptions that mention a supplier in this guide.

4 Management of Relationships with Suppliers

■ 4-1 Direction of Relationships with Suppliers

As the first step to manage relationships with suppliers, it is necessary to clarify the directions of the relationships with suppliers such as what kinds of suppliers you should or should not have a business relationship with and how to maintain and develop the relationships with suppliers.

The followings are the major items that are included as directions:

[1] Requirements which suppliers should meet

Stable performance, established quality system / environment management system / information security system, appropriate CSR support, availability of appropriate BCP, etc.

[2] Discontinuation conditions of current suppliers

Cases where no continuous transaction remains or the continuous trade conditions are not met in performance evaluation. For example, a condition that the account is abolished when no item is procured for one year.

[3] Correspond to risk

Policies as a buyer company to make responses to risks associated with suppliers such as supply risks CSR risks, and response rules in the event of misconduct, etc.

4-2 Holistic Supplier Relationship Management

Normally, a Japanese manufacturer has business relationships with a few dozens to thousands of suppliers.

What kind of relationships should they establish with such a large number of suppliers?

Firstly, it is impossible and unreasonable to deal with all of these suppliers in the same way. It is often the case that they arrange suppliers in descending order of the purchasing amount and apply a different management method for each group: e.g., grouping suppliers accounting for 60% of total purchasing amount as group A, suppliers accounting for 60 – 90% as group B, and the rest (90 – 100%) of suppliers as group C. This applies the method generally called "ABC management" to segmentation of suppliers (Figure 1–13).

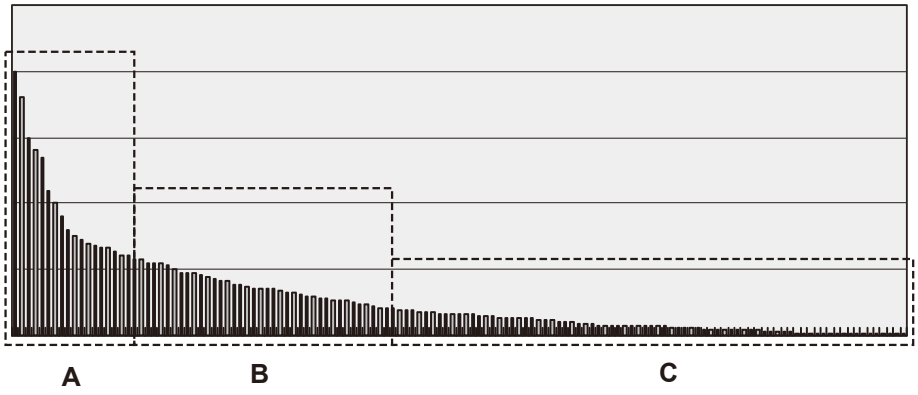
Arrangement of an environment where close collaboration with suppliers can be made is an example of a method to manage relationships with suppliers of group A. For example, buyer companies would build relationships between the people in top management of suppliers and theirs and take measures such as promoting appropriate improvements by taking time and cost to execute evaluation.

On the other hand, group C is so called long tail. Basically, the number of suppliers with small amounts and low frequencies should be reduced to save the effort. It is possible to execute such an action as maintaining the number at which suppliers can be managed appropriately by discontinuing the account if no transaction is made for a certain period of time, etc.

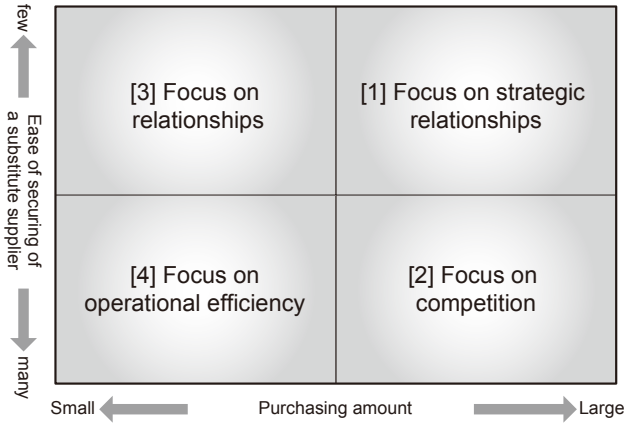
As seen above, it is necessary to comprehensively manage all suppliers based on the purchasing amount.

However, the problem which occurs whenever segmentation is performed by ABC management

●Figure 1–13 ABC Management of Suppliers



●Figure 1-14 Segmentation of Suppliers



is that some suppliers with small purchasing amount cannot be discontinued. In other words, they cannot be substituted by any other suppliers for some reasons such as their technical capabilities and quality. Normally, when examined carefully, the real reason is often not inability to procure from another supplier but the huge cost to switch to another supplier. It is often called high switching cost.

In any case, it is necessary to consider ease of securing of a substitute supplier.

Therefore, it is reasonable, for example, to segment suppliers with the two axes "purchasing amount" and "ease of securing of a substitute supplier" and set a supplier strategy for each segment.

Let's think about a case of segments made by two axes as shown in Figure 1-14. The four quadrants shall be [1] "Focus on strategic relationships," [2] "Focus on competition," [3] "Focus on relationships," and [4] "Focus on operational efficiency." Let's consider these contents and strategies to be implemented for each of them.

[1] Focus on strategic relationships

This quadrant has a high purchasing amount and the number of suppliers is limited. The number of suppliers is few in the market, and it is a monopolized situation. This corresponds to microprocessor and OS in the past personal computer industry.

The interest in terms of procurement for this quadrant is how to secure procured items stably from the limited number of suppliers even though the transaction value is high. In this case, the suppliers are not dependent on specific buyers so much and do not make special treatment for specific buyers without any special reasons.

Therefore, it is important for a buyer to build "strategic relationship" with the suppliers such as building direct relationships between people in top management.

[2] Focus on competition

This quadrant has a high purchasing amount and there are multiple or many suppliers. Since the purchasing amount is high, CR is a big interest and there are multiple supplier candidates, so it is

easy to create a competitive environment.

Therefore, in this quadrant, it is prioritized to manage the competitive environment appropriately, allocate resources, and build "competitive" relationships aiming at a high CR.

[3] Focus on relationships

In this quadrant, the transaction value is not high, but discontinuation of supply from the suppliers has a big impact of manufacturing of the company. For example, in some case, parts made by special metal processing are made only by a small factory run by just 10 employees in spite of the small purchasing amount.

In such a situation, suppliers are highly dependent on the buyer and both parties need each other, in most cases. This situation is associated with a risk that though the purchasing amount is small, the item cannot be substituted easily if it becomes difficult to get the item made by special processing such as retirement or illness of the engineer with skills of special processing.

Therefore, it is necessary to build business relationships with the suppliers in this quadrant focusing on "relationships."

[4] Focus on operational efficiency

In this quadrant, the transaction value is not high and there are many supplier candidates, so it is important how efficiently procurement activities such as CR can be executed. In this case, it is necessary to get procured items which meet the requirements with limited resources using new tools such as electronic bidding. With the suppliers in this quadrant, buyer companies should build a business relationship focusing on streamlining.

Like this, it is one of the important points of the supplier strategy to design a reasonable response stance for a supplier for each its segment and execute procurement activities.

■ 4-3 PDCA Management for Suppliers

To have suppliers deliver performance for buyer company's value creation, it is important to maintain and manage relationships with them in which buyer company can trade through good communication with appropriate degree of tension.

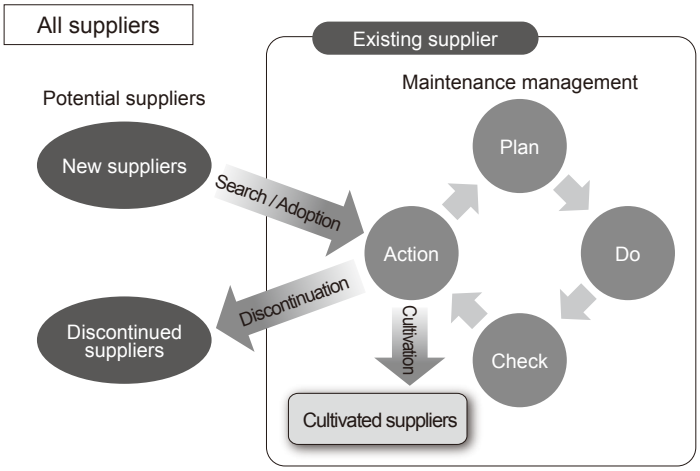
This section examines the following measures separately:

- Maintenance and management of the existing suppliers
- Search for and adoption of new suppliers

In maintenance and management of the existing suppliers, so-called PDCA cycle shall be executed: make plan, execute procurements, evaluate the performance, and then take the necessary actions. The necessary actions may be selection and cultivation of suppliers to be cultivated or discontinuation of a business relationship to encourage the supplier to try again.

On the other hand, in search and adoption of new suppliers, search new suppliers as needed, evaluate them, determine whether or not to adopt them, and build a new relationship.

●Figure 1-15 Strategic Structure Image of Suppliers



●Figure 1-16 PDCA Management for Suppliers

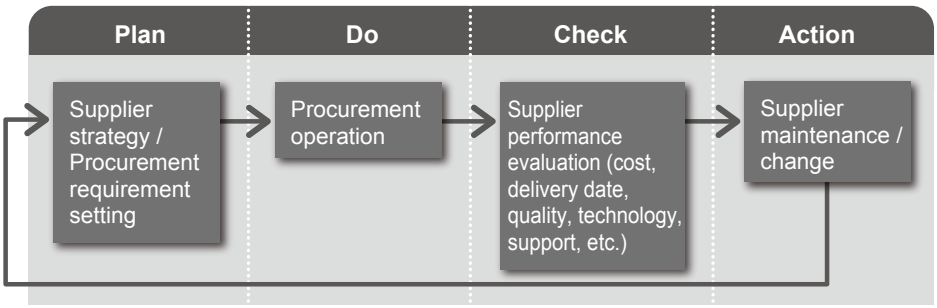


Figure 1-15 shows an image of these relationships.

"PDCA management for suppliers" is very important in execution of a supplier strategy.

In other words, as shown in Figure 1-16, PDCA management for suppliers is to plan, execute, and check relationships with suppliers and carry out continuous improvement activities to build better relationships with suppliers.

As explained in description of segmentation of suppliers in the preceding section, the response method should be changed for each segment and it is also desirable in PDCA management to adjust the depth in accordance with each segment.

■ 4-4 Steps of PDCA Management for Suppliers

This section describes the specific contents of the four steps of PDCA management for suppliers.

[1] Plan

Clarify the response policy to suppliers, requirements of the procured items, order plans, etc.

[2] Do

Actually, do procurement from suppliers which meet the planned requirements, order plan, etc.

[3] Check

Check the performance of supplier in each factor of procurement such as price, delivery date, quality, technology, and support and also the total performance, based on the procurement actually done.

[4] Action

Based on the result of check, take the necessary actions such as requests or instructions for improvements to and cultivation of the supplier, change in the supplier, and reconsideration of the supplier strategy itself.

■ 4-5 The Point is Reinforcement of "Check" and "Action"

In PDCA management for suppliers, the point is to perform this cycle consistently, deepen the relationships with competent suppliers, and encourage suppliers with insufficient capabilities to make improvements.

In this PDCA cycle, the steps of "Check" and "Action" are very important.

Generally, when determining a new supplier or new procured item, a company performs a careful selection process. However, there are many issues with the procurement activities and supplier performance check after actual procurement such as insufficiency of feedback to suppliers and insufficient utilization of the check results for the order policies. From the viewpoint of "building a long and stable relationship" of the supplier strategy as mentioned at the beginning, it is extremely important to reinforce the check step. Check and feedback are very effective communication methods in themselves for maintenance and improvement of the relationships with suppliers.

It is often the case when talking with persons concerned with procurement that they have no clear answer to the question, "Why do you procure form the supplier?" about a supplier with which they have a long business relationship.

For example, it is often unclear for the concerned persons themselves why they purchase items from the supplier, except the fact that they have been procuring the items from the supplier for a long time. It must be avoided such a situation and clarify to really procure items from a supplier which can contribute to improvements in the company-wide values. It is desirable to perform the PDCA management for supplier in order to check the relationships with suppliers based on this axis and build a strong supplier base.

For the specific methods to check suppliers, see 🅂Chapter 4 "1 Supplier Evaluation, Maintenance, and Management."

According to the result of evaluation, it is desirable to take measures such as increasing the procurement share for suppliers with high ratings according to their results and taking improvement actions for suppliers with low ratings.

5 Direction of Other Activities to Build Relationships with Suppliers

This section examines the direction of other activities to build relationships with suppliers.

■ 5-1 Sharing of the Strategic Direction

Suppliers can be said to play a role in execution of buyer company strategy. In that sense, a buyer company has to make suppliers understand well the company-wide strategy or business strategies such as in which markets the buyer company tries to get customers with what kinds of products by what kinds of actions.

One of the effective methods to get understanding is events such as meetings between top managements and supplier's meeting to explain business trend. Through these events, the buyercompany shares the strategic direction with suppliers.

■ 5-2 Involving Suppliers in the Early Stage (Participation of Suppliers in Sourcing for Development)

It is effective to make strategic suppliers participate in planning and development of products in the early stage for planning and development of new products by a buyer company, because by doing so, buyer company can make use of external resources for reinforcement of product competitiveness. In America, this is called ESI (Early Supplier Involvement) and often utilized for cost reduction, shortening of the development period, etc.

■ 5-3 Exertion of an Influence on Suppliers Positioned in the Upstream of the Supply Chain

Recently, from the viewpoint of CSR, an idea has been spreading that a buyer company should exert an influence on suppliers on the supply chain to enable to fulfill CSR as the whole supply chain including suppliers. ISO26000, which was announced in 2010 as a guideline of CSR [Exactly speaking, SR (social responsibility) for not only companies but also all organizations], focuses on this idea. For ISO26000, see Ⓢ Chapter 2-1 "2-3 International Guideline of CSR/ISO26000."

6 Relationships with Suppliers Which Support a Company-Wide strategy

Finally, this section examines cases that the relationships with suppliers are important components of the company-wide strategy. These cases are examples in which suppliers are incorporated in the strategy of a buyer company and the strategy is based on the relationships with suppliers.

6-1 Horizontal Specialization

In the past, in large-scale manufacturing, there were many vertical integration models in which all stages of business including planning and development of products to procurement of raw materials, material processing, parts manufacturing, unit manufacturing, and final product assembly were done in-house. Such companies were considered to be large and strong.

However, recently, companies which execute business in horizontal specialization different from vertical integration have increased. They leave each stage of business up to each dedicated company. In this case, it is possible to execute business assuming appropriate relationships with suppliers.

For example, let's examine a semiconductor industry. In the semiconductor industry, a semiconductor company called IDM (Integrated Device Manufacturer) performed all stages of business in-house including planning and development of products, production of semiconductor devices, assembly of packages incorporating a semiconductor device, and inspection in the past.

However, after 1990s, fabless semiconductor manufacturers assuming horizontal specialization have appeared. They are dedicated to only planning, development, and marketing of products and consign production of semiconductor devices for assembly and inspection of packages with semiconductor chips other companies. In this model, the company in charge of each stage exerts its strengths to create values for customers in cooperation.

6-2 Virtual Corporation

Some IT companies that emerged at the end of 1990s expanded horizontal specialization and managed business with suppliers together as if they had been one company. Especially, they strengthened collaboration with major parts manufacturers and suppliers in charge of assembly of electric circuit, final assembly, etc. using Internet and the business was managed as if they had been one company though legally it was just a group of different companies, so they were called virtual corporation, etc.

They narrowed down the number of suppliers, built a mechanism to proceed with sharing of information with such suppliers using Internet, and established a high-speed business management system. Their business management speed was even faster than competitors who run business in one company.

Maintenance and management of this system assumes that each member supplier of virtual corporation plays their roles properly. Therefore, the following procurement responses were made: sharing of strategies with suppliers by top management of a buyer company, replacement of suppliers based on a strict evaluation system, severe attitude toward quality issues, etc.

As a result, the concept of virtual corporation was recognized as an ultimate form of supply

chain management and accelerated reinforcement of supply chain management involving suppliers in buyer companies.

6-3 Supplier System

Finally, this section introduces the relationship between a buyer and suppliers which has been formed in the Japanese car industry. Collaboration called supplier system is formed between the final assembly manufacturer and suppliers which supply parts to it, and it is said to contribute to improvements in QCD. According to Professor Fujimoto at Tokyo University, the supplier system has three characteristics: [1] Long-term stable trading, [2] Competition of building capabilities between a few suppliers, and [3] Bundle consignment.

Traditionally, the proportion of consignment in the Japanese car industry was higher than those of competitors of Europe and America, but it was recognized that the reason for the high competitiveness of Japanese cars was the supplier system and then European and American manufacturers have also come to introduce this method by separating the parts production function, etc.

It is said that the whole supplier system functions properly when these three points exist at the same time. It is worth noting that the three points include contents which seem to be contradicted at a glance: "Long-term stable trading" and "Competition of building capabilities between a few suppliers."

Moreover, the professor pointed out as an important point in procurement of Toyota Motors, which runs the supplier system effectively, that it retains a "multifaceted evaluation capability." This point overlaps the focused point in PDCA management for supplier.

As described above, in a supplier strategy, it seems to be important for the procurement department of a buyer company to build and implement a mechanism to establish relationship of "cooperation and competition" and to evaluate of procurement actually done.

CPP certified Procurement Professional

Procurement Professional Study Guide

Study Guide 2

JMA JAPAN MANAGEMENT ASSOCIATION

Study Guide 2

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Chapter 5

Procurement Management

1 Procurement Budget Management

1 Developing a Procurement Plan from a Procurement Strategy

In order to develop a strategy within the procurement domain, scenario creation is required to fill in gaps found in the current situation.

In order to transition from this procurement strategy to actual execution, a plan need to be developed which clarifies what sort of goals are to be achieved with what kind of resources, and within what period of time this is to be done. For cases in which strategy goals are to be met within a period of several years, a specific plan of achievement must be put together within a mid-term procurement plan that spans several years. Then a specific action plan will be performed as a business plan each year of the planned period. This is the annual business plan.

The annual business plan provides a layout of the goals for that particular year. More specifically, an annual CR of 30 billion yen, an annual 5% reduction in raw material expenses, etc. Then, in order to meet these goals, a budget must be prepared for resources namely human resources, activity expenses, IT investment, etc.

ROI (Return on Investment) is preferred for the Procurement Department to achieve the most significant results for the lowest cost possible. So the Procurement Department should be able to systematically achieve these goals based on an estimated procurement amount, an estimate of costs incurred for procurement activities, etc.

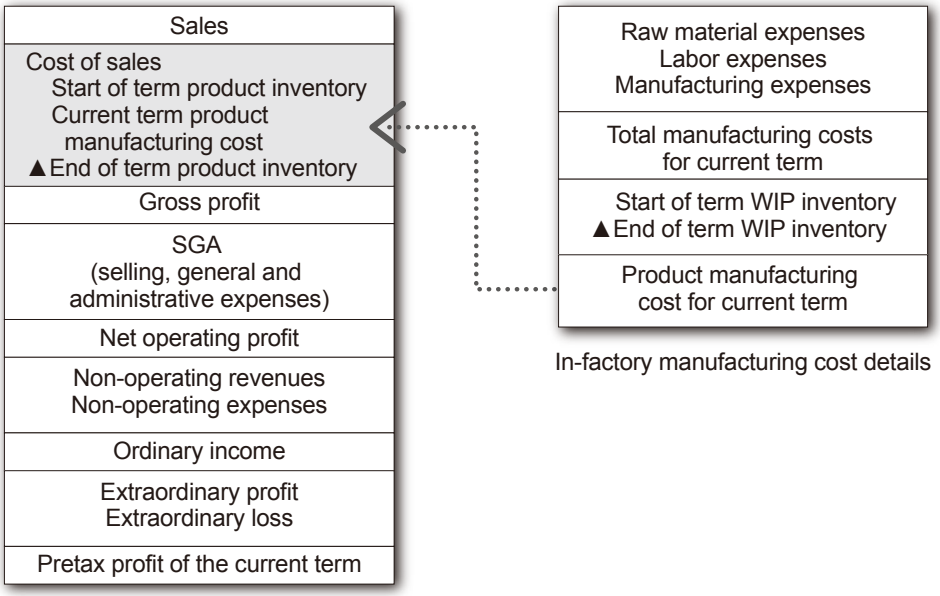
2 Budget for Purchased Material Expenses

In this guide, all activities for obtaining items needed from outside sources will be referred to as "procurement". But in this section, commodity and services to be procured from outside sources will be referred to as "purchased material expenses". Using the term "procurement expenses" may lead to a misunderstanding of the meaning as "costs incurred in order to perform procurement".

Purchased material expenses include direct materials, in which a direct charge is incurred for products used in manufacturing, indirect materials allocated to products such as tools, devices, consumables, repair articles, or fuel, and development expenses for prototype purchasing and software. (Development expenses include both direct charges for individual products, and allocated items.)

The Procurement Department must understand that the purchased material expenses under one's own department's jurisdiction are covered by company-wide expenditures, and their placement within financial statements. If the area that is covered by the Procurement Department is

●**Figure 5-1 Raw Material and Manufacturing Expenses on a Profit and Loss Statement**



insufficient, the procurement controlling area needs to be expanded.

As shown in Figure 5-1, the profit and loss statement includes manufacturing costs for sales, broken down further into raw material expenses, labor costs, and manufacturing expenses. Usually, these raw material expenses make up most of the purchased material expenses for manufacturing business. Also, indirect materials are generally included with manufacturing expenses, while dispatched worker costs are included in labor costs. Here we will focus on raw material expenses used directly in manufacturing. (For non-manufacturing business, substitute "raw material expenses" with "purchasing costs" as you read.)

When reading through this section, be sure not to equate raw material expenses on the detailed manufacturing cost statement with the raw materials total purchase amount. Raw material expenses on the detailed manufacturing cost statement are raw material expenses used for products included in sales for the current term. This is not an actual purchase amount for the current period. To put it simply, for both raw materials included and not included in the current term's purchased material expenses, procured items are not used, and since the inventory passes on to the next term, the difference arises.

A budget for purchased material expenses (including raw material expenses) is planned within the Business Department budget in order to prepare resources for future business activities. Sometimes it is called the "CR budget" to further clarify CR, which is one of the Procurement Department's goals.

In either case, if an estimate is not made for securing necessary items, such as raw materials and parts, and for securing the manufacturing capabilities of affiliate companies, the sales budget cannot be met, and any hope of meeting the purchased material expense budget is nothing more

●**Figure 5-2 Image of a Business Department Budget System**

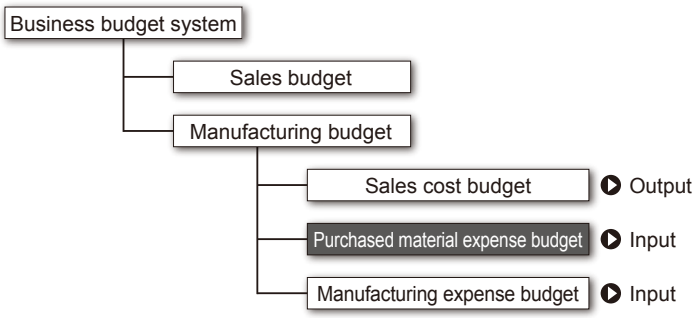
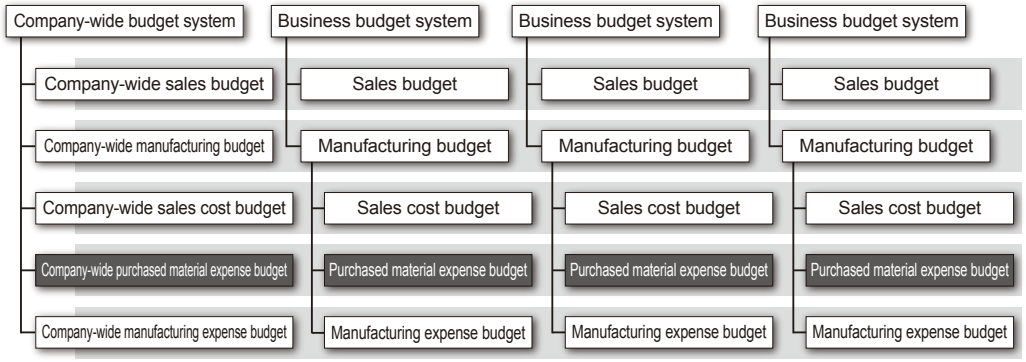


Image of budget system for company with multiple businesses



than wishful thinking. To achieve sales goals, an aim needs to be set to secure the necessary materials.

Companies with multiple business departments must put together a budget for each of them. These cross-sectionally gathered raw material expense funds act as a company-wide purchased materials expense budget. The Business Management Department is usually in charge of budget management itself, but the Procurement Department is expected to manage purchased material expenses. For example, in a term where sales are slow, the necessity of procurement is put to the test when it comes to impactful purchase materials, and the timing to receive them need to be strictly managed. In cases like this, the Procurement Department is expected to head up this sort of management (Figure 5-2).

There is one more point to be aware of when managing a budget for procurement purposes. That would be procurement using foreign currency from overseas. Foreign currency need to be prepared in advance to pay for certain procurement items. Unlike Japanese yen, foreign currencies must be accommodated separately to Japanese businesses. If such a case arises, and the situation requires immediate procurement of a foreign currency, essentially unnecessary costs may be incurred such as costs related to procurement of the foreign currency at a bad exchange rate.

To prepare for these situations, estimate a certain amount of foreign currency for procurement in the form of a budget, then submit it to the Finance and Accounting Department. This will allow

them to set aside foreign currency more efficiently for such cases.

3 Budget for the Procurement Department

A budget to cover expenses incurred by the Procurement Department should be kept separate from the budget for purchased material expenses, and called the Procurement Department budget.

A purchased material expense budget must be drawn up based on a procurement plan developed from a procurement strategy, which is linked to a company-wide strategy or business strategy. Then a Procurement Department budget need to be drawn up in order to perform execution management of that purchased material expense budget.

Securing resources to carry out plans is a central concern when it comes to the Procurement Department budget.

First of all, the main expense items within Procurement Department expenses are shown in Figure 5-3.

After estimating the main Procurement Department expenses, an appropriate method of distribution is used to assign expenses to various business departments, and each of those departments will often take care of the expenses.

Some examples of distribution methods include dividing up procurement department budget expenses by estimated direct work hours, then distributing them by an estimated hourly labor rate (called ML: Material Loading), or allocating Procurement Department budget expenses via purchased material expense budget, then dividing expenses among each business department to be borne by them.

●Figure 5-3 Example of Procurement Department Expense Items

Item	Definition
Procurement Department personnel expenses	Personnel expenses and commuting costs
System expenses	System and portal operation expenses
Office rent	For house rent and allocation costs
Communication expenses	Telegraph and telephone expenses (including business trips)
Office expenses	Copy machines, paper, stationary supplies
Trip and transportation expenses	Business trip and transportation expenses
Business consignment expenses	Outsourcing expenses (temporary workers and system maintenance)

●**Figure 5-4 Main Key Codes for Understanding Purchased Material Expense Data**

Key codes	Definition
Department code	A code to specify the department to perform procurement
Requester code	A code for understanding which department among the business departments made the request
Delivery area code	A code for indicating the delivery location, such as a factory
Procured goods category code	A code for understanding delivery results for each category of procured goods
Supplier code	A code that indicated the supplier

4 Preparing an Environment for Managing the Purchased Material Expense Budget

To manage the purchased material expense budget, it's important to understand how results will shift according to plan. In other words, purchased material expenses must be visualized. In order to do this, accurate purchase results data must be accumulated to withstand improvement analysis. Then a key code as seen in Figure 5-4 need to be set, and the data need to be prepared. This data is generally set when a purchase results analysis approach is postulated during system construction.

Direct materials for manufacturing business are generally classified by these sorts of codes, but an indirect material domain for both manufacturing and non-manufacturing business has still not been well-prepared. Please refer to the following code system for preparation of data.

Two issues that arise for many manufacturing using this code classification are: (1) whether or not these codes are consistent within the company or within the group, and (2) whether or not the codes were updated to correspond with procurement changes.

Let's take a look at the main key codes, and focus specifically on "procurement category codes" and "supplier codes".

■ 4-1 Procurement Category Codes

A lot of businesses try to grasp the actual procurement situation in detail based on certain types of procurement classification.

In such cases, using procurement category codes allows them to accurately understand purchased material expense trends in greater detail. (Procurement category codes are explained in detail in Ⓢ Chapter 4 "3 Spend Analysis".)

4-2 Supplier Codes

When set up correctly, the supplier code system can also provide extremely beneficial information.

For example, when setting an overall supplier code, along with a code for each business unit within the supplier, the business units can be managed from a practical business perspective, and procurement results from the supplier as a whole can be understood at the aggregation stage. And by understanding capital-related group business as a whole, information is provided that is more beneficial to building a procurement strategy to overlook the entire operation.

This will enable a higher level of business cooperation and potential partnerships, by observing the trade situation as an entire group business at venues of exchange for top executives.

4-3 Uniform Key Codes

When affiliates start up new programs, or group businesses are expanded via M&A, it might get harder to grasp purchased material expenses in their entirety.

If one uniform code is used within the business group, it's much easier to grasp procurement expense amounts from certain suppliers as the entire group.

However, a lot of effort is required to maintain and manage master data for a uniform code within the group like this. More specifically, if a company within the group starts using a new supplier, the group's supplier code master need to be requested from the department in charge of central management, so that the uniform code can be obtained.

If this gets too complicated, a highly-independent business within the group might create and operate their own code system, even if they want a uniform code. This means the master loses its accuracy, and only leads to more confusion.

Ideally, other codes such as procurement category codes should also be uniform, but when implementing a new uniform code, the level of unification needs to be aligned by assuming how much of common materials are used within the group companies and how much of benefits can be obtained from organizing the parts.

When implementing this type of uniform code, business rules need to be established to maintain and manage the code system, the division of roles among related organizations need to be clarified, an effective consensus need to be built for code unification within the group, and goals and processes need to be established for code maintenance and management.

5 Understanding Results

Along with a clear perspective on budget management, an understanding of procurement results is also extremely important for the Procurement Department.

For example, when going along with the initial procurement plan even if sales aren't expanding, the inventory of procured items will grow within the company as a result. Because of this, even though cash inflows have decreased due to slow sales, cash outflows will not decrease with them due to procurement payments. As a result, cash flow is restricted. In this case, if a solid understanding of procurement results can be obtained, unnecessary cash-outs can be avoided. Many businesses have a mechanism for understanding procurement results, but there seems to be a significant difference in how well they can collect actual data. Preferably, the necessary data is linked to daily procurement activities, accumulated in real time, and can be used whenever it is needed.

Also, it can be utilized for a diverse range of activities, such as revising order units and delivery units from data accumulated during a fixed period of time. In addition, if buyers can view or refer to this data whenever they want, then download what they need and analyze it, it is a very powerful tool for supporting CR activities.

Specific examples for which this tool is used for include spending analysis and supplier analysis, with results data at the foundation of CR activities. (Refer to Chapter 4 "3 Spend Analysis")

6 Procurement Department Evaluation

"Evaluation" of Procurement Department activities is an important point in terms of budget management.

On the business level, success is measured by indicators such as profit margin on sales and return on total capital. In the same way, success within a company's Sales Department is measured by sales and profit. For the Procurement Department, an evaluation should be given based on cost effectiveness.

6-1 CR Ratio Performance Evaluation

The most fundamental evaluation indicator for the Procurement Department is cost reduction (CR ratio). In general, it is compared to that of the previous year or previous period.

However, the cost reduction effect of this CR ratio is not always reflected on financial statements right away, as it may exceed certain lead time or inventory periods for procurement. Therefore, some business departments may look at the CR ratio as nothing more than a convenient self evaluation.

Also, the handling of market condition products within CR ratio performance evaluation is a difficult issue. Market conditions are generally determined by supply and demand, and some movement may be due to factors other than Procurement Department efforts. Because of this, factor analysis of market fluctuations and the Procurement Department's actual efforts must both

be explained with an easy-to-understand strategy.

And when purchasing with foreign currency from overseas, exchange rate fluctuation has an influence. Evaluation need to be done with a combination of Finance and Accounting Department activities such as exchange forward contract, along with the effects of procurement activities.

6-2 Performance Evaluation other than CR Ratio

Procurement Department activities span a wide range of areas with important evaluation indicators such as delivery compliance, etc. including quality maintenance control or securing required quantities other than the activities related to the purchased material cost. These are referred to as the Procurement Department's KPI (Key Performance Indicators) Set CR ratio and these other indicator goals to manage results progress. When there is a chance that plan goals will not be achieved, the reasons must be analyzed, an upgraded plan must be established, and the highest level of effort must be given to achieve those goals.

Figure 5-5 shows a typical list of KPIs.

●Figure 5–5 Procurement Department KPI (Evaluation Index) Examples

Index name	Implications	Definition
CR amount	CR measurement	CR amounts by business department or by category of procured goods
CR rate	CR measurement	CR rate changes by comparing business department or category of procured goods with data such as one from the previous year
CR amount in material expenses for management model product type	CR measurement	CR amount in material expenses for specified model product type
Material cost ratio	CR measurement	Allotment of material cost in sales costs
On-time delivery ratio	Measurement of on-time delivery accuracy	The number of items delivered on time from the total delivery quantity
Receiving defect ratio	Measurement of procurement good quality	Rate of defect for delivered items out of total received quantity
Ratio of market claim arose due to procured goods	One index for looking at procured goods quality	Number of products related to complains arose due to procured goods, divided by the total number of shipped products
Green procurement ratio	In procurement measurement of progress for green procurement*	Rate of green procured goods out of all procured goods
Purchase processing speed	Measurement of purchase processing speed in the Procurement Department	Reduction level of number of days for purchase processing, from receiving purchase request to order placement
Procurement lead time (LT) reduction rate	An index for determining how much procurement LT was reduced in procurement activities	Number of days reduced for procurement LT, divided by the original number of procurement LT days
Overseas procurement ratio	Measurement of overseas procurement progress	Ratio of overseas procurement out of total procurement
Procurement inventory turnover days	An index of how appropriate the timings of procurement performed	Inventory quantity and account of procured goods divided by total single-day amount of factory shipped goods
EDI ratio	Aim for progress into IT-based procurement	Rate of suppliers utilizing EDI out of total suppliers
E-bidding ratio	Aim for progress into IT-based procurement	Rate of e-bidding usage within total deal amount

* Green procurement is a method used by company to procure raw materials or parts, which prioritizes the selection of materials that are environmentally friendly, so that harmful substances are avoided, and water and soil are not contaminated when disposed, etc.

2 Quality Control

1 What is "Quality Control"?

Quality indicates the level in which customer demands and needs are satisfied through products and services.

Quality in business activities:

[1] Design quality: Product and quality specifications for designing a product that reflects customer wants and needs.

[2] Purchase part quality: Quality of raw materials and parts required to make a product.

[3] Manufacturing process quality: Quality within the manufacturing process required to make a product that satisfies design quality (manufacturing conditions, defect items, defect rate, etc.)

[4] Inspection process quality: Quality specifications used in the inspection process (inspection items, control standards, etc.)

[5] Usage quality: Quality when customers use the product (function and specification, ease of use, etc.)

[6] Service quality: Quality of after-sales service, etc.

[7] Environment quality: Quality related to the environment measured by recyclability during disposal.

Etc.

Quality control performed by a company is the management of the various types of quality within each department to raise customer satisfaction.

As shown above, there are different types of product and service qualities that are required by

●Figure 5–6 Quality Demanded by Customers

Request item	Request definition
Performance	Does it conform with its intended use?
Functionality	Is it easy to use?
Maintainability	Is it easy to take care of and maintain?
Safety	Is it safe to use?
Durability	Is it durable and free of malfunction?
Serviceability	Is after-sales service good and easily accessible?
Compatibility	Does it offer parts interchangeability?
Recyclability, environmental load	Does it take the environment into account?

customers; hardware-type, which is related to functionality and performance of the product itself, and software-type, which is related to product availability at nearby stores, customer service employee attitude, after-sales service, etc.

Figure 5-6 shows the types of quality generally required by customers.

■ 1-1 Difference between Quality Assurance and Quality Control

Quality assurance is defined as "systematic quality management activities to earn the customers' trust by assuring quality of the products and services provided to them".

On the other hand, quality control is defined as "repair and improvement activities performed as needed at all levels in order to economically and efficiently manufacture and provide products to customers that meet the standards of quality that is required by customers" (Figure 5-7).

■ 1-2 Quality Control in a Narrow Sense and Quality Control in a Broad Sense

There are implications of quality control in a narrow sense and a broad sense. Quality control in a narrow sense refers to confirmation activities performed in advance to make sure products and services meet the certain requirements.

Quality control in a broad sense refers to the systematic activities to meet quality standards for products/services required by customers or society and at the same time, to provide quality or

●**Figure 5-7 Scope of Quality**

services to satisfy customers more economically and efficiently.

1-3 QC Background and "Japanese Way" Quality Control

The words "Made in Japan" have come to represent a high level of quality all over the world. The method of quality control used to produce this high level of quality is called "Japanese way" quality control, and has drawn attention from the rest of the world.

This Japanese style of quality control refers to TQC (Total Quality Control) with everyone's participation focusing on a bottom-up approach which is based on statistical quality control introduced to Japan by the United States after World War II.

Japanese businesses first became aware of the latest production management techniques and high standards in the United States in 1948. That was when the statistical quality control method was introduced to Japan by GHQ (General Headquarters). GHQ realized that Japan's outdated telegraph and telephone network would hinder activities of the Occupation administration, and it was falling behind due to deficiencies in vacuum tube manufacturing technology. Because of this, GHQ had the statistical quality control technique implemented through the CCS (Civil Communication Section).

Japan's quality control roots, which are said to have influenced modern Japanese management techniques, are found in statistical quality control, which was introduced by Deming when he went to Japan in 1950. The following year, the Deming Prize was established by the Union of Japanese Scientists and Engineers, and JIS (Japanese Industrial Standards) were organized soon after that. In the 1960s, there was an increase in companies transitioning to TQC (Total Quality Control) for company-wide quality control activities.

Reasons for the development of quality control in Japan:

[1] A high-level of education, combined with a foundation based on statistical quality control

[2] Japan's village societies and cooperative social climate was applied to small group activities like QC circles.

[3] Japanese employment systems, such as lifetime employment and the seniority system, led to a higher sense of belonging among company employees.

[4] New ways of thinking were accepted enthusiastically

These are said to be the four main elements responsible.

In recent years, many companies have been implementing standards such as the Quality Management System ISO 9000 series provided by the ISO (International Organization for Standardization). Beneficial aspects from the refined "Japanese way" of doing quality control need to be combined with good ideas of the ISO 9000 series to improve/maintain quality

2 Procurement Business Aims

2-1 Two Ways of Thinking for Quality Control

With procurement business expanding around the world, maintaining procured product quality and cost reduction at the same time is a difficult problem always brought up by many businesses. Basically, supplier quality control should be treated as an expansion of quality control within the company. That method of control is explained in further detail later on.

Quality control in Procurement is:

[1] Placing importance on subsequent inspection, and discarding defective items

[2] "Elaborating" quality through design, processing, assembly, etc. Basically placing importance on the prevention of defects from forming.

The first viewpoint focuses on strengthening and streamlining receiving inspection to ensure the quality of procured items. The development of statistics-based mathematical theories such as AQL (Acceptable Quality Level) is reflected in this way of thinking.

The second viewpoint focuses on improving the quality assurance systems of parts manufacturers, striving to achieve quality control levels so that receiving inspection itself is unnecessary. Basically, instead of focusing effort on subsequent inspection and disposal of parts delivered by the supplier, the goal is to check the manufacturing process and quality control system in advance to prevent defects from forming in the first place.

The first viewpoint is espoused during startup periods for new parts, safety important parts, etc. while the supplier should move forward with independent quality control with the second viewpoint.

If quality is poor, meaning there are many defects, disposal costs rise, production is no longer efficient, and costs will increase. From a delivery perspective as well, if defective products form frequently, the possibility of delivery delays will increase.

This clearly shows how important it is to "build quality". Importance should be placed on the second viewpoint of quality control in procurement quality control.

2-2 Concept of Quality Assurance in Procurement

(1) Quality assurance in procurement

In the manufacturing industry, some types of products are always procured from the outside, in the process spanning product creation from raw materials and parts, to presentation of products to customers. If there are any nonconforming items among procured items, problems will occur in Manufacturing Department production, and quality may no longer meet customer demands. In order to prevent this from occurring, quality assured items have to be procured, and the activities

carried out to achieve this are quality assurance activities for procured items.

(2) Three points in the quality assurance activities of procured items

There are three main points involved in the quality assurance activities of procured items.

[1] Supplier selection and evaluation

[2] Supplier quality instruction

[3] Management of procured items

[1] Supplier selection and evaluation

Evaluate new suppliers when selecting to make sure their supplied parts meet required quality and are delivered to us continuously. Quality control for the supplier must include:

- The supplier's financial conditions (to determine financial stability for fulfilling quality standards)
- Whether or not measuring devices and inspection facilities are available to assure quality of items to be ordered
- Evaluation standards need to be drawn up for a quality assurance system that guarantees the items above (periodic inspection, device calibration, appropriate staff, skills qualification system, etc.) so that the supplier can be evaluated.

Since there are many points related to quality control that cannot be fully understood from documents alone, it is essential to go to the supplier's actual production site, and confirm the level of quality control in the supplier's production activities.

Also, when evaluating existing suppliers, importance should be placed on quality results, a periodic field audit should be performed, and a comprehensive QCD evaluation should be carried out to determine need for improvement, and whether or not transactions can continue.

For details, please refer to Ⓢ Chapter 4 "1 Supplier Evaluation, Maintenance, and Management" or Ⓢ Chapter 4 "2 New Supplier Sourcing".

[2] Supplier quality instruction

A quality audit and quality instruction plan must be drawn up each term (or semi-annually/ quarterly as needed), based on supplier evaluation results, and quality instruction must be carried out with cooperation from the QA Department and Manufacturing Department. If a major nonconformance occurs with a supplier, an emergency quality audit must be carried out at that time, and the applicable product must be dealt with accordingly on a short-term basis (via halted delivery, replacement delivery, repair, recall, etc.) Basically, quality instruction goals are provided through support activities so that the supplier itself can carry out activities to "improve on built-in quality".

[3] Management of procured items

Items to be delivered by the supplier come in various types with various features, such as a poor

threshold for high temperature and humidity, items that are easily damaged, etc. Control for these items should be performed based on storage standards determined in advance. Minimizing the number of touches is an important point in quality maintenance. Determining who will be in charge of the warehouse for each part triggers a sense of responsibility, and is one method for improving storage management technology.

The first-in first-out method is generally used for moving products from the warehouse. This will minimize deterioration through time, and maintain freshness of stored products. When handling procured items, keeping them neat and organized in the warehouse is extremely important, and preventing items from being damaged or incorrect/wrong items from being mixed in while storing is the most fundamental step.

2-3 QCM (Quality Chain Management)

QCM (Quality Chain Management) is a system for stabilizing the manufacturing process through prevention of important quality issues related to basic quality, or preventing them from spreading if they have already occurred, then analyzing the chain of factors responsible for forming defects throughout the entire process, and systematically carrying out countermeasures based on analysis results. QCM does not stop within the company, but expands into all supply chain activities, including those of suppliers.

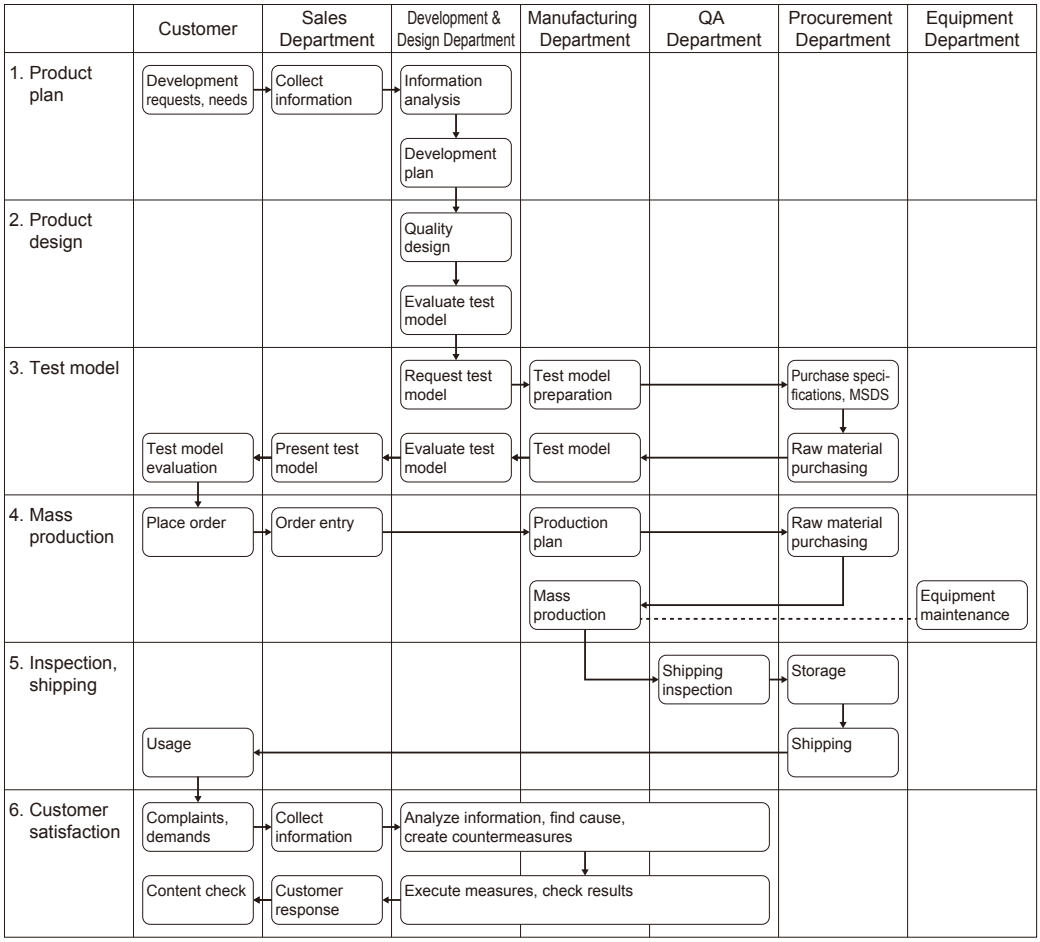
It starts with the product design phase, moves into the production preparation phase, includes organization and inspection of the quality control system for each process, moves into logistics settings, and expands into each phase of product flow.

The primary supplier demands thorough quality control for secondary suppliers and below. In particular, the secondary supplier is often depended on for important processes (such as machining and heat processing), so quality characteristics of these are demanded, as well as demands to improve cooperation in gaining a grasp of the current situation.

As the buyer, one must always realize that every type of quality is linked, and should not be dependent on a fixed QC tool. A mechanism to assure quality throughout the entire supply chain need to be created, and maintenance need to be improved.

Suppliers will request that a Quality Plan be drawn up and provided, including such components as a quality assurance system chart, QC process chart, and business flow chart, for performing quality control.

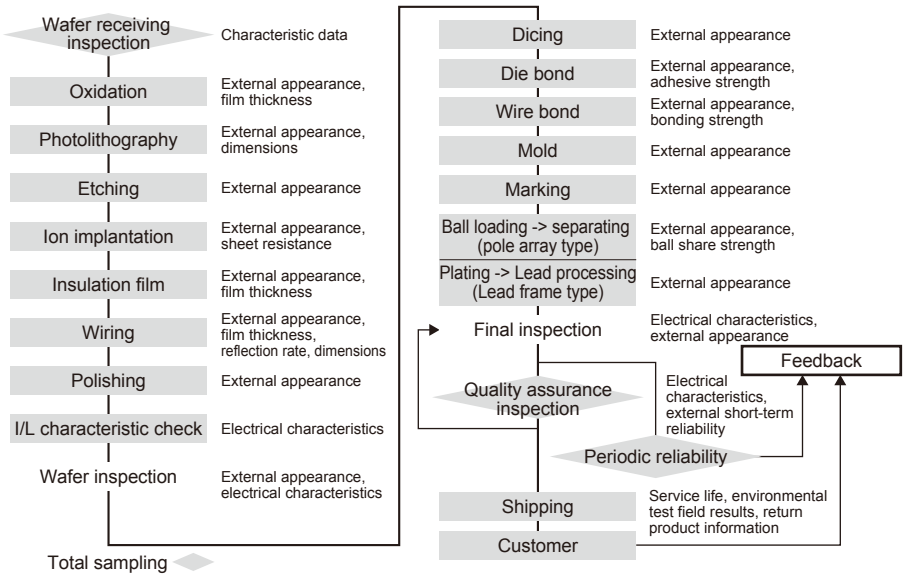
●Figure 5–8 Quality Assurance System Chart (Example)



●Figure 5–9 QC Process Chart (Example)

Manufacturing process chart	Process No.	Process name	Management items	Management standards	Management method: Frequency	Management method: Tools	Management method: Recording method	Procurement standard name and number
DDD	1							
FFF	2	Connector, Solder	Connector part number	Part No.: 19670●-13	Opening check		Enter Lot No. on manufacturing slip	Operation manual JSA●20113
			Soldering iron	HAKKO 933-01 Iron tip 900M-T-2C	Opening check			Soldering iron management standards JSA101
			Iron tip density	300 ± 20 °C	Opening check	Iron tip thermometer	Opening inspection chart	Operation manual JSA●20113
			Soldering wire specs	HAKKO HEXSOL F9500-01 φ0.5 mm term of use: 1 year	Opening check			Operation manual JSA●20113
			Soldering tool cleaning	Flux, There should not be any runoff for solder	Wash with alcohol during closing			Operation manual JSA●20113
GGG	3	External inspection	Solder status	According to Soldering quality standards	All	Stereoscopic microscope 10x	Manufacturing slip, List of defects	Soldering quality standards JSA001

●Figure 5–10 Task Flow Chart (Example)



3 Quality Control for Procured Items

■ 3-1 Concept and How to Proceed

Regarding quality control for procured items, there is some commonality between quality control for products and for parts, and there are many businesses with a Quality Assurance Department well–trained in the necessary techniques. However, the Procurement Department has a responsibility to QCD optimization, which is to procured items that have already been through quality control from the supplier at an appropriate price, and procure them at a determined delivery date. Because of this, it is preferable to have a parts quality control section within the Procurement Department. To improve the quality of procured items, activities need to be carried out with a focus on supplier selection, evaluation, and quality instruction. The following items must be carried out for this:

(1) Set quality targets in procurement

Analyze the quality situation for all procured items from the previous term by supplier, then set a quality target for the current term, and draw up a plan of action. Suppliers that need improvement should be notified of it, and if any suppliers need quality instruction, an instruction method (such as quality assurance system audit or process quality audit) must be determined along with a quality instruction plan, a term of execution must be decided on through discussion, and then all parties should move into action.

When determining whether or not to continue working with a certain supplier, or estimating an

order quantity etc., base the decision on a comprehensive evaluation including quality results, delivery and pricing results, etc. If necessary, it is fine to consider adding a new supplier at this phase.

(2) Quality improvement activities in procurement

Work to achieve the quality target, and carry out activities based on the action plan. If an unexpected, major nonconformance occurs outside of the scope of action drawn up in the plan, temporarily provide emergency quality instruction.

If a nonconforming item is discovered during receiving inspection or the in-house manufacturing process, quickly determine a measure for dealing with the item in question, perform a citation to prevent it from reoccurring, and follow up on the improvement situation.

(3) Quality assurance and delivery control

Some reasons a supplier cannot meet the delivery dates may be machine malfunction, frequent stop, etc. Suppliers unable to deliver on time may not be operating stably, and there may be some sort of deficiency in their quality assurance activities. Since delivery delays could have a negative influence on the buyer company's productivity and quality assurance, finding the cause of the delays is very important from a quality control standpoint as well.

(4) Quality assurance and purchase prices

When requesting an unrealistic low price from the supplier, the supplier may decide to pass on your offer to ensure profit, so it is important to procure items at the appropriate price from a quality aspect as well. If the cost (manufacturing cost) is not lowered, the price (purchase price) can't be lowered. This should be kept in mind.

■ 3-2 How to Move Forward with Supplier Quality Instruction

The main quality control task for procurement is quality instruction for the supplier.

The goal of quality instruction is to get a stable quality of incoming items from the supplier, for a continuous supply of items to improve productivity within the company's manufacturing process. Some types of instruction include quality auditing, quality improvement support, and quality training. But if this cannot be performed by the Procurement Department alone, getting cooperation from the QA Department, the Development & Design Department, and the Manufacturing Department can be quite effective.

To perform supplier quality instruction, a quality instruction plan can be drawn up for each term, which is the plan-oriented method, or instruction can be provided whenever quality nonconformance occurs. Preferably, both methods can be combined as needed in accordance with

the situation at hand.

(1) Drawing up a quality instruction plan

Evaluate suppliers by their quality results for each term, then determine an order of priority for instruction, such as starting from the worst ranking supplier, or based on points earned in specific parts categories determining who needs the most improvement. Then draw up a quality instruction plan including an instruction system, instruction method, date and time for instruction, etc. When carrying out quality instruction, inform the supplier in advance as to what will be covered, then have them create a receiving system in advance.

(2) Carrying out quality instruction

To carry out quality instruction, select instructing member(s), share the supplier's quality situation with them to provide a solid understanding, prepare points of instruction and a check sheet, then go to the supplier and begin instruction. Draw up a report in advance indicating points of concern, then have the supplier submit a quality improvement plan.

Send company technicians to the suppliers needing instruction based on the suppliers type of business and expertise, and then perform periodic quality instruction for effective results.

(3) Post-instruction follow up

Periodically check in with the supplier to observe the quality improvement situation, which should be based on the supplier's quality improvement plan. If improvements are delayed, formulate a catch–up plan together with the instructing member, then carry it out. Make sure the quality improvement plan is operating smoothly and goals are being met, then have the instruction team disperse. Compiling these activities in a report will make it easier to apply to similar situations.

(4) Built-in quality

There are three main steps involved when building quality into processing.

[1] Discover nonconforming items before processing, and remove them

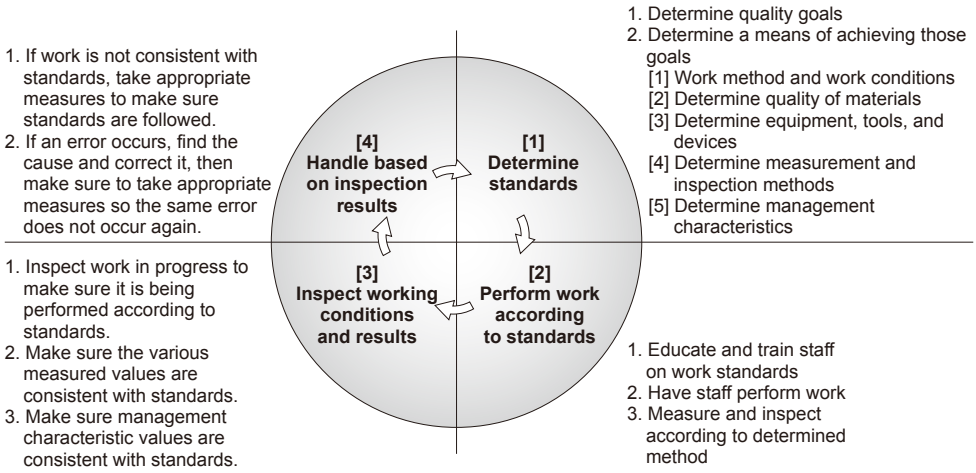
[2] Do not create nonconforming items during independent processing

[3] Do not let nonconforming items continue on after processing

The following points are important when carrying out these steps for built–in quality on–site:

- Clarify standards to adhere to for tasks to be carried out
- Carry out on-site tasks according to policy and standards, and use the instructed method
- Confirm the task situation
- If the tasks are not being carried out according to standards, correct the method being used, and perform tasks as instructed

●**Figure 5–11 On–Site Management Cycle for Improving Built–in Quality**



- Continue on, improve on the method being used, and be sure not to repeat the same failures or nonconforming actions

This process is shown in its entirety in Figure 5–11.

[1] Discover nonconforming items before processing, and remove them

Before performing independent processing, discover them through inspection, or use a jig and tool etc. to perform error proofing so that the nonconforming items cannot be set to equipment. If this is difficult due to technological reasons, clarify check points in a work standard manual, so that workers can easily remove the nonconforming items.

[2] Do not create nonconforming items during independent processing

Prepare a work standards manual to educate the workers, while also clearly indicating where materials and parts are located through displays, to make tasks easier. Also set error proofing to equipment and jigs as much as technically possible, so that nonconforming items are not created.

[3] Do not let nonconforming items continue on after processing

Prepare an inspection device, error proofing, or some other means of removing nonconforming items during or after work is completed, so that nonconforming items do not continue into post–processing. It is important to periodically inspect equipment and jigs, and quality inspection for current products. But it is also important to organize a work standards manual so that workers can efficiently deal with errors or abnormalities when they occur. Continuous worker education will enable them to perform their tasks properly on site.

(5) Create a means of traceability

Recently more recalls are being reported due to the advancement and complexities of newer products, along with an increase in consumer awareness. Also, with the advancement of parts standardization, recalls are happening on a larger scale.

When a recall is reported due to defective parts, product name, company name, supplier name,

period of manufacture, period of sale, lot number, etc. are to be reported. Because a means of traceability is in place for these instances, specific details can be provided. If this means of traceability was not in place, all delivered items up to that point would be recall targets, resulting in enormous expenses and an extensive recall period.

Traceability is a way of tracing an items production history, to find out when the item became nonconforming, and what sort of process was occurring.

In order to trace a product, a means of process control need to be developed with close association to product flow and task records. Product flow is easy to grasp for individual production, but lot production requires extra attention because a high quantity of items are being produced at once. Even if products are from the same lot, the raw materials and parts used from them will often extend to many different lots.

Also, if a nonconforming item is generated, and a portion of the lot is temporarily suspended, or nonconforming items are discovered after product completion so that reinspection and selection must be performed, lots will be split up, merge with other lots, or change places in many cases. In this case as well, a mechanism need to be created that can link to product flow and task records to deal with the situation. In order to do this, raw materials, parts, and products must be clearly identified, and it is important to correct task records whenever needed to deal with the current situation. In order to accurately perform these complicated tasks, suppliers should also be thoroughly informed of the importance and necessity of traceability.

(6) What does inspection entail?

Inspections are performed to compensate for quality assurance in the manufacturing process. The quality characteristics indicated in a design sheet are compared to quality criteria, then measurement, testing, and observation are performed to determine whether an item passes or fails. This goal of this activity is to make sure nonconforming items never reach the customer after processing.

If quality assurance is performed perfectly during the manufacturing process, and no nonconforming items are generated, an inspection is not necessary. However, since quality assurance is created and carried out by people, it is impossible to completely prevent nonconforming items from being generated due to human error, etc. To compensate for this, inspections take on the role of quality assurance.

There is a general misunderstanding that the QA Department performs all inspections. But in fact, the Manufacturing Department performs in-process self-inspection for each process within its department. This is to make sure defective products produced via independent processing do not make it to the post-processing phase. The QA Department then performs process inspection to make sure each process in the Manufacturing Department is meeting quality characteristics covered in the design sheet.

However, if the QA Department inspects each Manufacturing Department process at its own discretion, product quality cannot be effectively assured. As a method for resolving this issue, an inspection standards guide need to be created so that inspections can be carried out based on those standards.

An inspection standards guide is a book of standards created to ensure product quality. It is created by determining which quality characteristics and which methods of inspection are the most effective and efficient for each process, spanning from raw materials and procured items to completed products. The guide includes inspection order, inspection items, sections in charge, inspection methods, determination standards, etc.

A QC process chart and work standards manual quality check items are to be created based on this inspection standards guide. Inspections for each process are to be carried out based on the work standards manual.

(7) Statistical approach in sampling inspections

There are two main parts to inspection, which are classified by four characteristics.

1) Main parts of inspection

[1] Inspection of individual quality

[2] Inspection of single lot quality

2) Inspection types

[1] Classification by inspection level

Procurement inspection (receiving inspection), in-process inspection (intermediate inspection), final inspection (product inspection, shipping inspection)

[2] Classification by inspection location

Bench inspection, patrol inspection

[3] Classification by inspection method

Nondestructive inspection, destructive inspection

[4] Classification by inspection frequency

100% inspection, sampling inspection

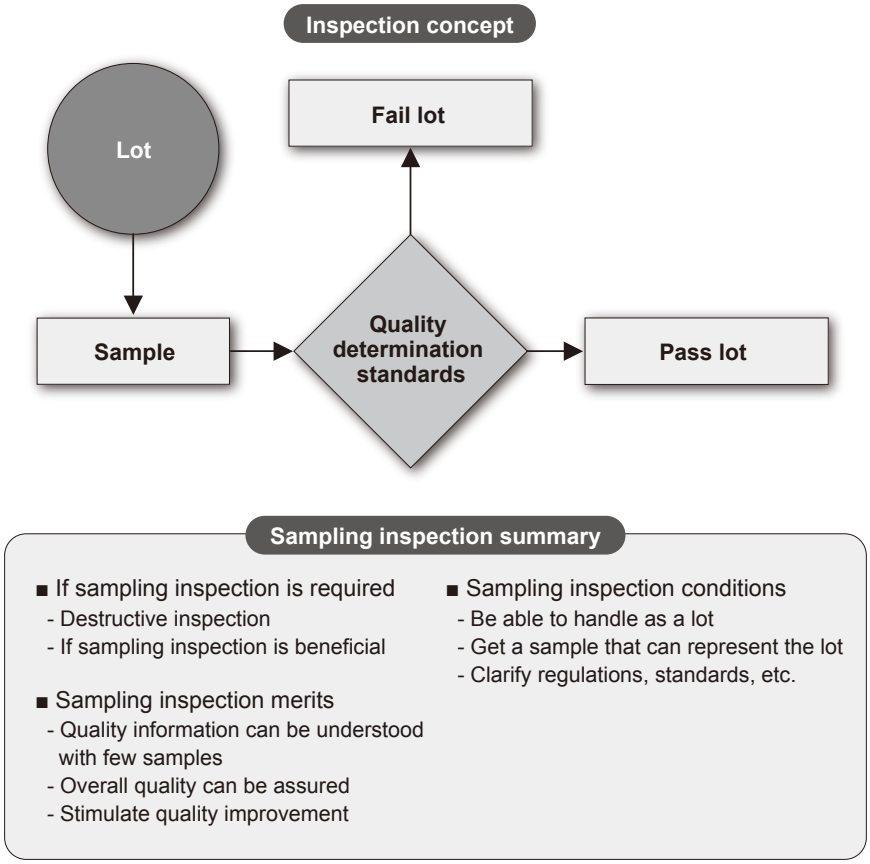
Basically, sampling inspection is inspection of single-lot quality, and is classified under inspection frequency.

First determine the inspection targets (products, inspection units, inspection items), then make an economical choice on the frequency of inspections. Sampling inspection is based on statistical methods, as a way to confirm that multiple defective products are not mixed in with a lot of multiple products when received, produced, and shipped. When even a single defective product is not allowed, 100% inspection is required.

The philosophy of sampling inspection and a summary are provided on Figure 5-12.

There are several types of sampling inspection. First of all, "counting-type sampling inspection"

●Figure 5-12 Sampling Inspection Summary



focuses on the quantity of defective items and number of defects, while "measurement-type sampling inspection" deals with the characteristics of measured values.

Types that apply to different situations include the "standards-type", in which pass/fail is determined by standards agreed upon by the buyer and seller, and "adjustment-type", in which the inspection's level of scrutiny is adjusted according to product results. Some methods used to determine pass/fail include the one-time sampling method, two-time sampling method, multiple-time sampling method, and sequential sampling method.

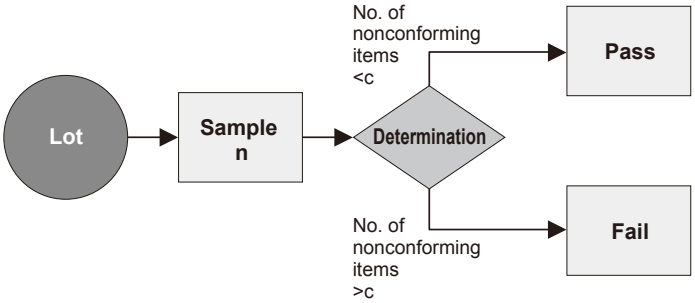
Sampling inspection is designed based on probability and distribution according to type and sample, with the main items designated by international standards such as ISO, or national standards such as JIS.

An "OC curve" (Operating Characteristic Curve) is used to indicate the characteristics of sampling inspection so that no bad lots can get through. When selecting a method of sampling inspection, this curve indicates the probability in which a lot with a rate of defect can pass inspection. When selecting a sampling method, it is important to use the OC curve for a logical understanding of performance without depending on feelings.

Figure 5-13 has information on sampling inspection and the OC curve.

●Figure 5-13 Sampling Inspection and the OC Curve

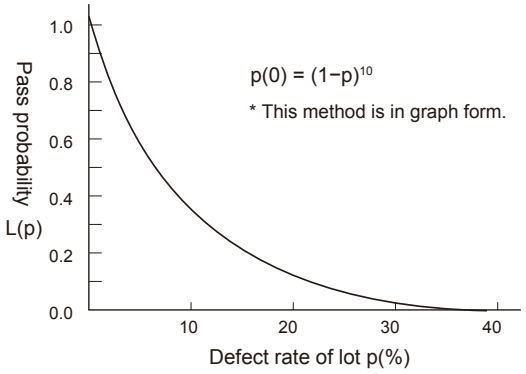
How to show the sampling inspection method



The concept above is called the sampling inspection method, and abbreviated to (n,c).

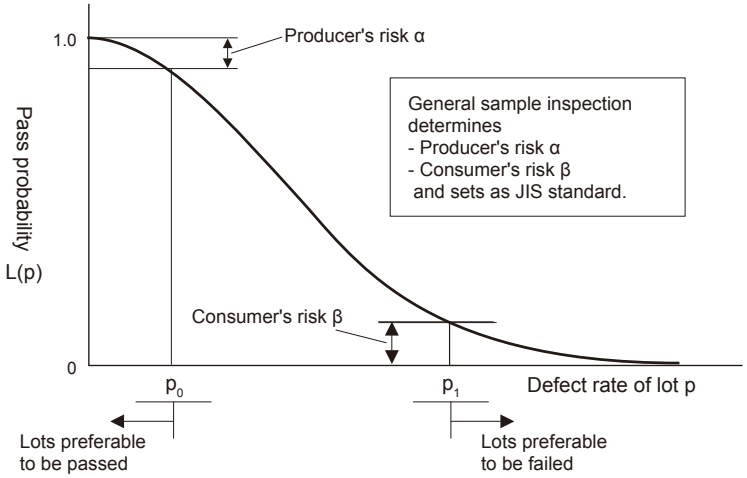
OC curve

- What degree of defect rate is accepted for a lot to pass?



OC curve if n=10, c=0

Viewing the OC curve



If quality standards are insufficient, sampling inspection is an important function for obtaining independent checkpoints used to build quality into processing. If inspection does not continuously find failed products, it will lose its effectiveness, and quality will decrease as a result. Because of this, it is important to perform containment and quality assurance activities for the inspection process as well. Some businesses intentionally insert nonconforming items to test whether or not the inspection process is functioning properly.

Sampling inspection is not limited to tangible objects, but can also be used to inspect services and other intangibles.

Quality control in procurement must be carried out for suppliers to improve the quality of delivered items, and also to have them improve the built-in quality of their business. The key to these activities is to prevent a repeat of daily failures, and to create a management cycle using quality instruction to prevent the recurrence of defective items. This cycle will continuously maintain and improve quality, prevent similar trouble from occurring again, and maintain a high level of quality for procured items through systematic learning.

4 Process Capability, Process Capability Examination

4-1 Process Capability (Index)

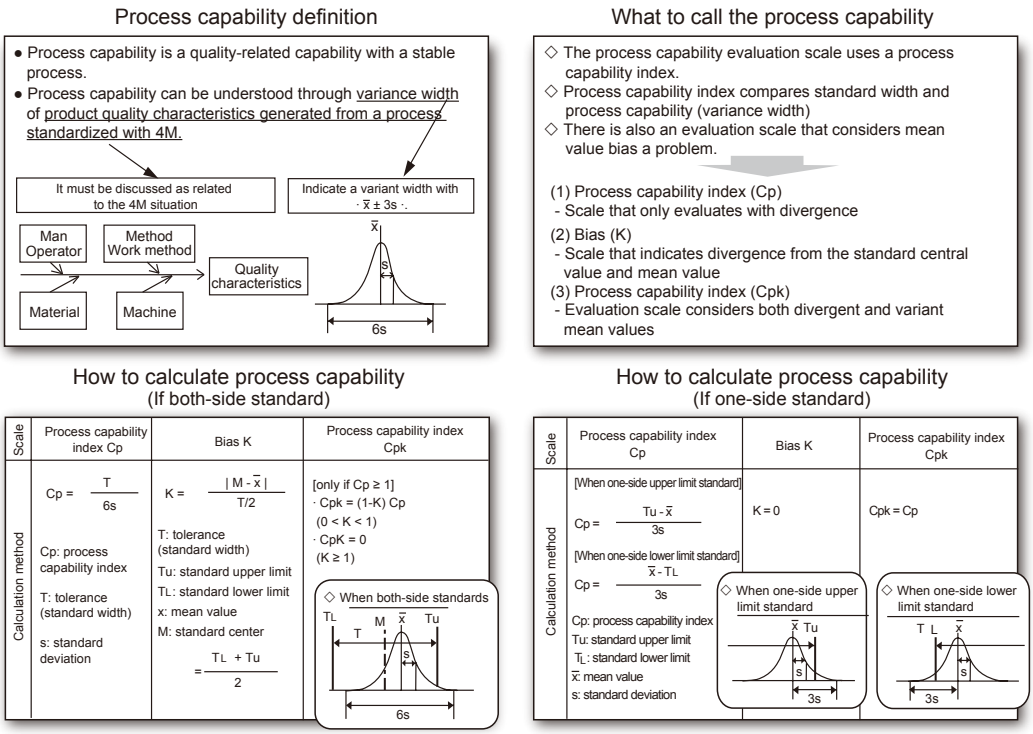
Process capability procurement is a well-known method allowing the buyer to quickly grasp the quality of a supplier's processes.

"Process capability" is defined by JISZ8101 "Quality Control Terms" as "the highest limit in which specific results can be achieved within a stable process". To put it differently, process capability is "an indicator of the level of quality that can be achieved when work is performed according to provided standards". One especially important aspect of this is the ability to indicate a variation of manufacturing quality under determined processing and work conditions.

Four things that influence manufacturing quality are materials, machines, methods, and men. This is generally referred to as 4M. When you want to check if 4M has the capability of achieving a certain level of quality, there is an extremely convenient indicator available called "process capability", which can show you the upper limit of quality that can be achieved by a certain process.

To summarize the items above, process capability is a "process quality-related capability used when process standardization is sufficient, abnormal causes are removed, and the process maintains a stable status, making it the optimal measure for evaluation indicating a supplier's capability to maintain stable quality" (Figure 5-14).

●Figure 5-14 Process Capability



■ 4-2 Process Capability Examination

Always keeping process capability at a good status is a fundamental of quality control. To do this, one important activity that must be performed is process capability examination.

Process capability examination is the action of checking work to make sure it is being performed according to standards, and verifying that the process is stable with no defects being generated. If the process does not meet those standards, continuous improvements must be made until it becomes stable.

Process capability examination is performed according to the steps shown in Figure 5-15.

There are three goals to attain through process capability examination.

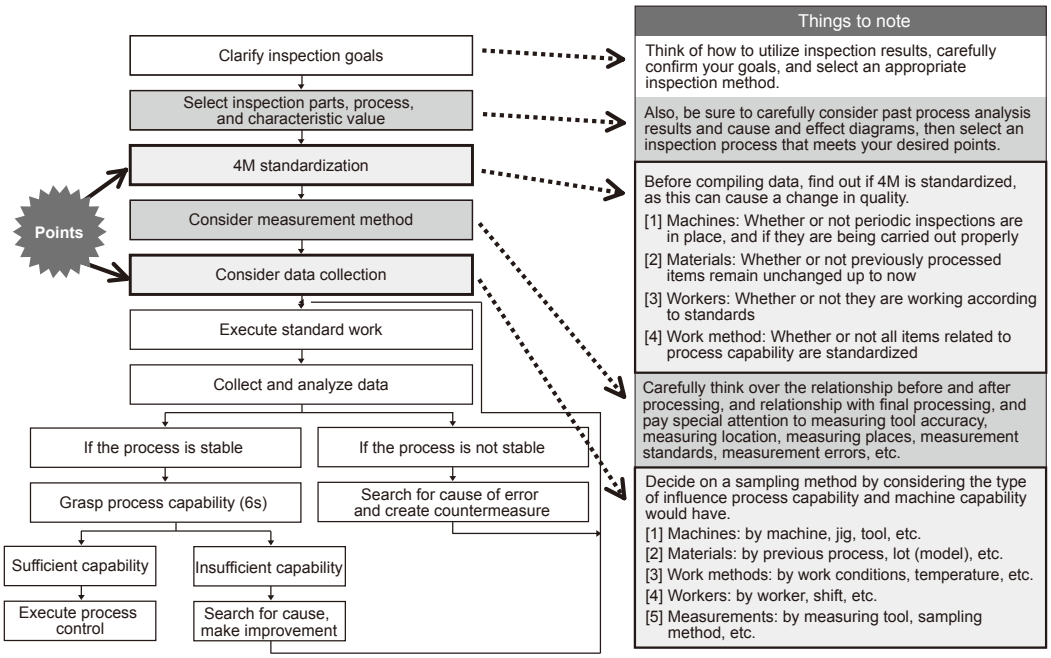
[1] Examination activity to improve process capability (if there is a problem, an improvement plan is devised, and the process is changed to one that produces no defects)

[2] Activity to maintain process capability (if the process is stable and not producing defects, it is to be maintained with management charts and periodic checks, etc.)

[3] Get other departments to utilize process capability information in multiple areas (product design, process design, process management plans, etc.)

Figure 5-16 shows ways to determine a process capability index.

●Figure 5-15 Process Capability Examination Steps



●Figure 5-16Ways to Determine a Process Capability Index

Cp	Determination
Cp ≥ 1.67	Process capability is remarkable (rate of defect is 0.0001% or less)
1.33 < Cp < 1.67	Process capability is satisfactory (rate of defect is between 0.0001% and 0.01%)
1.0 ≤ Cp ≤ 1.33	Process capability is not satisfactory, but is passable (rate of defect is between 0.01% and 0.3%)
Cp < 1.0	Process capability is insufficient (rate of defect is 0.3% or more)

Even if process capability is substantial, do not forget to perform periodic checks!

3 Delivery Control

1 What is Delivery Control?

Delivery control is a management task for making sure the delivery quantity and delivery period agreed on between businesses (buyer and supplier) are carried out as they should be. Many companies use on-time delivery ratio (OTD) as an index for evaluating suppliers, to confirm that items are delivered on the delivery period agreed upon when ordering. If items are delivered late, production plans and sales plans will be hindered, but if they are delivered too early, it leads to a waste of overstock, capital, and storage space, increasing the costs to be borne by businesses. "Just in Time" (delivered in time) and "Just on Time" (delivered at the exact date and time specified) are two evaluations which came from this mechanism and are now mainstream.

Daily delivery control is often utilized to make sure the "contracted amount" is delivered by the "contracted delivery date", or if a delivery is late, formulating measures to deal with it. Late delivery is not always the supplier's fault alone, as the buyer will often bear some responsibility as well, when making a sudden change of plans, etc.

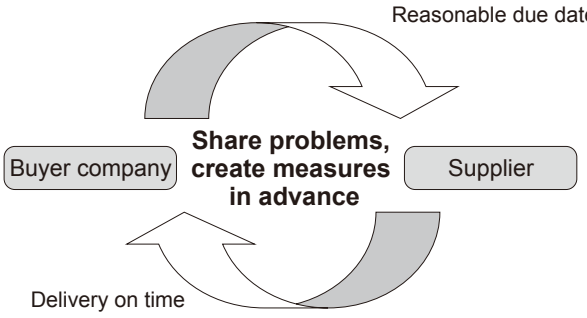
If delivery trouble occurs, and items are never delivered on time, activities should be focused on in advance that get the supplier to independently follow the delivery date, and also prevent the problem of arriving too early. Through delivery control, the buyer and supplier should intimately exchange information, and continuously work to improve cooperation based on mutual trust (Figure 5-17).

2 Procurement Business Aims

Delivery control plays a role in procurement activities as follows.

[1] Supply the necessary quantity of procured items and subcontract items to the customer

●Figure 5-17 What is Delivery Control?



according to delivery schedule, so that they can perform on-time delivery and carry out production as planned

- Structure the upstream process so that late delivery causes are eliminated
- Work to meet on-time delivery even if there are temporary changes in specifications or delivery schedule

[2] Dramatically reduce the supplier's in-process inventory, and have them improve asset turnover ratio without possessing unnecessary stock.

[3] Reduce procurement lead-time to help reduce production lead-time.

- Simplify and systematize procedures spanning from order to acceptance inspection
- Reduce delivery lead-time by cooperating with supplier through support and guidance up to secondary subcontract

[4] Have the supplier create a management system for delivery assurance

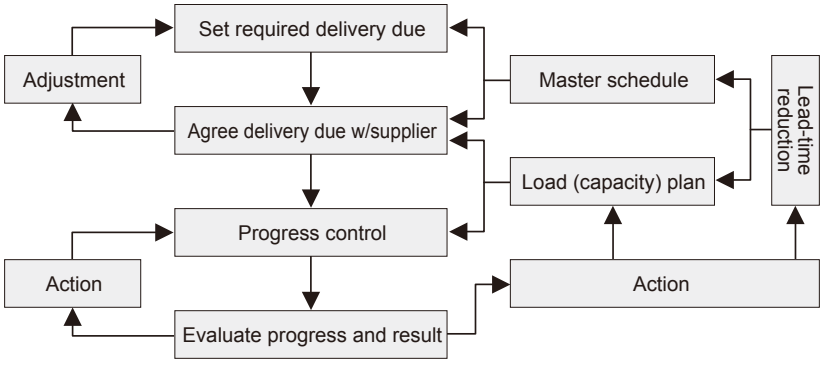
3 Delivery Control Concept and Approach

The basic steps of delivery control are as follows

- The buyer company determines and presents a requested delivery time, based on its own production planning
- Check the supplier's capabilities and circumstances, then determine a contracted due date
- Independently manage production progress for the supplier, and if it seems a delivery date problem may occur, immediately notify the buyer in charge to discuss remedial measures.
- Perform a tally results evaluation, formulate an improvement plan as needed, then work out a substitute supplier development plan.

In order to achieve the aims of procurement tasks, buyer company and supplier must work together, set a standard schedule as shown below, then adjust requested delivery date and contracted delivery date as needed (Figure 5-18).

●Figure 5-18 Delivery Control Functions



3-1 Setting Up a Standard Schedule

A standard schedule should be created to receive ordered items on the specified delivery date, by determining which processes should commence on which dates, as well as which arrangements should be made when. Figure 5-19 shows an example breakdown of the standard production period used in a standard schedule. "Allowance" on the diagram refers to the amount of wait time needed for production plan and production preparation tasks to be done before processing, and the period required for inspection, packaging, etc. after processing.

When setting up allowance time, you must determine how much order receiving is to be taken on by whom, according to the supplier's production management level and production capabilities. Since this is influenced by the power relationship between buyer company and supplier, the following points must also be considered when setting up allowance time: dependence (what percentage of the supplier's order receiving amount is occupied by the buyer company's order amount), occupancy (what percentage of the supplier's production line capability is occupied by the buyer company's order quantity), management standards (past on-time delivery rate, etc.)

By setting up a standard schedule, the buyer company can consider a time frame agreed on by both parties in advance before ordering, and a system must be created so that the supplier can complete all work and get the items delivered within that time frame.

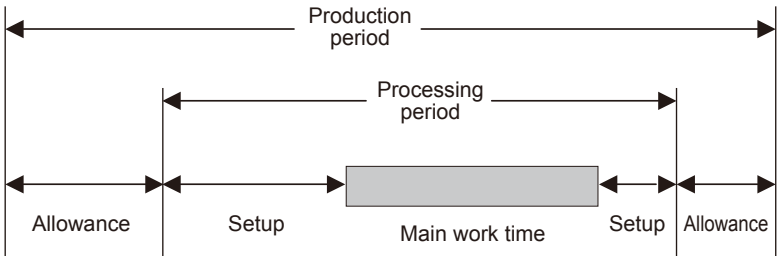
3-2 Adjustment of Required Delivery Date and Contract Delivery Date

The buyer relays its requested delivery date to the supplier based on its own production/ procurement plan, and the supplier responds with a deliverable period based on its own workload capacity. Both parties then adjust as needed to come up with a contracted delivery date.

(1) How to set a requested delivery date

Generally, the buyer company will set a requested delivery date based on its production plan and the standard schedule created earlier. A schedule plan chart, a process plan chart created on-site, or a plan based on the required quantity of parts etc. created by the Production Plan Department is

●Figure 5-19 Standard Production Period and Breakdown



received by the Procurement Department, slack (period of allowance) is considered, and the supplier is notified.

In cases where new products or products ordered for individual production such as prototypes, design processing, etc. take up a significant portion of the schedule, the requested delivery date is sometimes set based on an ATP (available-to-promise) response from the supplier providing a delivery date estimate.

(2) ATP (available-to-promise) response from the supplier

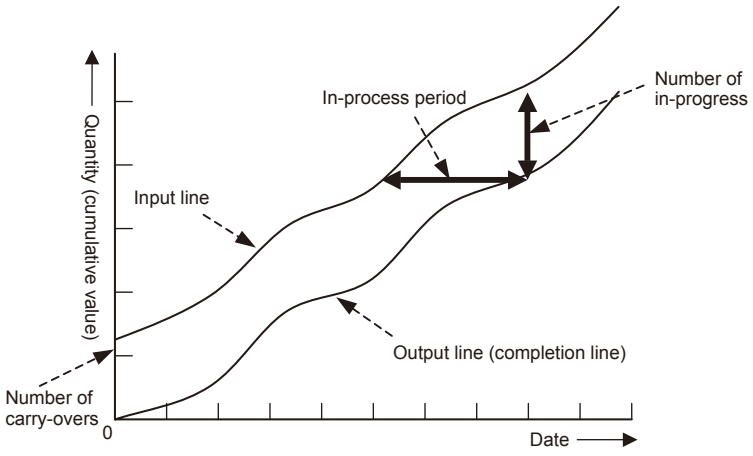
There are two types of ATP (available-to-promise) provided by the supplier, one based on the standard schedule, and one based on a capability plan.

The ATP based on a standard schedule is comparatively easier if the supplier has substantial production capability, and a standard schedule has been drawn up in advance for each product. However, if the supplier does not have substantial production capability, the delivery may take longer than the standard schedule states due to the supplier's current order receiving situation or level of progress in processing. When using this sort of ATP based on capability, the production load for product orders is unstable, and it would be difficult to deliver according to the standard schedule if the buyer suddenly requested a massive order. Also, the supplier can only provide a delivery date estimate after receiving the order, so this sort of ATP cannot be determined in some cases.

Even for repeat products, the quantity of orders received can change dramatically for some products depending on the season, so the buyer must always grasp the supplier's current load situation. In order to increase the accuracy of fixed time delivery, delivery periods should be analyzed based on past results, and it would be beneficial to set factors based on those analysis results, along with a seasonal index (Figure 5-20).

A load chart can be created to clarify capability-based ATPs, including the relationship between

●Figure 5-20 How to Find a Delivery Date from the Fluidity Number Curve

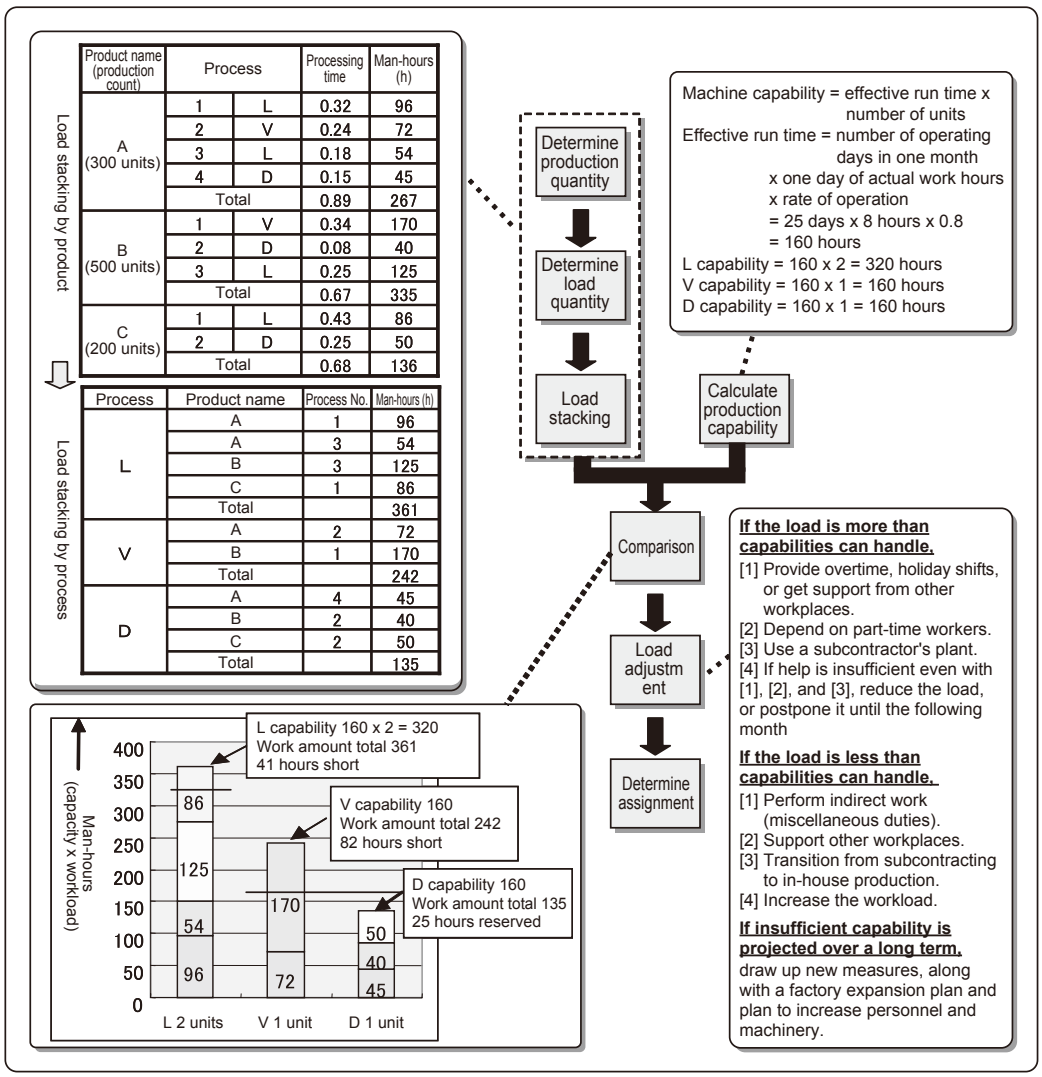


the supplier's work load and production ability, based on orders received and production plan information. The load chart is a useful tool for illustrating which processes have insufficient capability, or which processes have insufficient work. Creation of a load chart highlighting production capability and workload over a certain period will help with leveling, so that the gap between capability and work can be narrowed for each process and facility. Leveling is done for employee movement, process and machine usage adjustment, dealing with overtime, etc. (Figure 5-21).

(3) Delivery date adjustment

If the buyer company's requested delivery date does not match up with the supplier's ATP response, the delivery date will have to be adjusted. Of course, keeping the requested delivery date

●Diagram 5-21 Loading Process Example



is important to the buyer, but in reality, the buyer company and supplier will sometimes have to work together to adjust the delivery date to something both parties can handle. Even if the buyer company insists on keeping the requested delivery date unchanged, and the supplier accepts the unrealistic schedule knowing that it's too difficult, it may lead to increased costs, and eventually delivery delays, which is a far cry from optimal QCD.

The buyer decides in-house whether or not the delivery date can be postponed due to machine switching in production planning, etc. Also, the supplier can put a great deal of effort into moving as close as possible to the desired delivery date by improving bottleneck process production capabilities, improving production efficiency, changing the order of priority, utilizing a subcontracted factory, etc.

Eventually, the contracted delivery date might be adjusted to a date that both parties agree on, but in cases where delivery date adjustment frequently does not go well, adding a supplier, or changing to a different supplier, is also an option.

3-3 How to Improve On-time Delivery Ratio (OTD)

To improve the supplier's on-time delivery ratio (OTD), there are many points in which the buyer company can cooperate, making delivery control easier for the buyer.

Causes of stable production are as follows:

[1] A stable production plan

[2] A stable production process

[3] Short production period, and small quantity of in-process inventory

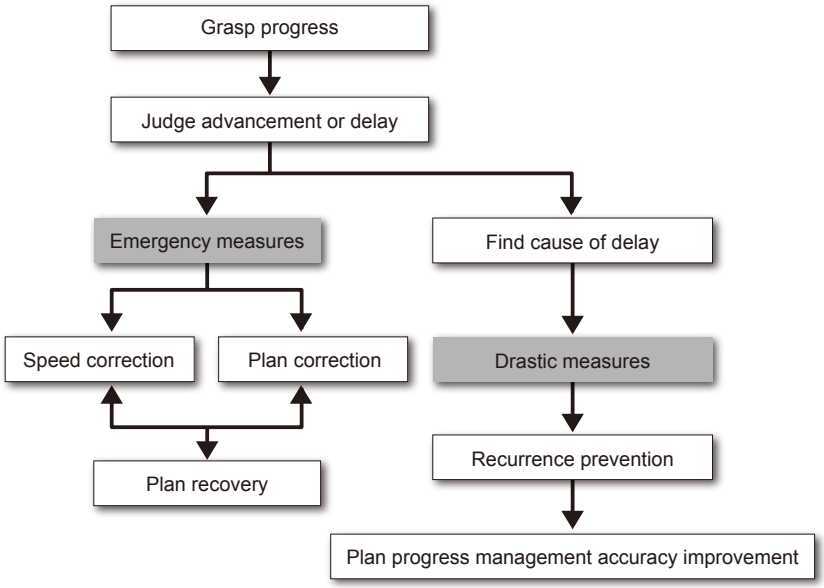
[4] No reasons for changing design, etc.

If these production conditions are stable, delivery control can be simplified. Sales plan and production plan adjustments are to be done by the Production Management Department, but it is important to carefully consider the extent in which these changes will influence the supplier. For design changes as well, it's important to look at inventory and WIP, and determine a logical time to make the change that considers the level of urgency. There are other things to think about as well, such as whether or not the use of special processes or materials is necessary, if a change can be made to standard products or processes, etc. to decrease lead time.

Progress management is essential for long-term process products and construction-related delivery control, or when a significant delivery delay occurs once. Progress management is basically the same for all tasks involved, but the significance of certain management points may change depending on the task.

When dealing with a supplier that frequently delivers late, the buyer needs to check if a progress management mechanism is firmly in place, urge action on any improvements needed, and must offer support in creating a system that assures on-time delivery.

●**Figure 5-22 Progress Management Functions and Steps**



When receiving orders for individual products in the manufacturing industry, it becomes a "various kinds and small quantity" situation, with process-centered progress management becoming the main focus for each order, and since continuous order production results in a large production quantity for one type of product, quantitative progress management is the main subject.

(1) Process-centered progress management points

[1] What product is advancing to what point? (individual progress)

[2] What is involved in each process? (WIP situation)

[3] Compare processes to the plan to see which are moving forward and which are delayed, to manage progress by parts, by products, and by orders.

For individual orders, progress management of each order unit (progress management by product) and progress management of total ordered products (factory progress management) come together like a matrix, so the buyer needs to clearly present the supplier with an order of priority, and needs a strategy to minimize damage from delivery delay, with no hindrance to total factory efficiency.

(2) Quantitative progress management points

With continuous build-to-order manufacturing, the product line is determined successively, so:

[1] Gain quantitative understanding (how many of a product has advanced)

[2] Compare to plan to see which are moving forward and which are delayed, to understand progress by parts, by products, and by orders.

Point: The buyer should instruct the supplier to maximize the capabilities of each process, and

think carefully about how output can be raised in the bottleneck process.

(3) Mass production plant and individual-production plant progress management

For mass-production plant progress management, quantity is easy to grasp, and plan accuracy is comparatively high, so people say it's easy. But if trouble occurs, the entire line is affected, which could be caused by:

- Machinery/equipment malfunction
- Employee absence
- Defective products generated
- Materials/parts delivered late

Pay close attention to these potential issues during progress management.

On the other hand, with individual-production plant progress management:

- Machining man-hours, specifications, etc. cannot be accurately understood at the planning phase
- A line cannot be formed, so capabilities cannot be sufficiently understood

Due to these reasons, planning is not nearly as accurate as compared to mass-production plant progress management.

Because of this, the key to successful individual-production plant progress management is to have a managing supervisor on site (to quickly discover and deal with potential issues). With a supervisor always on site, progress management can be carried out in a unified, meticulous manner.

(4) Construction-related progress management points

Progress management of factory or facility construction tasks involves many sections and vendors. So the challenge is to find out how it can get done within the planned construction period, by visualizing the overall progress situation, and improving cooperation between those involved. Of course, individual progress management is necessary, but critical path progress management of the overall construction period is especially important (Refer to Ⓢ Chapter 10 "2 Project Management and Procedures").

Allot tasks from a one-week or one-month process plan into the daily work plan, then confirm the starting day, arrangements to import materials, invested employees, etc. If anything is less than satisfactory, halt tasks or swap jobs as suited to the occasion. From a procurement standpoint in particular, one must pay close attention and check for any issues involved with importing fixed devices with a long delivery date. While performing individual progress management for these items, it is also important to check closely for any influence on the overall progress. If any influence is found on the overall progress, think of where and how recovery can be carried out.

(5) Progress management points

In any case, it is important to carrying out overall progress management while suppressing individual progress.

[1] Awareness that products are generally being made on site as planned

[2] Check thoroughly that there are no omissions in preparation

[3] Concentrate on managing exceptional items that require a decision

[4] Adopt a progress management method that conforms to the work site and production line (gathering of results, evaluation areas, timing)

[5] When there is a delay, thoroughly discuss the best route to recovery, reach a conclusion, and follow up as needed.

In order to perform these points, always specifically check the situations below and come up with measures to handle them.

- Prior management and post measures of machine/facility malfunctions
- Improvement measures for quality defects and defective product repair
- Resolve issues in advance at the trial production stage for mass production items
- Adjust capability and work load balance

■ 3-4 Reduction of Procurement Lead-time

(1) Period reduction approach for each procurement period breakdown

The most important goal in procurement tasks for delivery control is the reduction of procurement lead time. If the procurement lead time is short, ordering can be done according to a highly-accurate demand forecast. Basically, delivery control will be made easier. Inventory can be reduced as well, contributing to an improvement in cash flow. If there are long-delivery items among the basic parts, the procurement period itself is affected by customer sales lead time, and competition between businesses is influenced significantly. There are three perspectives covered here on the reduction of procurement lead-time.

[1] Information lead time

Many types of information are discussed between the buyer company and supplier, including demand forecast info, order placement info, technology info, design change info, inventory info, order backlog info, urgent service requests, delivery date response, late delivery alarm, etc. In the past, this information was handled on carbon paper, often used for purchase order and acknowledgement of purchase order, but with advances in information technology, many businesses are now exchanging information in digital form.

Finding ways to quickly and accurately transmit this information is directly linked to the spirit of competition among businesses. This exchange doesn't stop at simple communication between companies, but factors into each company's production management system, mutually increasing

their capability to quickly share information. This needs to be linked to the streamlining of business activities.

[2] Delivery methods

To trace the manufacture of products and parts from their original raw materials, a very long period of time is required. On the other hand, customers want a system that will get them their desired quantity at the desired time. The Procurement Department should work with its suppliers to reduce delivery lead time through various efforts, such as delivery frequency that considers economic efficiency, revision of delivery methods (JIT and delivery instruction methods) considering logistics and frequency of changes, and arranging stock points downstream. (For details, refer to Ⓢ Chapter 6 "5 Production Management"

[3] In-house lead time

When thinking about the responsibilities involved with procurement, from receiving and inspection to acceptance and warehousing, the supplier should work to reduce in-house lead time, after parts are delivered up to the warehousing phase.

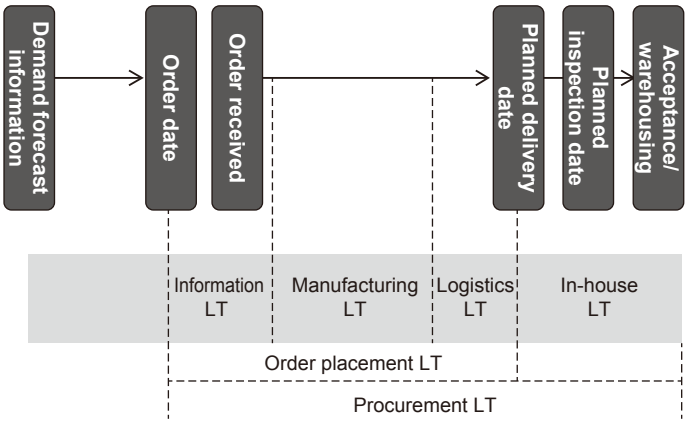
When drawing up a breakdown of procurement lead time, it should look like Figure 5-23.

One method of preventing in-house delays and congestion is for the supplier to hold independent inspections, which can eliminate the inspection period completely. For items that require in-house inspection, improvement can be made by increasing inspection efficiency (via staffing, scheduling, verifying the quality of periodic inspections, and clarifying inspection points). Accurate item management of accepted parts, and appropriate operation up to the warehousing phase are also important.

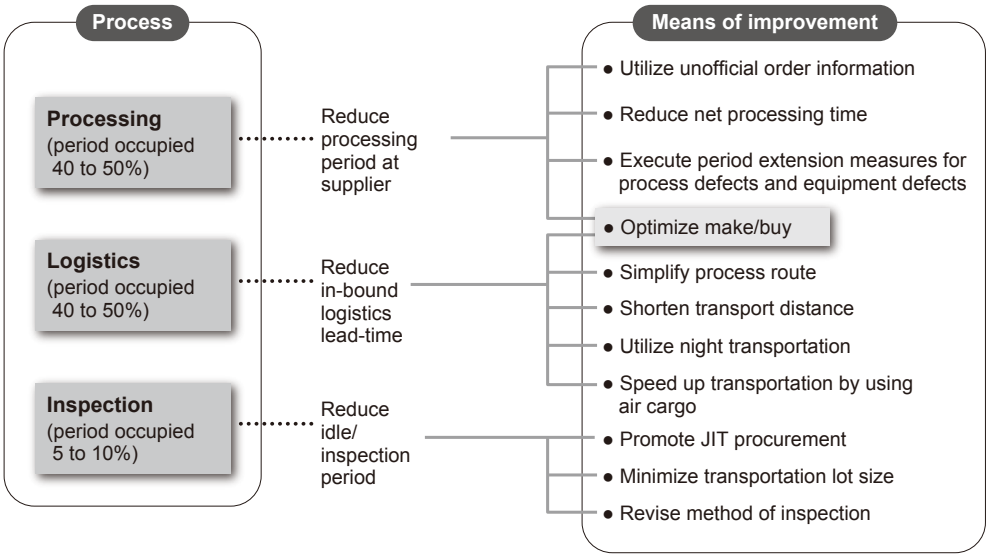
[4] Procurement lead time from supplier

Methods [1], [2], and [3] above should be applied to reducing the supplier's lead time as well, and possibilities of improvement should be explored for the supplier's relationship with the procuring party, delivery methods, and in-house lead time. For long delivery periods in particular, lead time should be analyzed with cooperation from the supplier, to clarify how much lead time is

●Figure 5-23 Procurement Lead Time (LT) Breakdown



●Figure 5-24 Procurement Period Breakdown Improvement Phases



needed for each process. The buyer company should also cooperate where possible, by actively working in-house to reduce lead time.

More specifically:

1) If there is a bottleneck process, think carefully about ways to improve its capabilities
2) If special materials are being used, discuss the possibility of changing to general-purpose materials
3) Are there ways to improve in-house manufacturing without outsourcing?
4) Increase the accuracy of demand forecasts
5) Eliminate waste and losses in logistics

Refer to Figure 5-24 for a breakdown of how to improve lead time for the supplier.

(2) Improvement approach to optimize "make-or-buy"

When a product is made up of multiple parts, the procurement period is different for each part. The part with the longest procurement period is called a bottleneck part. At first, it is beneficial to focus on that part in order to reduce the procurement period.

Ways of optimizing "make-or-buy":

[1] Subcontract by part and by process

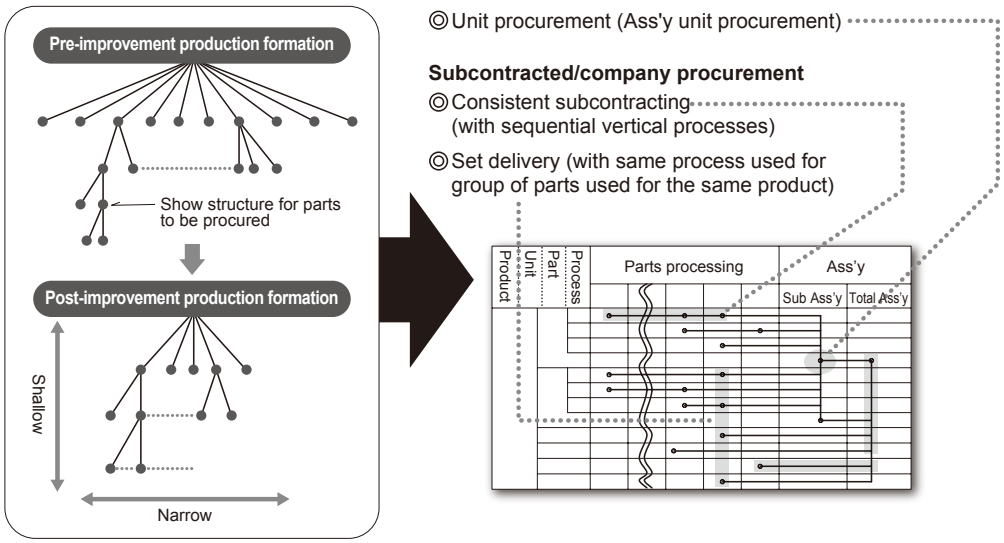
[2] Consistent subcontracting (have sequential vertical process)

[3] Set subcontracting (have same process for group of parts used for same product)

These are the three general methods, but when thinking of period reduction, number [2] consistent contracting is the preferable choice, especially for bottleneck parts.

This will eliminate movement and transfers between processes, and will also simplify delivery control by performing scheduling and inventory management with a focus on the bottleneck

●**Figure 5-25 Optimize Make or Buy Improvement Philosophy and Patterns**



process (Figure 5-25).

More businesses are going in the unit procurement direction (consistent subcontracting of mid-assembly parts) as a recent trend along with the CR effect.

4 Life Cycle Management

1 What is "Life Cycle Management"?

Originally a biological term, "life cycle" indicates a cycle of biological growth and reproduction that leads to general change.

In business studies, the term Product Life Cycle (PLC) refers to a product's life in the market, from the time it's first released, until demand for the product is lost and it disappears from the market.

Product Life Cycle is generally divided into four stages for a product: introduction stage, growth stage, mature stage, and decline stage. Appropriately managing each of those life stages is called life cycle management (Figure 5-26, Figure 5-27).

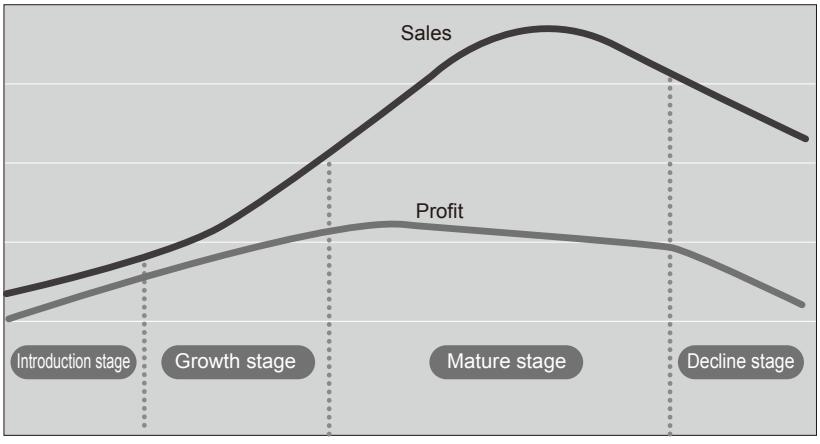
If the life cycle stages are different for the same product, important management points will also differ. Figure 5-28 shows the targets of each stage along with a basic strategy.

The philosophy behind "product life cycle" came from a basic concept with the purpose of

●Figure 5-26 Product Life Cycle Features

Stage	Feature
Introduction	Sales are still low, no profit, company in red. Cash flow goes into negative. Competition is still not difficult.
Growth	Sales quickly increase, and profit increases as well. Cash flow moves into positive. Competition increases.
Mature	Sales expansion decreases, profit is stable at high level. Cash flow goes into positive. Competition gets more difficult.
Decline	Both sales and profit decrease. Cash flow goes into negative. Competition decreases.

●Figure 5-27 Product Life Cycle Sales and Profit Images



●**Figure 5-28 Targets and Basic Strategy for Product Life Cycle**

Stage	Target	Basic strategy
Introduction	Innovation-oriented customers	Market expansion
Growth	Following customers	Market penetration
Mature	Conservative customers	Maintaining share
Decline	Delayed customers	Productivity ensured

creating a marketing strategy. The general way of viewing an overall life cycle today involves a comparison of account settlement for quarterly units. However, this perspective only tends to be a short-term correspondence. Looking at how much profit a product generated through its entire life shows total optimization over a longer time span.

In current times, with the difficulty of reaching a "high-growth period" type of sales increase, and no guarantees that a new product will be a hit, the importance of managing a product through its life cycle is increasing a great deal.

In the past, when a product reached the end of its life, it was common sense to get rid of remaining inventory by selling it off cheap or disposing of it. But from a modern "product life cycle" perspective, various factors must be considered, such as the reduction of wasteful disposal to be environmentally friendly, securing a certain level of profit expected from a business, and a smooth transition to the next new product.

2 Life Cycle Management for Procurement

Life cycle management in procurement need to be looked at from two angles: in-house products and procured items (Figure 5-29, Figure 5-30).

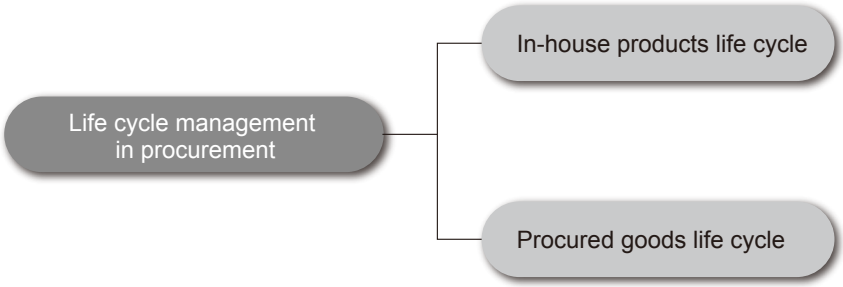
As shown by Figure 5-30, there are four stages in the lives of in-house products as well as procured products: which are introduction, growth, mature, and decline. And there are certain points to consider from each of those stages.

■ 2-1 In-house Product Life Cycle Management

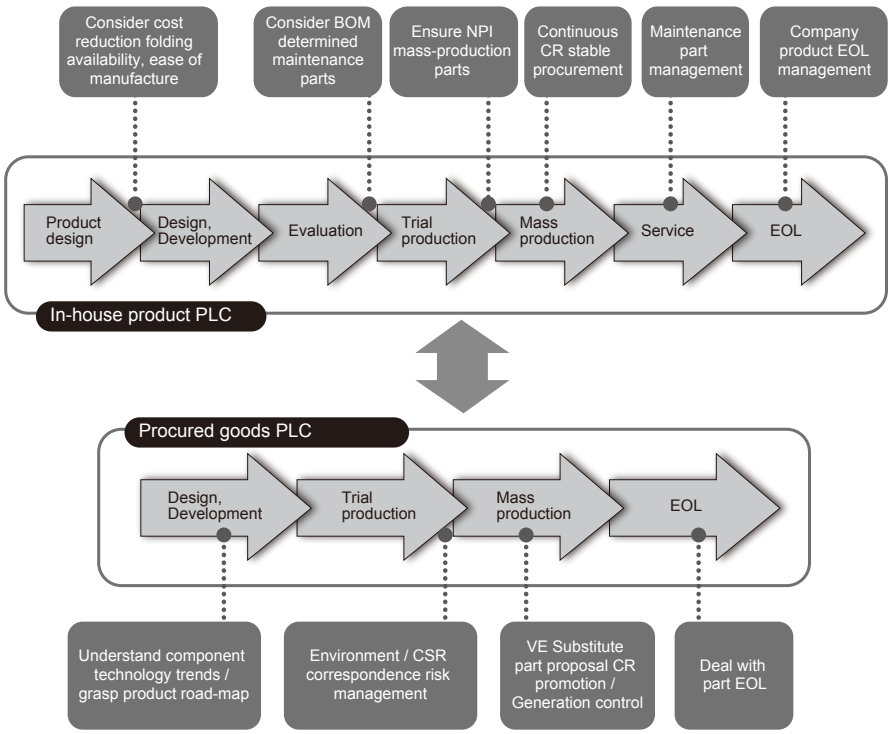
Procurement management points for each stage of the in-house product life cycle differ as follows.

For the introduction stage, initial parts need to be secured when starting up a product. During this startup phase, it's important to secure the needed quantity of parts in good quality, but due to

●**Figure 5-29 Life Cycle Management Points for Procurement**



●**Figure 5-30 In-house PLC (Product Life Cycle) and Procurement Good PLC Procurement Related Issues**



the addition of new parts, the possibility of unexpected issues arising will increase. Many businesses use a special system called NPI (New Product Introduction), and take all possible measures to ensure procurement activities.

In the growth stage, when a sudden increase in sales occurs, it may be impossible to keep supplying the required parts in some cases. Since the quality of parts these days is stable, quality is not an issue any more. However, it is important to ensure a parts supplying capability in order to procure parts without running into shortages.

In the mature stage, competition gets heavy with other companies entering the field, so CR requests to improve the product's competitive power will increase. With maturity comes an increase in production and efficiency, so thinking of ways to reap the benefits of CR becomes an

important point in this stage.

In the decline stage, production quantity drops, and profit tends to decrease as well, so ending production of the product is taken into consideration. At this stage, it is important to carefully monitor the planned production quantity, inventory, and remaining orders, while making sure not to end up with excessive parts.

■ 2-2 Life Cycle Management of Procured Items

With procured items as well, there are different ways of determining which stage of its life cycle a product is in. Figure 5-31 provides a list of procurement activity points for each stage of the procured good's life.

■ 2-3 EOL for Procured Items

One significant issue for the buyer to deal with regarding the life cycle of procured items is deciding when to halt manufacturing and sales. This is called EOL (End of Life) for the procured items, and it is a major issue for businesses handling products with a long supply period in particular.

Before handled parts or units reach their EOL, it is important to obtain information and draw up measures to deal with it in advance. Look over the following specific measures:

[1] Create a mechanism where parts near their EOL cannot be adopted during the product development of new products.

[2] Clarify the supplier's term of responsibility for supplying items.

[3] When sending a notification of sales cancellation, enter a contractual term a certain amount of time beforehand (for example, six months or a year before cancellation).

●Figure 5-31 Procurement Goods Life Cycle

Stage	Procurement activity points
Introduction	When newly procured goods enter the market, various issues can occur, such as samples not being shipped according to plan, and goods procured for mass production not meeting the delivery deadline. In any event, the supplier "wants to sell" before anything else, so it's important to carefully look over its shipping capacity, and ensure the required quantity.
Growth	A higher quantity of procured goods will be supplied, but demand will increase as well, and eventually there will be a shortage in supply. Since procured goods can no longer be obtained, the company will no longer be able to manufacture products in-house, and sales opportunities will be lost. So take all possible measures to ensure stable procurement.
Mature	Since an ample number of procured goods will be supplied, it will have a significant effect on price reduction.
Decline	If demand decreases for procured goods, and the profit margin gets bad, or the next new product is to be released etc., the supplier may decide to cancel the manufacture and sale of procured goods. This makes it difficult for the company to continue manufacturing in-house products, and leads to a loss in sales opportunity, so new measures will have to be drawn up in advance. Canceling the supply of procured goods may also influence the handling of maintenance parts for products that have already been canceled.

These and other measures should be taken.

Also, when actually receiving a notice of cancellation for the manufacture and sale of procured goods from the supplier, take the following steps.

[1] Contact related in-house departments and check into how they are influenced.

[2] If you want to continue using them, first contact the supplier to request or negotiate an extension of manufacturing and sales.

[3] Formulate a plan to continue business after cancellation occurs.

- Request a change in design from the Development department, and urge a switch to alternate parts.
- Calculate an estimate for the recommended required quantity from a future production plan of in-house products, and place a bulk order.

Etc.

In the electronic parts industry, excess or shortage resulting from this sort of production cancellation is seen as a business opportunity, with independent distributors as the main type of business (buying up excess product in various ways and reselling to customers).

Unlike agents (receiving commissions from vendors) which are under a formal agency contract with the manufacturer, distributors are independent sales companies. Depending on the situation, these types of selling agents can also be used to resolve the situation, but it is important to first confirm the production period and quality assurance.

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Study Guide 3

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CR Related Knowledge

1 Production Systems

1 Importance of Understanding Production Systems in Procurement Activities

The role of procurement throughout all production activities from order receipt to product shipment has become more important in recent years. The material ratio (external costs) in the overall production cost has tended to rise due to changes in make or buy work policies of factories, as well as due to the greater reliance on suppliers that has accompanied the increase of products with many kinds in small quantities.

As the reliance on suppliers increases, the importance of cost, quality and lead time control of procured items has also been increasing. The supreme mission of procurement is to achieve high management standards in all aspects related to costs, quality, and deliveries by discovering and cultivating outstanding suppliers and building good relationships with them.

In order to fulfill such roles, it is very important for the buyer to understand the processing methods and production systems how the parts, raw materials, and semi-finished products procured by the buyer are produced. Understanding the processing methods and production systems of suppliers clarifies management points such as the cost structure, quality, and delivery lead time of procured items and is helpful in achieving a reduction in total costs and stable procurement.

In addition, when the company consigns production, it is helpful to have a knowledge of these production systems such as the cost structures and bottlenecks of production schedule in order to facilitate the consignees management.

Furthermore, in case that the company itself is in the manufacturing business, this type of knowledge can be utilized to strengthen procurement activities such as setting up the appropriate frequency and calculating quantity of procurement for the company's own production activities.

2 Concepts of the Production of Industrial Products

■ 2-1 Types of Manufacturing Industries

The manufacturing industry is classified into process types and processing/assembly types based on differences between the utilized raw materials and parts the products to be produced.

Process type is manufacturing business that produces stable industrial materials by refining and processing raw materials and other materials such as underground resources and agricultural fishery products, while also producing industrial products by applying physical or chemical

changes to the industrial materials. This type of industry is represented by chemical, metal, and food businesses. In general, the process type manufacturing industry requires large scale equipment.

In processing/assembly types, inputs for the production are industrial products such as materials and parts.

Processing includes shaving or bending materials to convert them into parts for an intended purpose. On the other hand, assembly converts these parts into products with an intended function or form by assembling them.

Furthermore, from the viewpoint of manufacturing sites, classification can be made as follows.

For process types, production equipment is divided into continuous input production type by flow treatment equipment and lot–base input production type by batch processing equipment.

On the other hand, processing / assembly type are divided into line production type by flow shop (line) equipment arrangements and cell production type by job shop (grouping machines having the same function and performance) equipment arrangements.

Another classification of the manufacturing industry is based on which market the product is produced for. Products targeting general consumers are called consumer goods and products targeting other manufacturers are called production goods.

■ 2-2 Classification of Production Systems

Production systems in the manufacturing industry can be classified according to production control and production timing.

The following classification can be made with regard to systems of production control.

(1) Procurement method

[1] Product number system: This is a system focusing on products and managing with control numbers called product numbers given based on orders.

[2] MRP (Material Requirements Planning) system: This is a system focusing on parts and procuring/stocking the required quantity for each part. Procurement is based on plans, so products and orders are managed separately.

(2) Status control

[1] Product number/lot control: This is a system that controls manufacturing by work instructions and parts delivery based on manufacturing orders.

[2] Daily control: This is a system that manages total quantity by setting up a preplanned completion number each day and by determining the input quantity in consideration of the yield.

(3) Work instructions system

[1] Pull production system: This is a system that replenishes as much as the previous process used.

[2] Push production system: This is a system of production and procurement based on a plan.

Furthermore, the following classification can be made with regard to production timing.

Production start timing

[1] Forecast production: This is a system of production that utilizes forecasts based on demand forecasts.

[2] Built-to-order production: This system commences production after receiving orders.

3 Processing Methods and Production Systems

■ 3-1 Processing Methods

Processing refers to altering and transforming materials. A processing method refers to a specific processing method that is used in individual parts production. Processing methods are various. In this section, since there is no space that describes each of these processing methods, please refer to the respective technical documents for details.s In this section, the importance of knowledge about processing methods is described.

For the buyer, it is required to select the most suitable processing method for the production of the procured items from a variety of processing methods and to select suppliers who have the needed manufacturing know-how The selection of the processing methods is carried out from a comprehensive viewpoint of QCD according to characteristics such as the application, function, materials, size, strength, processing precision, quantity, number of types, and life cycle of the product to be processed.

What is important for the buyer is to know the characteristics and weaknesses of the processing method, including alternative processing methods about manufacturing the procured items. Knowing the characteristics and weaknesses can expand the options that pertain to the characteristics of the procured items, and make it possible to propose specifications for avoiding the weak points of the processing method.

What is even more desirable as a buyer is to be able to propose and promote improvements that increase the productivity of processing methods. It is important to have the ability to provide viewpoints of improvement on productivity losses so as to improve the material yield, quality yield, and occupancy rate, while shortening the cycle time.

What should be noted with regard to judgments on cost is the case where not only the unit price, but also an initial cost is required. Initial cost refers to initial investment on equipment

introduction, dies, and jigs. In general, processing methods that use highly versatile equipment (referred to as general-purpose machines) often require much time for processing work and a higher processing unit cost even when initial costs specific to the parts are not required. Alternatively, if customization (for example, press processing using a special die) is adopted, the processing time can be shortened and the processing unit cost can be suppressed. However, the judgment criteria in such a case must be whether or not it is possible to secure an amount just sufficient enough to gain an overall profit in spite of spending initial costs.

Technological innovation in the world is progressing rapidly and superior processing methods are being born every day. For example, it is considered that the utilization of 3D printers, which has recently been drawing attention, will increase in the future as a new processing method. Superior buyers are always on the lookout for this kind of information and always strive to expand their range of knowledge. By organizing such knowledge and having many options available, buyers will be able to do negotiation and business constructively with suppliers.

■ 3-2 Production Systems

(1) Production systems that combine hardware and software

According to Mr. Katsundo Hitomi of the Manufacturing Systems Engineering Center (MSEC), production systems can be defined as the fusion and systematization of three viewpoints:

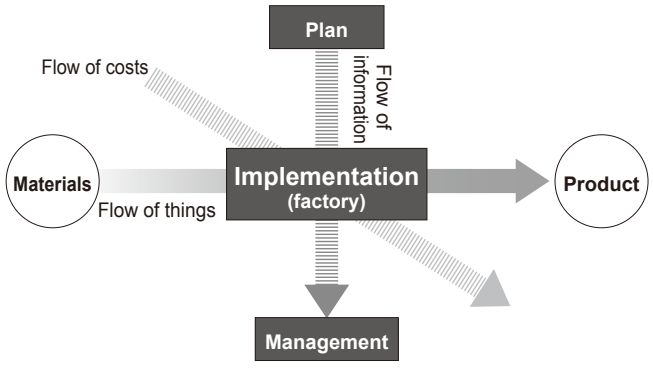
[1] Structure: Plant/layout

[2] Conversion: Logistics/supply chain system <flow of things>

[3] Procedures: Demand chain <flow of information and flow of cost>

In other words, production system in a narrow sense refers to a hardware such as production equipment, jigs and tools, and line layouts in the factory where production is carried out, but actually refers to an integrated system with software such as the "flow of things" and the "flow of cost" through overall process of manufacturing from the materials to the finished products and also the "information flow" which plans and manages these flows as shown in Figure 8-1.

●Figure 8-1 Three Pillars of Production: Flow of Things, Information and Cost



(2) Issues to be considered regarding production systems

Regarding the specific production processes related to the “flow of things”, there are usually several steps For example, when considering a simple steel desk production process, the following nine steps are required to finish from the steel plate of raw materials: cutting –> punching –> drilling –> bending –> welding –> painting –> pasting decorative boards –> assembling parts –> packing.

Then, how much time (lead time) is required to make one desk?

If the networking time required for each process is added up, the work can be completed in half a day.

However, actually, it cannot be simply said that half a day is enough when considering the time needed to receive an order from an end user and then ship the product. There are many variations of a "desk" such as in dimensions, color, and shape, and each of these must pass through the above mentioned nine steps.

In each process, when various items flow at random, inefficient production occurs due to step switchover work. As a result, there needs to be a consciousness at the production site, not only with respect to customer orders, but with regard to having a desire to process the same kinds of products to the greatest extent possible (batch processing).

Unfortunately, many problems tend to arise due to different points for determining the ease of manufacturing based on the circumstances of each process. For example, in the welding process, it is desirable to process items with the same dimensions all simultaneously. However, in the subsequent painting process, dimensions are not especially important, but rather, it is more efficient to batch orders that are painted with the same color.

In this respect, the painting process tries to wait until it is provided with products from the welding process that can be painted with the same color paint. In other words, a large volume of interim inventory is generated before the painting process begins, and at the same time, this results in a longer lead time as waiting time increases.

Most production systems have these problems more or less between the nine steps, and production time may be one week or ten days, whereas the production of a single product might only take half a day. This is not preferable situation in consideration of the service level provided to end users and of the inventory risk for the company.

The consideration of production systems for all processes in the manufacturing of materials is the theme pursued by each company for aiming how to produce in order to meet compatibility with conditions such as follows:

- Inventory reduction and lead time reduction
- Control of production costs due to switching loss

This theme is pursued continuously in all industries.

The degree of contribution and influence of procurement on the strengthening of the entire supply chain is large, and in procurement activities, it is also important to instruct suppliers with regard to manufacturing, while also considering the balance between the required cost and the requested lead time. It is extremely meaningful for the buyers to deepen their understanding of each individual processing method and these types of production systems.

4 Typical Production Systems

The basic form of mass production in the assembly industry can be traced back to the conveyor production system at Ford in America in 1914. Since then, the conveyor method has been adopted by many industries and developed with inventions added by each company.

In recent years, the weaknesses of the conveyor system have become apparent due to factors such as the diversification of goods, the shortening of the life cycle of goods, and the permeation of the importance of inventory control.

In this section, in order to further deepen an understanding of the production systems, this section describes following two systems that have been recently adopted and promoted by many companies as major production systems in the assembly industry.

- Toyota Production System (TPS)
- Cell Production System

5 Toyota Production System

The Toyota Production System is a production system established at Toyota Motor Corporation. As Toyota Motor Corporation is recognized as a representative company in Japan, the production method that supports its achievements is called TPS (Toyota Production System), and many companies have referred to it and promoted its adoption.

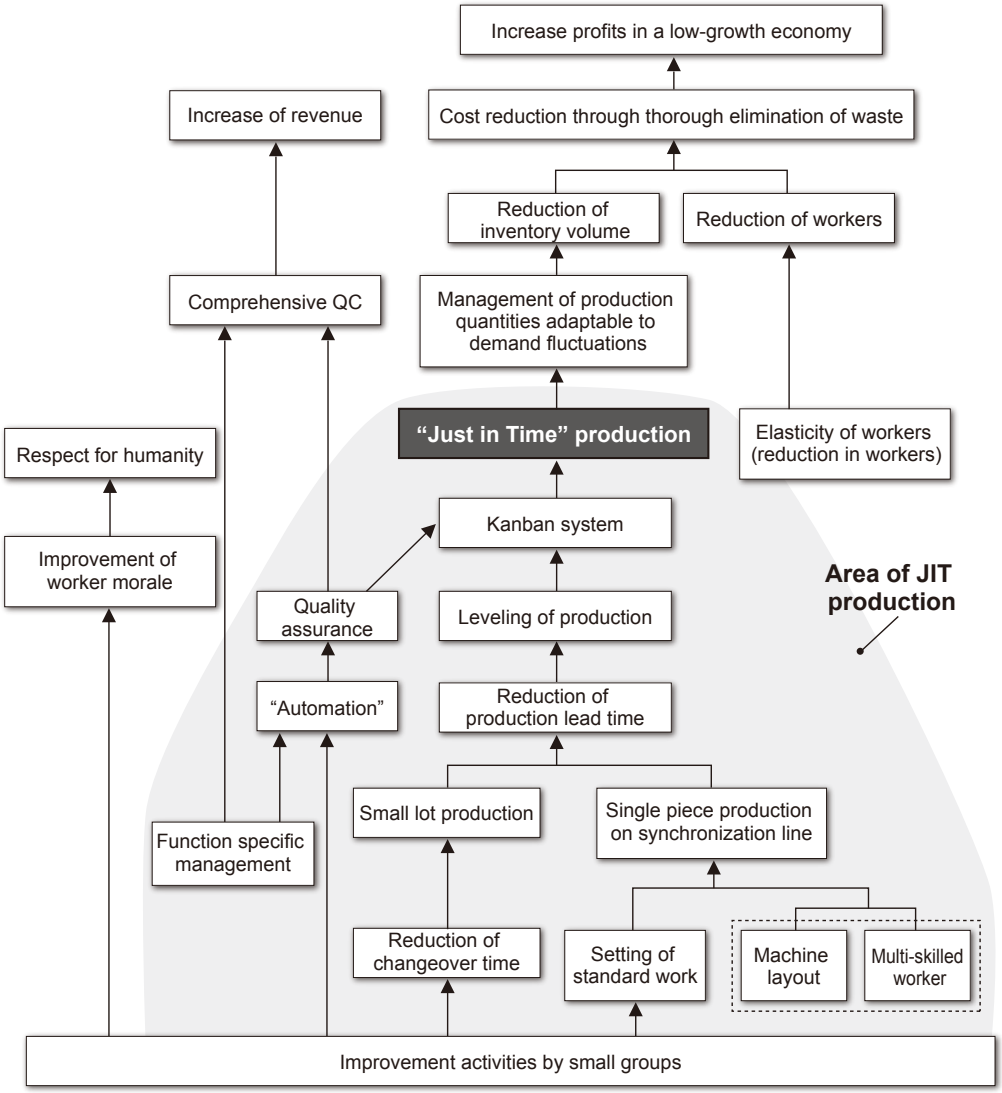
Since many books concerning the Toyota Production System have been published in recent years, detailed information can be obtained from such literature. This section introduces the pillars supporting the Toyota Production System.

■ 5-1 Foundation of the Toyota Production System

There are many factors that establish TPS, but the subsystem that forms the core, along with "Jidoka(automation)", is the JIT (Just In Time) production system (See Figure 8–2).

The Toyota Production System was created out of market constraints characterized by the production of many kinds in small quantities, and the JIT production system was also devised with the same origin.

●**Figure 8-2 Toyota Production System (TPS)**



Source: New Development of Toyota Production System (TPS) supervised by Taiichi Ohno, edited by Yasuhiro Monden Japan Management Association

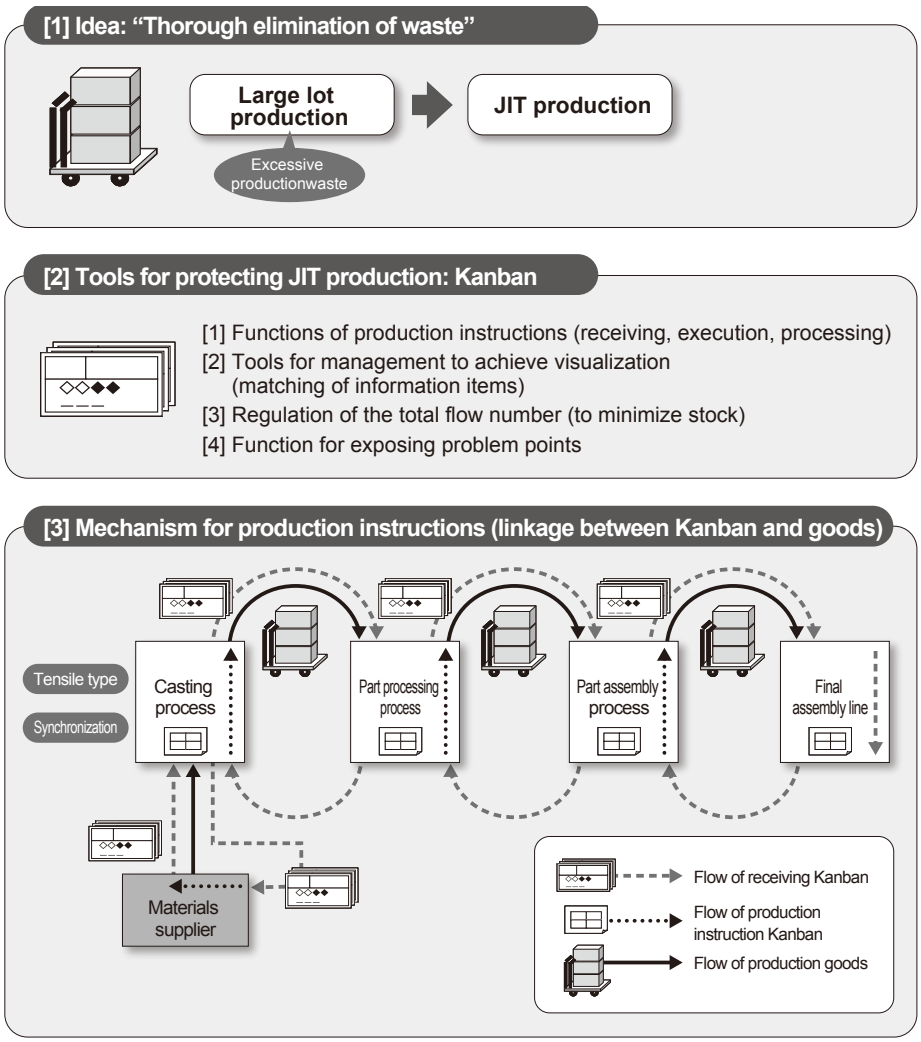
The concept of the JIT production system can be stated as a form of manufacturing by which "All processes are synchronized by only producing necessary parts with the necessary quantity at necessary time". This aimed at creating a flow of production that flexibly adapts to market fluctuations.

There are three main points that characterize the JIT production system (See Figure 8-3).

The first point is the "Thorough elimination of waste" such as waste that occurs from overproduction.

The second point is "Utilization of Kanban (means Signboard)" for developing JIT production in an easy-to-understand manner for the work site.

●Figure 8-3 Three Characteristics of the JIT Production Method



The third point is the "Creation of a mechanism for production instructions" that links Kanban with the actual goods.

The mechanism is based on the concept of creating and supplying only the necessary quantity of what is necessary for the subsequent process.

Up to this point, we have briefly introduced visible mechanisms such as the Kanban system to facilitate an understanding of the JIT production system, but the more important thing is to understand the concept of TPS and to employ it. This section will describe the following three points as important characteristics.

[1] Overcoming QCD trade-offs

[2] Flexibility

[3] Organizational learning

(1) Overcoming QCD trade-offs

In many companies' production activities, it is common to select a factor such as cost, quality, or lead time, and then set it as the main target point. This happens all too easily because it is connected to important factors such as there being an aversion to switching when cost is prioritized, or a prolongation of lead time when batch manufacturing is aimed for, or an increase in cost when quality standards are tightened.

Depending on the environment in which the company is situated, it is important to both aim at these high levels and achieve them, while striking a balance with factors that provide a competitive advantage such as “productivity”, “production quality”, and “production lead time”.

(2) Flexibility

This means achieving a production structure for products, responding flexibly to fluctuations in production volume and model changes, while also minimizing cost increases. More specifically, it is necessary to respond flexibly to the type, quantity, and product, while thoroughly striving to supply only the necessary goods with the necessary quantity and at the necessary time. This will act as the main axis, while improvements are made on-site with the purpose of achieving this goal.

(3) Organizational learning

An organizational learning mechanism is incorporated into daily work that continuously improves productivity, improves quality, and resolves other problems on a company-wide basis. By incorporating improvement cycles into daily work, improvement activities will be established. It is necessary that a recognition penetrate the workplace that the mechanisms for improvement are one of the most important work duties.

■ 5-2 Operation of the Improvement Cycle

The point of the life cycle operation lies in the cycle of continuous work duties that form the base of fostering awareness (See Figure 8-4) of improvement such as the following:

[1] Exposing waste

[2] Improvement (problem solving)

[3] Sustainment of improvement

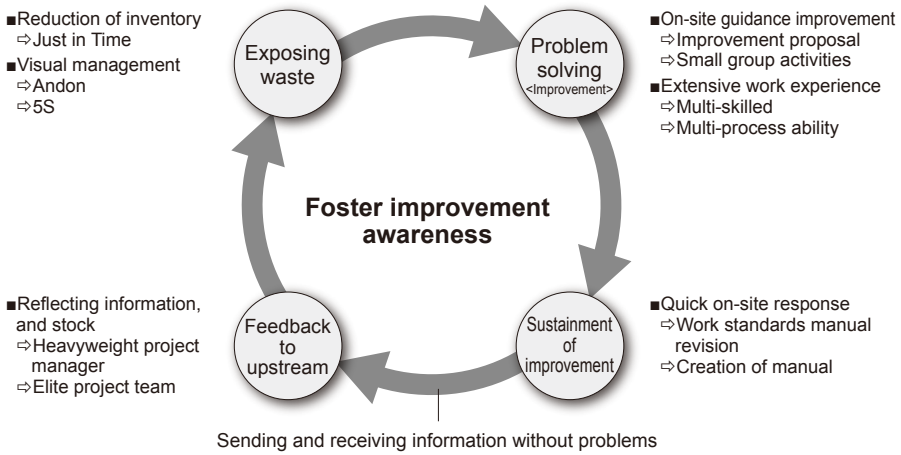
[4] Feedback to upstream

As to fundamental point, it is important to raise the level thoroughly by repeatedly going through the cycles.

(1) Exposing waste

Exposure of waste serves the purpose of implementing “visual management” by looking at the

●**Figure 8–4 Basic Operation Cycle of the Improvement Cycle**



workplace and items with the same standard of measurement regardless of whether it be the production side or management / supervision side to foster a common recognition among all workers, or preventing recurrence of abnormalities by using tools such as “Andon” and “Kanban” to expose process abnormalities and waste so that detection can be made quickly (“Andon” refers to a bulletin board system that displays the current progress status of the line, stoppage situations, and quality situations.).

Inventory volume is kept to a minimum through the concept of “Only producing necessary parts with the necessary quantity at necessary time”. It is possible to expose problems by using “inventory” as the barometer. Following exemplar problems may become obvious:

- When there are a lot of inventories for a certain process, this highlights that it is a “process for which improvements such as shortening the changeover have not advanced”.
- When there are a lot of inventories between processes, this highlights that it is a “process that cannot supply necessary goods for the subsequent process at the necessary timing”.

This can also be a type of “visual management”.

(2) Problem solving and improvement

Problem solving is done through the accumulation of improvements. It is important that improvement should be taken not only by staff and engineers but also by on–site workers who also take the initiative.

In improvement activities, if workers themselves acquire the ability to improve at small–scale equipment such as sheet metal processing and welding skills so that they can produce shelves, tools, and jigs, while also advancing in their “multi–skilled work ability”, it will be possible to accelerate the speed of improvement. In this way, the accomplishment of a work site improving itself is called a “voluntary improvement”, and one of the factors in promoting voluntary improvement is the ability to try to immediately make things just as one imagines.

(3) Sustainment of improvement

In addition to continuing to make improvements, it is impossible to obtain continuous results without the sustainment of improvements. It is always the first step toward sustainment to revise the standard work and implement document management for the latest version.

The standard work is indicated by two labels.

One is the "standard work combination label", which refers to multi-skilled work in which one worker processes many different machines and processes. This flow is summarized by a "man-machine chart" (combination diagram that show the work flow of workers and machines with a time axis.).

The other is the "standard work table" (the current specific procedure of the work, methods, points, cycle times, and work-in-process standards are described with illustrations), which is displayed inside the factory for all workers to see.

In addition, based on this "documentation", "work training" is also a key point for effectively cultivating skills. Training is to be done so that the level of workers increases to a certain standard, while also ensuring that work delays do not occur, and that quality is maintained.

(4) Feedback to upstream

In order to stabilize such improvements as those above, and facilitate improvements for the system, the basic activity is to promote to improvements and reform by going back to its source. The important thing in achieving this, when improvements are to be made on the work site, is to eventually move upstream in a manner that eradicates the root cause. From assembly sites to parts processing sites, to suppliers, to design... This grasping of true causes and reforming by returning to the source of origin is achieved by providing feedback to upstream.

■ 5-3 Lean Production

Finally, we will touch on lean production.

Lean production is a manufacturing system that aims to eliminate all waste, such as inventory, time, space, and labor, while continually improving the entire value chain. This term, lean production, was coined in the 1980s when research was carried out regarding the strength of Japanese manufacturers in America, and refers to the production system and mechanisms in Toyota which continued to carry out cost reduction activities. In that sense, it can be said that lean production was born from the Toyota Production System (TPS).

It was introduced to Japan in the form of reverse imports in the 1990s. In Japan, the Toyota Production System (TPS) has been drawing attention, but it has not yet to attain widespread adoption. On the other hand, the idea of lean production has spread widely in Europe and the United States, and its application is spreading beyond the manufacturing industry to other

industries. Similar to the Toyota Production System (TPS) mentioned earlier, lean production is not a form of manufacturing that should be set against a conveyor system, but should be regarded as a concept of manufacturing.

The value chain is the analysis framework Michael Porter presented in his book "Competitive Advantage". In order to secure a competitive advantage, it is considered that it is important to make each of these processes function as a chain and flexibly respond to market needs (Refer to S Chapter 1 "1 Strategy and Procurement").

6 Cell Production System

6-1 Characteristics of the Cell Production System

Cell production has taken the spotlight as a highly efficient production system that can replace conveyor production, and has been adopted in many companies.

The conveyor system is a representative production system that can be found in many companies even now. It reached full bloom during the era of high growth as a method of mass production of products as efficiently as possible.

This production system is famous for having been developed by the American automobile manufacturer Ford, as mentioned above. Since an automobile consists of many parts, this system suffered from poor efficiency because the various parts were not arranged next to the assembly processing lines, which meant that much space and time were needed to bring the parts in for assembly.

Ford searched for a solution by repeating a trial and error process, and in 1914, it built a mass production system with a belt conveyor system that implemented strict division of labor, reduced the amount of skilled work as much as possible to cut down on personnel expenses, and took measures to increase production volumes greatly. As a result, there was no conveyance of parts, and, production work became flow without waste or irregularities. This is the "Ford system". This technology made its way to Europe, and in 1925, Ford established a subsidiary in Germany.

However, in recent years, the following problems of the conveyor production system have become major obstacles for companies trying to respond quickly to changes in the manufacturing environment such as the diversification of market needs and globalization of competition.

[1] Humanity's potential cannot be fully utilized due to simple division of labor (lack of awareness regarding improvement)

[2] Difficulty in maintaining productivity in the course of flexible production system. (organization loss occurs)

[3] Increase in capital investment needed in the recombination of lines for each new product

While attempting to solve these problems, the cell production might be the solution that manufacturers have finally found out. This section classifies mainly the characteristics of cell production in comparison with those of conveyor production.

(1) Compact layout in consideration of traffic line

The foundation of cell production is to remove conveyors from the production line, and instead, lay out the work area with a combination of workbenches called cells.

There are many workplaces where cells are arranged in U shapes and L shapes as shown in Figure 8-5, while other companies have devised a petal like layout called a flower cell.

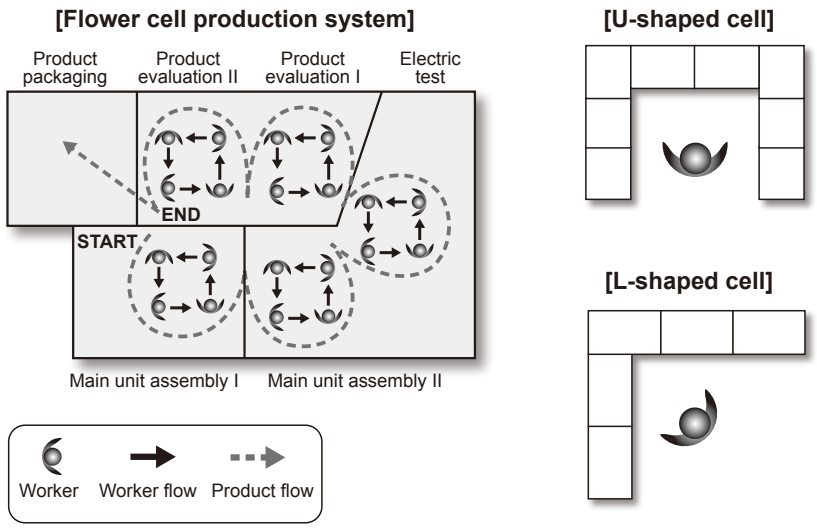
The common purpose of these layouts is to make the traffic line as short as possible since it is assumed that workers move while working in cells. U shape or L shape layout makes it possible for works to do other works by turning around themselves.

(2) Small group arrangement based on multi-skilled workers

A cell consists of a small number of operators, generally one or a few, and these operators are required to complete all processes from the initial process to the inspection process, and accordingly, accomplishment of multi-skilled is a precondition for introduction of cell production. As contrasted with cell production, conveyor production is fundamentally different in working style through a complete division of labor.

When introducing cell production, it is necessary to have a training period to foster multi-skilled workers, and it should be noted that it will take a certain amount of time to get things rolling in the beginning.

●Figure 8-5 Types of Cells



●**Figure 8-6 Comparison of Conveyor Production System and Cell Production System**

	Conveyor production system	Cell production system
Worker technology	Single-skilled worker (specialized in one task)	Multi-skilled worker (responsible for many tasks)
Skill required	Low	High
Workplace	Belt conveyor	Food stall type work booth
Operating speed	Adjust to slow worker	Helping one another
Work-in-process inventory	Large	Small
Line construction	Slow	Fast
Tools and jigs	Machine-oriented	Worker-oriented
Lot	Suitable for low mix-high volume production	Suitable for high mix-low volume production

(3) Flexible task sharing

In conveyor production, workers are arranged in fixed positions and work while waiting for the flow of products, but in a cell formation, there is a distinction in that both products and workers move. In a cell composed of multiple workers, flexible change of the assigned process is possible in order to support the delayed process while progress of work is being observed.

In principle, conveyor production maintains a certain pace while enforcing a strict division of labor based on fully designed work procedures, whereas cell production complements the limits of the work design with the ability of workers (Figure 8-6).

Since it is assumed that the contents of work are not fixed like in conveyor production, but mutual support is provided according to the work is progressing, it is understandable that the indispensable point is shortening the traffic line between products and workers using a compact layout like U shape..

■ 6-2 Advantages and Disadvantages of Cell Production

(1) Advantages of cell production

[1] Making efficient changeover work

The greatest merit is that product items (product variations) can be easily changed by replacing parts boxes and simplifying the change of work order in the cell. Efforts are made to greatly shorten changeover time, and this is most suitably applied to the high mix-low volume production. In order to make full use of this merit, it is important to determine by what unit the cells will be set. The point of success is to properly set up a cell meeting the requirements as much as possible compared to product varieties in the company.

[2] Improvement in line balance efficiency

It is possible to implement the work design with the line balance efficiency of the worker being 100%, that is, without waiting time, and without being restricted by the load balance of workers positioned before or after such as was the case with conveyor work.

[3] Improvement in worker morale

In terms of worker consciousness, it is not a monotonous repetition task, because many tasks are entrusted to the worker, mental satisfaction will be high and consciousness towards quality improvement can be expected to increase naturally. In the same manner, since workers can easily understand the meaning of the process (work) before and after their own work, efforts to improve work and quality are inevitable.

As a merit in operation, since the volume is increased or decreased according to individual worker ability, monetary incentives are easy to arise in terms of labor management, and there are companies that have adopted an evaluation system such as piece work system based on this merit.

[4] Training multi-skilled workers

From the perspective of training, it is expected that the training of multi-skilled workers will be easy because of the work evaluation in the cell through OJT. In particular, in a cell composed of multiple operators, it is relatively easy to train operators without reducing overall productivity by placing newcomers and experts in combination so as to help new comers in need.

[5] Shortening process lead time and reducing of work-in-progress

It is expected that it will be possible to shorten manufacturing lead time through strict single-piece flow production, while it can also be expected that there will be a great reduction in intermediate work-in-process due to the improvement of space utilization (reducing the distance of conveyance between workers and processes) based on the removal of conveyors. This merit is the ripple effect of cell production systems.

In Canon's production line, which always emerges as a successful case of cell production, the work-in-process, which averaged 20 days in the past, has been decreased to 4 to 5 days by the utilization of cell production. The fact that the work-in-process is less than a quarter of what it was means that working capital has also been reduced to one quarter.

In the case of Canon, efficiency improved as proficiency got higher, so that a cell which employed 30 workers only needed 20 workers after half a year, then only 15 workers. The company was thus successful at greatly improving productivity.

(2) Disadvantages of cell production

Then, is the cell production system perfect in every respect? There are also disadvantages in cell production, and it is necessary to fully examine these when adopting cell production in one's company.

One major disadvantage of cell production system is that it is difficult to maintain and manage productivity. The reason is that work efficiency is dependent on the individual motivation of workers, and as many processes are involved in a cell, the difference in individual skills and performance tend to occur even with the same training.

In the case of conveyor production, the work pace is forcefully restricted by the conveyor speed. Even in the case of not being an automatic conveyor, since it can be assumed that there is a division of labor, the progress of the pre and post processes tends to produce a constant pace. On the other hand, in the case of cell production with respect to the completed work of individuals, the pace is completely entrusted to the worker, and as a result, variations in the work performance of each worker are directly connected to productivity.

In recent years, many companies have been forced to lower the ratio of full-time employees for the sake of CR (cost reduction), and thus, cell production systems, which are based on individual skills and motivation, have required new idea ingenuity as to labor management.

Also, from the standpoint of workers who have undergone a division of labor in line production, the sense of burden increases as the scope of responsibility widens, and dissatisfactory through of harder work load in the same working hours lingers. It is sometimes difficult to persuade workers in adopting the system (Figure 8-7).

●Figure 8-7 Advantage and Disadvantage of Cell Production

	Advantage	Disadvantage
Productivity	Line balance efficiency is 100%	Work pace management is difficult
	Suitable for high mix-low volume production	Not suitable for mass production assembly
	Suitable for fluctuations in production volume	Manual work rate increases
Awareness of workers	Awareness to quality increases	Stressful
	High mental satisfaction	There are difficulties in persuasion
	Can earn monetary incentives	Depends on the worker pase
Training	Possible to train multi-skilled workers	Individual skill difference comes out

2 IE

1 What Is IE?

IE (industrial engineering) is a technique that aims at designing, improving and establishing an optimized integrated system of people, materials, equipment, and energy in order to improve productivity. In addition, engineering analysis, design principles and techniques, expert knowledge, and experience are used to clearly indicate and evaluate beforehand the results that arise in designing, improving and establishing an optimized integrated system.

The scope of application ranges from design and innovation of production systems to the improvement activities of a work site, and it provides strategic support for management.

■ 1-1 Importance of Understanding IE in Procurement CR

The buyer needs to judge whether the procurement price is appropriate. The procurement price consists of the cost and profit of the supplier. Since the cost includes various losses at the work site, it is possible to connect this to CR by assessing the cost and encouraging improvement.

It can also be important to understand the processes of procured items which go from raw materials → processing → delivery, while assessing what kind of losses are occurring, and working with suppliers to make improvements. IE is what can be applied in such a case.

In this section, the representative techniques of IE will be introduced mainly in regard to its purpose and procedure. In order to collaborate with suppliers to make CR, it is important to understand the purpose and analysis procedure of IE, to appropriately apply analysis techniques and improvement steps, to quantify losses, and understand what leads to improvement.

It is requested that IE be used as one tool for building partnerships with suppliers and to promote further improvement.

■ 1-2 Two Aspects of IE

There are two aspects of IE, which include method engineering and work measurement. These need to be applied according to purpose.

(1) Method engineering

Investigate and analyze how the work is to be done, and design and improve the most efficient method, that is, the ideal picture. Application is made to such things as the design of the work

method of the new product, to the improvement of the existing work method, to the change of the layout, and to the startup of a new factory.

The basic application procedure is as follows.

[1] Observe and record the way the operator work (This is an analysis method developed by Gilbreth who was the founder of motion analysis and method engineering, i.e., Therblig. With this method, motion can be analyzed by dividing it into detailed elements. It is a reversal of the founder's name Gilbreth).

[2] Study the results of analysis

[3] Design the most efficient work method (apply principle of motion economy)

(2) Work measurement

Achieve the management aim by defining standard work and setting up standard time.

The basic application procedure is as follows.

[1] Decide the proper method to work (standard work)

[2] Train workers in the proper way

[3] Indicate specific targets

[4] Define a proper speed (standard time)

For setting the standard time, there is the MTM analysis method (Method Time Measurement) and WF analysis method (Work Factor). MOST (Maynard Operation Sequence Technique), which is one of the MTM analysis methods, facilitates easy analysis and covers conventional drawbacks in terms of analysis speed and accuracy, and is a method compatible with the current demands of rapid change.

In general, IE sets a standard time based on standard work designed (improved) by the method engineering, measures implementation efficiency (standard time ÷ actual work time) with that standard, and uses this information when managing performance loss.

2 Basic Techniques for Improvement

■ 2-1 Basic Techniques for Improvement

When promoting improvement activities at the production site, it is necessary to achieve results as efficiently as possible. In order to achieve this, the easiest way is to utilize a quantitative approach based on efficient improvement steps and analytical techniques.

The aim of the efficient improvement step is as follows:

- To advance in the most important items so that the maximum effect can be obtained with minimum investment
- To avoid returning and redoing afterwards by proceeding according to the proper procedures

●**Figure 8-8 Major Techniques of IE**

Current status analysis technique	Improvement idea development technique
Grasp the production situation and quantify losses Method to find the target of improvement	Perspectives and ways of thinking for making improvement proposals
- Work unit - Time study - P-Q, P-MH analysis, data analysis - Process analysis (flow process chart, assembly chart, route analysis, flow diagram) - Utilization analysis (work sampling) - Line work analysis (pitch diagram) - M-M chart analysis (M-M chart)	- ECRS - 5W1H - Principle of motion economy - Brainstorming

The aims of the quantitative approach are the following three points:

- To aim to unify a recognition of people involved by grasping situations with numerical values (time, percentage %, number of cases, etc.) regardless of whether conditions are good or bad
- To narrow down the scope that can be expected to yield an effect via improvement
- To make a proper evaluation of improvement activities by predicting achievements quantitatively

Typical improvement steps can be the following:

[1] Selecting improvement scope (divided into units to be improved)

[2] Analyzing the current status (grasping of problems <losses>)

[3] Discussing improvement ideas

[4] Executing improvement

Techniques necessary to promote improvement are roughly divided into two types: current status analysis technique and improvement idea development technique (Figure 8-8). Each technique in the table will be described later.

- Current status analysis technique quantitatively identifies problems, grasps losses, and uses this information to find the area of improvement.
- Improvement idea development technique is used as a basic viewpoint and way of thinking for making a plan through discussing improvement ideas.

■ 2-2 Application of Improvement Technique

Current status analysis is characterized by basic analysis and detailed analysis. It is common to select important area of improvement after conducting basic analysis, and then analyze them in more detail. It is not efficient to carry out detailed analysis on all operations, but rather, it is better

to comprehensively grasp the loss structure through basic analysis, and then apply the detailed analysis technique on area that can be further clarified.

Figure 8-9 summarizes which improvement technique to apply in each step of improvement.

(1) Selection step for improvement scope

In this step, the following methods are used to select improvement scope:

- P-Q (Product-Quantity) analysis: Pareto analysis of product and production volume
- P-MH analysis (Product-Man Hour): Pareto analysis of product and man hours required for production
- Daily report analysis and utilization analysis (work sampling: WS): Analysis of situations of on-site operation/non-operation

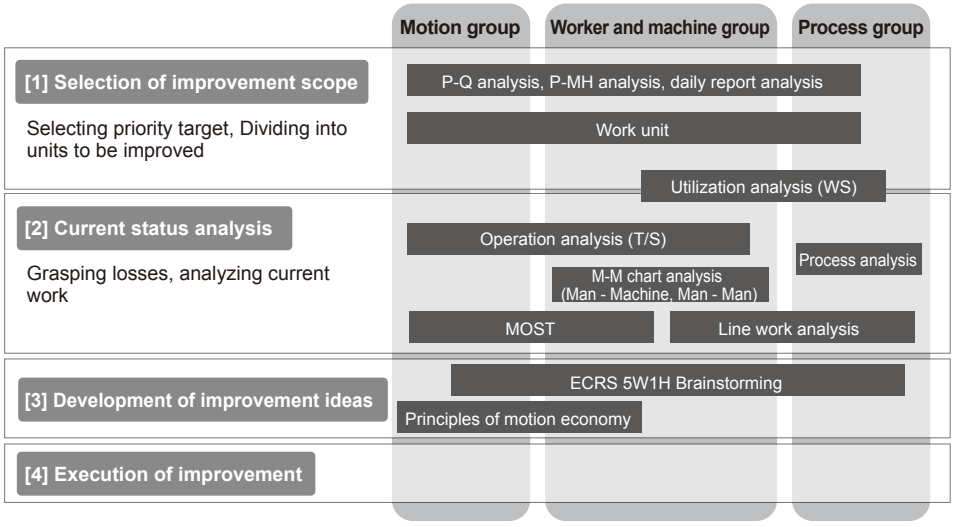
P-MH analysis is conducted when there is a large difference between products with respect to production man-hours. However, it is possible that products with a high improvement need, such as small production volume products with a large amount of production man-hours, will not be selected by using P-Q analysis only.

(2) Current status analysis step

In the current status analysis step, losses are grasped in detail by means of analyses such as process analysis, operation analysis (time study: TS), M-M chart analysis (Man - Machine, Man - Man), and line work analysis for the selected improvement scope.

In doing so, the analysis scope and their analysis units are classified into "motion groups", "worker and machine groups", and "process groups". Thereafter, the analysis method to be applied is appropriately selected.

●Figure 8-9 Targets of Improvement Technique



- The scope for a motion group is a job shop type workplaces that mostly do work by hand.
- The scope for a worker and machine group is workplaces that utilize and operate equipment that people use for machine processing, etc.
- The scope for a process group is workplaces that utilize line work and equipment lines

(3) Step for discussing improvement ideas

In the step for discussing improvement ideas, improvement ideas should be discussed by applying the principle concepts of improvement described in ECRS (Refer to this chapter "4 Improvement Idea Development Technique") and the principle of motion economy with respect to the loss extracted in the current status analysis step. Furthermore, when discussing the improvement ideas, it is important not to be confined to preconceptions, but rather, face the ideas with a conscious and questionable attitude and utilize brainstorming as a method for extracting improvement ideas.

3 Current Status Analysis Technique

■ 3-1 Time Study (Operation Analysis)

(1) What is a work unit?

A time study is an analytical method which divides work into an elemental work unit, and actually measures and evaluates time as a measure. This is also referred to as operation analysis.

A work unit is a structural unit of work and is classified as shown in Figure 8-10.

During a time study, measurements are made at the elemental work level. Elemental work is the smallest unit that can be measured with a stopwatch, being a detailed unit of work following a motion.

(2) Objectives of time study

The objectives of a time study are the following three points:

[1] To comprehend work amount quantitatively and identify the key objects for improving after modeling current work methods.

[2] To avoid omission of work which should be improved by clarifying and analyzing the contents of the current work.

[3] To discover waste at the elemental work level and make it the first step to pay attention to improving on it.

Regardless of the purpose of improvement, it is necessary to measure the time value of the work in order to quantify the current status. Furthermore, a time study should be conducted as the basis of the analysis method. In the following line work analysis and M-M chart analysis (Man -

●**Figure 8-10 Work Unit Classification**

Level	Work unit	Description	Example
6	Final product operation	Unit that unifies work and tasks necessary to fulfill the purposes (completion) Final output consisting of the accumulation of each process	- Automatic vehicle assembly - Manufacturing
5	Intermediate products/ operations	Completion state of the work sequence at the intermediate stage after several steps	- Engine assembly - Machining
4	Work processes	Unit that oversees completion as one work cycle by one unified work task in a fixed work area	- Gear processing - Car body welding
3	Unit operation	Smallest unit that can concretely evaluate the degree of work effort and work results with the smallest unit to be completed as work	- Material cutting - Drilling
2	Elemental work	Breaking off one work composed of a combination of several motions Smallest unit that can be measured with a stopwatch	- Pick up materials - Hit with a hammer
1	Motion	Division of the smallest unit of work Smallest measurable unit that composes elemental work	- Reach out - Grab

Machine, Man – Man), it is necessary to measure the working time in order to quantify the current status.

(3) Analysis procedure of the time study

The output image of the time study is as shown in Figure 8-11, and the procedure is described below.

[1] Classification of the target work

When preparing for the time measurement, the target work should be observed, while dividing the work procedure into elemental work units and writing it out. Although it is possible to analyze while observing the work directly at the work site, it is common to conduct the analysis by carrying out VTR photographing of work. It is best to make the unit size of the elemental work as small as possible, but in consideration of observability, it should be limited to 2 to 3 second units. In particular, it is important to distinguish between tasks with different work objectives or frequencies of occurrence.

[2] Measurement of work time

Measure the time for each elemental work unit that is written out.

During the observation, confirm whether the work is being done normally, and get cooperation after having experienced workers explained and understood the purpose of observation. There are ways to use stopwatches for observation, but it is more convenient to use the time value on the digital display of the video camera. In the case of regular repetitive work, after 5 to 10 consecutive observations, the representative values of each elemental work should be determined. As shown in the figure, observations 1 to 5 on the horizontal axis are conducted, and the average values are

●**Figure 8-11 Example of Time Study**

Time observation form (repetitive work)

Elemental operation			1	2	3	4	5	Average
1	Take the main unit, then take part A, and mount it to the main unit	INDV	5	5	6	3	3	4.4
		READ	5	42	79	122	158	
2	Take part B, and then use the jig to mount it to the main unit	INDV	6	5	6	7	6	6.0
		READ	11	47	85	129	164	
3	Reverse the main unit, and then take part C, and mount it to the main unit	INDV	4	5	3	3	4	3.8
		READ	15	52	88	132	168	
4	Tighten part D to the main unit	INDV	4	3	12	5	5	4.3
		READ	19	55	100	137	173	
5	Take the ratchet, and tighten part D to the main unit	INDV	5	4	4	4	5	4.4
		READ	24	59	104	141	178	
6	Take part E, and mount it to the main unit	INDV	4	6	5	4	4	4.6
		READ	28	65	109	145	182	
7	Take part F, and mount it to the main unit	INDV	3	3	3	3	2	2.8
		READ	31	68	112	148	184	
8	Take part G, tighten it to the main unit, and place down the main unit	INDV	6	5	7	7	6	6.2
		READ	37	73	119	155	190	
Total			37.0	36.0	46.0	36.0	35.0	36.5

●**Figure 8-12 Modeling Procedure and Time Values**

Modeling the procedure	Modeling the time values
- Basically, in many cases, the method/ operation procedure most frequently observed under current conditions is modeled. In other words, the work procedure performed on average by an experienced worker will be modeled. - Causes of procedure variation, irregular work, and troubles are naturally considered to be subject to improvement, and it is necessary to examine improvements separately.	- There are several methods of modeling individual time (calculation of representative value), but in general, average value or 1/4 selection value is recommended. * Average value... Average value of all observed values * 1/4 selection value... The value of the 1/4 sample (the third sample in the case of ten samples) from the smallest value among all observation values

calculated. “READ” is the read in value of the stopwatch, and “INDV” is the individual time of each piece of work.

[3] Reviewing the observation results

- The observation records should be summarized while fresh in one’s memory (the same day), and records of items being observed for improvement should be recorded in the greatest detail and utilized for work improvement.
- Calculate individual time and representative value. In particular, it should be checked whether the long times and short times are abnormal, and then calculate the representative

value after excluding abnormal values. (In the figure, the work for the 4th item of the 3rd time is an abnormal value.)

The procedures and time values will vary for the results of the work observation in many cases. It is necessary to model the current status and think about improvements based on the current procedures/time values. The concept of current modeling is as shown in Figure 8-12.

[4] Reviewing the improvement ideas

When analyzing the current work and proposing an improvement idea, it is important not to be confined to preconceptions, but rather, face the ideas with a conscious and questionable attitude.

■ 3-2 Process Analysis

(1) Purpose of process analysis

Process analysis is a method of capturing the processes and routes used to make materials and products at a production site by utilizing a series of processes, and then expressing them with predetermined symbols, and clarifying the current status to obtain the idea for improvement.

A process refers to a work range shared by one worker, one piece of equipment, or one work area to achieve a certain task (objective) (Figure 8-13).

The objectives of process analysis are the following three points:

[1] To clarify the structure of the process and the mutual relationship of each process

[2] To find unnecessary parts of the process and to clarify the area of the improvement

[3] To find problems related to the varieties and sequences of processes and to clarify the area of the improvement

●Figure 8-13 Positioning of Processes

Level	Work unit	Description	Example
6	Final product operation	Unit that unifies work and tasks necessary to fulfill the purposes (completion) Final output consisting of the accumulation of each process	- Automatic vehicle assembly - Manufacturing
5	Intermediate products/ operations	Completion state of the work sequence at the intermediate stage after several steps	- Engine assembly - Machining
4	Work processes	Unit that oversees completion as one work cycle by one unified work task in a fixed work area	- Gear processing - Car body welding
3	Unit operation	Smallest unit that can concretely evaluate the degree of work effort and work results with the smallest unit to be completed as work	- Material cutting - Drilling
2	Elemental work	Breaking off one work composed of a combination of several actions Smallest unit that can be measured with a stopwatch	- Pick up materials - Hit with a hammer
1	Motion	Division of the smallest unit of work Smallest measurable unit that composes elemental work	- Reach out - Grab

Process analysis

(2) Flow process chart

A flow process chart is also referred to as processing process analysis, and the state in which one material or part changes through each process is shown from top to the bottom with process symbols in the order of processing (Figure 8–14).

It is used when materials and parts are processed in the workplace, and by clarifying conditions such as the process contents, time, distance traveled, and worker share, it is possible to reduce the work–in–process inventory and improve the lead time.

Although the details are omitted, the basic procedure of process analysis is as follows.

[1] Confirm objectives and scope
[2] Understand the outline of products and processes
[3] Investigation and analysis
[4] Create a summary table
[5] Review improvement ideas

(3) Points of improvement obtained from the flow process chart

From the analysis results, is it possible to eliminate the process?

Or is it possible to reduce the number of steps in each process?

Is it possible to reduce the time?

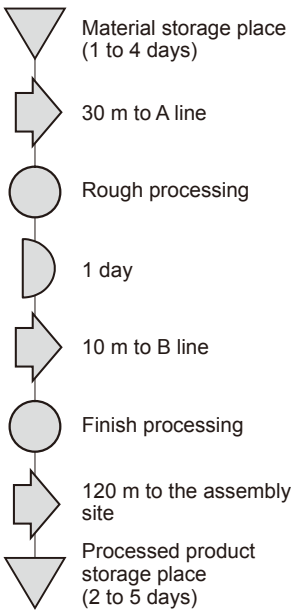
Is it possible to shorten the distance?

These questions should be considered when reviewing improvement ideas in detail (Figure 8–15).

●Figure 8–14 Symbols and Analysis Examples of Flow and Process Charts

Positive type	Name of symbol	Symbol	Description
Processing	Processing		Shows the process responsible for changing materials, semi-finished products, and parts
Transportation	Transportation		Shows the process of moving and transporting materials, semi-finished products and parts.
Inspection	Quantity inspection		Shows the process that measures the amount or number of materials, semi-finished products, and parts and compares them with the standards to know the difference
	Quality inspection		Shows the process that tests the quality characteristics of materials, semi-finished products, and parts and compares them with the standards to know the difference
Stagnation	Congestion		Shows the state of stagnation for materials, semi-finished products, and parts
	Storage		Shows the state of planned storage for materials, semi-finished products, and parts

[Process symbols]



●**Figure 8-15 Improvement Points for Process Analysis**

Process	Reduce number of process	Time reduction	Distance reduction
Processing	- Change of product design (VE) - Change of material specification - Change of packaging specification - Simultaneous processing with other processes	- Implementation of other work during waiting time - Increase of simultaneous processing processes - Elimination of operation waste - Improvement and automation of equipment capacity	
Transportation	- Reduction of distance between processes	- Change of transportation method - Increase of transportation lot - Change of transportation containers - Motorization of transportation methods	- Change of layout
Inspection	- Implementation of self-inspection - Elimination of defect causes and elimination of inspection	- Change of inspection tools - Implementation of sampling inspection	
Stagnation storage	- Synchronization with previous process - Install line production - In-lining of subassembly - Improvement of process control level	- Smaller lots for processes - Reception of smaller lots of parts - Smaller lots for transportation - Elimination of process instability factors	

■ 3-3 Utilization Analysis

(1) Types of utilization analysis

Utilization analysis is a method of grasping the time ratio of the state of the workers and equipment during a certain time period (for example, working time).

There are two main analysis methods: the continuous observation method and the sampling method.

[1] Continuous observation method

The continuous observation method is a method of observing the state of workers and equipment continuously and grasping the time ratio. Although it is suitable for investigating specific workers and equipment in detail, it is difficult to investigate multiple subjects at once, so it is not suitable for general analysis of the entire site.

[2] Sampling method (work sampling)

The sampling method is a method for instantaneously observing the state of work or equipment, and then totaling them to grasp the time ratio of each work. Although it is not suitable for detailed

analysis due to instant observation, it is suitable for grasping the overall actual situation of the current status since it is possible to investigate a large number of workers and equipments with a small number of man-hours in a wide range.

These methods need to be selectively used depending on the required accuracy of the investigation, economic efficiency, and characteristics of the scope. However, work sampling is commonly used for general purposes.

(2) Purpose of utilization analysis

The purpose and aim of utilization analysis are the following three points:

[1] To quantify the loss and narrow down the scope for improvement

[2] To comprehend overall productivity improvement potential

[3] To comprehend the time value of each work/state generally

(3) Procedures for work sampling

[1] Clarification of the purpose of investigation

For example, clarify the purpose of the investigation, such as wanting to quantify the actual situation of transportation work or frequent stops of equipment, and then confirm whether the work sampling is appropriate as an analysis method.

[2] Classification and definition of the items of investigation

The target of observation suitable for the purpose of the work sampling is decided beforehand, such as people, equipment, workplaces, and time zones, and then the observation items (work items) are set and defined after doing a preliminary observation of the site to understand the work content.

In the case of observation shared by several people, it is necessary to make definition so that the point of the start and the end of the observation item can be known so as not to obscure the consistency of the observation, such as checking the same contents that were regarded differently by observers (Example of screw tightening work: pick up the screwdriver, tighten the screw, place down the screwdriver).

[3] Determination of observation period, number of observations, times, and traveling routes

The observation period is determined by the target state change cycles and analytical objectives. For example, in order to capture all changes at the site that is producing on a weekly cycle, generally a week-long observation period is required. However, in order to quantify frequent stops of equipment, it can be a one day observation if prediction is done for the product so that its ratio does not change regardless of what happens. Also, since accounting work fluctuates on a monthly cycle, a one month observation period is desirable.

When conducting work sampling, the actual value is approached as the number of observations

increases (improvement in accuracy). However, if it is only for finding the loss, the number of times is decided within the range in which the result does not differ greatly from actuality. Normally, the number of observations is calculated by the following formula:

Number of observations n = Number of observation objects × Number of observations per day × Days × Number of observers

During the observation, it is important to prevent "bias", which observes only a specific work.

Therefore, care must be taken to ensure observational randomness so as not to match the work cycle. To ensure randomness, there are methods to change the observation cycle and to change the observation timing as a result achieved by changing the observation route. When periodicity is not seen in the work, observation is often carried out in constant cycles.

[4] Implementation of observation

Observe the work site on days other than abnormal days such as inventory days and major cleaning days, and make sure to obtain the consent of the work site in advance. Confirm the operators assigned to the target workplace and the number of operators receiving aid during the observation, and ensure that the number of observations and the number of observed objects each time are the same. If the applicable person is absent, ask the reason on the spot and check the corresponding item. If no item is applicable, check "absent".

When an operation that is not in the observation item occurs during the observation, new observation items are set or contents thereof should be written in the margin of the sheet paper so that they can be reviewed later. Write points and improvement ideas noticed during the observation on the paper (Figure 8-16).

[5] Summary of results

Total up the number of checks from the result of work sampling and calculate each work ratio that occupies working hours. Summarizing the result by process, equipment, each workplace, and occasion for each time period and task manager (administrator and worker), so that problems can be easily reviewed (Figure 8-17).

●Figure 8–16 Example of Filling in Work Sampling Observation Form

For each time zone the ☑ of the number of applicable persons (one person A in the case of the example shown below) is written without excess or deficiency.

5 minute cycles
Observation time example

[Work sampling observation form]

Workplace: Bottling plant	Operation name: Bottle feeding operation	Worker: A	Product name: B	Implementation date:	Observer: C

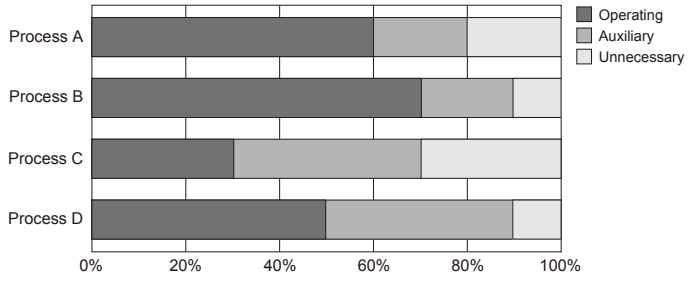
Observation time	7:30	7:35	7:40	7:45	7:50	7:55	8:00	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	9:00	9:05	9:10	9:15	9:20	9:25	9:30	9:35	9:40	9:45	9:50	9:55	10:00	10:05	10:10
Operation items	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
	✓	✓	✓																														
Startup																				✓													
Bottle supply on a pallet basis																																	
Machine room inspection				✓								✓																	✓				
Fill in production notes					✓																												
Goods receipt confirmation						✓	✓																										
Battery charging																					✓	✓										
Pallet processing																																	
Cover/sheet processing																							✓	✓									
Indoor cleaning																																	
Inventory check at ending time																																	
Waiting(Standby)																																	
Changeover																																	
Mechanical preparation																																	
Trouble (debulk machine)															✓	✓	✓																
.....																																	
Absent																								✓									
Waiting(Standing by) while equipment in operation								✓	✓	✓	✓		✓	✓											✓	✓	✓	✓		✓			
General meeting																																	

*8:40 to 8:50 breakdown, line stoppage

Notes while observing abnormalities and improvement points during work

The location was confirmed with other workers, but since it is unknown, ☑ was given “Absent”.

●Figure 8–17 Example of Summary of Work Sampling Results



■ 3-4 Line Work Analysis

(1) Characteristics of line work

Line work makes it possible to achieve efficient production by maintaining merits and avoiding the risk of demerits.

Line work has the following four merits:

[1] Less conveyance man-hours [3] Line work is easy-to-learn

[2] Easy-to-manage [4] Less work-in-process

On the other hand, it has the following three big demerits:

[1] Trouble in one process will affect the whole line

[2] Man-hour loss is large in case of poor work balance

[3] Equipment and people are fixed, and a lack of flexibility for the change in production quantity and varieties.

In particular, man-hour loss due to poor line balance (difference in man-hours between processes within the line) and line stoppage due to troubles tend to create large losses, while conversely, it can also be said that there is room for improvement.

(2) Purpose of line work analysis

Line work analysis is an analysis method that expresses the man-hours of work assigned to each step in a pitch diagram based on the data obtained by the time study and clarifies the balance loss with the target cycle time to obtain points requiring improvement.

The goal is to shorten cycle time (increase output) and reduce personnel by clarifying and improving loss via a pitch diagram.

(3) Procedure of line work analysis

[1] Selection of improvement targets

In order to promote efficient improvement, important target products are set by P-Q analysis and/or P-MH analysis based on future production forecasts. It is important to consider the similarity and commonality of processes, as well as future roll-out to other products.

[2] Quantifying the current status

Quantify line operation time, yield rate, and net working time. The line operation time is calculated by subtracting the line stoppage time from the working time. The net working time is quantified by the time study of each process work.

[3] Setting the target cycle time

Divide the line operation time by the production volume and set the target cycle time of the line. For line reorganization, assign work up to this target cycle time (TCT). If a process exceeding the target cycle time occurs, overtime will be needed and this will be a loss. At the same time, if it falls below the TCT, line balance loss will occur. Production volume is calculated by dividing required production volume by the yield rate.

$$\text{Target cycle time} = \frac{\text{Working hours} - \text{Line stoppage hours}}{\text{Production required volume} \div \text{Yield rate}}$$

[4] Creation of current pitch diagram

The pitch diagram is a bar graph of the net working time of each process/step with time represented on the vertical axis and processes (workers) on the horizontal axis (Figure 8-18). By drawing the horizontal line of the target cycle time (TCT) on this graph, it is possible to calculate the line balance efficiency and the balance loss, which is the ratio of the net working time to the

target cycle time. As a result, balance loss is recognized as an improvement target.

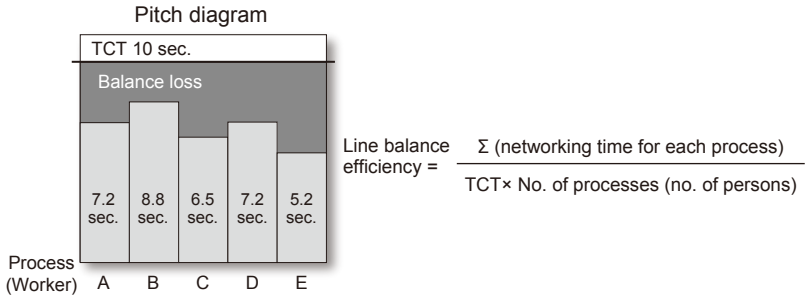
[5] Reviewing line work improvement ideas

There are three approaches for improving line balance efficiency in order to reduce personnel (reduction of input) and shorten cycle time (increase of output), which are the aims of improving the line work. These include shortening the net working time via work improvements, extending the target cycle time (reducing stoppage hours and improving yield rate), and reviewing work allocation.

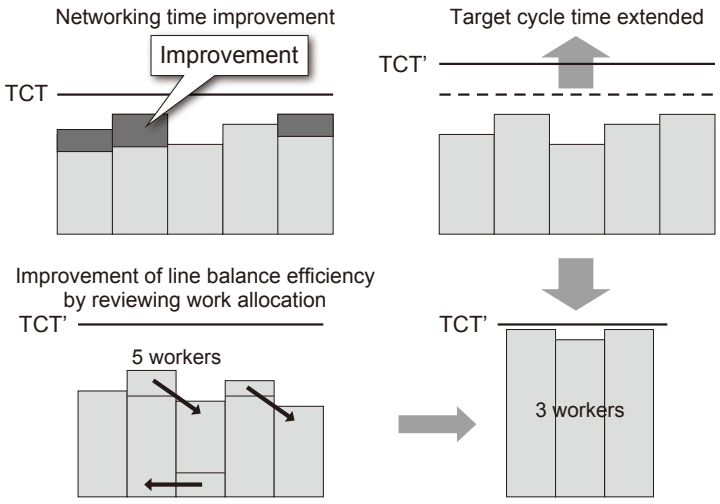
The following is a brief supplementary explanation on the target cycle time extension. Take a look at the equation to calculate the above target cycle time. The line operation time is calculated for numerator. Increasing the availability of the line (reducing downtime) extends the target cycle time to be calculated. Similarly, if the yield rate improves, the target cycle time will be extended.

If the target cycle time is extended, the time spent in each process will increase, which will make it easier to reduce the number of line operators (Figure 8-19).

●Figure 8-18 Pitch Diagram and Calculation Formula for Reorganization Efficiency



●Figure 8-19 Three Approaches to Line Work Improvement



[6] Layout design

When designing the layout of work area in line, it is important to pay attention to the following points so as to take advantage of the merits of the line and avoid the risk of the demerits.

- Set the shortest travel distance by devising the arrangement of parts and tools
- Secure adequate space such as work space, empty parts boxes and places for defective parts
- Ensure flexibility for assigned operators changes due to change in production quantity and varieties

[7] Evaluation and selection of improvement idea

In addition to a single improvement idea, multiple alternatives should be prepared, and evaluation made from the viewpoint of the impact of productivity improvement, cost of improvement, period for execution, and flexibility to condition variation, and thereafter, selection should be made of the best ideas.

In addition, it is important to pay attention to and review the following when performing the operation:

- Management of bottleneck processes
- Measures against work pace fluctuation
- Measures against fluctuation in production volume, occurrence of troubles, and fluctuation in yield rates
- Measures against wandering off and absences

Regarding bottleneck processes, it is also important to take measures so as not to set the first process as a neck process, arranging skilled workers, and arranging relief workers.

■ 3-5 M-M Chart Analysis (Man - Machine, Man - Man)

(1) What is M-M work?

M–M work is work wherein multiple work entities (humans and machines) collaborate to perform work such as machining and changeover. At the site where there is M–M work, each work entity has both independent work and collaborative work, and works while receiving mutual timing constraints. There are Man – Man and Man – Machine combinations (for example, a person makes 5 copies with a copy machine).

M–M chart analysis (Man – Machine, Man – Man) refers to the work process of each work entity performing M–M work that is described on a chart in consideration of each other's work timings, and it makes classification according to independent, M–M, and waiting/stoppage characteristics, while clarifying losses and aims of improvement. Charts created during this analysis are called Man – Machine charts, Man – Man charts, and M–M charts (Figure 8–20).

●Figure 8-20 M-M Chart

The following analytical symbols are used in M-M chart analysis (Man - Machine, Man - Man) so that each operation can be classified at a glance

Symbol	Name	Description	Worker	Machine
	Individual work	Operations not performed along with machines or other workers	Individual work	Automatic
	M-M work (Man-machine, Man-man)	Operations performed jointly, with machines or other workers	Collabor-ative	Handling
	Unnecessary	Waiting while an operation is performed by a machine or by other workers	Waiting (Standing by)	Stop – Idle

M-M chart analysis example

Worker	
	Removing chips
	Chucking
	Waiting (Standing by)
	Unchucking
	Measuring

Lathe	
	Removing chips
	Chucking
	Cutting
	Unchucking
	Stoppage

(2) Purpose of M-M chart analysis

The purpose of M-M chart analysis is to achieve the following two objectives by clarifying the loss and the work timing by the M-M chart, and then to improve the loss.

[1] Reduce the current cycle time (CT) to the target cycle time

[2] Decrease in number of operators allocated within the target cycle time (decrease in operators or multi-machine operation)

(3) Procedures for M-M chart analysis

[1] Selection of improvement targets

In order to promote efficient improvement, important targets are set by P-Q analysis and P-MH analysis based on future production forecasts. In order to improve the utilization rate, it is also applicable to non-repetitive tasks such as changeover work.

[2] Quantifying the current status

Operation time, yield rate, and working time should be quantified when there is repetitive work. For non-repetitive work (changeover work), the working time should be quantified. Regarding the quantification of working time, pay attention to the following points:

- To select tasks that mutually confine work timings for the work entities under observation
- To observe all working processes of the work entities
- To clarify what part of the M-M occurs at "what timing" of the work process
- Not to observe waiting time or inactivity/stoppage (clarified later in a chart)
- To unify the M-M working time between each work entity
- To clarify work allocation

[3] Setting the target cycle time

Set target cycle time according to the calculation formula that is described previously.

[4] Creation of the M-M chart

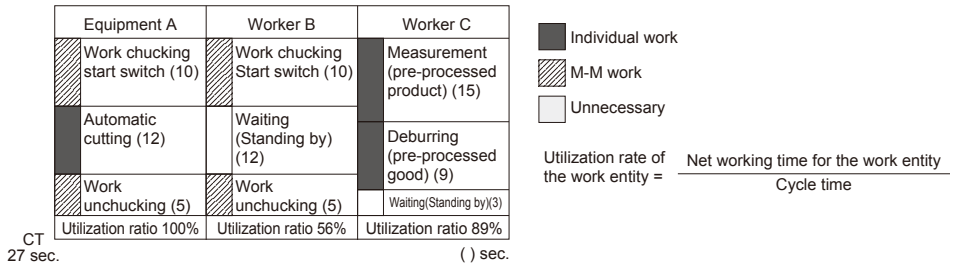
Create the M–M chart by matching up the quantified work with the work processes of each work entity. Keep the below points in mind when creating the M–M chart. By creating an M–M chart in this manner, the waiting time for personnel and stoppages of machines will become obvious (Figure 8–21). After this, the utilization rate of the work entities should be calculated.

- To unify the work start point of each work entity
- To unify the M-M work timing
- To clarify the single work cycle

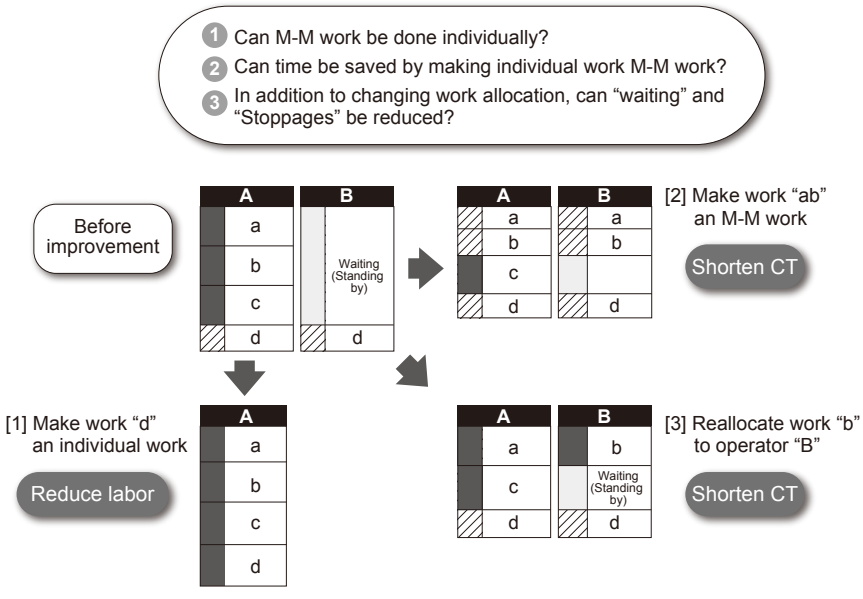
[5] Reviewing M-M work improvement ideas

There are three approaches for reducing personnel (input reduction) and shortening cycle time (increase of output), which are the aims of improving M–M work. These include shortening the net working time via work improvements, extending the target cycle time (reducing down time and

●Figure 8–21 Example of Creating M–M Chart



●Figure 8–22 Perspectives on Improving M–M Work



improving yield rate), and reviewing work allocation.

The viewpoints of improvement concerning M–M work allocation, procedures, and timing are shown in Figure 8–22.

[6] Layout design, [7] Evaluation and selection of improvement ideas

Specific details should be advanced after reviewing the improvement ideas. At such a time, the layout design should also be done, but the points to be noted are the same as those described in the line work analysis section. In addition, the procedure for evaluation and selection of the improvement ideas is also the same.

4 Improvement Idea Development Technique

In this section, the following two improvement idea development techniques will be introduced.

[1] Principle of ECRS

[2] Principle of motion economy

These are the most basic principles of improvement idea development. It is important to consider applying them to each loss or work item clarified by the current status analysis.

4-1 Principle of ECRS

(1) Consider elimination (E: Elimination)

[Can we eliminate the work?]: First, consider "Can we eliminate that job or work purpose?" If the work disappears, the improvement effect will be maximized. Therefore, it is necessary to think ahead of every improvement.

(2) Consider combining or separating (C: Combine)

[Can the work tasks be done simultaneously, or can they be done separately?]: Think about "what kind of work should be done" for work that cannot be eliminated. Regardless of preconceptions and prejudices, reorganize in as simple a way as possible. This viewpoint is the integration of tasks that are separately conducted, and vice versa.

(3) Consider rearrangement and replacement (R: Rearrange)

[Can the timing of work be changed?]: Consider "When the work should be done", and "In what order it should be done".

(4) Consider simplification (S: Simplify)

[Can't the distance be shortened, or the weight reduced, or it be done more easily?]: To make individual work as easy as possible, consider improvement such as shortening distances or reducing weight.

"E" should be considered first since it has the biggest effect if jobs or work themselves can be eliminated. On the other hand,

"S" should be considered last since it tends to yield easy improvements through mechanization and automation.

■ 4-2 Principle of Motion Economy

The origin of work improvement is improvement of motion. The principle of motion economy is to raise points of caution when aiming for efficient work design from the viewpoint of motion level.

[Principle 1: Reduce the number of motion]

[1] The number of motion should be as low as possible

[2] Consider holders for motion that require holding

[3] Effectively utilize automatic feed time and heating time

[4] Use appropriate tools and materials

[5] Integrate two or more tools into one, or use containers that make it easy to handle materials and parts

[6] Combine two or more motion into one

[7] Reduce extra motion by replacing the arrangement order of actions

[8] Reduce hand motion by effectively using feet

[Principle 2: Use both hands simultaneously]

[1] When possible, both hands should start work at the same time, so that they end simultaneously

[2] Ensure that both hand movements are in the opposite direction and symmetrical

[3] Use holders and foot stepping devices as much as possible

[Principle 3: Reduce movement distance]

[1] Shorten walking distances as much as possible

[2] Reduce body movements such as bending and twisting the body

[3] Shorten the movement distance of the arm. Use only forearms, wrists and fingers.

[4] Always look diligently at processed items or tools and place them as close as possible so that they can be reached by hand (To do this, one must be familiar with the normal working range when workers perform work)

[Principle 4: Easing operations]

[1] Use as much inertia, gravity, and natural power as possible

[2] Conveyance of heavy objects is often easy to do with simple conveyance equipment

[3] Hand grip tools and machines so that they are easy to handle

[4] Move along a natural motion path rather than a zigzag motion or a linear motion that changes direction at acute angles

[5] For work requiring accuracy, use simple tools to maintain the fixed motion paths

[6] Reduce difficulty of operation by using a little ingenuity

[7] Avoid unnatural posture and work in as easy a posture as possible

[8] Enhance the efficiency of workers by using good lighting

[9] Reduce fatigue through proper ventilation and normal temperatures and humidity

[10] Protect workers from injuries and obstacles and increase efficiency by providing safe, clean, tidy, and proper uniforms

4-3 Other Improvement Viewpoints

The principles of ECRS and motion economy mentioned in the previous section are the starting viewpoint of work efficiency improvement. For a more practical and generalized improvement viewpoint, 5S and space reduction need to be mentioned. Buyer is requested that these viewpoints be mastered and that one's eyes be opened to see supplier production sites.

5S refers to five Japanese words: seiri, seiton, seiso, seiketsu, and shitsuke. When transliterated into Roman Script from Japanese, the words start with the letter "S". They can be translated as organize, stabilize, cleaning, cleanliness, and habituation. Although direct efforts do keep the workplace clean, these activities also aim at improving employee morale, improving work efficiency, prevention of outflow of defects, and improvement of workplace safety. 5S is being adopted world-wide.

Space reduction refers to the activities that reduce wasted space in the production site, save space, and make space for other activities. Space reduction is a term that has spread about when cell production system has spread. Space reduction efforts are made to eliminate wasted movements, improve work efficiency, increase space productivity, reduce energy costs, lighting cost and so on.

Finally, improving the efficiency of such production sites will lead to true results only when the workers at the workplace acquire and establish a viewpoint of improvement, and are determined to continuously advance in improvement activities. Therefore, it is important to infuse a way of thinking on the site using easy-to-understand and easy-to-remember terms such as 5S and space reduction.

3 Equipment Maintenance

1 Objectives of Having the Knowledge of Equipment Maintenance in Procurement

Many factories use equipment to perform production activities. The productivity, quality, and yield of a product are greatly affected by the quality of operation of the equipment, and as a result, this is reflected in the cost of the procured goods. Needless to say, products produced with equipment that have few losses and run smoothly create low cost and higher quality products than those produced with equipment that have a lot of losses and stop frequently. The equipment maintenance structure and its contents are largely related to the state of such equipment. The structure and contents of equipment maintenance differ depending on the equipment and factories being used, and as a result, there is a difference in the productivity of equipment.

As a buyer, it is important to grasp the equipment conditions in the factory of the supplier and have the skills to be able to properly give guidance on how the equipment maintenance structure should be systematized, as well as on how to operate the equipment stably and provide products stably from the viewpoint of QCD.

In this section, basic contents such as equipment loss, maintenance methods, and structures will be explained so that this knowledge can be utilized in procurement activity.

2 Equipment Productivity Loss

In order to raise the productivity rate of the equipment, it is necessary to reduce equipment loss. Since the loss is also divided among several items, it is necessary to know the structure. It is efficient to quantify the loss and to implement loss reduction activities systematically.

Therefore, this section will explain the structure and quantification of loss.

■ 2-1 Structure of Equipment Productivity Loss

Equipment efficiency is high because it makes full use of the functionality and performance of the equipment, but this is hindered by equipment productivity losses. The structure is shown in Figure 8–23.

CPP certified Procurement Professional

Procurement Professional Study Guide

Procurement Professional Skill Standard

JMA JAPAN MANAGEMENT ASSOCIATION

1 Aim of the Skill Standard of the Procurement Professional

The Skill Standard shall be used as the guideline to confirm the current procurement skill levels of those who are engaged in procurement and its aim is to contribute to standardization of and effective improvements in the procurement skills.

The Skill Standard can be used for confirmation of the procurement skills of each individual, but it does not necessarily indicate high operation execution capabilities that the evaluation result based on the Skill Standard is high. However, at least, it is difficult to expect high operations execution capabilities for buyers whose evaluation scores of the Skill Standard are low.

The Skill Standard lists the items generalized to enable general application, but these items can also be changed in accordance with the actual condition of each company and utilized.

2 Composition of the Skill Standard

The Skill Standard prescribes the five items "Work category," "Operation theme," "Expected role," "Skill requirement," and "Skill levels."

[Work category]

The operations and knowledge related to procurement are divided into 12 domains. This division does not necessarily fit the operations of procurement in each company, but it assumes the procurement operations of general companies.

***Work category: 12 domains**

(1) Procurement infrastructure, (2) Strategy and management,
(3) Social responsibilities of procurement, (4) Sourcing for development,
(5) Procurement execution, (6) Procurement management,
(7) Basic knowledge of procurement operations, (8) Procurement system,
(9) CR related knowledge, (10) Procurement for specialized fields,
(11) Management methods, and (12) Business fundamentals

[Operation theme]

This breaks down the work categories by the perspective of the procurement operations and the domains of knowledge.

[Expected roles]

One or more roles to be fulfilled to execute the operations are prescribed for each "Operation theme."

[Skill requirements]

This defines the skill requirements and their contents for each "Expected role".

There are 108 items in total.

[Skill levels]

This defines each skill level for each "Skill requirement" to evaluate the current capabilities. For each skill requirement, the skill level is divided into four stages: Level 1 to Level 4. The basic concepts of the Levels are as follows: Level 1 shall be the highest level.

***Level**

Level 1: Can exercise leadership and improve the corresponding operations

Level 2: Can teach the corresponding operations to the relevant persons

Level 3: Can understand the operation contents and act independently

Level 4: Can execute operations according to instructions

Classification of the Skill Standard

*M in "No." indicates the corresponding items in the Management Guide and the numbers indicate the corresponding items in the Study Guide

Work category	No.	Operation theme	Expected roles	Page
Management Guide Procurement Infrastructure	M	Standardization of Procurement Processes	Clarification of the procurement conditions (QCD)	8
	M	Building Framework to Improve Procurement Skills	Evaluate capabilities of buyers and grasp the status of organizational skill level	9
			Develop a capability improvement plan	9
			Implementation of a capability improvement plan	10
Study Guide Chapter 1 Strategy and Management	1	Strategy and Procurement	Grasping of the management policy and business policy	11
			Formulation and promotion of the procurement department strategy (business plan)	11
			Formulation and management of procurement budgets	13
			Deployment and promotion of issues for strengthening procurement function	14
	2	Procurement Organization	Clarification of the procurement function	15
			Organization design to maximize the functions	15
	3	Supplier Relationship Management	Classify the relationships with suppliers into segments and consider the supplier strategies	16
Chapter 2 Social Responsibilities of Procurement	1	CSR	Understanding and implementation of CSR	17
	2	Environment-Friendly Procurement Activities	Understanding and implementation of the environmental regulations, etc.	17
	3	Procurement Ethics	Creation and arrangement of rules, etc.	18
	4	Procurement-Related Rules	Clarification of the responsibilities and authorities of procurement	19
			Definition of a procurement method	19
Chapter 3 Sourcing for Development	1	Sourcing for Development	Implementation of target cost management considering the sales strategy	20
			Formulation of a procurement item strategy based on the product development strategy	20
			Target price setting	21
	2	Development and Design Processes	Front loading activity in the development and design stages	22
	3	VE	Implementation of VE	23
	4	VR	Implementation of VR	24
	5	Procurement Management Including Development and Design Consignment	Selection of the optimal supplier based on the consignment type	25
			Design review (DR)	25
	6	Procurement Environment Analysis	Grasping of the economic trends	26
			Grasping of the currency movement	26
			Grasping of the industry trend	26

Work category	No.	Operation theme	Expected roles	Page
Chapter 11 Business Fundamentals	1	Communication	Understanding and implementation of communication methods	58
	2	Problem Solving	Evaluation of quality records	59
			Understanding and implementation of problem solving methods	59

3 How to Use the Skill Standard

It is desirable to conduct the skill evaluation with the Skill Standard on a regular basis such as annually or semiannually. If the evaluation is conducted, it is important to confirm the evaluation result of each work category rather than the total score and grasp your own weaknesses. You can also reflect on your growth by periodical evaluation and comparison of the evaluation result with the past ones.

It is important to arrange what to learn to overcome your weaknesses, formulate a specific plan, learn knowledge, and gain experience, based on the evaluation result.

The Skill Standard is linked with the Study Guide and Management Guide. The related items of the Management Guide and Study Guide are indicated for each operation theme so that you can learn what is necessary to overcome your weaknesses with the Study Guide and Management Guide.

In the Skill Standard, a "□□□" check box is prepared in each level of the skill level. Check "□" of each skill requirement to evaluate your skill levels.

This document has three check boxes and please use it again and again to reflect on your growth.

On the other hand, it is important for the manager to encourage each buyer to improve and enhance their skills based on the evaluation result of each individual. The manager has to grasp the composition and trend of the organizational skill level and make considerations to improve the skills of the overall organization in a well-balanced manner.

M Standardization of Procurement Processes

Expected roles Clarification of the procurement conditions (QCD)

Skill requirement 1 **Can set, present to and agree with suppliers for materials and parts on the procurement conditions such as the order quantity, delivery date, quality standards, and delivery method to prevent trouble at the time of mass production.**

Skill levels

☐☐☐Level 1 Can present the optimal procurement conditions including their resetting upon adjustments with the related departments and suppliers to prevent trouble at the time of mass production

☐☐☐Level 2 Can make adjustments with suppliers assuming the determined procurement conditions to prevent trouble at the time of mass production

☐☐☐Level 3 Can present the set standard procurement conditions and reach agreement

☐☐☐Level 4 Can understand and explain the set procurement conditions

Skill requirement 2 **Can set, present to and agree with related departments and suppliers on procurement conditions for supplied materials, jigs and tools, and packaging**

Skill levels

☐☐☐Level 1 Can set the procurement conditions and request improvements based on the specifications of the ordered goods and the capabilities of the suppliers

☐☐☐Level 2 Can set the procurement conditions based on the specifications of the ordered goods

☐☐☐Level 3 Can set the standard procurement conditions from similar items

☐☐☐Level 4 Can set the procurement conditions upon receiving instructions

Skill requirement 3 **Can set and present the optimal procurement conditions considering the lead time, inventory, procurement logistics cost, payment conditions, etc.**

Skill levels

☐☐☐Level 1 Can set the optimal procurement conditions and make instructions for improvements to realize them

☐☐☐Level 2 Can point out issues to be solved to set the optimal procurement conditions

☐☐☐Level 3 Can set the standard procurement conditions from similar items

☐☐☐Level 4 Can set the procurement conditions upon receiving instructions

M Building Framework to Improve Procurement Skills

Expected roles Evaluate capabilities of buyers and grasp the status of organizational skill level

Skill requirement 4 **Can evaluate the capabilities of the overall department and each buyer through the Skill Standard and operations**

Skill levels

☐☐☐Level 1 Can evaluate the capabilities of the overall department through the Skill Standard and operations, and judge the priorities of skill improvements toward strengthening of the procurement function

☐☐☐Level 2 Can evaluate the skill of each buyer and judge the priorities to improve skills through the Skill Standard and operations

☐☐☐Level 3 Can evaluate your own skill and judge the priorities to improve skills through the Skill Standard

☐☐☐Level 4 Can evaluate your own skill through the Skill Standard but relay on the judgment of your superior for setting of the priorities to improve skills

Expected roles Develop a capability improvement plan

Skill requirement 5 **Can develop and promote a skill development plan to improve the level of the overall department**

Skill levels

☐☐☐Level 1 Can develop and promote a skill development plan for the overall department

☐☐☐Level 2 Can develop a skill development plan for the overall department

☐☐☐Level 3 Can understand the overview of the necessary skill development plan within the range of your own job to improve the level of the overall department

☐☐☐Level 4 Can point out the issues within the range of your own job to improve the level of the overall department

Skill requirement 6 **Can develop and guide execution of a skill development plan to improve the level of each buyer through skill evaluation**

Skill levels

☐☐☐Level 1 Can develop and guide execution of a skill development plan suitable for each buyer

☐☐☐Level 2 Can develop a skill development plan suitable for each buyer

☐☐☐Level 3 Grasp the overview of the necessary skill development action to improve your level

☐☐☐Level 4 Can point out the issues within the range of your own job to improve your level

Expected roles Implementation of a capability improvement plan

Skill requirement 7 **Can arrange an education environment (special books, magazines, material room, and Tear Down room) for the department and buyers**

Skill levels

☐☐☐Level 1 Can plan and arrange an education environment for each domain of procurement

☐☐☐Level 2 Can make a plan to arrange an education environment for each domain of procurement

☐☐☐Level 3 Can propose materials related to skill improvements to be collected for the domain which you are in charge of

☐☐☐Level 4 Can collect the instructed materials

Skill requirement 8 **Can provide training opportunities (Off-JT and OJT) according to the developed skill development plan based on grasping of the skill of each buyer**

Skill levels

☐☐☐Level 1 Can provide OJT education opportunities selected appropriately for each buyer

☐☐☐Level 2 Can provide training(mainly Off-JT) opportunities for the overall department

☐☐☐Level 3 Can provide the training opportunities necessary to improve your level

☐☐☐Level 4 Utilize training opportunities according instructions

1 Strategy and Procurement

Expected roles Grasping of the management policy and business policy

Skill requirement 9 Involved in formulation of the management policy, CSR policy, and business policy

Skill levels

☐☐☐Level 1 Participated in formulation of the management policy, CSR policy, and business policy to reflect the opinions and way of thinking from the viewpoint of procurement

☐☐☐Level 2 Understand the presented management policy, CSR policy, and business policy and explain them to and make them accepted by the relevant persons as needed

☐☐☐Level 3 Understand the presented management policy, CSR policy, and business policy and be aware of it for your actions

☐☐☐Level 4 Understand the presented management policy, CSR policy, and business policy

Expected roles Formulation and promotion of the procurement department strategy (business plan)

Skill requirement 10 Can formulate a procurement strategy based on the management policy, CSR policy, and business policy

Skill levels

☐☐☐Level 1 Can formulate the strategy of the overall procurement department considering changes in the procurement environment based on the management policy, CSR policy, and business policy

☐☐☐Level 2 Can find out the issues for formulation of the strategy of the overall procurement department considering changes in the procurement environment based on the management policy, CSR policy, and business policy

☐☐☐Level 3 Can grasp the management policy, CSR policy, and business policy and formulate a procurement strategy considering changes in the procurement environment about the procurement item which you are in charge of

☐☐☐Level 4 Can implement the procurement strategy of the procurement item which you are in charge of according to instructions