Handbook
for
TQM and QCC

Volume II

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Volume II
How to Start QCC

A Guide for Facilitators and Circle Leaders

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Foreword

In this globalized world and business environment quality is the key to competitive advantage.

No man is a prophet in his own land, and this is particularly true of the work of Edward W. Deming. Deming's work and his original recommendations on quality were ignored in his homeland before Japanese business imported his ideas and made them work in Japan. Deming encouraged the Japanese to adopt a systematic approach to problem solving. He also encouraged senior managers to become actively involved in their company's quality improvement programs. His greatest contribution was the concept that the consumers are the most important part of a production line. Meeting and exceeding the customers' needs and requirements is the task that everyone within an organization has to accomplish. Quality means satisfying customers' requirements continually. In addition, the management system has to enable everyone to be responsible for the quality of his output to his internal customers.

During the period 1955—60, following the visits of Deming and Joseph M. Juran to Japan, the Company-wide Quality Control (CWQC) movement started to develop. Kaoru Ishikawa was its leader, and this movement asserts that quality refers to more than product quality alone. It also takes in after-sales service, quality of management, the company itself, and human life. Ishikawa also made a significant contribution to the development of Total Quality Management (TQM). The other quality management gurus such as Crosby, Deming and Juran have shaped the dimensions, practices and basis of the concept, but none have gurus actually coined the term TQM. By the end of 1980s, TQM concept had become a recognized part of quality-related language.

Total Quality Management includes a number of management practices, philosophies and methods to improve the way an organization does business, makes its products, and interacts with its employees and customers. Kaizen (the Japanese word for continuous improvement) is one of those philosophies. Other recognized TQM practices are:

Japanese 5-S Practice (Seiri, Seiton, Seiso, Seiketsu and Shitsuke; which stands for Structurize, Systemize, Sanitize, Standardize, and Self-discipline); Business Process Re-engineering (BPR); and Quality Control Circles (QCCs).

The success of Japanese business in Canada, Latin America, and the United States as well as in Europe is attributable to TQM, a concept now widely practiced throughout Asia

In this context, and as a knowledge exchange between Asia and Latin America and the Caribbean, the Japan Program organized a workshop on the topic of Quality Control at the IDB's headquarters in December 1999.

As a follow-up activity, to develop and disseminate the Total Quality Management and Quality Control Circle (TQM/QCC) system in Latin America and the Caribbean, the Japan Program of the Inter-American Development Bank (IDB) has entrusted the Development Bank of Japan (DBJ) and the Japan Economic Research Institute (JERI) with the task of producing a TQM/QCC handbook.

It is hoped that this publication will be useful and we welcome readers' comments and suggestions for improving this manual.

Kaname Okada
Chief of the Japan Program
Inter-American Development Bank

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Introduction

Until around 1950, Japanese products were perceived worldwide as being very inexpensive, but with poor quality. By the 1980s, products made in Japan were known all over the world for their high quality and reliability. What happened during those three decades?

Also in the 1980s, U.S. companies were gradually losing their industrial competitiveness, so they and the U.S. government undertook a series of revolutionary movements that included thorough exploitation of Japanese quality management. The subsequent recovery of U.S. industries in competitiveness is well-known. An anecdote for their successful recovery was the *big three* (automobile companies)'s revival in the 1990s. What had they found in Japanese management practices and which parts contributed to the recovery?

Are such events only incidents of the past? We do not think so. They are relevant to contemporary questions on *quality management* that are shared around the world.

Historically, *quality control,* in its modern terms, was born in the U.S., and Japan, in its high economic growth period, imported and developed that concept as *Total Quality Control (TQC)*, which later evolved as *Total Quality Management (TQM).* Contrary to many misunderstandings, TQM is not a tool merely for big companies or the manufacturing sector; it is a way of managerial thinking for any type of corporation.

The *Quality Control Circle (QCC)* method, a *Japanese-made* institutional development tool by which employees continuously strive for improvement in their work, usually functions as an integral part of TQM. More generally speaking, the QCC method can serve to enhance people's problem-solving skills in organizations that have not yet introduced TQM as a leading management policy: not only in profit-making organizations but also in non-profit organizations, public administration, associations, and any voluntary group. However, QCC functions best as part of TQM, and company-wide quality management through TQM is the most effective way to sustain QCC activities in an organization.

Are TQM and QCC *Japanese* things? Are they effective only in some cultures in the world? Our answer is a firm, "No!" They are not and should not be perceived to have such a narrow scope. Our firm belief is that they are applicable anywhere because they invoke universal values, and this is why this handbook has been produced. In our view, TQM and QCC values are much more than so-called *Japanese management.*

Pursuit of quality management never stops. We face more and more tasks in controlling and improving quality in the increasingly integrated world. Requirements of the ISO (International Organization for Standardization) 9000 series are representative of that truth. We are certain that TQM and QCC can contribute tremendously to any institution that has become conscious about quality management, including those doing so through compliance with the ISO 9000 series.

HOW TO USE THIS HANDBOOK

Nature of the Handbook. This two-volume handbook is a guide for people at all levels who have wide-ranging desire to improve the quality of work in their organizations. It is a *basic manual cum explanatory guide*—that is, it aims at providing not only hands-on know-how to install and implement Total Quality Management and Quality Control Circle programs but also explanations as to why and in which ways they are useful for organizations. In order to establish appropriate objectives, one must first completely understand what is to be tackled. TQM and QCC do not come in a one-size-fits-all manual, yet they are not complicated. They merely require that the decision-makers in an organization be really convinced of the usefulness of the well-elaborated and standardized methodology.

Target Readers. Volume I is intended for managers: explaining what TQM and QCC are all about and how to install and implement them in their organizations. It targets many levels of decision-makers, from *top managers* of corporations to *middle-level managers* functioning as division heads. Its topics range from the theoretical concept of TQM to practical knowledge on QCC—showing managers how these quality concepts have developed worldwide, how QCC activities have contributed to the development of company-wide quality management, and what kinds of benefits QCC may bring.

Volume II is a practical guide for starting QCC. Under the full support of management that is sold on TQM and QCC, focal persons or units of quality management (regardless of whether they were already in place or were newly appointed to install TQM and QCC) will take the lead in promoting QCC movements and educating employees on QCC techniques. Those focal persons are called facilitators. In the implementation process, leaders will usually be selected by the individual Circles, which are formed in frontline operation or administrative units. This volume is for these practitioners (facilitators and Circle leaders). It will direct them on how to carry out daily QCC activities and how to tackle common problems that facilitators as well as Circle leaders and members often find difficult to solve.

Both Volume I and Volume II attempt to explain TQM and QCC to the degree required for their respective targeted readers. Note that the technical aspects of implementing the QCC method are kept to a minimum in Volume I, whereas the description of QCC tools, techniques, and tips are compiled in detail in Volume II. However, any manager interested in QCC practices may find Volume II also useful, and any frontline operator interested in TQM or the QCC concept may want to refer to Volume I. The authors assume that Volumes I and II will be always distributed as a set, not in a separate manner, to ensure this type of multiple use.

Another type of reader may be persons who are interested particularly in QCC—for example, people who are working in organizations where quality management has already been firmly established but are searching for ways to strengthen employee participation. Such persons may be eager to learn about the QCC concept, but not necessarily all the aspects of TQM. Or, readers may belong to a voluntary group or association and be looking for problem-solving methods for the group. These persons may also find QCC to be the right answer. Such readers are recommended to focus on Volume II, and, depending on their interests, occasionally refer to Part 2 of Volume I, (e.g., on parts such as chapter 7, which describes QCC benefits).

This handbook also is meant for readers with different types of concerns than those of *implementers*—that is, readers who are willing to *support,* technically or financially, the implementers of quality management. Examples are government policy makers; business associations; academic persons; international or domestic donors; or any other private or public institutions that support quality management of the corporate sector. Indeed, introduction of TQM and QCC in a country is only possible with the help of such supporters, particularly in the case of small- and medium-sized companies; so the authors strongly desire that the handbook contribute to raise awareness on TQM and the QCC concept among those supporters. These types of readers may find interesting both the descriptions about the historical background of TQM and QCC and the supporting institutions in Asia, both in Volume I and Volume II.

For Readers in Small Organizations. Finally, a note for readers who manage or belong to relatively small organizations that may want to introduce TQM or QCC. Technical explanation of institutional arrangements of TQM and QCC in this handbook may appear, to their eyes, to be relevant only to medium- or large-sized enterprises—for example, QCC, as a company-wide movement, is implemented by various units and groups with several layers: steering committees, QCC offices, facilitators, Circle leaders, members, and so forth. However, adapting those explanations for less stratified organizations is not a difficult task, and small organizations can implement QCC in a manner appropriate to their size, once readers gain core knowledge on QCC methodologies and minimum institutional requirements. Because the Handbook is targeted at a broad range of readers, some of its parts have to be comprehensive.

AS MATERIAL FOR AN INTRODUCTION SEMINAR

This handbook's design enables a reader to start self-learning, but its best expected application is as a material for a seminar that either introduces TQM and QCC or explains QCC as an institutional development tool. In such a case, the reading of this handbook in its entirety after the seminar will be even more beneficial.

TQM and QCC seminars are typically organized so as to present the material to managers and facilitators in separate groups. A half-day seminar for managers may be organized by QCC resource persons, utilizing figures and charts in Volume I as presentation materials. And perhaps a three-day seminar for facilitators could include figures and charts in Volume II and introduction of discussions and exercises. Any subsequent guidance to facilitators from QCC resource persons may not particularly require organized materials.

A seminar for Circle leaders may be organized as another undertaking, once pilot Circles are identified in an interested organization. Circle leaders are typically instructed on QCC implementation in a one-day seminar, after which the facilitators provide the guidance.

Abbreviations

APO	Asian Productivity Organization
ATM	Automatic Teller Machine
CL	Center Line
FMEA	Failure Mode Effects Analysis
FTA	Fault Tree Analysis
5M1E	4M1E + Measurement (or Money)
5S	Sorting, Systematizing, Sweeping, Sanitizing, Self-discipline
5W1H	What, When, Where, Who, Why, How
4M1E	Man, Machine, Materials, Method, Environment
ICQCC	International Convention on QC Circles
ISO	International Organization for Standardization
JUSE	Union of Japan Scientists and Engineers
NPO	National Productivity Organization
PDCA	Plan-Do-Check-Act
QC	Quality Circle
QCC	Quality Control Circle
QCRG	Quality Control Research Group
SL	Specification Lower Limit
SOP	Standardized Operational Procedure
SU	Specification Upper Limit
3Mu	*Muda* (wastefulness), *Muri* (excessiveness), *Mura* (dispersion)
TPM	Total Productive Management
TQC	Total Quality Control
TQM	Total Quality Management

1 What is a QCC?

Today when one reads or hears about the transformation of Japan during the last three decades from being a cheap product seller to being the leader in quality, one notes that the role of QC Circles is an integral part of its journey towards excellence. This chapter describes a series of events that led to the birth of QC Circles brought about by the need of Japanese industries immediately after the Second World War, to improve the quality of their products so they could compete in the international market. This chapter also describes how the QC Circle concept spread to the neighboring Asian countries and the United States.

1-1 The Birth and Spread of QC Circles

1-1-1 History of QC Circles in Japan

After World War II, Japanese companies could not compete in the world market, because even though their products were cheap, they were considered of poor quality. Today, however, Japanese products are known for their quality and reliability.

How did this happen? The Japanese companies undertook major steps, such as having their management personally take charge of the quality function; having quality-related training throughout the company hierarchy; and adopting the QC Circle concept as a means of enabling the workforce to participate in the quality activities of the company.

The Union of Japanese Scientists and Engineers, organized in 1946, played a major role in the training of management and engineers on quality. It organized in 1949, its Quality Control Research Group (QCRG), which was tasked with studying the international quality control field for information on how to rationalize the war-torn Japanese industries, how to improve quality of exports, and how to raise the living standards of the Japanese.

The General Headquarters of the United States Armed Forces in that year, invited management of Japanese companies and some members of the QCRG to a lecture by Dr. W. E. Deming on the importance of Statistical Quality Control techniques to the telecommunications industries, like those engaged in telephone equipment, maintenance and related services. The objective of the lecture was to help these industries organize themselves and improve the war-torn telephone network.

In 1950 Dr. Deming came to Japan upon the recommendation of QCRG to give a detailed lecture on Statistical Quality Control to management of different industries. And in 1954, Dr. J.M Juran, another guru on Quality Control, came to Japan to talk about Quality Control and Management.

After intensive study, management and the engineers woke up to the need to follow the recommendations of Mr. Deming and Dr. Juran. They were convinced that for future development they needed to move away from the old concept of quality certification by inspection to a new one of quality control activities that promoted full employee participation with the objective of ensuring customer satisfaction. However, there was no specialist or lecturer on this subject yet in Japan, so management and the engineers requested JUSE (Union of Japan Scientists and Engineers) to spearhead a national radio-based campaign on Quality Control for concerned parties, especially foremen of factories.

The engineers started introducing the concept in the workshop and tackled the quality problems with frontline operators, teaching them simple statistical methods that resulted in fewer defective products. The frontline operators were amazed with the results and from then on voluntarily tackled the problems in the workshop with their colleagues. This voluntary activity was the start of QC Circles.

Management recognized that its people are intelligent and must be given opportunities to use their brains as well as their hands. They undertook a massive program of training them and the entire hierarchy on how to manage for quality. Thus, they adopted the QC Circle concept as a means of enabling the workforce to participate in the quality revolution. The first Quality Circle was organized in 1962, and from then on, the QC Circle movement grew, slowly at first, then with increasing speed.

1-1-2 Spread of QC Circle Philosophy to Other Countries

The QC Circle philosophy spread first to Japan's neighbors South Korea and Taiwan, later to Singapore, Malaysia, the Philippines, and Hong Kong, and then to India, Indonesia, Thailand, Sri Lanka, Pakistan, and Vietnam. It is worth noting that these countries have one thing in common; they are all members of the Asian Productivity Organization (APO).

The APO, an inter-governmental regional organization with headquarters in Tokyo, Japan, was established in 1961 by several governments in Asia. Its aim is to increase productivity and hence promote economic development of the Asia Pacific region through mutual cooperation among its member countries. APO's programs are implemented in the member countries by organizations designated by each country's official representative, and such organizations are called National Productivity Organizations (NPOs).

NPOs often have significant roles in the promotion of QC Circle philosophy, such as
-Arrangement of observational study missions for management
-Training of management, middle management, engineers, and supervisors
-Development of Circle associations
-Arrangement of international and national conventions on QC Circles
-Publication of training materials

Arrangement of observational study missions for management
In Japan, the study missions visit companies that have installed QC Circles.

They discuss various issues with their counterparts, hear QC Circle case presentations, and tour company premises to see for themselves the actual improvements generated by QC Circles.

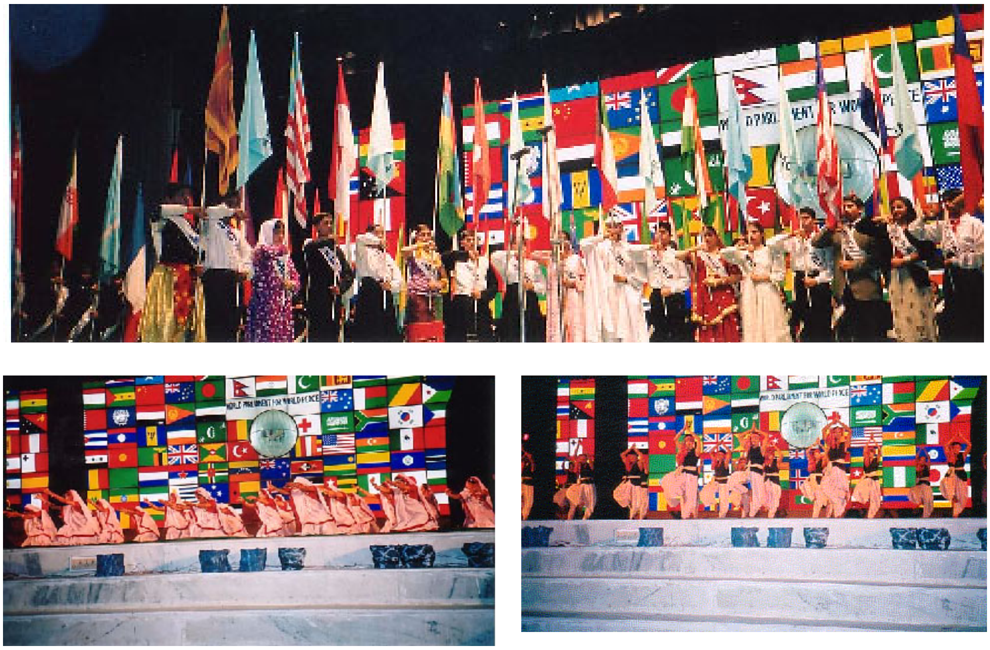
Training of management, middle management, engineers, and supervisors
The NPOs invite experts from Japan, usually from the academe or from companies with QC Circles, to conduct training. They also provide consulting services to these companies, teaching them how to install a QC Circle program.

Development of Circle associations
The NPOs organize associations with the objective of providing forums for companies to talk about their experiences and difficulties in implementation. They also provide venues and other logistical support (e.g., snacks for the members attending the meetings).

Arrangement of International and national conventions on QC Circles
The NPOs support the participation of delegates from member countries in international conventions by sponsoring their travel expenses and convention fees. They organize national conventions in cooperation with the Circle associations.

第32回 全日本選抜QCサークル大会
アナロジー
発想法

QC Circle National Conventions, Japan, 2002 (Photo by JUSE)



QC Circle World Convention (Photo by Miyauchi)

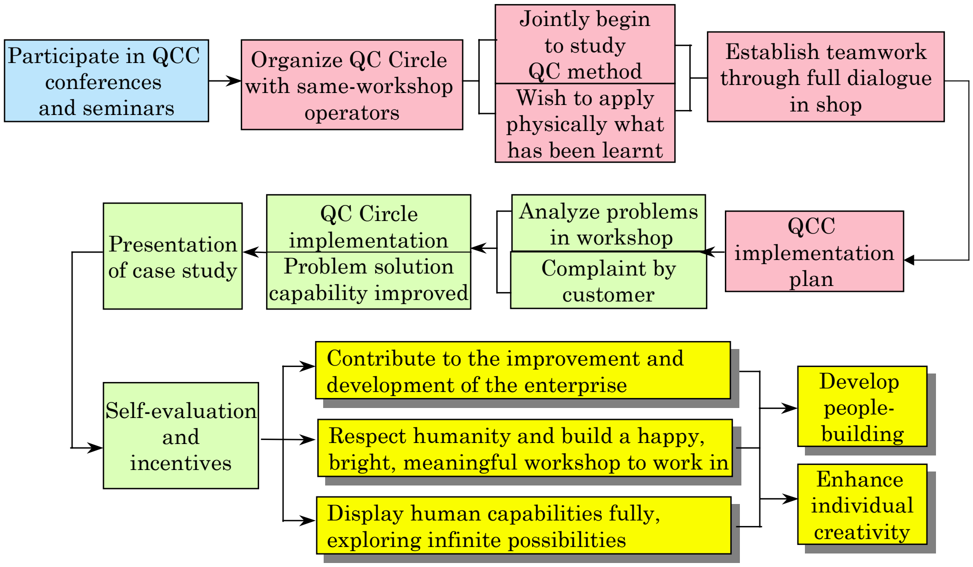
Publication of training materials

They develop training materials (e.g., QC Circle case studies suited to the needs of the local companies). Thus, it is easy for the companies in these member countries to adopt the QC Circle philosophy.

The QC Circle movement not only spread in Asia, but also reached the United States. A group from Lockheed Missile and Space Company went to Japan in 1974 to learn about the QC Circle phenomenon and went home convinced that the QC Circle concept could be implemented successfully anywhere as long as there was management support and people were trained appropriately. They implemented QC Circles the following year, calling them Quality Circles (QCs). They dropped the word *control* because it has a strong connotation. The Circle activities were successful—they were able to reduce the number of defects per thousand man-hours by two-thirds. Two years later they surveyed their personnel and found that the majority of the Circle members believed that Quality Circles were useful and the program must be expanded throughout the company. The Lockheed experience prompted other companies in the United States to adopt the QC Circle concept. By the late 1970s the QC Circle movement had spread to Great Britain, Sweden, Denmark, Australia, and France.

1-2 What is the QC Circle concept?

Figure 1 QC Circle Activity Flow Chart


Participate in QCC conferences and seminars
Organize QC Circle with same-workshop operators
Jointly begin to study QC method
Wish to apply physically what has been learnt
Establish teamwork through full dialogue in shop
QCC implementation plan
Analyze problems in workshop
Complaint by customer
QC Circle implementation
Problem solution capability improved
Presentation of case study
Self-evaluation and incentives
Contribute to the improvement and development of the enterprise
Respect humanity and build a happy, bright, meaningful workshop to work in
Display human capabilities fully, exploring infinite possibilities
Develop people-building
Enhance individual creativity

1-2-1 Why do we need QC Circle activities?

Customers are very difficult to please nowadays. Their demand for better products and better service is never ending. Take the banking sector for instance. Customers used to be burdened by having to go to the bank to pay their utility bills, where the time spent for such service was about half an hour—in addition to their travel time. Then came the automatic teller machine (ATM), which when modified to process payments, reduced the time it took to pay bills to about one minute, depending on the number of people waiting to use it. Yet the customers still had complaints. This example shows that speed of service is not the only determinant of satisfaction. Accuracy of transaction receipts, access to ATMs, and courtesy and competence of bank personnel are other determinants of satisfaction on the quality of service. Thus in any company, management must mobilize the whole organization towards providing products and services that satisfy the customers. This means that quality must be ingrained in the mind and heart of every member of the organization; must be built into each process, each raw material, each machine, and each technology; and must be palpable even in the work environment. This also means that processes have to be improved; standards have to be defined if they don't exist, or revised if they do exist; policies have to be revised; people have to be trained; and machines have to be replaced if they are no longer efficient.

Making all these changes happen requires a lot of political will from management and a lot of help from the whole organization (executives, middle management, supervisors, and operators), all of whom are expected to be value-creators for customers as they work together in teams called Quality

Control Circles, or QC Circles.

QC Circle activities are carried out as part of Total Quality Management (TQM), with the objective to develop the members' capabilities to the fullest and make the workshop a pleasant place to work in order that members contribute to the company goal of ensuring customer satisfaction.

The QC Circle provides an opportunity for members to develop their creative thinking as they look for better ways to do their work, which is imperative as customers become more demanding and their needs become more varied and complex.

As the members study and learn together, their full potential is realized. They understand their work better, they see their importance in the company, they enhance their analytical skills, and they learn new things, not just about their jobs but also about their company: its vision, mission, and goals; its convention; its partners; its suppliers; and the requirements of its customers. And as the QC Circle matures through the years, the members become involved in the improvement efforts of the company; and for them to participate actively, the various members' training needs, which become diverse over time, must be addressed. Therefore, companies that have implemented QC Circles have established a training program for their Circle members.

There are various potential benefits brought by Circle activities: overall the productivity will be enhanced, management's ability to improve will be developed, and teamwork will be improved through encouragement by both management and colleagues, resulting in higher morale on the frontline operation. The QC Circle activities are essential for the operators but also for the management, as such activities are designed to improve the relationship between the two.

1-2-2 Definition of a QC Circle

The QC Circle headquarters of JUSE, which serves as the center for continuing education on QC Circles, defines a Circle as "a small group of frontline operators who continually control and improve the quality of their work, products and services; they operate autonomously and utilize quality control concepts, tools and techniques."

1-2-3 Characteristics of QC Circles

Based on this definition, which has been adopted in many countries, the QC Circle Headquarters enumerates the following features of a QC Circle:

Characteristics of a QC Circle

- Small group
- Continual control and improvement in the quality of work, products, and service
- Autonomous operation
- Utilization of quality control concepts, tools and techniques
- Part of TQM or company-wide QCC
- Self-Development

SMALL GROUP

The Circle is normally composed of three to ten volunteers who come from the same workshop and are under the same supervisor. Keeping the group small enables the members to participate actively in Circle activities. During meetings for instance, each member has a chance to contribute ideas; whereas, if the group is more than ten, it may happen that a member is not able to contribute an idea because of lack of time, for the Circle usually meets for an hour at most. If the group is small, the chances are high that members are able to foster better interpersonal relations and develop cohesiveness. Each member is able to define his role and responsibilities better, making him feel more secure in his job relations and see his importance to the group; thus, his self-esteem is developed. If the Circle has less than three members, it is usually more difficult to get things done, whereas if it has more than ten, the group becomes unwieldy.

The Circle is likened to a small community where everyone is familiar with everyone, where one's contribution is easily recognized, and where sense of belonging is realized. Coming from the same workshop, it is easier for them to talk about how to improve the way their work is done because they have a common language, have the same work environment and experiences, are affected by the same factors, and have one goal.

CONTINUAL CONTROL AND IMPROVEMENT THROUGHOUT THE FLOW OF WORK

QC Circles continue to look for opportunities for improvement from the time they receive their inputs to the time they deliver their product or service to their customers. They employ the concept of the Plan-Do-Check-Act (PDCA) continual improvement. Because the customer is never satisfied, the Circles never stop looking for better ways of doing the work. Once a problem is solved, they move to solve other problems; thus, they are in a never-ending search for ways to satisfy the customer.

AUTONOMOUS OPERATION

Circles solve problems in their own workshops; so, they operate autonomously in the sense that they are free to choose the problems to solve, they identify what data to collect in order to better understand why the problems exist, and their members analyze the problems' causes among themselves (though they sometimes consult other departments that affect their work). They analyze these causes in detail until they are able to isolate the most critical cause of the problem. They are on their own when they think of possible solutions to eliminate this most critical cause, although they are free to consult supervisors, engineers, or facilitators for ideas. The decision on what is the best solution is theirs. Also, they decide how to implement their solution, confirm that the standard operating procedure is implemented, and show that the solution is effective.

Since they are the experts in their work, they have the job of identifying problems in their workshop, of selecting the one they want to tackle, of working out their solution, and of selling their ideas to management. It is also their job to implement their solutions once they are approved by management, monitor results, and ensure that the problems do not recur. So it is in this context that the QC Circle is practically left on its own in carrying out its activities.

UTILIZATION OF QUALITY CONTROL CONCEPTS, TOOLS AND TECHNIQUES

The Circle works with the aid of data throughout its problem-solving activities. They show that a problem exists by collecting data (using a data collection form, like a checksheet) that they then summarize and analyze using simple statistical tools like graphs, scatter diagrams, cause and effect diagrams, Pareto diagrams, and histograms. They also use problem-solving techniques like matrix diagrams, the What, When, Where, Who, Why, How (5W1H) concept, the Sorting, Systematizing, Sweeping, Sanitizing, Self-discipline (5S) concept, the Man, Machine, Materials, Method, Environment (4M1E), and the Muda (wastefulness), Muri (excessiveness), Mura (dispersion)(3Mu) concept.

PART OF TQM OR A COMPANY-WIDE QCC PROGRAM

Many companies introduce Total Quality Management or company-wide QC Circle activities as a company management tool in order to improve the quality of their products and services. In the TQM framework, management announces the company's mission and vision to its employees, and each one of them plays a significant role in implementing quality management activities. QC Circle activities play an essential role in a company's management system, the development of which will lead to an activation of quality management throughout the company.

SELF-DEVELOPMENT

A QC Circle contributes not only to the development of a sound working environment but also to the enhancement of individuals' abilities and potentials. In other words, the activities lead also to self-development of individuals. Through the activities, each member can develop various qualities, such as sound personal relations, analytical skills, presentation ability, and knowledge on various QC tools.

1-2-4 Objectives of QC Circle Activities

Objectives of QC Circle Activities

- Establishment of a pleasant workplace
- Establishment of a state of control
- Enhancement of morale
- Establishment of sound human relations
- Better income
- Improvement in Quality Assurance

QC Circle Headquarters 1980

ESTABLISHMENT OF A PLEASANT WORKPLACE

The atmosphere of a workplace has two dimensions: the psychological and the physical. The psychological is usually measured through organizational climate surveys in which people are asked about their perceptions of leadership, availability of information and resources to do their job well, teamwork, rewards and recognition, and job satisfaction. The physical pertains to orderliness and cleanliness; access to raw materials, tools and machines; and safety.

It is important that people perceive that their jobs offer opportunities for them to fully develop their potentials and have a say in how work is done and that their workplace is conducive to producing quality products and services. When the company's employees are satisfied, its goal of ensuring customer satisfaction, the ultimate goal of the QC Circle activities, is not difficult to achieve.

ESTABLISHMENT OF A STATE OF CONTROL

It is very important that people operate their tasks according to the specified way. As Ishikawa (1981) avers, "Well controlled workshops are those that observe agreed standards, take adequate corrective measures or preventive measures, remove causes of abnormal or out of control conditions before problems become readily apparent, and revise standards if necessary." And this cannot be done by means of mechanization, automation, and elimination of manpower—it has to be controlled through human effort.

ENHANCEMENT OF MORALE

QC Circle activity is aimed at enhancing the morale of Circle members. Ishikawa (1981, 29) suggests that "the morale should be elevated as a natural consequence of taking part in the activity." By achieving self-development though QC Circle activities, members can enhance their morale, both as individuals and as members of society.

ESTABLISHMENT OF SOUND HUMAN RELATIONS

QC Circles provide a place where people can solve problems with active communication toward the achievement of common objectives. It is in this respect that a QC Circle can contribute to develop human relations among its members and even with management. Members learn interpersonal skills through their discussion with other members, acquiring a sense for building up harmonious relationships.

BETTER INCOME

In the long run, with company income increases through QC Circle activities, the income of the members will often increase. But we should not think of such increases as direct increases. As it will be stated later in this book, the benefit of the Circles can be measured not only by tangible impacts but also by intangible impacts.

IMPROVEMENT IN QUALITY ASSURANCE

As Ishikawa (1981, 34) states, "It is well understood that better quality assurance is a key to quality control." There are many accidents and problems in a workshop that can be addressed in the QC Circles. It is often the case that problems are caused by operators' minor errors. The ultimate goal of QC Circle activities is to achieve quality assurance. By solving problems in the workplace in a systematic manner, the Circle can achieve quality assurance in the workplace, which consequently leads to improvement in the quality of life of the individual operators.

2 How to Get Started: QC Circle Activities

The installation of a QC Circle program in a company needs careful planning for it to be successful. It cannot be left to chance, because once an attempt to introduce it fails, the effect on the company's people may last long. The experiences of some companies, for instance, show that after an initial failure, people are apathetic to new attempts at introducing participation-based programs. The companies that implemented QC Circle activities more successfully followed a roadmap in installing the program, and the general steps they took are described in this chapter.

The installation of a QC Circle is normally carried out after taking several preparatory steps. The QCC concept is commonly introduced where a company-wide quality program such as TQM has been already carried out, becoming one of the components of such a framework. There are largely two patterns of adoption of the QCC concept in a company: (1) introducing it as a part of company-wide quality management activity (2) introducing it prior to the deployment of a company-wide quality control program. The procedures of the installation vary, depending on which of the two patterns applies. (QC Circle Headquarters 1991, 121).

(1) Introducing the QCC concept as a part of TQM
In this case, the management first learns the basic aspects of quality control, seven QC tools, problem solving procedures, and *kaizen* improvement activities. Management take the lead in directing its employees in the line with the company's mission and vision—utilizing all human resources, from frontline operators to middle management. When the conditions are set for QC Circle activities, the management will announce the introduction of the concept into the company.

(2) Introduction of the QCC concept prior to the deployment of company-wide quality control programs
This type of installation is often seen in the service industry. In it, the company introduces QCC activities and then learns about quality through those activities. JUSE has suggested the following merits for this approach:

- The resistance to introducing TQM will be small, as employees get used to the quality concepts when they are first introduced through QC Circles.
- The dissemination of TQM will be easier, as a foundation for the quality concept will be already accepted by the employees.

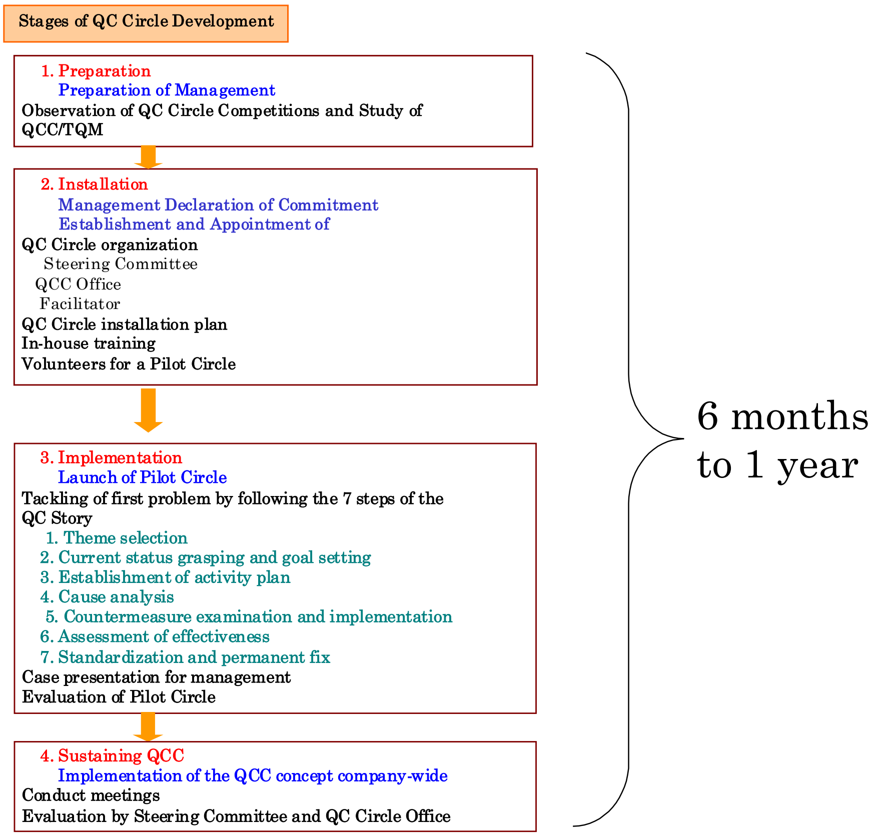
On the other hand, there are also demerits for this approach:

- Those who are engaged in the QCC concept will have more knowledge about quality than will management. As a result, management will not be able to take a lead in company quality management, which will make them disinterested in quality activities.
- From the standpoint of QC Circles, members tend to think that they are the only ones working hard to make things better, and thus management will be less respected by its employees.
- As the QCC program achieves its goal or solves problems, management tends to get a misunderstanding that QCC is the only way for quality management, and thus

tends to neglect other quality components (ibid., 121).

Even though we understand that there are two ways of QCC installation, we are going to focus on the first one listed above, as it has been the most common.

Figure 2



Stages of QC Circle Development

1. Preparation
   Preparation of Management
   Observation of QC Circle Competitions and Study of QCC/TQM

2. Installation
   Management Declaration of Commitment
   Establishment and Appointment of QC Circle organization
   - Steering Committee
   - QCC Office
   - Facilitator

   QC Circle installation plan
   In-house training
   Volunteers for a Pilot Circle

3. Implementation
   Launch of Pilot Circle
   Tackling of first problem by following the 7 steps of the QC Story
   1. Theme selection
   2. Current status grasping and goal setting
   3. Establishment of activity plan
   4. Cause analysis
   5. Countermeasure examination and implementation
   6. Assessment of effectiveness
   7. Standardization and permanent fix

   Case presentation for management
   Evaluation of Pilot Circle

4. Sustaining QCC
   Implementation of the QCC concept company-wide
   Conduct meetings
   Evaluation by Steering Committee and QC Circle Office

6 months to 1 year

Preparation

2-1 Preparation for Installation of a QC Circle Program

Key Factors in the Preparation Stage

- Finding a rationale for QCC activities
- Management indoctrinated in QC Circle activities
- Management attendance at QC Circle convention

Finding a rationale for QCC activities

It is important, before starting QCC activities, that management be fully aware of the importance of quality management and be fully convinced that QCC will have significant impacts on the company's quality management. Often QCC develop a sort of trend in the industry whereby once Company A introduces QCC activities, so does Company B. This tendency is not undesirable, as it helps to open the eyes of management to QCC activities, but each company's establishment of a unique vision and mission is important, relating them to the potential QC Circle activities.

Management indoctrinated in QC Circle activities

The first step for management is to get to know about QC Circle activities. Although reading books and magazines is one way of learning, it is difficult to grasp the QCC concept without actually seeing the activity. Therefore, management is recommended to attend outside seminars and see how QCC activities in other companies are organized and how they have contributed to those companies' visions and missions.

Management attendance at QC Circle conventions

Attending a QC Circle convention is one way for management to get to know about QC Circle activities in other companies. At the convention, selected Circles will present the history of QCC activities in their organizations, their QC Stories, their problem solving processes, and the benefits and other impacts that have been seen in their daily operations.

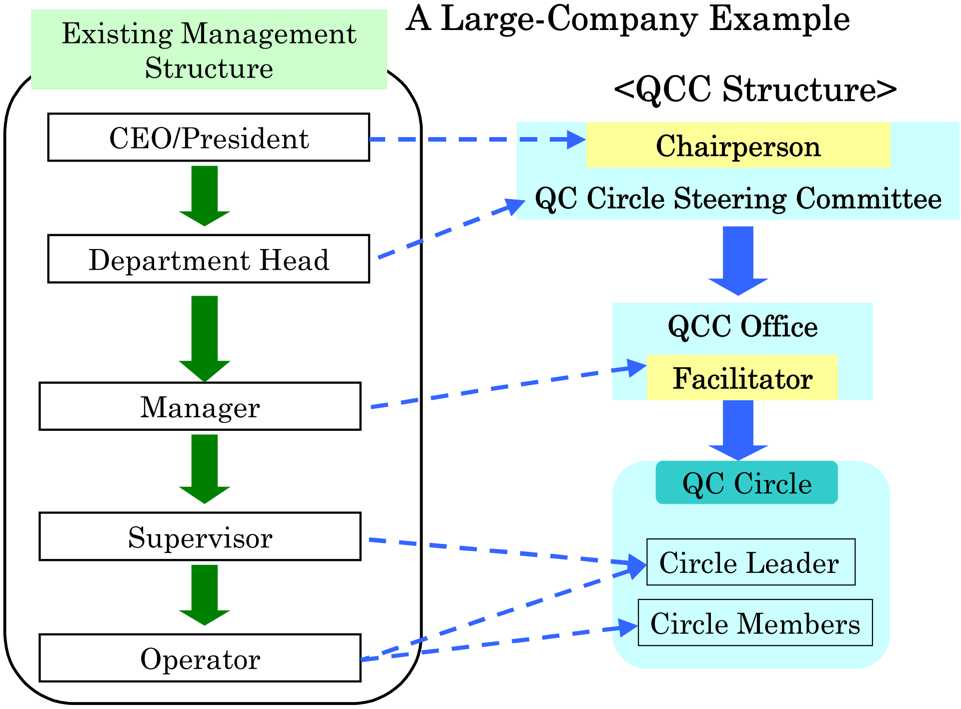
Installation

2-2 Establishment and Appointment of a QC Circle Organization

Establishing a QC Circle organization

The installation of the QC Circle program is managed by the QC Circle Steering Committee, and the QC Circle Office, which includes facilitators. The QC Circle Office secretariat reports to the QC Circle Office manager; whereas the facilitators report to the QC Circle Office manager in matters relating to QC Circles and to their department management in matters pertaining to their other functions.

Figure 3 **QC Circle Organization: A Large-Company Example**

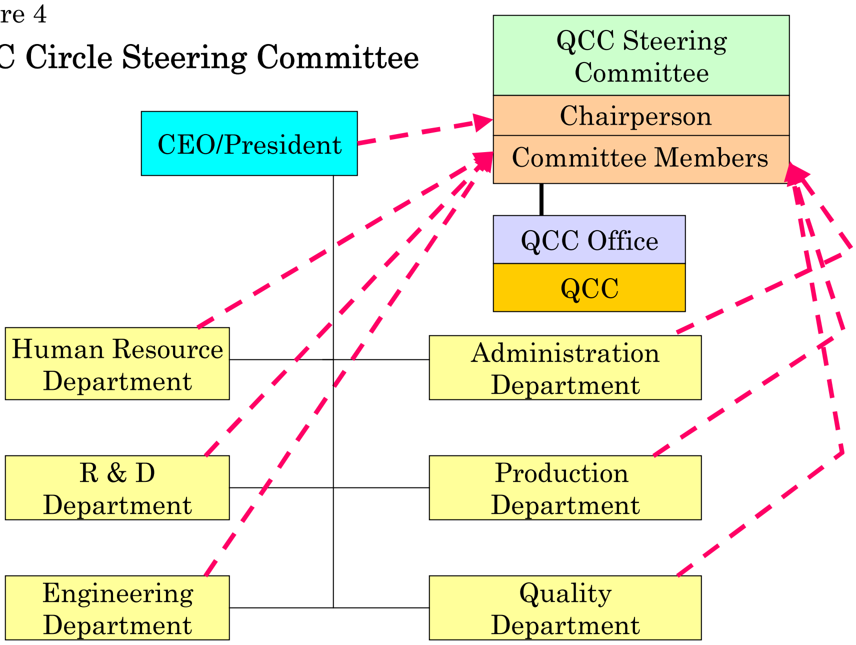

Existing Management Structure
CEO/President
Department Head
Manager
Supervisor
Operator
<QCC Structure>
Chairperson
QC Circle Steering Committee
QCC Office
Facilitator
QC Circle
Circle Leader
Circle Members

2-2-1 QC Circle Steering Committee

The QC Circle Steering Committee is composed of senior management chosen by the TQM Steering Committee and is chaired by the president (figure 4). It oversees and provides direction for the implementation of the QC Circle program. Its roles are as follows.

Figure 4

QC Circle Steering Committee


QCC Steering Committee
Chairperson
Committee Members
CEO/President
QCC Office
QCC
Human Resource Department
Administration Department
R & D Department
Production Department
Engineering Department
Quality Department

Roles of the QC Circle Steering Committee:

1) Define the ultimate goal of the QC Circle program in the company.
2) Formulate a master plan for the installation of the program.
3) Formulate a plan on how to recognize the exemplary performance of Circles, members, leaders and facilitators.
4) Formulate a plan on how to monitor and evaluate the components of the QC Circle program.
5) Formulate a budget for the program and identify sources of funds.
6) Define qualifications and functions of facilitators.
7) Act on concerns that may be raised by the QC Circle Office, the facilitators, or the QC Circles themselves.
8) Evaluate the overall status of the QC Circle program, including training, rewards and recognition, promotional activities, and procedures for evaluation of QC Circle case studies and activities.
9) Formulate corrective and preventive actions based on findings in the evaluation.

2-2-2 QC Circle Office

The QC Circle Office is responsible for the day-to-day management of the QC Circle activities in the company. Specifically, the Office implements policies and plans formulated by the QC Circle Steering Committee; handles all paperwork and maintains records such as the QC Circle registry, minutes of meetings, and QC Circle case studies; provides support to the QC Circle Steering Committee and the leaders; and organizes promotional activities like company-wide conventions. Service in the QC Circle Office is usually a concurrent assignment of facilitators.

Basic Functions of a QC Circle Office

(1) Training facilitators
(2) Coordinating training courses, working closely with the department heads
(3) Assisting leaders in their QC Circle activities
(4) Motivating QC Circle leaders and members
(5) Conducting QC Circle case presentations
(6) Coordinating QC Circle activities
(7) Approving QC Circle actions referred to them, such as those that have been found not to violate public law or regulation or company regulations

Responsibility of a QC Circle Office

(1) It implements the policies and plans formulated by the QC Circle Steering Committee.
(2) It handles all paperwork and maintains records like the QC Circle registry, minutes of meetings, and QC Circle cases.
(3) It provides support to the QC Circle Steering Committee and the leaders.
(4)It organizes promotional activities like competitions and visits to other companies with QC Circles

2-2-3 Appointment of Facilitators

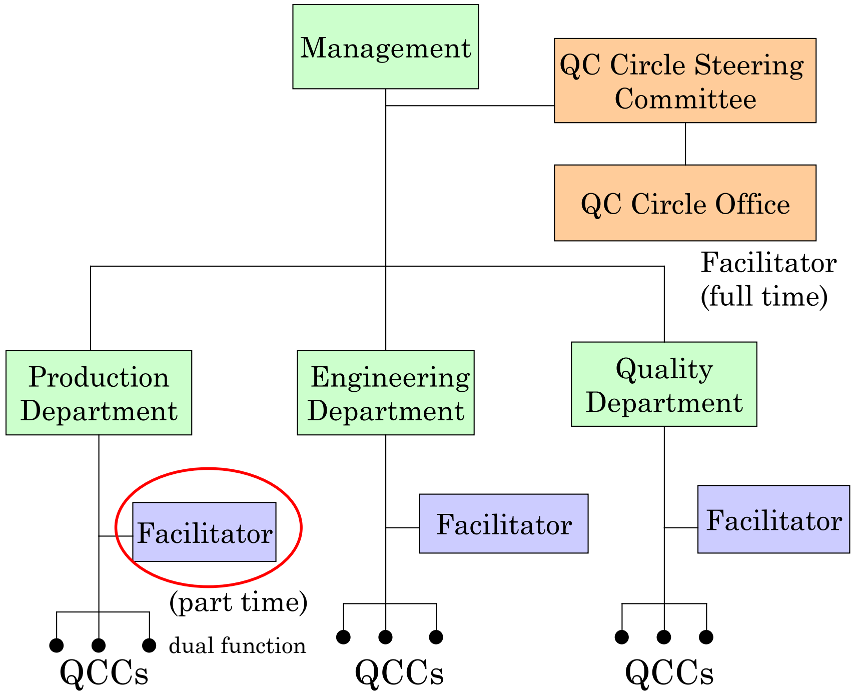
Facilitators, who are chosen from among the managers, comprise a key element that greatly influences the success of the QC Circle program, especially at the beginning of its development. In manufacturing companies the facilitators are often experienced manufacturing engineers.

Basic Functions of a Facilitator

(1) Training leaders
(2) Coordinating training courses, working closely with the department heads
(3) Assist leaders in their QC Circle activities
(4) Motivating QC Circle leaders and members
(5) Arranging QC Circle case presentations
(6) Coordinating QC Circle activities
(7) Approving QC Circle actions referred to them like those that have been found not to violate public law or regulation or company regulation

Each department selects one to three facilitators, depending on the size of the company. In the beginning, one facilitator is usually assigned to three QC Circles. The QC Circle leaders call on the facilitator when they need support during meetings.

Figure 5 **Facilitators**


Management
QC Circle Steering Committee
QC Circle Office
Facilitator (full time)
Production Department
Engineering Department
Quality Department
Facilitator
Facilitator
Facilitator
(part time)
dual function
QCCs
QCCs
QCCs

2-2-4 Appointment of QC Circle Leaders

Participation in the basic activity of a QCC is normally on a voluntary basis, yet there are several ways in which a Circle's leaders are actually selected. In new Circles, supervisors often play the role of leader, because they are very familiar with the workplace and possess certain pertinent personal qualifications. Some Circles have their members take turns being the leaders, and others elect their leaders, but these approaches have the potential to create a dictatorial environment for leaders who are not well qualified for the role. Also, leaders can be tempted to choose themes that are easy to solve. Therefore, a Circle leader must be selected carefully, particularly when it is at the beginning of its activities. After a few years of QCC implementation, when the QC methods are well disseminated, Circles are able to select leaders (or theme leaders) depending on the themes that they are going to tackle.

Basic Functions of a Circle Leader

(1) Conducting QC Circle meetings
(2) Deciding roles of individuals and proceeding QC Circle activity
(3) Learning QCC tools and techniques
(4) Disseminating what is learned in (3) above
(5) Trying to improve members' abilities
(6) Establishing annual activity plan
(7) Encouraging members
(8) Doing administrative work for the QC Circle Office
(9) Participating in industry-wide conventions
(10) Studying about QC Circle activities and disseminating the knowledge
(11) Seeking advise and support from the QCC Office on behalf of its members

Implementation

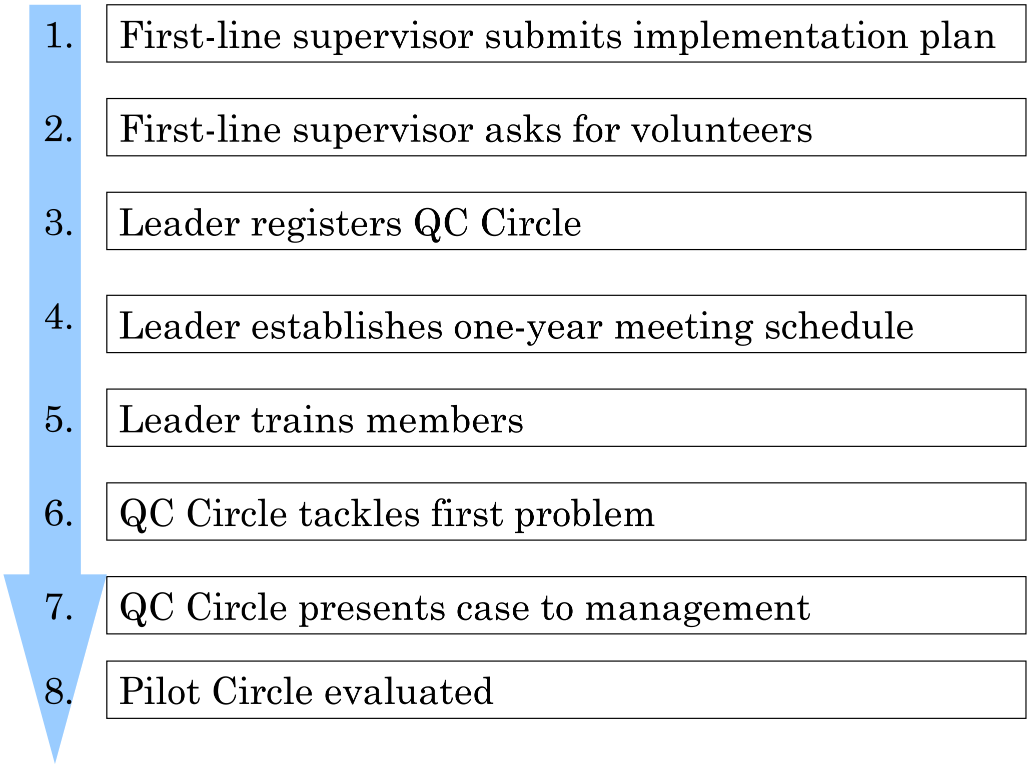
2-3 Launch of a Pilot Circle

As in anything that is new, the QC Circle program should be tried first on a small scale, in one to three departments. The company needs to have some prior experience with QC Circles in order to manage a company-wide implementation successfully. In the beginning of the program, it is important that the first-line supervisors, who are closest to the frontline operators and are well familiar with them and their operations, lead the activities.

It is critical that the first-line supervisors start and participate in the activities on a voluntary basis so as to encourage their subordinates to volunteer as well. Any initiative to direct their members to participate should be avoided, as directing introduces the notion of *commanding* or *controlling*.

The implementation stage consists of organizing a pilot Circle, training its members, solving its first problem, presenting the case to management, and then evaluating the pilot Circle. Following is a flowchart of a pilot QCC's activities at its implementation stage.

Figure 6 **Implementation Procedure Flowchart**


1. First-line supervisor submits implementation plan
2. First-line supervisor asks for volunteers
3. Leader registers QC Circle
4. Leader establishes one-year meeting schedule
5. Leader trains members
6. QC Circle tackles first problem
7. QC Circle presents case to management
8. Pilot Circle evaluated

1. **First-line Supervisor Submits Implementation Plan**
   The pilot Circle is organized, on a voluntary basis, by the first-line supervisor, who acts as its leader. He formulates his implementation plan and submits this to the QC Circle Office.

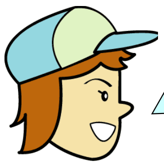
Figure 7 **QC Circle Leader's Implementation Plan**

	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Brainstorming: Theme Selection	↔											
Data Collection	↔											
Data Analysis		↔										
Brainstorming: Cause Identification			↔									
Group Discussion Root-Cause Isolation			↔									
Countermeasures Establishment				↔								
Implementation of Countermeasures				↔								
Review of Results					↔							
Evaluation of Outcome						↔						
Standardization of Countermeasures						↔						

2. First-line Supervisor Asks for Volunteers

The first-line supervisor invites his people and explains, with the assistance of the facilitator assigned to his department, the following topics:

- What a QC Circle is
- Why they are needed in our company
- What the prime objective of QC Circle activity in our workshop is
- What the benefits to the company are
- What is in it for us
- How we will participate



Pilot Circle leader

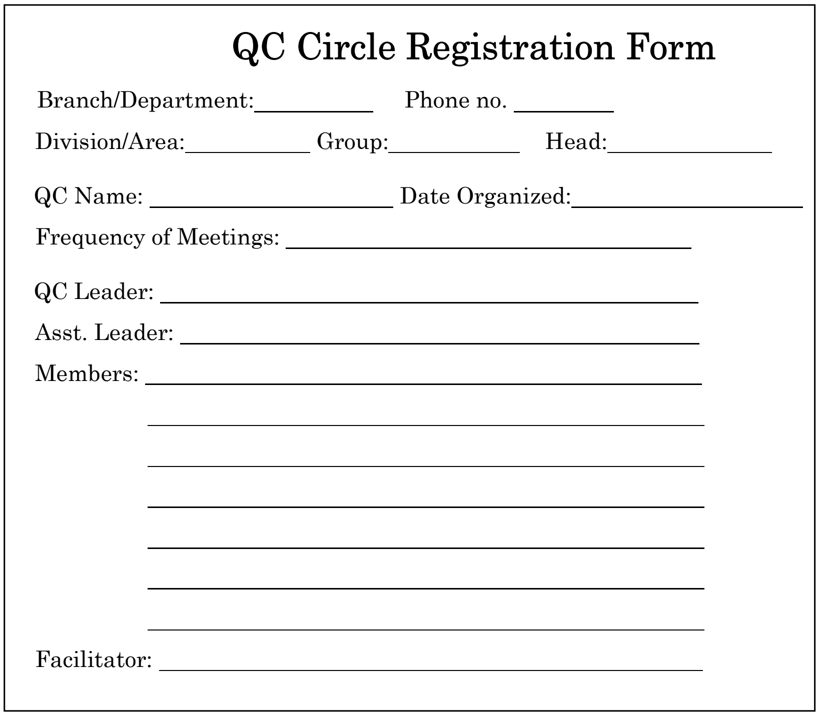
3. Leader Registers the QC Circle

If there are at least four volunteers, the QC Circle leader organizes a Circle and formally registers it with the QC Circle Office. When registering they are often required to provide the following information, which must be decided on by the Circle during its first meeting.

- QC Circle name
- QC Circle logo
- QC Circle leader
- Members (with simple bio data)
- Facilitator
- Meeting schedule

The QC Circles are required to register so that the company knows that they exist and the QC Circle Office can provide them the necessary support.

Figure 8 A Sample QC Circle Registration Form



QC Circle Registration Form

Branch/Department:__________ Phone no. ________

Division/Area:__________ Group:__________ Head:______________

QC Name: ____________________ Date Organized:____________________

Frequency of Meetings: ______________________________

QC Leader: ____

Asst. Leader: ____

Members: ____

____

____

____

____

____

____

Facilitator: ____

4. Leader Establishes One-hour Meeting Schedule

Most of the activities of the QC Circles are done through meetings, so it is necessary to consider how to eliminate members' boredom during meetings, especially when they study the QC Circle concept, behavior science, and other customer satisfaction concepts. This is why the QC Circle should meet twice a month for the first year. The duration of these meetings is usually for an hour. This way, the leader is able to hold the attention of the members. Figure 9 is a typical QC Circle meeting agenda.

Figure 9 A Sample of QC Circle Meeting Schedule

Time	Subject
0 〜 05′	Greeting, roll call, review of last meeting's assignments, confirmation of today's agenda
05 〜 10′	Group discussion on subject - Ideas submitted to leader on short memos
10 〜 20′	- Summarize submitted memos - Prepare a table for easy review
20 〜 40′	- Consolidate ideas
40 〜 50′	- Confirm consolidated ideas - Discuss remaining ideas
50 〜 55′	- Wrap up discussion - Record conclusion and items for discussion
55 〜 60′	- Ask facilitator for comments - Confirm assignments - Announce next meeting's agenda - Adjourn meeting

5. Leader Trains Members

Based on the curriculum prepared by the QC Circle Office, the leader teaches members, with the assistance of the QC Circle Office secretariat. Usually, the leader handles technical topics, like the QC Story, the tools, and the techniques. Training sessions are best held in the morning (for two hours), when members' minds are still fresh.

The following is a list of topics usually taught in the QC Circle meetings.

Issues to be Taught in QC Circle Training

ISSUES	POINTS
1. The importance of customers	Be thorough in Quality Assurance
2. Utilization of data	Make good use of QCC tools
3. Usage of management cycle	Introduce the PDCA cycle
4. The importance of tools	Make good use of QCC tools
5. Concentration measures	Make use of the Pareto diagram
6. Search for root causes	Examine the cause and effect diagram
7. Pursuit of all causes	Be conscious about quality
8. Importance of processes	Fully standardize the process

Figure 10 is an example of a training course outline for the Circle members.

Figure 10 Training Course Outline for Members

Topic	Description	Number of hours
Concept of QC Circles	1. Birth of QC Circles in Japan 2. Spread of QC Circles in other countries 3. Description of a QC Circle, its objectives 4. QC Circle organization 5. Importance of QC Circles	1.0
Installation of QC Circles in a company	1. Preparation phase 2. Pilot phase 3. Company-wide implementation 4. How to sustain QC Circle activities 5. Roles of the QC Circle Steering Committee, QC Circle Office, department management, facilitators, leaders, and members	1.0
QC Circle activities	1. PDCA concept 2. QC Story 3. Tools and techniques 4. QC Circle case study	12.0
Benefits, elements of success, and impediments	1. Benefits to the members, to the leaders, and to the company 2. Elements of success 3. Impediments	1.0
Total number of hours		15.0

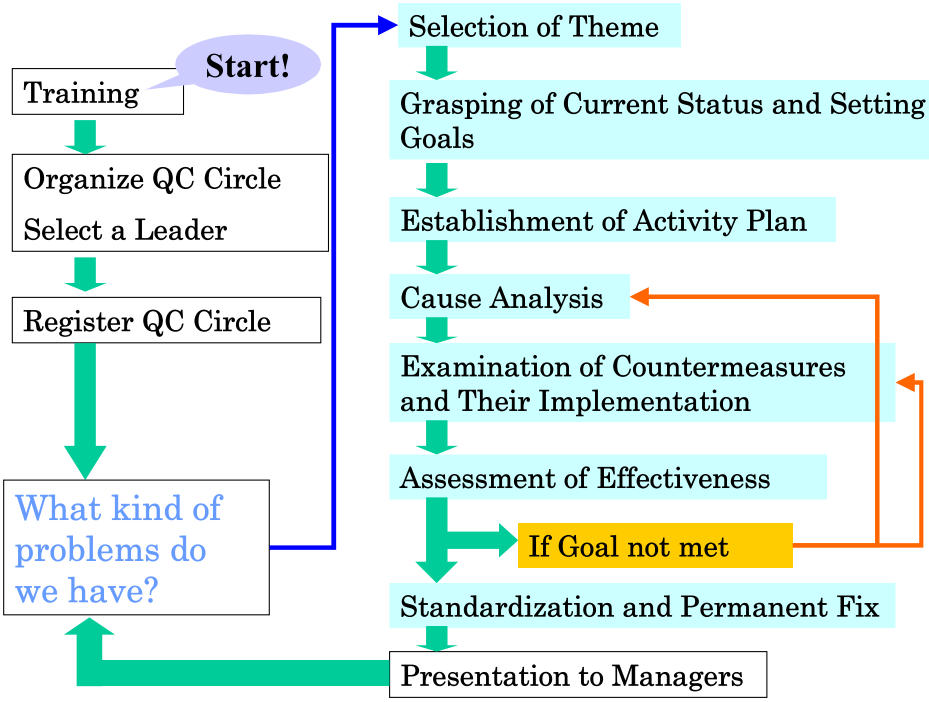
6. Pilot Circle Holds Meetings: QC Circle tackles first problem

The QC Circle is now ready to tackle its first problem using the Quality Control Story approach. The first problem chosen should be a simple one (e.g., housekeeping, the 5S concept, or safety) so that the Circle is able to solve it within a short period of time. Solving one problem will often give the members a sense of accomplishment and motivate them to pursue other problems they experience in their work.

Circles meet to study further the QC Circle concepts, tools, and techniques that they learned in their training. Once they are confident of their level of understanding, then they start to act on their theme. A Circle spends at least eighteen meetings in completing a theme before presenting it to management.

The details for each meeting will be covered in chapter 3.

Figure 11 QC Circle Activity Procedure


Start!
Training
Organize QC Circle
Select a Leader
Register QC Circle
What kind of problems do we have?
Selection of Theme
Grasping of Current Status and Setting of Goals
Establishment of Activity Plan
Cause Analysis
Examination of Countermeasures and Their Implementation
Assessment of Effectiveness
If Goal not met
Standardization and Permanent Fix
Presentation to Managers

Elements of Successful QC Circle meetings

- QC Circle meetings kept lively
- Facilitator support provided, when needed
- Logistical support provided

QC Circle meetings kept lively

It is necessary for the QC Circle Office to evaluate every member's attitude and behavior during meetings. It wants to ensure that meetings are lively so that members always look forward to them, anticipating the chance to share their creative ideas and listen to those of their teammates. Every meeting must meet members' expectations. There must be a conscious effort on the part of the leader and the facilitator to ensure the following ingredients for effective meetings:

1. Members actively participate in discussions
2. Members are committed to the tasks assigned to them
3. Members listen to each other at all times
4. Discussions are thorough, open, and to the point
5. Disagreements are accepted
6. Members are comfortable in examining the causes of disagreement and work toward a resolution
7. Members are eager to perform well and continually seek to improve
8. The leader provides necessary direction and encourages members to share in the leadership

For any negative observation, the facilitator must be quick to discuss this with the leader and work out a resolution together.

Facilitator support provided, when needed

Whenever a QC Circle meets and the leader requests assistance from the facilitator, it is important that this is provided. In circumstances when department facilitators are not able to provide the necessary support, they should find suitable substitutes to meet the requests.

Logistical support provided

QC Circles must be furnished with office supplies such as stationery, notebooks, flip charts, and colored pens. It is important that Circles have a place where they can meet comfortably and discuss their themes freely. They should have access to equipment like overhead projectors, computers, and slide projectors.

In some companies, meeting rooms are designated solely for the use of Circles. These rooms have white/black boards, flip chart stands, overhead projectors, and screens. Supplies like stationery should also be provided. Since there are more Circles than rooms, the use of the rooms is scheduled by the facilitator.

7. QC Circle Presents Case to Management

When the QC Circle finishes its case, it presents it to the department management. The case is presented for one of two purposes—namely, to inform management of their improvement efforts or to get management's support for the implementation of their solution. For this presentation, non-Circle personnel from the workshop are invited so they get a chance to see what a QC Circle does and what benefits can be derived from its activities. This is also an occasion for management to recognize the members for volunteering to be part of this pilot phase.

The department management evaluates the case based on how effectively the Circle used the QC Story, the tools, and the techniques. Evaluation criteria are summarized in a checklist, which is used as a guide when giving comments to the QC Circle about its project (figure 12).

Figure 12 **Evaluation Checklist for Beginner QC Circles' Case Presentations**

1.	Theme Selection	Selection of clearly identified themes to be tackled by members
2.	Analysis	Use of data and examination of isolated causes Use of fishbone charts for cause isolation
3.	Countermeasures	Clear establishment of countermeasures
4.	Effectiveness	Observed result of value to the company
5.	Standardization	Understanding of areas for recurrent preventive action

If the Chairman of the QC Circle Steering Committee is available at the time of the presentation, it is recommended that he attends and gives his comments. The facilitator also evaluates the case, using the following parameters: how the Circle identified the problem, the degree of member participation in the case study, the extent they followed the QC Story, the utilization of the QC tools and techniques, and the level of satisfaction of the department management.

Figure 13 QC Circle Case Evaluation Checklist

Evaluation Criteria	Evaluation Point			Marks
1. Theme Establishment (20 marks)	1) Was the theme established by all members participating in the studies? 2) Was the theme established in line with needs and importance? 3) Is the anticipated solution effective enough?			0 10 20
2. Members' Participation (20 marks)	1) Is each member attending the meetings? 2) Is any necessary cooperation being furnished by a related organization? 3) Are members positively supporting the activity?			0 10 20
3. Adequacy of Activity Proceeding (40 marks)	Evaluation Item	Evaluation Item	Marks	0 20 40
	1. Accomplishment of goal (10 marks)	1) Was the goal adequately established? 2) Was the established goal fully met?	1 5 10	
	2. Analysis (10 marks)	1) Was the past data fully available? 2) Was the analysis deep enough to find true cause? 3) Was the QC technique skillfully utilized?	1 5 10	
	3. QC Circle activity (10 marks)	1) Was teamwork effectively displayed? 2) Was positive cooperation gained?	1 5 10	
	4. Validation (5 marks)	1) Was the revealed result fully validated? 2) Was the problem encountered during the validation process identified definitely?	1 3 5	
	5. Standardization (5 marks)	1) Was every necessary action for full standardization taken?	1 3 5	
4. Utilization of Various Analysis Techniques (10 marks)	1) Was an adequate analysis technique utilized during each step? 2) Were the QC techniques appropriately employed? 3) Was any remarkable analysis technique specifically observed?			0 5 10
5. Management Satisfaction (10 marks)	1) Did the manager fully recognize the achievement? 2) Did the manager recognize that the accomplishment resulted from the QC Circle activity? 3) Was the manager satisfied with the leader's action?			0 5 10
				Total point 100

Aside from the department-based case presentation, it is recommended that the QC Circle Office organize division and company-wide presentation of cases to challenge and encourage others to organize their own QC Circles.

8. Pilot Circle Evaluated

It is necessary to evaluate the pilot Circle before proceeding to the company-wide implementation of the QCC concept, so that the positive lessons are sustained and the negative lessons are addressed to prevent recurrence. The evaluation is normally conducted by the QC Circle Steering Committee, the QC Circle Office, the facilitators, the department management where the pilot QC Circle was organized, the leaders, and the members.

The facilitators, leaders, and members also assess their level of satisfaction with their own competence and performance, via checklists. The members can also evaluate the leader using the Leader's Competencies Checklist, and the leader can evaluate individual members using the Member's Competencies Checklist.

Figure 14 **Facilitator's Competencies Checklist**

Level of Satisfaction Evaluation Items	Very satisfied	Satisfied	Neither satisfied nor dissatisfied
1. Ability to teach QC Circle concept to leaders	2	1	0
2. Ability to teach QC Story to leaders	2	1	0
3. Ability to teach QC tools to leaders	2	1	0
4. Ability to teach QC Circle techniques to leaders	2	1	0
5. Ability to provide technical support to leaders	2	1	0
6. Ability to provide moral support to leaders	2	1	0
7. Ability to monitor and report progress of QC Circles	2	1	0
8. Ability to sustain Circle enthusiasm	2	1	0
9. Ability to get necessary support from management	2	1	0
10. Ability to attend QC Circle meetings regularly	2	1	0

Figure 15 **Leader's Competencies Checklist**

Level of Satisfaction Evaluation Items	Very satisfied	Satisfied	Neither satisfied nor dissatisfied
1. Ability to teach QC Circle concept to members	2	1	0
2. Ability to teach QC Story to members	2	1	0
3. Ability to teach QC tools to members	2	1	0
4. Ability to teach QC Circle techniques to members	2	1	0
5. Ability to encourage members to participate in discussions	2	1	0
6. Ability to keep meetings on track	2	1	0
7. Ability to get Circle to implement actions as planned	2	1	0
8. Ability to get members to help in the preparation of case presentation materials	2	1	0
9. Ability to encourage members to participate in case presentation	2	1	0
10. Ability to encourage Circle to tackle next theme	2	1	0

Figure 16 **Member's Competencies Checklist**

Level of Satisfaction Evaluation Items	Very satisfied	Satisfied	Neither satisfied nor dissatisfied
1. Understanding of QC Circle concept	2	1	0
2. Understanding of QC Story	2	1	0
3. Understanding of QC tools	2	1	0
4. Understanding of QC Circle techniques	2	1	0
5. Participation in discussions	2	1	0
6. Contribution in keeping meetings on track	2	1	0
7. Contribution to implementation of actions as planned	2	1	0
8. Contribution in the preparation of case presentation materials	2	1	0
9. Participation in case presentation	2	1	0
10. Willingness to tackle next theme	2	1	0

The leader also assesses the QC Circle case using the same parameters used by the facilitator: the method the Circle used to identify the problem, the level of members' participation in the case study, the extent they followed the QC Story, the utilization of QC tools and techniques, and the level of satisfaction of the department management.

A QC Circle meeting in a telecommunications company (Photo by JUSE)

A QC Circle meeting in a machinery-manufacturing company (Photo by JUSE)

Sustaining QC Circle Activities

2-4 Implementation of a Company-wide QCC Program

Given the experience of the pilot Circle, the company is now ready to organize more QC Circles and the number depends on the size of the company and the plans of its QC Circle Steering Committee. The training procedure for an interested first-line supervisor is the same as that for the pilot Circle leader. As the number of Circles increases, several ways of systematically monitoring all QC Circle activities are employed. The following are some additional issues that are important during the company-wide implementation of QC Circles.

Figure 17 **Sustaining QC Circle Activities**

1. Installation of More QC Circles
2. Facilitator Meets Circle Leaders Monthly
3. QC Circle Office Secretariat Meets Facilitators Every Other Month
4. Evaluation

1. **Installation of More QC Circles**

   Once a pilot circle has been proved successful, the company can hold a launching ceremony and provide a chance to gather new members to join the QC Circle activity. The objective of this activity is to provide a forum for the president, who is the chairman of the QCC Steering Committee, to talk about his commitment to QC Circles, to explain why QC Circles are important to the company, to give an overview of the plans, and to enjoin his people to support the program. All levels of management and all the rank and file employees are invited to the launching. It is usually held during office hours, thereby conveying the message that the program is important to the company.

In some Asian countries, the atmosphere is made festive by giving souvenirs (e.g., pencils, ballpoint pens, notepads) to those who attend. These items may carry QC Circle slogans like “Have fun, be a QC Circle member!” In some companies, snacks are provided after the speech of the president. This gives him a chance to go around while people are eating and engage them in discussions. He can also ask what they think of QC Circles. For some of the employees, it may be their first time to see him; so, when he asks them how they are, it can mean a lot.

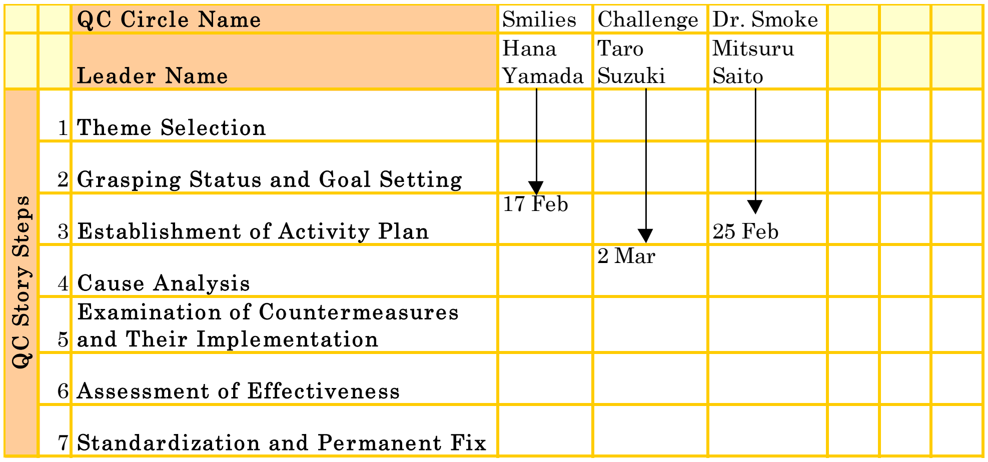
To get more people to attend the launching ceremony, some companies hold conventions or contests prior to the ceremony and announce the winners after the speech of the president. Examples focal points of such contests are slogans, posters, jingle compositions, and essay writing, all geared towards encouraging people to learn more about QC Circles and eventually join them.

Pictures of the highlights of the event are taken for later display on bulletin boards or in the newsletter. If the event was captured on video, it can be played in the cafeteria, with the intention of reminding everyone of the objectives of the company in installing the program. The speech of the president can be played again and again for better understanding of his message, given the possibility that not everyone heard and understood him during the ceremony. The launching ceremony usually lasts between 30 minutes and 1 hour.

2. **Monthly Meeting of Facilitator with Circle Leaders**
   Each leader prepares a status report every month, indicating in which steps Circle members and leaders encounter difficulties. He reports this during the meeting with other leaders. Collectively they come up with corrective and preventive actions to address all of the Circle members’ difficulties. The meeting duration is one hour.

Figure 18 **Minutes of Leaders Meeting**

Facilitators fill in the date when each step is accomplished.



		QC Circle Name	Smilies	Challenge	Dr. Smoke			
		Leader Name	Hana Yamada	Taro Suzuki	Mitsuru Saito			
QC Story Steps	1	**Theme Selection**	↓	↓	↓			
	2	**Grasping Status and Goal Setting**	↓	↓	↓			
	3	**Establishment of Activity Plan**	17 Feb	↓	25 Feb			
	4	**Cause Analysis**		2 Mar				
	5	**Examination of Countermeasures and Their Implementation**						
	6	**Assessment of Effectiveness**						
	7	**Standardization and Permanent Fix**						

3. **Every-Other-Month Meeting of QC Circle Office Secretariat with Facilitators**
   The objective of this meeting is to provide a venue for the facilitators to talk about their experiences and learn from each other. The QC Circle Office secretariat summarizes the overall status of the Circles based on the minutes of the leaders meeting submitted by the facilitators.

   The QC Circle Office secretariat prepares the minutes of each meeting, which include the date, time and venue of the meeting; attendees; overall status of the QC Circle activities; concerns of the facilitators; and things to do (figure 19).

Figure 19

Minutes of Facilitators Meeting

Facilitators Meeting

Held on ________ , at ____________

Present

____

____

____

____

____

____

____

____

Status of QC Circle Activities

QC Circle Name	No. of Meetings	Problem Statement	Status (Indicate Step in QC Story)

Concerns and Action Plans

Concerns	Action Plans

To Do List (for next meeting)

What to Do	Person(s) Responsible

Next Meeting
Date/Time/Venue

____

Agenda ______________________________

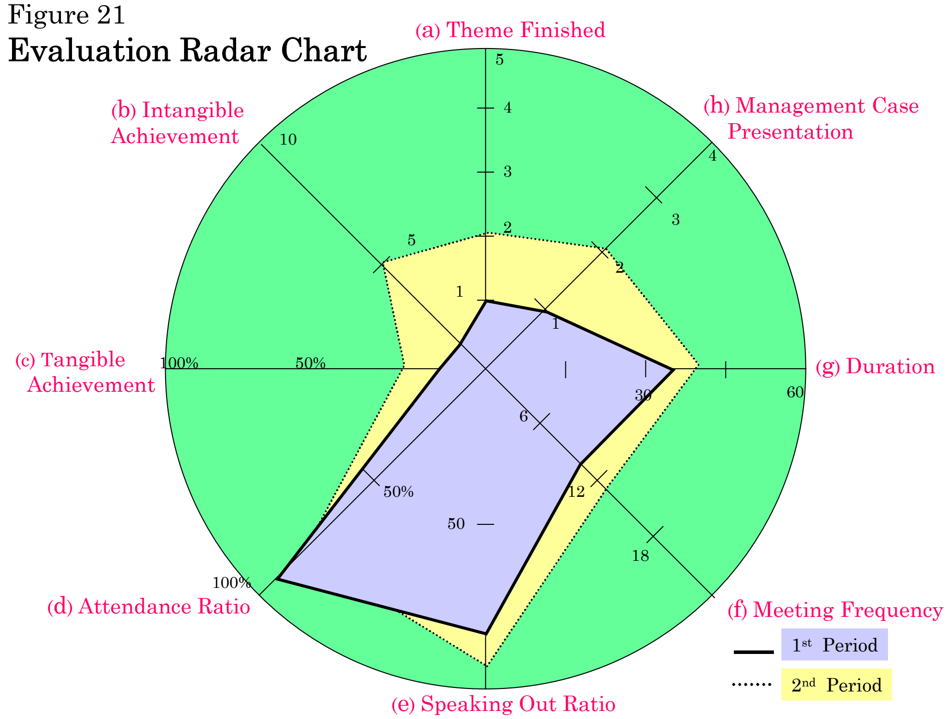
4. **Evaluation**

The evaluation done in this phase is basically the same as the evaluation done during the pilot phase. The QC Circle Steering Committee does an overall evaluation based on planned activities, goals and budget; and the QC Circle Office does an evaluation of specific activities, such as progress of Circles, training, promotional activities, and its support to Circles. The facilitators, leaders, and members evaluate themselves and each other's support to the Circles.

Figure 20 Evaluation Chart

Evaluation		1st period	2nd period
a	Theme Finished	1	2
b	Intangible Achievement	1	5
c	Tangible Achievement	10	20
d	Attendance Ratio	90	80
e	Speaking Out Ratio	75	90
f	Meeting Frequency	10	13
g	Duration (minutes)	35	40
h	Management Case Presentation	1	2

Figure 21
Evaluation Radar Chart



■ Evaluation by the QC Circle Steering Committee

It is important that the QC Circle Steering Committee assesses the progress of the program on a regular basis; most companies do it quarterly. This is to ensure that corrective and preventive actions are taken in cases where plans and goals are not achieved and budgets are not kept.

■ Evaluation by the QC Circle Office

The QC Circle Office has many concerns at this stage. They have to address the varying training needs of leaders and members. Some will need refresher courses, especially on the tools, whereas others will need supplemental courses on topics such as how to make meetings more effective. The Office must determine whether they are able to respond fully to these needs at any time.

■ Evaluation by Facilitators

The facilitators, too, have to evaluate their own capabilities, performance, and level of enthusiasm, in order to head off any risk of burnout. They can use the Facilitator's Competencies Checklist for this. It is recommended that the QC Circle Office manager or the QC Circle Office secretariat use this checklist to evaluate the facilitators and to discuss what actions to take for improvement in facilitators' capabilities. The facilitators make quarterly evaluations of the QC Circles assigned to them. They can use radar charts to give pictorial representations of their evaluations (figures 20 and 21).

■ Evaluation by Department Management

Using the radar chart of each Circle in its department and the facilitators' Circle Activity Status Report, the department management makes its own assessment of the progress of those Circles. Together with facilitators and leaders, it formulates corrective and preventive actions—it also makes an evaluation of any Circle case presented to it. If a Circle is just starting, the department management uses the Evaluation Checklist for Beginning QC Circles. If the Circle is at a slightly advanced stage, it uses the following criteria: theme selection, analysis, countermeasures, effectiveness of countermeasures, standardization, future plan and case presentation (figure 22).

Figure 22 **Evaluation Checklist for Slightly Advanced QC Circles' Case Presentations**

1. Theme Selection
    - A) Identifiable theme for maintenance or improvement
    - B) Goal defined by qualitative value
2. Analysis
    - A) Stratification fully utilized
    - B) Pareto diagram correctly used
    - C) Cause and effect diagram correctly used
    - D) Analysis procedure followed as taught
    - E) Appropriateness of any trial action taken to define the right actions
3. Countermeasures
    - A) Actions determined by analysis
    - B) Actions taken according to schedules
4. Effectiveness
    - A) Results evaluated by unit that established goal
    - B) Evaluation is pictorially represented by graphing
5. Standardization
    - A) Appropriateness of any action taken to revise the SOP* or insert additional check items
6. Future Plan
    - A) Self-examination considering the future plan
7. Case presentation
    - A) Presented clearly
    - B) Clear visual aids

*SOP: Standardized Operational Procedure

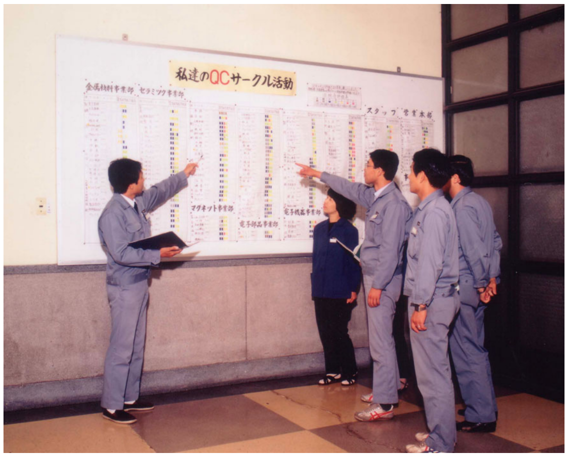
■ Evaluation by Leaders and Members

As in the cases for pilot leaders and members, new Circle leaders and members also assess the level of their satisfaction, both of their own capabilities and of the support given to the Circle. They can use the Leader's Competencies Checklist and the Member's Competencies Checklist. They also evaluate their own Circle and show it pictorially in a radar chart.

5. Necessary Arrangements for Sustainable QCC Implementation

■ Monitoring Board

Some companies have a bulletin board in their QC Circle Offices, in their canteens, and in each department, where the status of the activities of the different Circles is plotted, including the names of the current leaders and members. Sometimes if the size of the board allows it, a picture of the Circle is also posted.


私達のQCサークル活動

A QC Circle monitoring board in a factory (Photo by JUSE)

■ Company Newsletter

Newsletters are a very effective way of publicizing the progress of Circle activities and motivating the concerned. For example, if the pictures of successful Circles are shown in the newsletter, those who are on track are instilled with pride and those who are not on track can find resolve to get there. The amount of column space reserved for QC Circle activities (as many as eight pages in some companies, only a corner of a page in others) depends on the regular number of pages of the newsletter.

Newsletter inclusion of the QC Circle cases that have been presented to management, in addition to publishing of the status of QC Circle activities, is another positive idea. Sometimes the department that has the most number of active QC Circles is featured, including photos related to conventions, training conducted for leaders, members, or facilitators, or any other QC Circle–related event.

NEWSLETTER EXAMPLE

High Raters Given Recogn
BancoNews
15 Quality Teams make it to the Finals

Examples of newsletters (Photo by DBJ)

3 QC Story

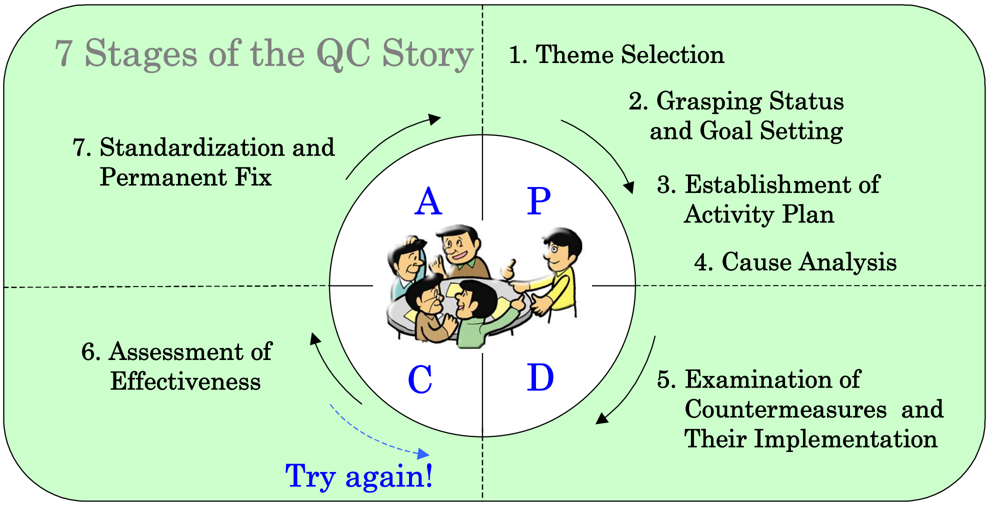
We saw in an earlier chapter that QC Circles were organized in Japan as a way of getting operators to participate in quality control activities. In order to be efficient and effective in their problem-solving activities, members follow the Plan-Do-Check-Act (PDCA) cycle, in which they plan for improvement, implement what is planned, check and analyze what has been implemented, and act based on the results of the checks.

*This problem-solving process is commonly referred to as the **QC Story**. Each Story shows how QCC members solve a problem in a systematic PDCA manner. By looking at these stories, therefore, those who are not part of the QCC can also learn the problem-solving processes for their own use. This chapter will direct leaders on what a QC Story is, how it is organized, what its benefits are, and how it is to be monitored. Evaluation and monitoring play important roles in improving QCC activities. The chapter also discusses the role of management in evaluating a QC Story.*

3-1 What is a QC Story

The problem-solving processes of QCC activities will be often presented in the form of a QC Story. Initially this method was used to report Circles' activities after they had solved their problems. Later it became what is now a problem-solving process. This process is a very effective method for addressing not only chronic problems in the workplace but also unforeseen problems and issues for which the causes have not been identified. Following the standard flow of stories, the QCC members summarize the procedures and identify the main factors in the processes. The following is a depiction of the seven major steps in establishing a QC Story.

Figure 23


7 Stages of the QC Story
1. Theme Selection
2. Grasping Status and Goal Setting
3. Establishment of Activity Plan
4. Cause Analysis
5. Examination of Countermeasures and Their Implementation
6. Assessment of Effectiveness
7. Standardization and Permanent Fix
A
P
C
D
Try again!

3-2 Why do we use the QC Story?

QC Circles follow a problem-solving process that provides guidelines for processes to be taken in order to run QCC activities. But why do we need to follow a process? Why not follow our own ideas and procedures? Why are guidelines so important?

The reason is that in problem-solving procedures, it is very important to analyze the data and provide appropriate judgment according to scientific evidence. In other words, operators on the floor should observe conditions, collect data, and analyze the problems using the evidence taken from the observation. If one does not rely on data, but rather make judgment based on one's own experiences and instinct, the problem is unlikely to be solved in the fastest and most efficient way. However, if, instead, one uses an already existing procedure, while making use of ones own specialized skills, it will lead to an efficient way of solving problems.

Some have noted that problem-solving procedure is patterned and organized in a way that everybody is assured to reach a solution in the most efficient way. Most anyone who uses this procedure can solve even difficult problems in a fast and efficient way.

3-3 QC Story Procedure

Each stage of the Story has steps that are common to all cases. The following is the detailed flow of processes. The steps in problem solving are explained in this chapter, but the tools and techniques will be explained in chapter 4.

1. Theme Selection

At the first stage, members select a theme from among the problems in the workplace—a theme concerning problems for which they think solutions would be most beneficial. This is to provide clear vision on the objectives for the activity. Members ask themselves, "What kinds of problems do we have and how do we improve them?"

- **Select a theme to tackle**
  A process to deliver products or services consists of activities carried out to complete a job. Suppose that we know a process has a problem, but do not know exactly which part of the process causes the problem, and to what extent. The QC Circle cannot study all of the activities of its work section simultaneously, so it has to focus on the most critical part of the process, which is determined by factors like the number of customers affected, potentials for bottlenecks, the number of complaints, and so on. If the most critical part of the process is not obvious, then the QC Circle can use a matrix diagram to arrive at a decision.

2. Grasping Status and Goal Setting

After a theme is selected, members try to understand the current situation of the problem. They list all of the possible problems related to the process, use data to validate that the "problems" are indeed problems, select the priority problem, and again use data to define the extent of this problem. The main objective of these steps is to gather information and grasp the status of the problem so that members can establish a detailed set of goals.

An investigation in a machinery-manufacturing company (Photo by JUSE)

- **List all possible problems related to the process**
  Brainstorming can be used to get each member's ideas as to what problems exist in the workshop. Not everything identified will necessarily be a problem (e.g., some causes of problems might be mentioned), so at the end of the brainstorming session, the QC Circle must determine whether each idea is a problem or is a cause of a problem. A business process has both inputs and outputs. The inputs come from suppliers or service providers, and the outputs go to customers. Anything negative about the input is a cause of a problem; and anything negative about the output is a problem. Here is an example to illustrate it.

Example: Ordering in a Restaurant

Process:	Order-taking in a restaurant
Processor:	Waiter
Order Source:	Customer
Input:	Order
Output of the waiter:	Filled-out order slip
Problem:	Wrong order served
Cause:	Order not written correctly because waiter did not hear it clearly

3. Establishment of Activity Plan

*Based on the data acquired in the second stage, the members establish an activity plan, according to the 5W1H concept. In this concept, five W questions and one H question are addressed. The members decide the issues to be tackled (***what***), the rationale for tackling them (***why***), the detailed time scheduling of the program (***when***), and the place and resource allocation (***where***, and* ***who*** *and* ***how***).*

How to establish an activity plan

1. Confirm the problems

   Brainstorming is based on opinion, so the ideas classified as problems must be confirmed with data. The need to speak with facts rather than opinions has to be stressed because we all have opinions and very often they are all different. This makes it very difficult for the Circle to arrive at a decision and may lead to frustration. Checksheets and other forms are used for easy collection, summarization, and analysis of data. (The details of brainstorming are further discussed in chapter 4.)

2. Select a high priority problem

   The choice of a high priority problem is based on the data collected in step 1. If data is not readily available, the QC Circle can use a **matrix diagram** to arrive at a high priority problem. Confirm the problem. Once the problem has been selected and confirmed, the Circle states it from the customer's point of view—like was done in the restaurant example: "Wrong order was served."

3. Define the extent of the problem

   The extent of the problem must be defined in quantifiable terms (e.g., from January to March 2002, 30 percent of the orders were not processed correctly).

   This is a very important step because it establishes the baseline data and it will be used later as a reference in measuring improvement generated by the Circle. A mere statement to the effect that there was reduction in incorrect orders served is insufficient; the reduction has to be backed up by data. Therefore, if historical data is not available, the QC Circle must collect data as the process is being done (e.g., by tallying how many orders are correctly served and how many are not).

4. Establish a goal

   The goal must be based on data; it must be quantified and time-bound (e.g., the filling out of order slips must be done correctly 100 percent of the time by the end of the second term in 2002).

4. Cause Analysis

The main objective of this stage is to confirm which measures can be taken for what kinds of problems. After a theme is selected, the causes and effects of *problems are to be identified. This is the most important stage of the process, as it identifies the root causes of the problems and shows what needs to be changed. In problem-solving processes, it is very important that results are examined in line with causes, thus identifying the cause–effect relationship. Members consider all possible causes of the problem and see if there is any correlation among them. Then they use data to verify the causes, narrow these down to root causes, and finally select the most critical root cause. They then consider all possible solutions to eliminate the most critical root cause, select the best solution, and establish a detailed plan on how to implement it.*

How to proceed cause analysis

1. List all possible causes of the problem
   The Circle brainstorms on the causes of the problem. A very important question in this step begins with the word *why*. Why are the orders incorrectly served? The Circle members enumerate their answers to this question until they have exhausted all possible causes.

2. Show relation among the causes
   After enumerating the causes, the Circle groups the related causes according to man, method, machine, materials, and environment (4M1E; explained in chapter 4 section 3-7). And to show relation among the causes, the **cause and effect diagram** is used. Once the causes are fitted into the cause and effect diagram, the Circle asks "why?" again for each cause. The more times "why?" is asked, the more extensive is the analysis.

3. Identify the causes
   The cause and effect diagram is a structured brainstorming, so it is also based on opinion. It is necessary, therefore, to identify the causes using data. A cause is valid if there is proof both that it occurs and that when it occurs, the problem exists. For example, the Circle may say that one cause of serving something other than what a dining customer ordered is that the order slip was not filled in correctly. To assert this, they have to establish that there is a correlation between serving wrong orders and incorrectly filling out order slips.

4. Select root causes
   From the valid causes, the QC Circle selects the root causes. If there is a direct relationship between the cause and the problem and this cause is seen repeatedly in the cause and effect diagram, then it is a **root cause**.

5. Select most critical root cause
   Among the root causes, the Circle selects the one that is most directly related to the problem. Voting can be used to decide which root cause to work on.

6. List all possible ways to eliminate the most critical root cause
   Again the QC Circle brainstorms to generate ideas from the members. The leader must be able to challenge the members to be creative, to let go of their preconceptions. If a QC Circle hits a mental block—that is, it is not able to

come up with ideas—it leaves the list where everyone can see it (e.g., on a wall in the workplace) and add new ideas easily. This helps provide a longer list for consideration at the next meeting.

7. Select a best solution
   The suggested solutions must be carefully evaluated and tested for potential complications. The QC Circle can use matrix diagrams to select the best solution.

8. Establish a detailed plan
   The next step is for the QC Circle to flesh out the details on the implementation of the solution by asking the question "How?" For each activity, someone is given responsibility and a timetable. The details of the plan are summarized in a Gantt chart.

5. Examination of Countermeasures and Their Implementation

After causes are identified, countermeasures are examined, evaluated, and selected. This stage aims both to correct the root causes and to establish the most effective measures to prevent the reoccurrence of the problems. All the people concerned on the issue are gathered to discuss it, considering factors such as effectiveness, cost, condition of restrictions, and impacts on the other factors. Members then implement countermeasures in daily operations, according to the plan, and monitor the results.

1. Implement action plans
   The Circle is now ready to implement its action plans. Teamwork is very crucial in this step. The solution may be a very good solution and the plans may be very detailed, but if not everyone does their share of the work, the desired result may not be achieved.
2. Monitor activities and results
   Implementation must be monitored according to the agreed procedure to check both if the activities are implemented according to the plan and if the expected results are observed. Actual implementation dates must be reflected against the planned dates as seen in the Gantt chart.

6. Assessment of Effectiveness

Then an assessment is carried out to see whether the impediments have been overcome or to what extent the initial objectives have been met. It is carried out together with evaluation for further improvement of the work. The Circle identifies the tangible and intangible results, verifies them using data, and compares them with the initial goal. Tangible results are results targeted through changes in processes, whereas intangible results are those in areas such *as improvement in employee learning skills and education. If the results do not meet the goal, then the Circle needs to return to previous stages and reexamine the processes.*

1. Identify tangible and intangible results
   Tangible results are those that can be quantified, like when a defect rate is reduced by a certain percent. Intangible results on the other hand are those that are qualitative, like when teamwork among the members is improved.

   The Circle must be able to establish at this point that the project gains also bring them direct personal benefit. Therefore, a very important question that each QC Circle must answer is "What is in it for me?" By answering this question, the members realize that they themselves, in addition to the company, benefit from the project, which induces personal satisfaction as well as a sense of achievement. This sense of achievement is the most important intangible result of QC Circle activities.

   Take, for example, a case in which a defect rate is reduced by 90 percent. Obviously this is good for the customer, and what is good for the customer is good for the company, but how is it good for the Circle members? A member who is sold on the QC Circle philosophy will say, "It is good for me because now I can be proud of my work, whereas before, I was ashamed of the defective parts that I was making."

2. Verify results
   The QC Circle verifies the results over time. For instance, has the 90 percent reduction in defects been sustained over a period of two weeks, over a month, over a quarter? Is improved teamwork manifested in all activities at the workplace or only during QC Circle–related activities?

3. Compare tangible results with goals
   The QC Circle may achieve some results but these must be compared with the goal set in stage 3 step 4. Various types of diagrams can be used, but accurate comparisons cannot be made between diagrams of the different types—that is, the same type must be used consistently.

7. Standardization and Permanent Fix

Finally after effective methods are identified, they are standardized and made a permanent part of daily operations. Based on the standardization, members train the people concerned. Also, new training manuals are created and disseminated among the people concerned, and evaluation is carried out from time to time, aimed at ensuring that the process is maintained appropriately. The last step in this stage is for the Circle to determine the next problem to tackle, which may be chosen from the list generated in the beginning of the first QC Story.

1. Standardize solution
   If the goal is achieved, the new procedure should be standardized. If the goal is not achieved, then the QC Circle must retrace its steps, starting with analysis of the causes. Standardization ensures that the solution stays permanent.

2. Train employees on the new SOP
   If the work is done in more than one shift but the QC Circle members come from only one shift, then all employees in the other shifts must be trained on the new SOP (Standardezed Operational Procedure). This way, the benefit from the new SOP is maximized.

3. Verify that the SOP is followed
   Like for any other SOP, monitoring is needed for this new one to see that everyone concerned is adhering to it all the time. If they are not, then the reasons must be determined and countermeasures must be put in place. Spot checks must be conducted from time to time.

4. Select next problem to tackle
   The QC Circle activity does not end once the solution to one problem has been found, because there are other problems in the workshop that have to be addressed. The Circle may choose to solve the second most critical problem in their list of problems identified at stage 2 step 1.

   Thus the PDCA wheel continues to turn as the QC Circle looks for better ways to satisfy the customer even better.

3-4 Benefits of the QC Story

Benefits of the QC Story

1. Easy to understand the problem-solving processes
2. Can reflect on other activities
3. Can be disseminated horizontally for deployment
4. Facilitates accumulation of experiences and lessons learned
5. Improves members' analytical skills and statistical knowledge in a systematic manner
6. Enhances individual abilities in a group orientation

Establishment of the QC Story is highly beneficial, not only because of its problem-solving properties but also because of what the members learn as they proceed through the steps. In fact, the QC Story brings both internal and external benefit to those involved in the processes.

As for the internal benefit, through QC Story activities, members systematically learn analytical skills as well as knowledge on statistical tools used in the process. The steps of the QC Story can serve as a roadmap for those who are not familiar with problem-solving processes. What Circle members learn through these activities can be applied to future processes. Externally, the QC Story has great impact horizontally, as it disseminates individual experiences among all those interested in the QCC concept.

4 Seven QC Tools and QCC Techniques

QC Circles need a well-defined process for collecting facts and data that help them to understand situations in real time and develop countermeasures (implemented through the following PDCA management cycle or the QC Story) to address problems and prevent them from recurring. QC tools and QCC techniques, weapons to help QC Circles make decisions that allow them to properly follow the QC Story, are not only powerful but also imperative. In other words, it is impossible for QCC members to follow the QC Story without proper QC tools. This chapter describes the seven QC tools and QCC techniques that QC Circles all over the world use in their problem solving.

4-1 Data Collecting and Analysis

4-1-1 What is data?

The most critical matter for QC Circles is to understand facts and data. Without correct data collecting and analysis, it is impossible to solve problems in the workshop. Points concerning the treatment of data are described hereinafter.

Data is information about a certain event or matter expressed objectively and through both numerical values (numerical data) and language (verbal data).

Numerical data has measurement values and discrete values.

1. Measurement values—Fixed data such as length, weight, and profit
2. Discrete values—Variable data such as the number of defects

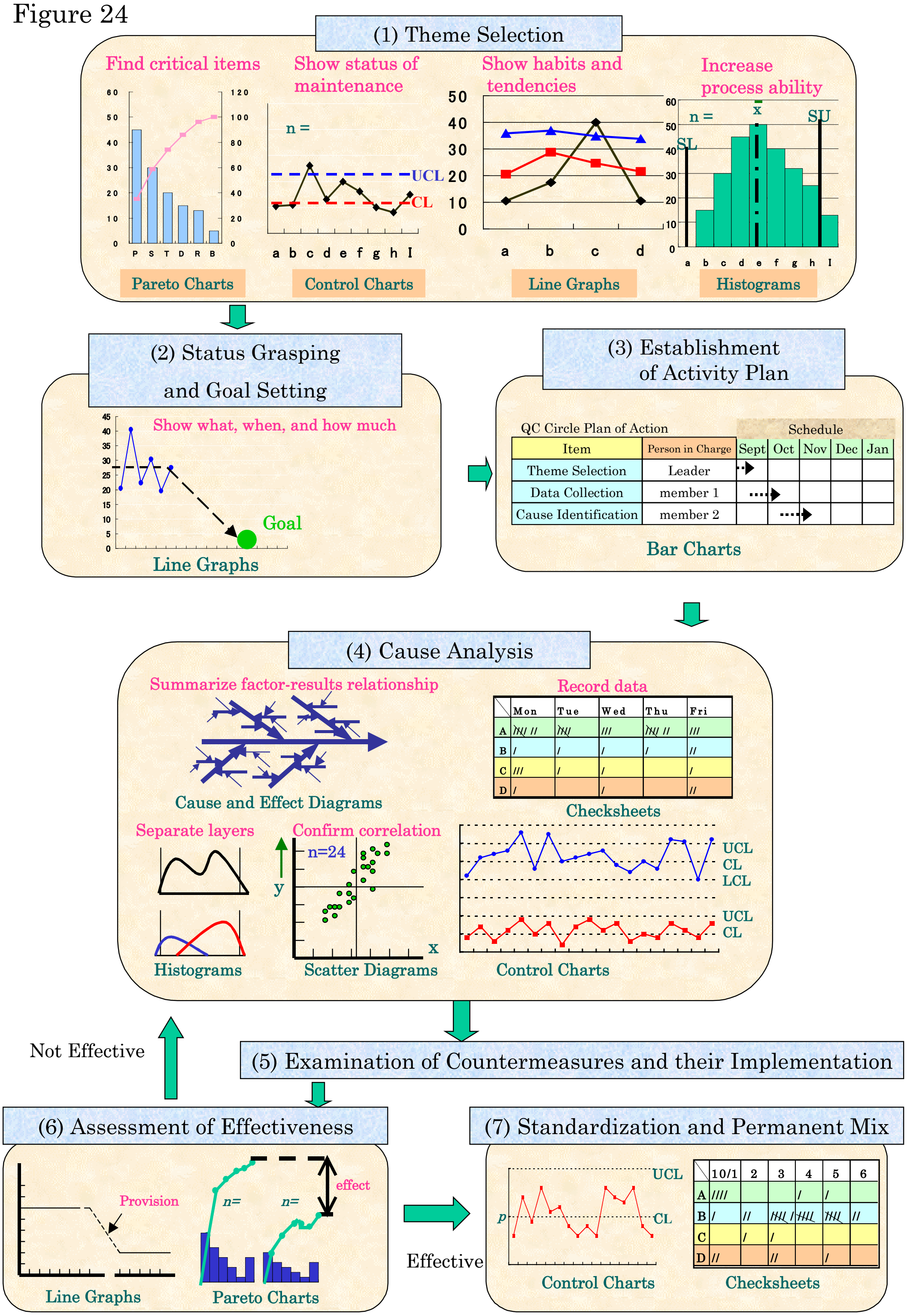
Verbal data has logical expression words and emotional expression words.

(1) Logical expression words—Communicated objectively (instrumental words for reporting)

(2) Emotional expression words—Needing translation into logical expression words

Process Flowchart for QCC Tools

Figure 24


(1) Theme Selection
Find critical items
Show status of maintenance
Show habits and tendencies
Increase process ability
n =
UCL
CL
SL
SU
x
Pareto Charts
Control Charts
Line Graphs
Histograms
(2) Status Grasping and Goal Setting
Show what, when, and how much
Goal
Line Graphs
(3) Establishment of Activity Plan
Bar Charts
(4) Cause Analysis
Summarize factor-results relationship
Cause and Effect Diagrams
Record data
Checksheets
Separate layers
Histograms
Confirm correlation
n=24
y
x
Scatter Diagrams
UCL
CL
LCL
UCL
CL
Control Charts
Not Effective
(5) Examination of Countermeasures and their Implementation
(6) Assessment of Effectiveness
Provision
Line Graphs
n=
n=
effect
Pareto Charts
Effective
(7) Standardization and Permanent Mix
UCL
p
CL
Control Charts
Checksheets

QC Circle Plan of Action

Item	Person in Charge	Schedule Sept	Oct	Nov	Dec	Jan
Theme Selection	Leader	▸				
Data Collection	member 1	▸				
Cause Identification	member 2		▸			

	Mon	Tue	Wed	Thu	Fri
A	𝍸 //	𝍸	///	𝍸 //	///
B	/	/	/	/	//
C	///	/	/		/
D	/		/		//

	10/1	2	3	4	5	6
A	////			/	/	
B	/	//	𝍸 /	𝍸	𝍸	//
C		/	/			
D	//		//		/	

4-1-2 How is data collected?

How to collect data

Step 1: Clarify the objectives of collecting data.
Step 2: Clarify the items to be understood within the problem.
Step 3: Determine the method of stratification.
Step 4: Make a checksheet.
Step 5: Gather facts from the data using QC tools.

Points to consider when collecting numerical data

- Have the objectives of collecting data been clarified?
- Is the sampling fit for the purpose of the subject item?
- Is there sufficient time to collect the required amount of data?
- Is the method of stratification appropriate?
- Is the checksheet adequate?
- Have the proper QC tools been used?
- Is the graphing adequate?
- Has the technique been properly tested?

Points to consider when collecting verbal data

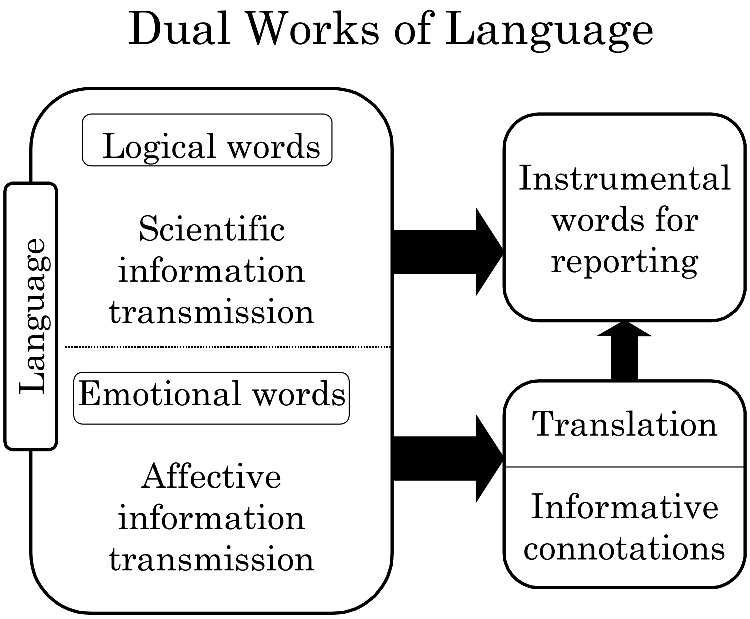
- Understanding of the background of spoken language and the ways of expression by speakers is important in order to prevent misunderstanding when collecting verbal information.

4-1-3 Analyzing Data

1. Correct use of verbal information (words):
   - Translate verbal language into report language.
     - ✓ Avoid making inferences or conclusions.
     - ✓ Communicate objectively with logical language.
     - ✓ Translate emotional language into logical language before presenting it.

Figure 25

Translation from Emotional Words to Logical Words


Dual Works of Language
Language
Logical words
Scientific information transmission
Emotional words
Affective information transmission
Instrumental words for reporting
Translation
Informative connotations

- Be multi-value oriented in all expressions.
  - ✓ Avoid two-value orientations, such as yes/no questions.
  - ✓ Use expressions for which multiple values can apply—explaining the method, amount, and extent of things.

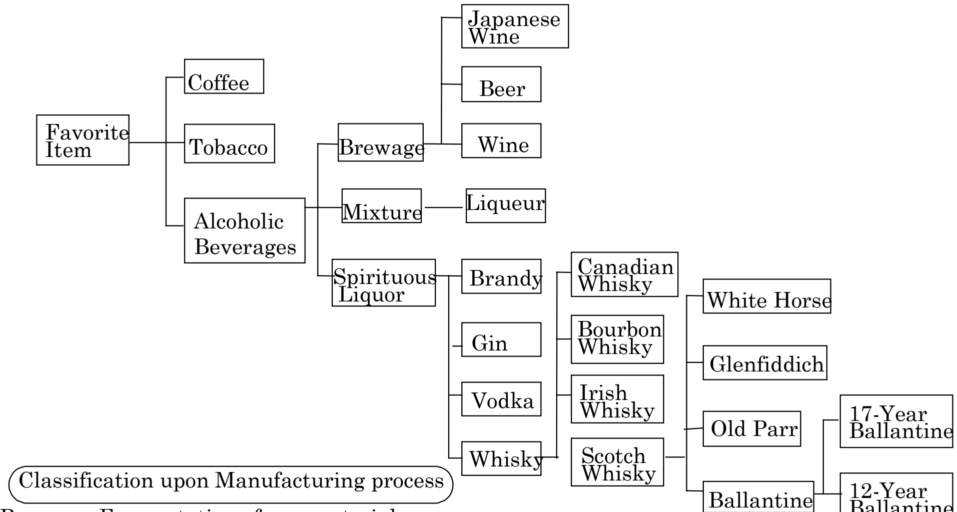
In two-value expressions, evaluation is by only one scale (e.g., something is either *good* or it is *bad*, with no degrees in between). Actions based on two-value orientations will often fail to reach objectives.

In multi-value expressions, rather that an all or nothing choice, a more detailed degree of evaluation is possible (e.g., with options such *very bad, bad, so-so, good,* and *very good*). Even under complicated conditions, actions taken from multi-valued orientation have a high chance of reaching their objectives.

(Hayakawa 1985)

2. Caution in terms of word abstraction (see figure 26)
   - Mixed usage of an abstracted word can be the critical cause of misunderstandings.
   - Indicate concretely as much about the actual thing as possible, then summarize to a higher abstraction level for better communication.

Figure 26 **Stratums of Word Abstraction**


Favorite Item
Coffee
Tobacco
Alcoholic Beverages
Brewage
Mixture
Spirituous Liquor
Japanese Wine
Beer
Wine
Liqueur
Brandy
Gin
Vodka
Whisky
Canadian Whisky
Bourbon Whisky
Irish Whisky
Scotch Whisky
White Horse
Glenfiddich
Old Parr
Ballantine
17-Year Ballantine
12-Year Ballantine
Classification upon Manufacturing process

Brewage: Fermentation of raw materials
Spirituous Liquor: Distilling the brewage with high % of alcohol
Mixture: Mixture of various kinds of materials

4-2 Seven QC Tools

Figure 27 **7 tools of QC**

No.	Steps	Method	Stratification	Pareto Charts	Cause and Effect Diagrams	Graphs	Check-sheets	Histograms	Scatter Diagrams	Control Charts
1	Theme Selection		◎	◎	○	○	○	○		○
2	Status Grasping and Goal Setting	Learn Current Status	◎	○	○	◎	○	○		○
		Set Goal	◎	○		◎		○		○
3	Establishment of Activity Plan		○			◎				
4	Cause Analysis	Study Relationship between Factors and Result	◎		◎				○	
		Study Past and Present Situation	○	○		◎	◎	◎		◎
		Separate the layers	◎	○	○	○	○	◎	◎	◎
		Look at Changes in Time				○				◎
		Look at Correction				○			◎	
5	Implementation of Countermeasures				◎	○				
6	Assessment of Effectiveness		○	◎		○	○	◎		◎
7	Standardization and Permanent Fix		○			○	◎	○		◎

○ Shows a relation between the QC Story's steps and its tools
◎ Shows strong effectiveness between the two

The seven QC tools (figure 27) are used to collect, summarize, and analyze data (quantitative and qualitative), whereas basic techniques such as brainstorming, the why-why approach, affinity diagrams, 5S, 3Mu, 5W1H, and 4M1E are used to assist members to think creatively.

The seven QC tools and QCC techniques described here are the most basic ones. As the Circle matures and the members are able to handle more complex QC tools and techniques, these should be made available to them by the QC Circle Office.

The seven tools are usually considered to be

1. Stratification
2. Pareto diagrams
3. Cause and effect diagrams (Ishikawa diagrams)
4. Graphs
5. Checksheets
6. Histograms
7. Scatter diagrams

(8. Control Charts)

A QC Circle meeting in a hospital (Photo by DBJ)

Although *stratification* is sometimes replaced as a tool by *control charts,* beginners are recommended to follow the seven QC tools listed above.

4-2-1 Stratification

The objective of stratification is to grasp a problem or to analyze its causes by looking at possible and understandable factors or items. Collected data of a single population is divided—by time, workforce, machinery, working methods, raw materials, and so on—into a number of stratums (or layers) to find some latent characteristics among the data—be they the same or similar. For example, after collecting data on photocopy mistakes, we can find some factors or peculiarities that can be stratified in terms of operator, photocopy machine, sheet size, time, date, or copy operation method.

How to stratify data

Step 1: Clarify the objectives of stratifying data.
Step 2: Clarify the items to be stratified within the problem.
Step 3: Determine the method of collecting data.
Step 4: Check and compare the stratified data items.
Step 5: Find causes by finding big differences among data items

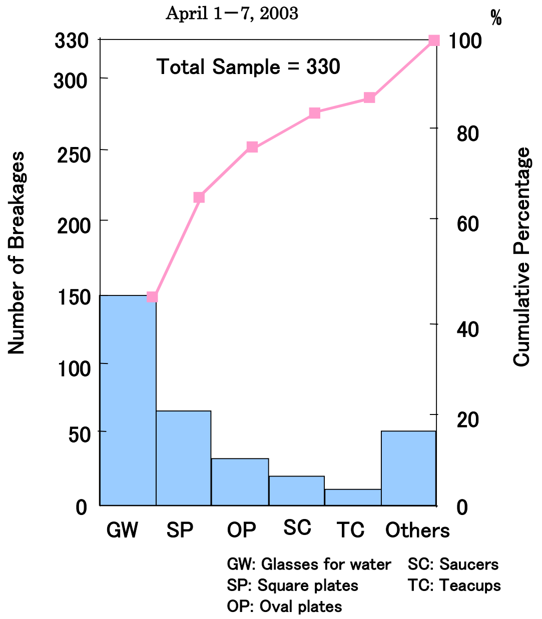
If a big difference is not found, keep going back to step 2 to add some other stratifying items until obvious peculiarities among the data are discovered.

Typical Categories of Stratification

- By time: year, month, week, day, hour, night, afternoon, morning, period, etc.
- By workforce: division, section, dayshift, nightshift, group, age, experience, etc.
- By machinery: line, equipment, machine number, model, structure, jigs, dies, etc.
- By working method: working procedure, manual, speed, etc.
- By raw material: place of origin, supplier, lot, charge, etc.
- By product: country, unit, order, manufacturer, service provider, etc.
- By environment: temperature, humidity, weather, etc.

4-2-2 Pareto Diagrams

Figure 28 **Pareto Diagram of Kitchen-Ware Breakage, by Type**



A Pareto diagram is a form of bar chart with the items arranged in descending order so that you can identify the highest contributing factors to a problem. A Pareto diagram shows which defective items should be tackled first. This type of diagram was given its name by Dr. Joseph M. Juran because of its likeness to the 19th century work of Vilfrido Pareto on uneven economic distribution—work postulating that 80 percent of the wealth of a nation is owned by 20 percent of its population. Applying the principle to the production of a typical company, Juran referred to the 20 percent of workers who produced 80 percent of its output as the *vital few* and the remainder as the *trivial many*. By depicting events or facts in order of decreasing frequency (or decreasing cost, decreasing failure rate, etc.) a Pareto diagram can easily separate the *vital few* from the *trivial many*. They are also used to compare conditions over time, to see how both the distributions and the total effects have changed after corrective action has been taken. This type of diagram is one of the most common statistical tools used by QC Circles.

How to construct Pareto diagrams

Step 1: Clarify the objectives of constructing a Pareto diagram.

Step 2: Clarify the stratified items of collected data within the problem.

Step 3: Design a data tally sheet listing the items with their totals (figure 29).

Step 4: Fill out the tally sheet and calculate the totals.

Step 5: Make a Pareto diagram data sheet listing the items, their individual totals, cumulative totals, percentages of overall total, and cumulative percentages (figure 30).

Step 6: Arrange the items in terms of number of occurrences and fill out the data sheet. The item "others" should be on the last line, no matter how large it is. This is because it is a collection of items for which the largest number of occurrences of any one item is smaller than that for the smallest of the individually listed items.

Step 7: Construct a Pareto diagram from the Pareto diagram data sheet (figure 28).

1. Draw two vertical axes, marking the left-hand vertical axis with a scale from 0 to the overall total and the right-hand with a scale from 0% to 100%.
2. Draw a horizontal axis. Then construct a bar diagram, dividing the horizontal axis according to the numbers of items.
3. Draw the cumulative curve (Pareto curve)

Step 8: Add necessary information regarding the diagram: title, significant quantities, units, sampling period, subject and place of data collected, total number of data, etc.

Figure 29

Data Tally Sheet of Kitchen-Ware Breakage

Breakage items	Tally	Total
Teacups	𝍸𝍸	10
Glasses for water	𝍸𝍸𝍸𝍸𝍸𝍸𝍸 …………………𝍸𝍸	150
Saucers	𝍸𝍸𝍸𝍸	20
Oval plates	𝍸𝍸𝍸𝍸𝍸𝍸	30
Square plates	𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸	70
Others	𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸𝍸	50
Total		330

Figure 30 **Pareto Diagram Data Sheet of Kitchen-Ware Breakage**

Theme: Cost reduction of kitchen-ware breakage

Total Sample: 300

Period: April 1－7, 2003

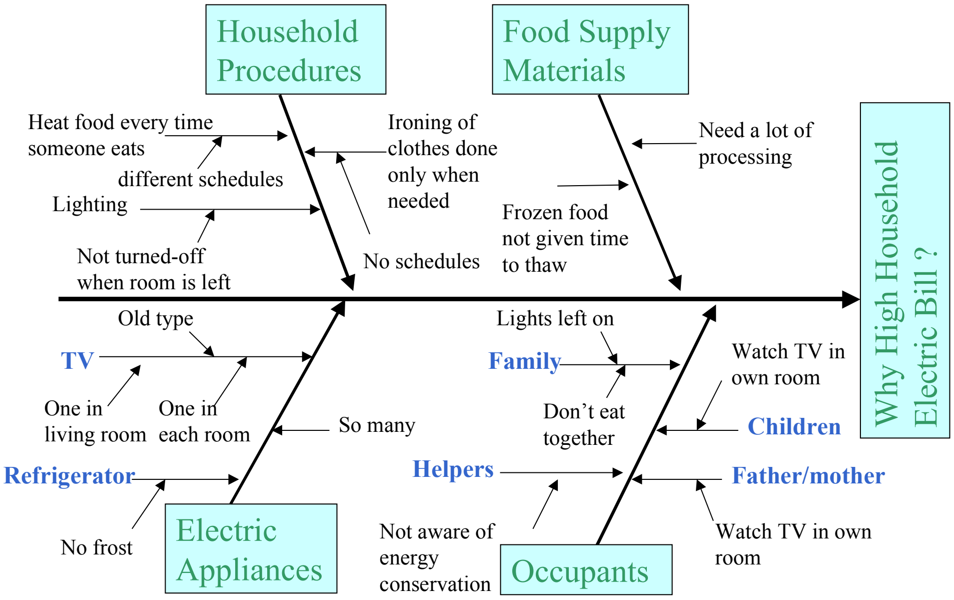
Date: May 01, 2003

Name: N. Kaneko

Items	Number of Breakages	Cummulative Total	Percentage of Overall Total	Cumulative Percentage
Glasses for water	150	150	46	46
Square plates	70	220	21	67
Oval plates	30	250	9	76
Saucers	20	270	6	82
Teacups	10	280	3	85
Others	50	330	15	100
Total	330	—	100	—

4-2-3 Cause and Effect Diagrams (Ishikawa Diagrams)

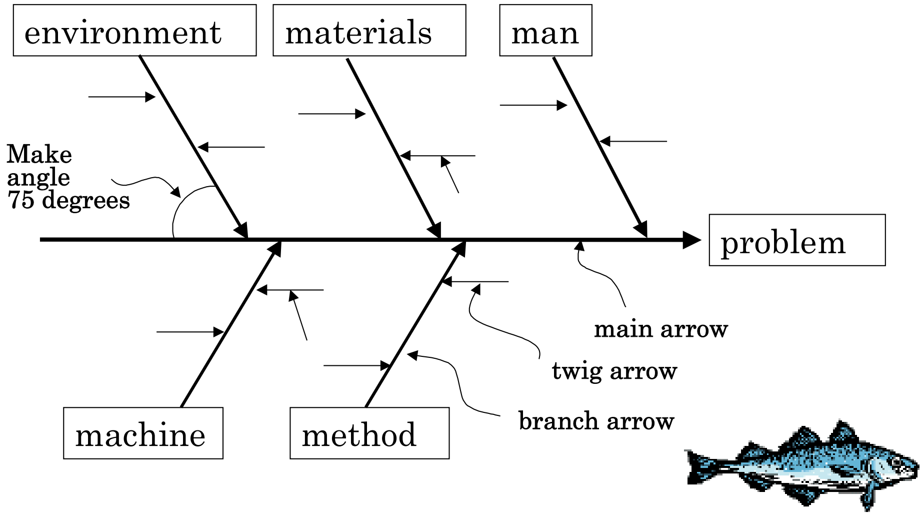
Figure 31 **Cause & Effect Diagram (Ishikawa Diagram)**


Household Procedures
Food Supply Materials
Heat food every time someone eats
different schedules
Lighting
Not turned-off when room is left
Ironing of clothes done only when needed
No schedules
Need a lot of processing
Frozen food not given time to thaw
Why High Household Electric Bill ?
Old type
TV
One in living room
One in each room
So many
Refrigerator
No frost
Electric Appliances
Lights left on
Family
Don't eat together
Watch TV in own room
Children
Helpers
Father/mother
Not aware of energy conservation
Watch TV in own room
Occupants

This diagram composed of lines and symbols is designed to represent the relationship between effects and their causes. It is sometimes called an **Ishikawa diagram**, after Dr. Kaoru Ishikawa who is considered the father of QC Circles. Others call it a **fishbone diagram** due to its resemblance to a fish skeleton. It is a very effective tool for analyzing the causes of a problem, even household problems like high consumption of electricity.

How to construct cause and effect diagrams

Figure 32 Cause and Effect Diagram



Step 1: Write the problem on the right side and box it. Draw a main arrow from left to right, with the head of the arrow pointing to the problem.

Step 2: Identify all of the main categories of causes of the problem, for example, man, method, materials, machine, and environment. In figure 31, these factors were grouped as appliances, occupants, household procedures, and household food supplies. Use branch arrows to connect the categories to the main arrow.

Step 3: Using twig arrows, connect the individual main causes identified in step 2 to their respective branch arrows.

Step 4: Identify the detailed causes of each main cause and connect them to the twig arrows, using even smaller twig arrows.

4-2-4 Graphs

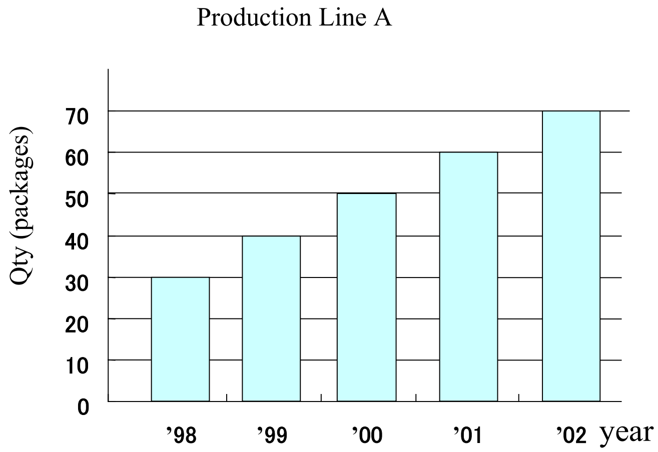
A graph is a tool used to present an area of interest in visual form. There are various types of graphs, and the most common are bar graphs, line graphs, and pie charts. People involved in QCC activities are recommended first to decide on the data to be collected and the period in which it will be collected, regardless of the type of graph they will use.

Ten merits of graphs

(1) Numbers can be visualized.
(2) Readers get to sense the whole picture.
(3) They require few words.
(4) They are interesting to look at.
(5) Contents can easily be understood.
(6) They are objective.
(7) They are easy to make.
(8) Comparisons are easy to display.
(9) They are a universal form of language.
(10) They enhance the image of the contents.

A. Bar graphs

Figure 33 **Bar Graph**



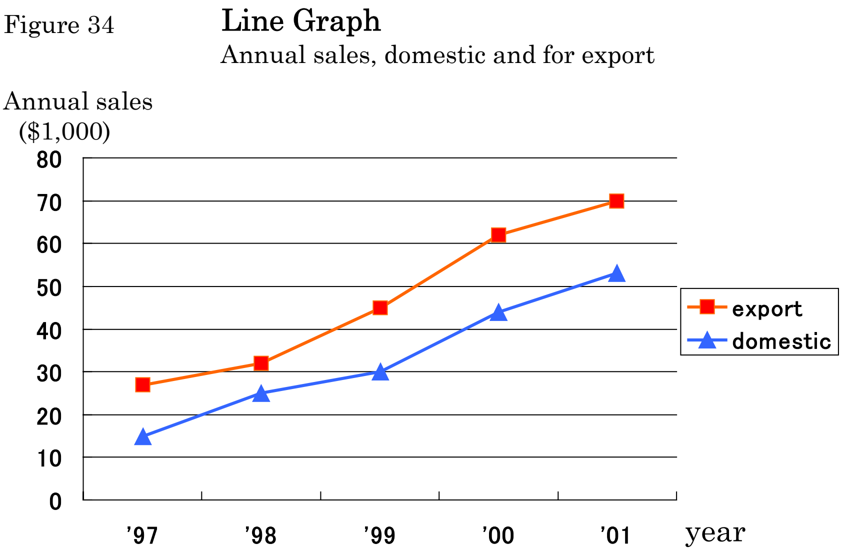
Bar graphs are used to show trends (e.g., of a product or service). They make use of bars whose lengths represent the size of the factors under consideration. The bars may be positioned vertically or horizontally.

How to construct a bar graph

Step 1: Draw the horizontal and vertical axes of the graph, using the horizontal axis for the period and the vertical axis for the value.
Step 2: Divide the horizontal axis into equally spaced vertical columns, each column representing a period.
Step 3: Divide the vertical axis into as many equally spaced horizontal rows as required, each higher row representing a higher value.
Step 4: Draw the bars.

B. Line graph

Figure 34



Line graphs are used to show actual situations at given points in time. They may also be used to predict future trends. They may be broken lines or straight lines.

How to construct a line graph

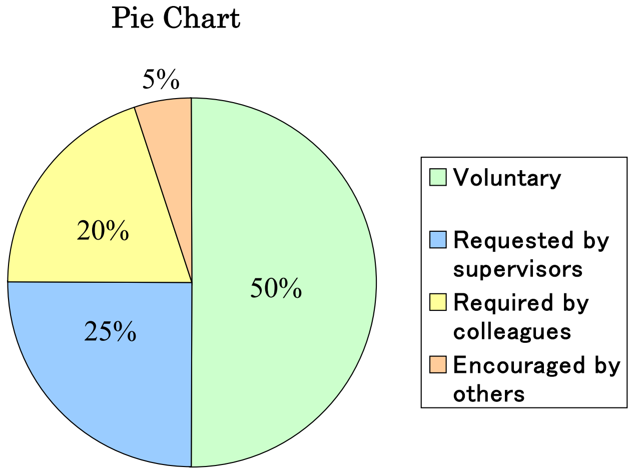
Step 1: Draw the horizontal and vertical axes of the graph, using the horizontal axis for the period and the vertical axis for the value.

Step 2: Plot the points corresponding to the values.

Step 3: Connect the points.

C. Pie chart

Figure 35



Reason for Joining QCC in 2002

A pie chart is used to denote relative portions of a situation; each slice of pie represents a percentage of the whole.

How to construct a pie chart

Step 1: Draw a circle.
Step 2: Divide the circle into slices that correspond in size to the relevant percentages. For instance, if you divide the circle into four equal slices, then each is 25 percent of the whole.
Step 3: Moving clockwise from the topmost part of the chart, arrange the items in order of percentage size, unless another order is inherently logical.
Step 4: Indicate the name of the item and its percentage.
Step 5: Consider what color or pattern to use for identification of items.

The by-objective bases of selecting a graph:

(1)When comparing the size of numbers
→ bar graph, band graph
(2)When showing a change over time
→ line graph
(3)When giving a breakdown
→ pie graph, band graph

4-2-5 Checksheets

Checksheet are forms used to collect data in an organized manner. They are used to validate problems or causes or to check progress during implementation of solutions. Checksheets can come in different shapes and sizes, and Circle members must be able to design them to suit their needs.

How to design a checksheet

Step 1: Include the date on the checksheet
This can be expressed as a single date (e.g., August 11, 2002), as a week (e.g., week ending August 19, 2002), or as a month (e.g., month ending August 31, 2002). The date is vital—to show when the data was collected.
Step 2: Include a title
The title should include the location and the type of information being collected—for example; The causes of breakdown of machine #2.
Step 3: Indicate the name of the data collector
Putting the name of the person who collected the data is important, especially in case there is a later need to clarify data gathered.
Step 4: Ensure that everyone is using the same form

> In cases where more than one member is collecting data, the Circle must ensure that the same form is being used by all of the collectors. It is frustrating for the Circle to have collected a large mass of data only to find out later that large-scale analysis is required and maybe some of the collected data are not really required.

As the Circle designs its checksheet, it must consider some questions to establish how much information must be collected.

Q. What is to be done if the information to be collected is seasonal?
An example would be if data on absenteeism were collected only during winter. This could be biased because absenteeism may be high also during summer when families want to go out of town. This means data must be collected throughout the year, to cover all seasons.

Q. Is there anything unusual in the normal pattern of working that would affect the information being collected?
For example, if a Circle is investigating how many people are in line waiting for their turn to make a transaction with a teller, it has to consider related factors like the operational status of the ATM inside the branch and the number of tellers present.

Q. Is there anything unusual in the outside world that would affect the information being collected?
For instance, the attack on the World Trade Center on September 11, 2001 might have affected the number of tourists that entered the United States. The Circle therefore, must collect data from July to November in order to get a complete picture of the number of tourists.

Q. How often does this particular effect being studied happen?
Does it happen every day, or is it once a week, once a month, or some other frequency? If it happens every day, five days of data is acceptable; if once a week, five weeks of data; and if once a month, five months of data are needed.

Checksheets come in several types, depending on the objective for collecting the data. Some of the more common ones are as follows:

A. Recording checksheet

Figure 36 **Recording Checksheet**

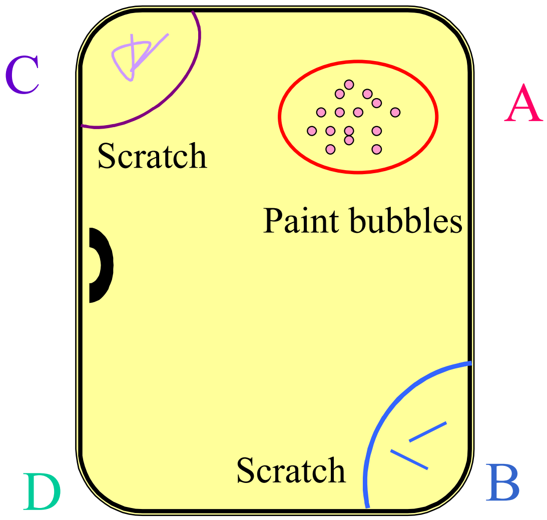
Characteristic: Customer Complaints on Refrigerators
Period of data collection: June 2002
Source of data: logbook

Location	Complaints	Frequency of Occurrence	Subtotal	Percent
A	Paint bubbles	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	45	35.2
B	Dents	𝍸 𝍸 𝍸	15	11.7
C	Scratches	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	30	23.4
D	Rubber lining of door not fixed	𝍸 𝍸 |||	13	10.2
E	Bulb does not light	𝍸	5	3.9
F	Trays for ice cubes not included	𝍸 𝍸 𝍸 𝍸	20	15.6
	TOTAL		128	100

Bits of data are entered for subsequent tallying and analysis. Such checksheets are usually used to collect data on defects. The types of defects are listed, and with each occurrence of a defect, a running total is tallied using *five-bar gates* (i.e., multiples of five—four vertical marks with one crossing them), which makes addition easy.

B. Location checksheet

Figure 37 **Location Checksheet**



Defects on Refrigerator Door

The location and/or condition of something (e.g., a defect, is indicated in a drawing). It is a pictorial way of indicating the location of a problem. It makes investigation easier by evoking the question "Why there?"

C. Checklist checksheet

Figure 38 **Checklist Checksheet**

	Items to bring for trip abroad	Yes	No	Remarks
1	toothpaste		x	Toothpaste available in airplane
2	toothbrush	x		
3	comb	x		
4	shampoo	x		
5	lotion	x		
6	Rubber shoes	x		No laces
7	Leather shoes	x		2-inch heels
8	Leather jacket	x		Hip length
9	Black hat		x	Bring white hat
10	Red scarf	x		
11	Long black skirt	x		
12	Denim pants (Levi's)		x	Bring Guess denim pants
13	White slacks	x		
14	White long-sleeve blouse	x		
15	Jogging pants	x		
16	Three white T-shirts	x		2 white and 1 off white

Observed results or conditions are recorded by choosing among diametric opposites (e.g., yes or no, on or off, present or not present) for each item on a list. They are sometimes referred to as inspection checklists. Checksheets simplify data collection, organize information, increase accuracy and facilitate verification of data.

4-2-6 Histograms

Processes' outputs naturally vary from one to another. A product may be said to be uniform, but actually no two units are exactly the same. Using precision instruments, these differences will be detected. For example, if we examine the weight of a bottle specified as 50g ± 1g, we may be surprised to find that the bottles vary in weight.

Figure 39 How to construct a Histogram (I)

- Characteristic being measured: Weight of 100 coffee bottles
- Data collection period: produced on August 11, 2002; taken after every 10 bottles
- Data collector: Naomi Isabel Aquino

Specification: 50g±1

	1	2	3	4	5	6	7	8	9	10	Low	High
1	50	55	49	46	49	48	50	50	51	52	46	55
2	56	54	52	50	51	52	55	47	49	54	47	56
3	45	53	54	52	51	50	53	50	51	52	45	54
4	49	47	48	50	51	52	54	53	52	50	47	54
5	48	48	49	51	52	49	48	50	49	48	48	52
6	50	48	45	49	50	51	52	51	53	52	45	53
7	51	49	48	50	51	52	50	52	51	52	48	52
8	52	50	51	55	46	51	53	50	51	50	46	55
9	49	49	51	50	54	52	52	51	54	55	49	55
10	49	49	48	50	51	53	50	53	50	51	48	53

Arranging these data into a histogram will show how dispersed the weights are. Since the use of average is sometimes misleading, it is necessary to see how values are distributed in a population in order to get a true picture of performance.

The Circle collects data to be studied (e.g., in terms of weight of bottle) and decides on the period of data collection. Data must be collected using checksheets, which are used to construct the histogram in the following manner.

How to construct a histogram

Step 1: Determine the highest and lowest values.
Step 2: On the top row, write the values observed, increasing from left to right.
Step 3: In the left-hand column, list in multiples of five, increasing from bottom to top, which makes it easier to keep count.
Step 4: Put marks in the appropriate columns, starting from the bottom row and ascending by multiples of 5.
Step 5: Add the total number of marks per column and write the sum at the bottom of the row.
Step 6: Indicate the standard. This helps pinpoint the columns that exceed the standard.

Figure 40 **How to construct a Histogram (II)**

- Characteristic being measured: Weight of 100 coffee bottles
- Data collection period: produced on August 11, 2002; taken every after 10 bottles
- Data collector: Naomi Isabel Aquino

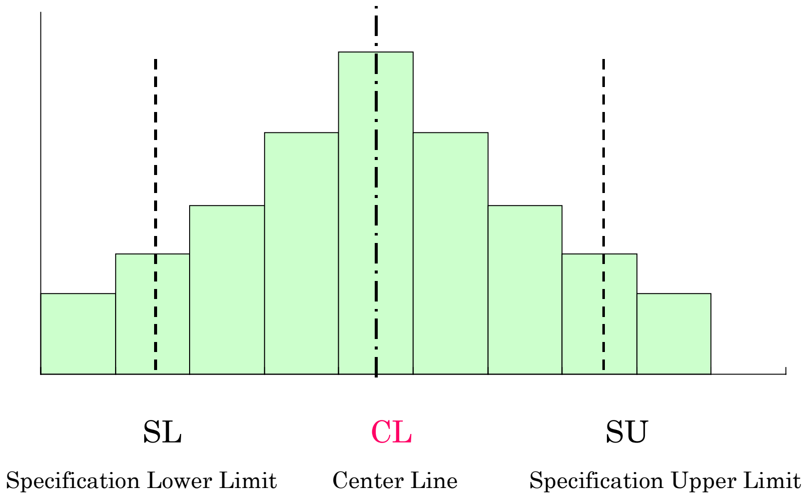
Specification:50g±1

Weight(g)	45	46	47	48	49	50	51	52	53	54	55	56
					Lower Specs	Specs	Upper Specs					
30												
25												
20						𝍸	///	/				
15					///	𝍸	𝍸	𝍸				
10				////	𝍸	𝍸	𝍸	𝍸	//	/		
5	//	//	//	𝍸	𝍸	𝍸	𝍸	𝍸	𝍸	𝍸	////	/
Total Frequency	2	2	2	9	13	20	18	16	7	6	4	1

Use histograms for a visual presentation of the data distribution. They facilitate the QCC's understanding of the present situation, drawing attention to significant items so that causes of problems can be determined and countermeasures devised.

A. Bell-shaped

Figure 41 **Bell-shaped or Symmetrical Histogram**



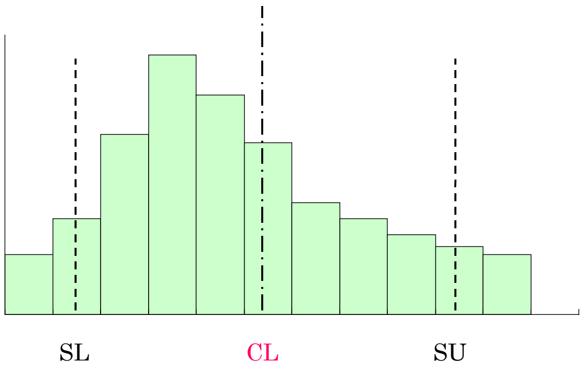
The bell-shaped histogram is a normally distributed curve, where the left side is equal to the right side. This shows how frequently the samples fall within the standard of the given operation.

B. Skewed

1. Skewed to the right

This type deviates from the normal curve. Taking the packaged volume of shampoo as an example, if the distribution shape is skewed to the right, it may mean that the company is over-filling the containers.

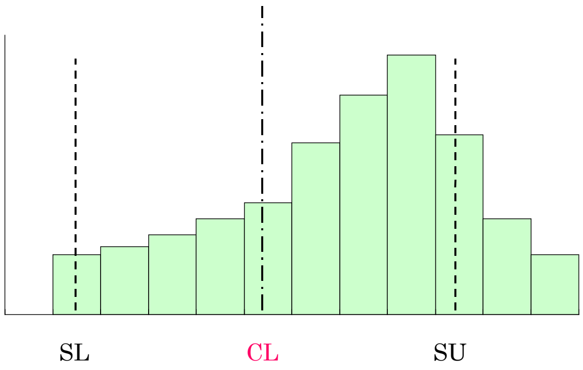
Figure 42 **Skewed to the Right Histogram**



2. Skewed to the left

This type also deviates from the normal curve; the samples fall to the left of the standard. Using the same example, a left-skewed histogram may mean that the company is under-filling the shampoo containers.

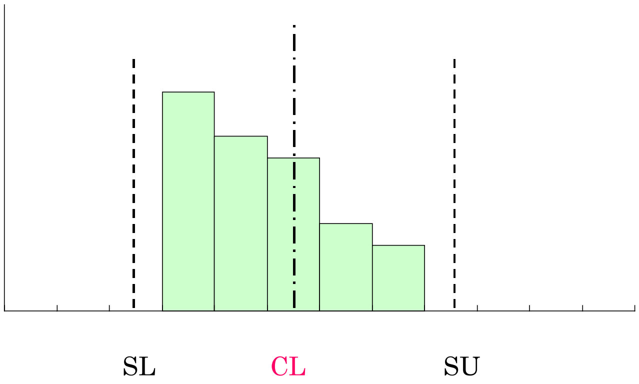
Figure 43 **Skewed to the Left Histogram**



C. Cliff-like

A cliff-like shape shows a certain peak in the graph, not necessarily within the standard. This could be the result of a problem in data collection, but it also could indicate a problem in machine operation.

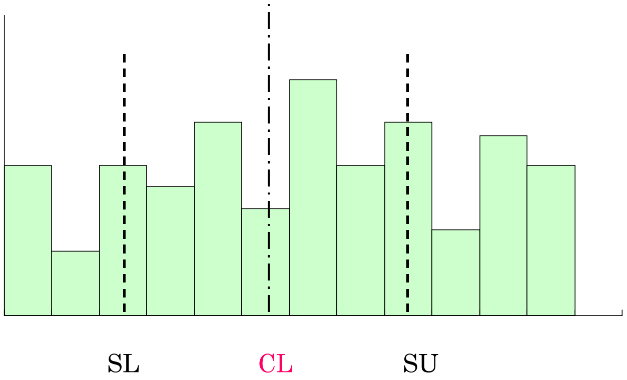
Figure 44 **Cliff-like Histogram**



D. Comb-like

A comb-like shape is a combination of several cliff-like shapes, indicating that the distribution is uneven. This may be attributed to several factors (e.g., the person doing the work, the machine, or even the standard itself).

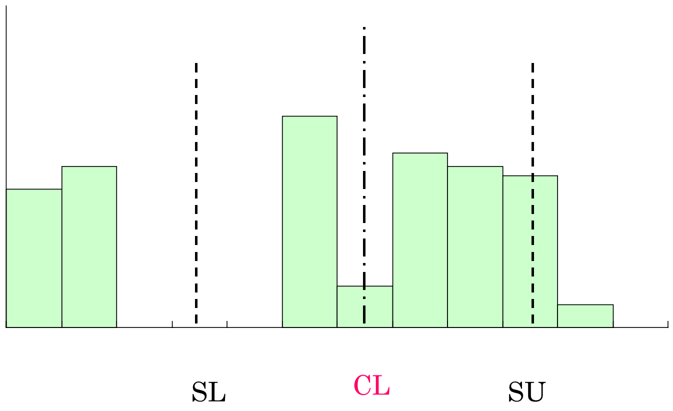
Figure 45 **Comb-like Histogram**



E. Island-type

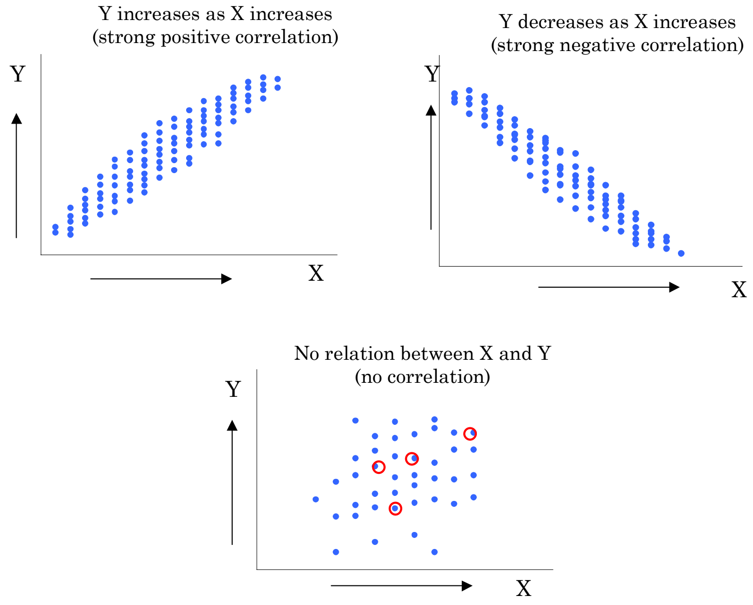
An island-type histogram is normally the result of a small isolated peak in addition to the major part centered around the standard. It suggests that there might be "a small inclusion of data from a different distribution, such as in the case of process abnormality, measurement error" (Kume 1985, 51) or some data inclusion from different processes.

Figure 46 **Island Type Histogram**



4-2-7 Scatter Diagrams

Figure 47 **Common Scatter Diagrams**


Y increases as X increases
(strong positive correlation)

Y decreases as X increases
(strong negative correlation)

No relation between X and Y
(no correlation)

A scatter diagram examines the relationship between paired data. This tool is usually used by the QC Circle when it wants to establish the relationship between cause and effect, the relationship between one cause and another, or a relationship between one cause and two causes.

Examples include the relationship between an ingredient and the hardness of a product, the relationship between the speed of cutting and the variation in the length of parts cut, the relationship between the level of illumination in a room and mistakes in validating a bank transaction slip.

The scatter diagram is used when a number of people or procedures are producing widely varying results.

The scatter diagram may show that two variables have positive correlation, have negative correlation, or have no correlation at all.

How to construct a scatter diagram:

Step 1: Collect data samples of pairs whose relationship is to be studied. Enter these data in a data sheet (figure 48).

Step 2: Draw a vertical axis (effect); calibrate it from smallest to largest value (from top to bottom).

Step 3: Draw a horizontal axis (cause); calibrate it from smallest to largest value (from left to right).

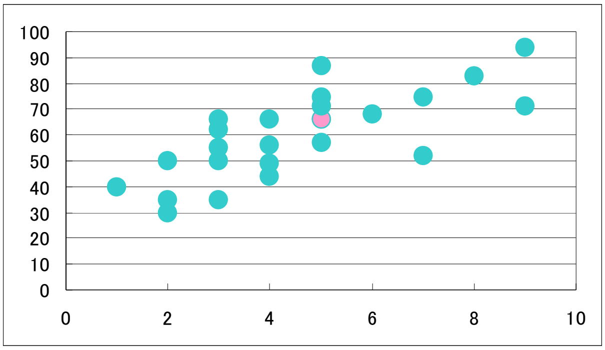
Step 4: Plot the paired values. If values are repeated, make concentric circles (in the graph indicated as pink).

Step5: Plot data in a graph, with material content as the horizontal axis and elongation as the vertical axis.

Figure 48

Scatter Diagram

Number of paired data	Material Content (%) x	Elongation (%) y
1	9	94
2	4	66
3	1	40
4	2	30
5	7	52
6	3	66
7	4	44
8	6	68
9	2	35
10	3	55
11	3	50
12	3	62
13	5	66
14	5	66
15	4	56
16	2	50
17	3	35
18	9	71
19	5	87
20	4	49
21	5	57
22	8	83
23	5	71
24	7	75
25	5	75



The circle ● is a double counted value.

4-2-8 Control Charts as Supplemental Tools for QCC Beginners

Control charts, first proposed by W. A. Shewhart of Bell Telephone Laboratories in 1924, are used for maintaining both process and manufacturing control in a stable condition. A pair of lines indicating the control limits are drawn on the control chart, and the points expressing the quality of products or whether the manufacturing process is in a stable condition can be examined by checking whether these points fall within or outside the control limits.

Specific features of control charts:

1. They can be understood at a glance; the status of operation (good/bad, normal/abnormal, right/wrong) is clearly identified.
2. They can be utilized to monitor the trends and changes during certain time spans, thus enabling users to identify abnormal occurrences at early stages of operation.

How to interpret a control chart:

If the plotted points on the control chart are all within the control limits, as illustrated in figure 49, the manufacturing process may be regarded as stable, but if a point falls outside the control limits, as shown in figure 50, the manufacturing process may have a problem. In such cases, corrective action should be taken.

Because the application of this statistical tool is sometimes difficult to understand, QCC beginners should focus on the seven basic QC tools at first. Control charts are supplementary tools for QC Circles. For details, please refer to other QC technical books on how to construct control charts and how to use them.

Figure 49 **Under Control Condition**

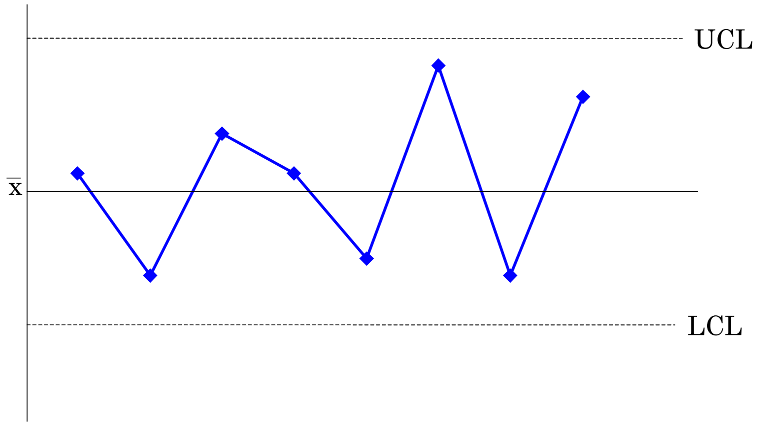
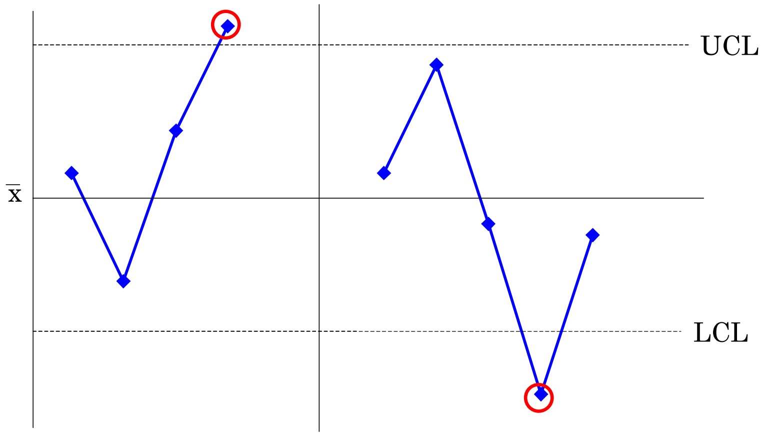
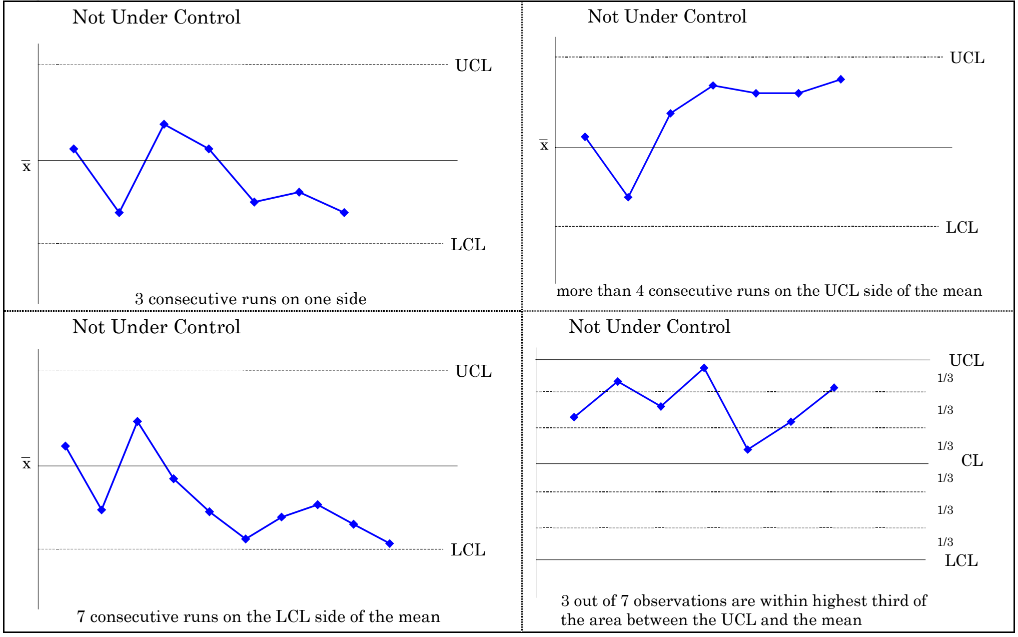


Figure 50 **Not Under Control Condition**



out of control limits

Figure 51 **Additional Information**



Not Under Control

3 consecutive runs on one side

Not Under Control

more than 4 consecutive runs on the UCL side of the mean

Not Under Control

7 consecutive runs on the LCL side of the mean

Not Under Control

3 out of 7 observations are within highest third of the area between the UCL and the mean

4-3 QCC Techniques

In addition to their use of the seven QC tools, QC Circles are strongly recommended to use other problem-solving and idea generation techniques such as brainstorming, the why-why approach, affinity diagrams, 5S, 3Mu, 5W1H, and 4M1E to aid them in their QCC implementation. They are also encouraged to experiment with how they conduct their meetings.

QC Circles are not expected to use all of these techniques during their problem-solving activities; only the appropriate ones. In summary, there are specific tools and techniques for each step of the QC Story.

The following are techniques for QCC activities.

1. Brainstorming

4-3-1 Brainstorming

Brainstorming is used extensively by QC Circles at various stages in their problem-solving activities. This technique was developed in 1930 by Alex Osborne as a way of encouraging groups to be more creative with their ideas. It is important to recognize that there are barriers to creative thinking.

One is the tendency to assume that the way things have always been done is the only way they can be done. We often hear people say, “Yes, but we’ve always done it this way!”

Another barrier is the fear of looking foolish. This fear limits our range of contribution—to things that are safe and conventional—and leads to our giving the expected answer.

A third barrier is the tendency to make hasty judgement on what is said, without careful consideration. How many ideas get thrown in the waste bin without anyone really thinking about them and trying them, merely because they initially seem impractical, impossible, or crazy?

A fourth barrier is the commonly held view that there is always one right solution to every problem. This leads people to look for the obvious and logical answer rather than the less obvious, creative solution.

Having discussed barriers to creative thinking, we will now define brainstorming. Brainstorming is a method of getting a group of people to generate a lot of ideas in a short space of time. Group thinking usually produces more ideas than individual thinking.

A QC Circle can use brainstorming to identify problems in the work area, to find causes of a problem, to search for a solution to a specific cause of a problem, to choose a name for the Circle, or to search for a format on how to present a project to management.

Rules to follow in brainstorming:

1. Establish a relaxed atmosphere.

   The most creative ideas come from a relaxed atmosphere, so the leader should attempt to loosen up the group either through humor or a quick exercise using a non-work related subject. The leader can ask, for example, “If you win the lottery tomorrow, how will you spend it?”

2. Ensure participation by all members.
   To ensure participation by all members, the leader may begin by asking each member, in sequence around the room, to contribute. After one or two members say "pass," the leader may accept ideas from anyone. When there are seemingly no more ideas, the leader announces a *last round* and again queries each member in sequence. This last round usually results in important and productive ideas.

3. Go for a large number of ideas.
   A large number of ideas are required to make brainstorming fruitful.
   - Do not criticize ideas.
     One way to receive a large number of ideas is to see to it that none are criticized during brainstorming. In addition to discouraging members from putting forward their ideas, criticism also dampens the creative spirit of the Circle.
   - Welcome suitable and non-suitable ideas.
     Even the seemingly non-suitable ideas must be accepted. Oftentimes they act as stimulus for other members to generate more suitable ideas.
   - Combine ideas.
     Two or more ideas can sometimes be combined to evolve into an improved idea, and this new idea can even lead to another new idea.
   - Record all ideas.
     All ideas must be recorded. The appointed recorder notes the ideas as they are given. Lengthy ideas are reworded concisely. It is the responsibility of the individual members to ensure that their ideas are reworded and recorded correctly.

2. Why-Why approach

4-3-2 Why-Why Approach

Curiosity is a marvelous part of the human mind. Our curiosity causes us to analyze and isolate critical root-causes and corrective actions via the *Why-Why* approach as follows.

General *why* analysis on problem solving

When a problem is observed, remedial actions such as stopping operation, hitting the cut-off switch, notifying the supervisor, and waiting for instruction for the next action are taken in workshops. Then, some action to prevent recurrence of the problem will be presented by supervisors who thought about why the problem occurred.

But such solutions are apt to not be so effective or long-lasting. It is difficult to give proper countermeasures and isolate root-causes of problems unless we have a proper analytic idea generation method such as the *Why-Why* approach.

5 *Why* approach

One variation of the *Why-Why* approach involves repeating the question *why* five times to analyze things. This basic procedure is meant to effectively and efficiently utilize time, funds, and human resources to eliminate problems (e.g., problems in terms of quality, price, delivery, safety, or environment protection) in any operation, ensure customer satisfaction, and maintain employee participation.

Numerous recurrent problems have been observed in various forms of processing, not only in production sectors but also in clerical offices; and most of the time, the responses to those processing problems are merely remedial-type patchwork. Some of those recurring problems occur many times an hour and waste much money.

It is a shame to have a preventable mistake or error repeated at a station, shop, or office. A TQM and QCC implementation program that pays careful attention to analysis of root causes of problems and establishes corrective actions can be implemented for 100 percent assurance against preventable waste.

Toyota Motor Co. Ltd. is one of the most well known adherents to the 5 *Why* approach in Japan, and without it, their *kaizen* (continuous improvement activities) would never have been successful.

5 *Why* processing

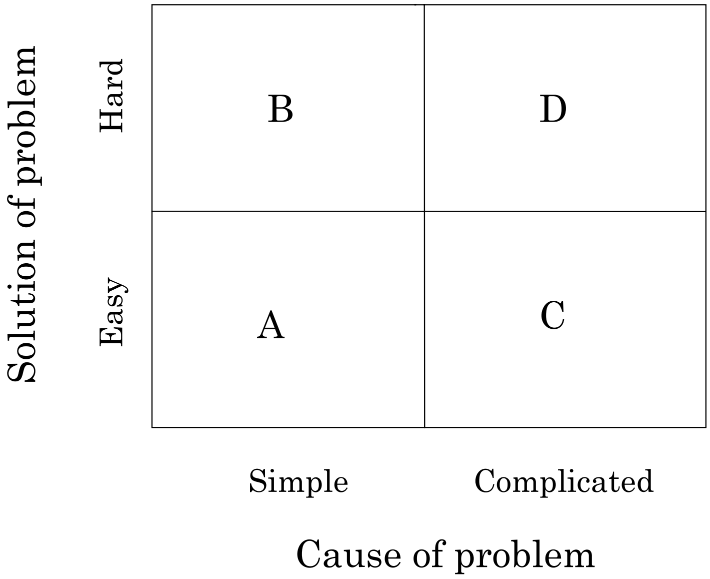
A. Initial Stage

Until becoming fully familiarized with the Plan-Do-Check-Act cycle, it is necessary to identify root causes of rather easily solvable problems through data collection, analysis, and evaluation and to establish corrective actions—not by the 5 *Why* approach, but by a 2 or 3 *why* approach.

B. *Why-Why* analysis for simple problem solution

As shown in figure 52, problems with simple causes can sometimes be tackled by easy solutions (section A). Through skill improvement, problems with simple causes but difficult solutions (section B) or problems with complicated causes but simple solutions (section C) can be tackled through two or three levels of *why* questioning. Through this questioning, issues such as what happened and when, where, and how it happened are addressed. A fishbone chart (figure 53) aids in visualizing the process.

Figure 52 **Cause and solution types**



C. 1st *Why* analysis

1. Verification of fact
    - By personal verification of problem at the site where the issue arose
    - By verification of problem status and collection of physical evidential data
    - By analysis of data
    - By comparison with the standardized operational procedure (SOP), standards, or specification requirement—to justify their status
    - By comparison with general engineering/technical principles or rules—to verify their conformance
2. Preparation of problem/failure mechanism flowchart

    Technical interpretation of how a problem or failure is manifested as shown in figure 53.

    (a) First, identify the immediate problem based on observed factual symptoms (e.g., smoke, abnormal noise, vibration).

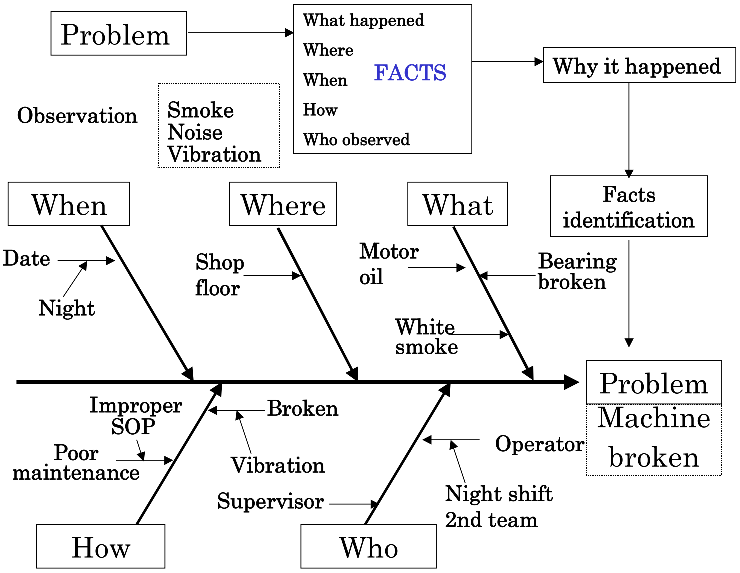
    (b) Then, hypothesize on probable causes of the symptoms (e.g., motor oil burned, bearing broken).

    (c) Next, establish the identified probable causes as the as shown in the following schematic, and assume their probable causes (e.g., no oil on bearing, ball bearing broken).

    (d) Thus, *fact* is a fundamental source to be studied and analyzed to identify probable causes—causes that are interim in nature, and to be analyzed for the next round of probable cause identification, and on and on.

Figure 53

Fact-finding relationships flowchart and the *why* approach

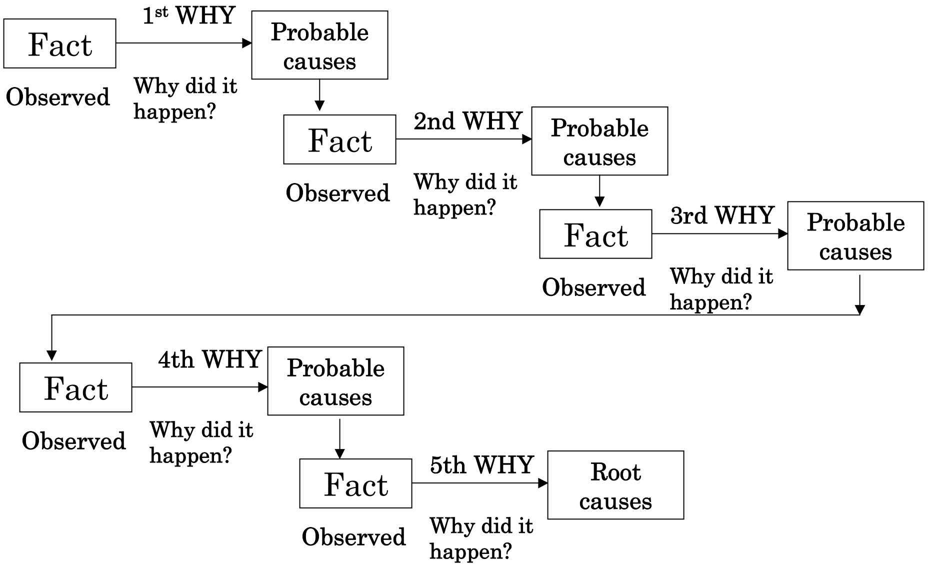

Problem
What happened
Where
When
How
Who observed
FACTS
Why it happened
Observation
Smoke
Noise
Vibration
Facts identification
When
Where
What
Date
Night
Shop floor
Motor oil
Bearing broken
White smoke
Problem
Machine broken
Improper SOP
Poor maintenance
Broken
Vibration
Operator
Supervisor
Night shift 2nd team
How
Who

These summarization charts are eventually formed as failure-mechanism flowcharts for identification and isolation of problem causes and establishment of corrective action. Doing this (answering *why*) five times to find probable causes to root causes is the 5 *Why* approach.

3. Comparison with engineering requirement, specifications, standards, SOPs, technical principle, and law.
4. In the first stage of *why* analysis, many other possible causes are revealed in other sectors.

Figure 54

Probable Causes to Root Causes by 5 *why* approach


Fact
1st WHY
Probable causes
Observed
Why did it happen?
Fact
2nd WHY
Probable causes
Observed
Why did it happen?
Fact
3rd WHY
Probable causes
Observed
Why did it happen?
Fact
4th WHY
Probable causes
Observed
Why did it happen?
Fact
5th WHY
Root causes
Observed
Why did it happen?

5. These analyses are important information to keep as records. They can be arranged in a cause and effect diagram (Ishikawa diagram) as shown in figure 53. In such diagrams, all possible causes of an effect can be listed. So even if a probable cause cannot be isolated immediately, it can be detected through a process of elimination whereby all the other possible causes are ruled out one by one. Ishikawa diagrams not only are recording tools, but also are useful for evaluating the effectiveness of, and improvement in, the company's problem-solving system.
6. Fault tree analysis (FTA) and Failure mode effects analysis (FMEA) are also recommended methods for probable cause isolation. These methods are basically used in design-stage reliability engineering, but they could also be quite effective for isolating causes of operation/production failure.

Daily routine operation stage

After all staff members have become familiarized with the above-mentioned procedures, not only can problems of the types in sections B and C of figure 52 be dealt with more frequently, but also its section D-type problems (those with complicated causes and difficult solutions) can be addressed.

And in cases of minor problems observed in the day-to-day operations of particular workshops, the responsibility is delegated directly to the relevant supervisors, or even operators, as per their capacity development under the program.

3. Affinity Diagram

4-3-3 Affinity Diagrams

Definition

An affinity diagram is a tool to clarify the nature of an uncertain problem or chaotic event by coordinating ideas and obtaining concepts through the integration of relevant verbalized data on the basis of affinity. (This method was originated by Prof. Jiro Kawakita as the KJ Method, a Japanese registered trademark, but here in after we will refer to such diagrams as affinity diagrams.)

Preparation of an Affinity Diagram

When preparing an affinity diagram, two approaches are recommended: one by individual action, the other by group action. As for management or staff personnel, individual preparation is better when trying to do the following.

- Identify the facts related systematically to the chaotic and unknown problems or areas.
- Summarize one's own ideas without interference of others.
- Establish one's own creative ideas that may be in conflict with conventional ones.

As for QC Circles, group preparation is better when trying to foster a teamwork spirit to achieve a solution to a common problem.

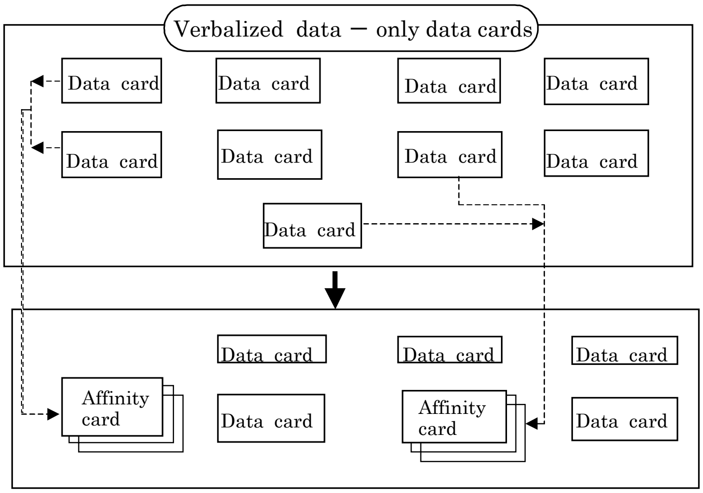
For Individual Preparations

A. Determine the theme.

B. Collect factual data for the determined theme.
Collect data, opinions, and creative ideas. At this time, brainstorming, observation, survey, and interviewing procedures are quite useful. Verbal information (it can be fact or opinion) is best stated in the (subject + predicate) form—that is, substantive expressions are not convenient.

C. Write the above verbal information onto cards, called *data cards,* one piece of information per card.

Figure 55


Verbalized data − only data cards
Data card
Data card
Data card
Data card
Data card
Data card
Data card
Data card
Data card
Data card
Data card
Data card
Affinity card
Data card
Affinity card
Data card

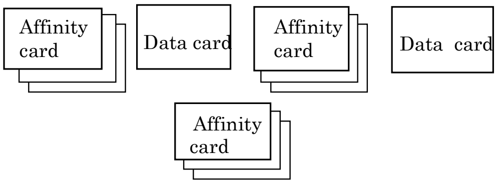
D. Shuffle the data cards, then lay them out on a flat area. Read through every card carefully (two or three times), looking for relationships between them and then grouping them accordingly. Continue this process until you identify several groupings of two or three cards.

E. Double-check that these groupings are the most appropriate.

F. Consolidate these small card groups into larger groups, linking them by new (subject + predicate) expressions that incorporate all of the smaller groups expressions without broadening the category. The card with the new expression is called an *affinity card.*

F. Repeat steps (D) through (F) until all data cards' possible affinities are exhausted.

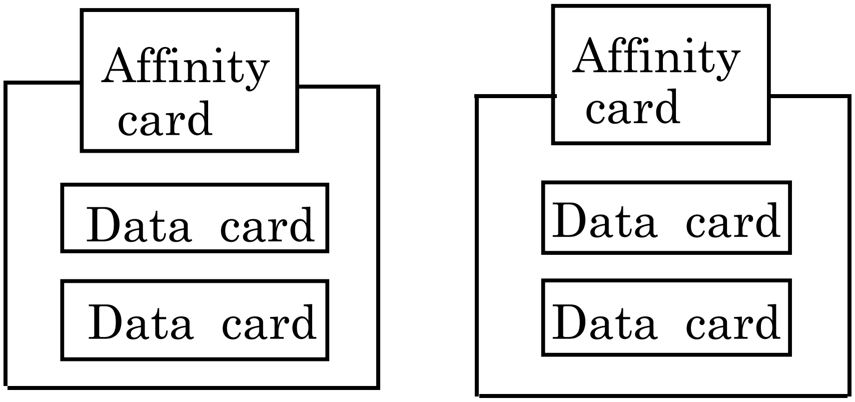
Figure 56


Affinity card
Data card
Affinity card
Data card
Affinity card

H. Position the bundled/consolidated cards on a large sheet of paper according to their relationships.

I. Maintaining the groups, strategically spread out the affinity cards and draw lines of relationship.

Figure 57

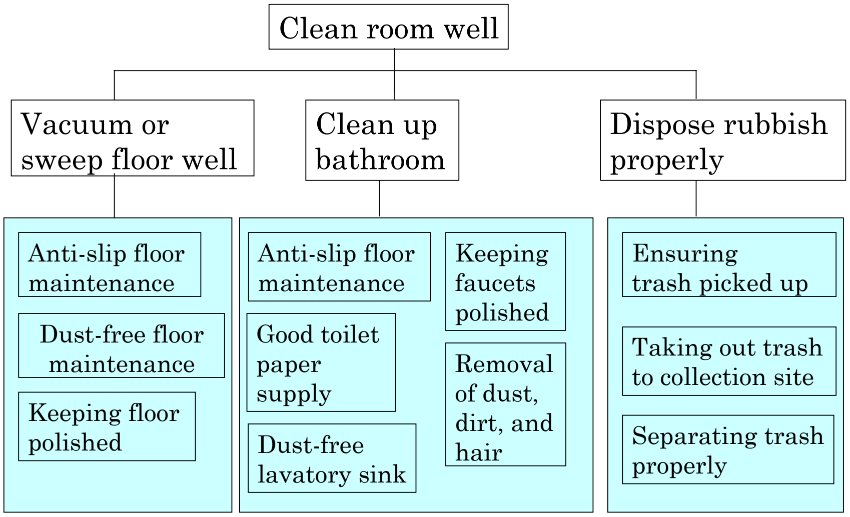

Affinity card
Data card
Data card
Affinity card
Data card
Data card

Note that in some cases a data card with a very specific expression will independently constitute one group.

For Group Preparations

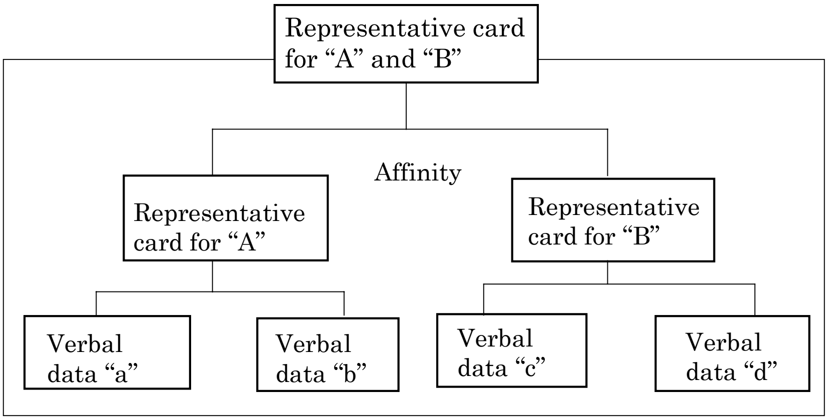
A. Determine a theme.
B. Collect data by way of brainstorming.
C. Get an understanding of all verbal information collected from every member. In some cases the data must be rewritten to prevent any misinterpretation or misunderstanding.
D. Do the same as for individual preparations' steps C and D.

Figure 58 **Affinity Diagram of House Cleaning**


Clean room well
Vacuum or sweep floor well
Clean up bathroom
Dispose rubbish properly
Anti-slip floor maintenance
Dust-free floor maintenance
Keeping floor polished
Anti-slip floor maintenance
Keeping faucets polished
Good toilet paper supply
Removal of dust, dirt, and hair
Dust-free lavatory sink
Ensuring trash picked up
Taking out trash to collection site
Separating trash properly

Noriharu Kaneko

Figure 59


Representative card for "A" and "B"
Affinity
Representative card for "A"
Representative card for "B"
Verbal data "a"
Verbal data "b"
Verbal data "c"
Verbal data "d"

Benefits of Affinity Diagrams

- enable both collection of verbal information amid a chaotic environment and identification of problems after summarizing such data
- enable the gathering of new ideas by way of break-through thinking
- enable both the isolation of essential points of problems and the recognition of the priority of those points by all personnel
- enable one's own and others' ideas to be implemented, contributing to motivation through participation

4. 5S Concept

4-3-4 5S Concept

In Japan, 5S is considered the basis for continuous quality and productivity improvements and it represents good housekeeping concepts. Good housekeeping and workplace organization are directly linked to achieving discipline in manufacturing workshops and even in clerical environments. Bad housekeeping problems in terms of production control, maintenance, quality assurance, and layout will lead to a disorganized workplace. In contrast, good housekeeping and workplace organization will result in better compliance with schedules, fewer machine breakdowns, lower defect rates, and prompt exposure of problem areas.

5S implementation is very common in various kinds of industries in Japan. The term 5S comes from the English equivalents of five Japanese words, whose Romanized spellings also begin with *s*.

1) Sorting (*seiri*, 整理), meaning to sort out unnecessary items in the workplace and discard them
2) Systematizing (*seiton*, 整頓), meaning to arrange necessary items in good order so that they can be easily obtained for use
3) Sweeping (*seiso*, 清掃), meaning to clean your workplace completely so that there is no dust on the floor, machinery, or equipment

4) Sanitizing (*seiketsu*, 清潔), meaning to maintain high standards of housekeeping and workplace organization at all times
5) Self-Discipline (*shitsuke*, 躾), meaning to train people to follow good housekeeping disciplines habitually, without being directed

Tangible Results Expected from 5S Concept Implementation

1) From people
   - ✓ Employees will be disciplined to be more aware of untidy workplaces and motivated to improve the level of cleanliness.
   - ✓ Greater team spirit and cooperation can be built up through involvement of all employees within the organization.
   - ✓ Employees will be disciplined to follow safer and better ways of work, resulting in reduced risk of accident.
   - ✓ Employees will be more conscious of improvement that leads to greater efficiency and effectiveness.
2) From machines and tools
   - ✓ Machine troubles can be detected at earlier stages to prevent major breakdowns, when machinery are cleaned daily by the operators.
   - ✓ Daily cleaning of measuring instruments will ensure accuracy and reliability.
   - ✓ The productive lives of machines and tools can be extended significantly when they are handled with care and placed in their designated locations.
3) From materials and work-in-progress
   - ✓ Flow of materials and work-in-progress will become smoother.
   - ✓ Floor space becomes well organized and possible areas for improvement can be easily identified by quick observation.
   - ✓ Inventories of material and work-in-progress become clearly visible and easy to handle.
   - ✓ The material yield ratio can be improved.
   - ✓ The work and time required for material handling can be reduced.
4) From products and customers
   - ✓ A clean workplace will ensure that final products will be free from dust.
   - ✓ A clean workplace will result in lower defect rates and prompt exposure of quality problems.
   - ✓ Sales people will be eager to show customers the plant as a marketing tool.

5. 3Mu Elimination Approach

4-3-5 3Mu Elimination Approach

The term *3Mu* stands for three elements—*muda* (wastefulness), *muri* (excessiveness) and *mura* (dispersion)—that should be eliminated to raise efficiency in the workplace.

A 100-seat bus that always has one hundred passengers is an example of highest order efficiency—one without wastefulness, excessiveness, or dispersion. In reality, however, more than 130 passengers can be observed at rush hours in the morning and late afternoon, but only two or three passengers might be aboard 100-seat buses in mid afternoons. The condition of 130 passengers on a 100-seat bus exemplifies *muri* (excessiveness), two or three passengers on that same bus is *muda* (wastefulness), and the condition of flux between inbound and outbound occupancies within the day is *mura* (dispersion).

The 3Mu concept can also be expressed in terms of the relationship between objective and means. To cut a twig with a chain-saw would be an example of *muda*; to cut a two-meter-in-diameter tree trunk with a knife would be *muri*; and to alternate between the two mismatches of objective and means would be *mura*. QCC people have to understand 3Mu concepts and eliminate them to improve quality and productivity.

6. 5W1H

4-3-6 5W1H

5W1H signifies six words that begin questions that are needed to be answered in order to describe a fact correctly: **what, when, where, who, why, and how**. QCC people are recommended to follow and ask these questions in order to grasp the facts without any omission. For example they define problems by asking and answering the following questions.

Figure 60

5W1H Approach (I)

What is the problem?	**Where does the problem happen?**	**When does it happen?**	**Who is responsible?**	**How does it happen?**
Order slips are not filled out correctly.	At the tables	During the lunch peak	The waiters	The waiters fill out the order slips while welcoming other guests or acknowledging other guests' requests for assistance.
Why is it a problem?	**Why does it happen there?**	**Why does it happen then?**	**Why is this person responsible?**	**Why does it happen that way?**
The food served is not what the guests ordered.	This is where the order-taking is done.	There are so many guests.	They are the ones taking the orders from the guests.	There are not enough waiters during lunch, so the waiters try to respond to the needs of many customers at the same time.

The Circle can also use this approach when they formulate their solution.

5W1H Approach (II)

What should be done?	**Where should it be done?**	**When should it be done?**	**Who should be responsible?**	**How should it be done?**
Why should it be done? Is there a better way?	Why should it be done there?	Why should it be done then?	Why should this person be responsible?	Why should it be done this way?

7. 4M1E

4-3-7 4M1E

4M1E stands for the five elements needed in production (man, machine, materials, method, and environment). Four words start with the letter *m*, and one with *e*, thus it is called 4M1E. This is often used as a method of stratification in cause and effect diagrams. Sometimes this system is referred to as 5M1E, with the fifth *m* representing either measurements (since data is obtained through them) or money.

A QC Circle meeting in a factory (Photo by JUSE)

5 Meetings and Case Presentations

Meetings and case presentation are key factors in implementing sound QC Circle activities. The ways meetings are conducted and case presentations are arranged are crucial as they help mold the members' principles and overall attitude toward company-wide QCC activities. Also, leaders' roles in those activities can determine whether their respective Circles achieve further development or take a few steps backward. Therefore, all members need to be cognizant of what their leaders expect and how it can be achieved. In this chapter, some of the key factors concerning meetings and case presentation are introduced. The roles of the leaders in each step are also discussed.

5-1 What is a meeting?

Meetings constitute one of the crucial aspects of QC Circle activity, which, itself, involves a group of people in the same workshop who share common interests and objectives. The following benefits are derived through QC Circle activity.

Benefits of QC Circle Meetings

1. Establishment of a broadened point of view
2. Changes in the way of thinking (becomes more positive)
3. Enhancement of individual ability
4. Establishment of a sound communication network
5. Improvement of individual character
6. Provision of an opportunity to speak out

QC Circle meetings develop various aspects of individual ability. In them, members come together to work through problem-solving processes. Through discussion and other exchange, members can broaden their way of thinking. They encourage each other and work together toward common objectives, engendering a positive way of thinking. In small group meetings like those of QC Circles, all members have individual roles. Therefore, members can learn to be responsible while simultaneously enhancing their ability to make things better. The word *individual* suggests uniqueness in terms of values and personalities, so when several individuals are pooled together in a Circle, there is abundant opportunity to learn in an environment of mutual exchange of ideas and information. Another good aspect of QC Circle meetings is that job titles are left aside; all members are on equal standing and are free to express their opinions and suggestions.

5-2 What does presentation for management entail?

There are two reasons for QC Circles to present their projects to management: to get management's approval or to inform them of their efforts to improve their process. It is a very important event in the life of any QC Circle, especially for those whose members seldom get to talk to management face-to-face. It is a moment where the Circle members take pride in their achievement and management in turn shows how grateful they are for their contributions and challenge them further to greater heights.

- Proper presentation
  Less-experienced Circles have only thirty minutes to make their presentations, and more mature ones have only fifteen minutes; so they have to be mindful of the agreed sequence for them. A facilitator keeps members aware of the time by flashing cards that say "10 minutes more" or "last 2 minutes," or by periodically ringing a bell.

- Open forum
  Every presentation to management is followed by an open forum. The objective of this portion is for management to receive clarification on points they consider vague. It is recommended that the facilitator remind management of this objective before the presentation so that they phrase their questions in such a way that the Circle does not feel that it is being grilled. It helps if the management is distributed a copy of the presentation beforehand. It also helps if management asks the facilitator for some clarification, even before the presentation. In this way the Circle is spared some potentially humbling questions. However, even though the facilitator answers the question, he must inform the Circle leader that such a question was raised so that the Circle can consider it.

  Most of the time, however, management gets the documents during the presentation and has to be reminded that this is an occasion for them to make the Circle feel good about contributing to the company.

- Agenda
  The QC Circle Office prepares an agenda for the presentation. It usually contains the following parts:

  A. Opening activities
  The company hymn is sung, a short community prayer follows, and the facilitator welcomes everybody and introduces the management member who will give the opening remarks. In a department presentation, the department head does this.

  B. Case presentation

  C. Closing activities
  The facilitator announces the end of the presentation and introduces the member of management who will give the closing remarks—again, the department head in the case of a department presentation.

Figure 61 **Example QCC Presentation Agenda**

4:00−4:10 Singing of company song
Opening by QC Circle leader
Opening remarks by the supervisor
4:10−4:45 QC Circle case presentation (1)
4:10−4:25 QC Circle case presentation
4:25−4:30 QC Circle sings jingle
4:30−4:45 Open forum
4:45−5:20 QC Circle case presentation (2)
4:45−5:00 QC Circle case presentation
5:00−5:05 QC Circle sings jingle
5:05−5:20 Open forum
5:20−5:30 Closing remarks by the supervisor

A QC Circle presentation in a hospital (Photo by DBJ)

- Attendees of presentation
  The QC Circle Steering Committee, the QC Circle Office, the department facilitator, the Circle, and management are the key people present in a management presentation. Additionally, facilitators, leaders, and members from other departments may be invited.

- Venue
  The choice of where the presentation is done is very important to the Circle. The more prestigious the place is, the more honored the members feel. Most often, presentations are done in multi-purpose halls because they are big, but any room can be used as long as it is free of disturbance, it can sit everyone

invited, and it allows for the use of presentation equipment like overhead projectors, slides, and PC projectors.

- Presentation procedure
  There are several forms of recognition that a QC Circle can receive for its efforts: for example, management presentation within and outside the company, publicity through company newsletters, participation in QC Circle conventions within or outside the country, exhibition of photos and projects on company bulletin boards, and inter-company visits. Among these, presentation in front of management is the most important because a presentation is a very powerful way for a QC Circle to get things done, including selling its concept to management, so the Circle must carefully prepare for it.

- Preparation for presentation
  The Circle's preparation for the presentation is intense because it is the highlight of the Circle activities.

  The following aspects must be done in this phase:

  1. Establish what the Circle wants to get out of the presentation.
     In some circumstances, the Circle may be aiming for a clear decision at the end of the presentation; in others, a commitment to further investigate what is being sought. The Circle must not lose sight of what they want to achieve.

  2. Try to see things from management's point of view
     The Circle must try to get into the head of management and see things from their point of view. One of the things that may be present in the minds of management is the question, "What is in it for the company?" In some companies, Circles do cost–benefit analysis; in others, they just highly emphasize the tangible and intangible benefits.

  3. Ensure that the sequence of the presentation is logical
     Circles generally use the following sequence:

     a. Introduce their Circle—Circle name, leader, assistant leader, members, and facilitator—and give the date when the Circle was organized and the number of meetings they have had
     b. Outline the problem the Circle is tackling
     c. Examine the facts that have been gathered
     d. Go through the possible solutions that were considered
     e. Highlight the selected solution and the reasons for its selection
     f. Stress the benefits of this solution
     g. Detail the actions done or needed to implement the solution
     h. Examine the effectiveness
     i. Examine the standardization
     j. Invite questions

4. Prepare notes and visual aids
   The Circle has a wide spectrum of choices as to how to present its case: from having a word-for-word script to speaking entirely from memory. However they want to do it, they must bear in mind that although presentations for management are fairly formal, they are not entirely so. The atmosphere must be relaxed as much as possible.

   Another point to consider is for every member to come to the presentation with an understanding of all aspects of the case. As for the visual aids, the Circle must consider that pictures are worth a thousand words because people remember more what they see than what they hear.

5. Rehearse
   The facilitator plays a very important role during rehearsals. He gives each member a critique on loudness of voice, body language, eye contact, and handling of presentation materials.

6. Ready the room and equipment
   The Circle leader, with the assistance of the facilitator, ensures that the room is properly ventilated and lighted, that there are enough chairs for everyone, and that the equipment, including the microphone, is in good working order.

5-3 The Role of Leaders: Overall

QC Circle Leadership

The first leader of every QC Circle is generally the first-line supervisor, until one of the members is able to assume leadership. It is recommended that Circle leadership be changed every two years, to give everybody a chance to become a leader. The procedure for selecting a leader is by vote, and the members usually base their choice on the ability of the candidates to

1. Persuade workshop employees to join the QC Circle
2. Teach members new tools or methods
3. Study continuously to improve their own competencies
4. Communicate with co-leaders for improvement
5. Maintain contact with management in their own workshops
6. Work with facilitators
7. Help new members
8. Organize meetings two or three times a month
9. Plan meetings, including doing the logistics
10. Persuade every member to attend the meetings
11. Conduct meetings effectively

An ideal leader would have the qualities shown in figure 62.

Figure 62 **Desirable QC Circle Leader**

BRAIN
- Flexibility
- Reasonable and sound talk
- Cool judgement
- Expertise in QC 7 tools
- Self-suppressed feelings
- Understanding of the theme

HEART
- Responsibility
- High spirit
- Sympathy
- Empathy
- Courtesy
- Composure

BODY LANGUAGE
- Physical contact
- Empathetic expression

MOUTH
- Persuasive power
- Humorous talk
- Contact w/smile

HANDS
- Skilled worker
- Quick worker
- Qualified worker

EYES
- Ability to identify workshop problems
- Always fully aware

FEET
- Contributor to discussions
- Acquirer of information
- Aggressive mover

EARS
- Careful listener (to even minor problems)
- Collector of information
- Attentive Listener to all members' opinions

It is obvious that the QC Circle meetings are the lifeblood of Circle activities. Thus, it is very important that the leader has a good understanding of the QC Circle concept, the tools and techniques, and the QC Story, and has good group dynamics and communication skills so that he can conduct the meetings effectively. In addition, each member should take the following responsibilities.

- **Being on time**—not wasting other members' valuable time by making them wait
- **Listening without interrupting**—not engaging in private conversation that disrupts the meeting
- **Listening with understanding**—listening to the points that others are trying to convey, regardless whether one agrees or not
- **Thinking analytically**—before speaking, organizing in a logical sequence what is to be said, making it short and simple
- **Making only constructive criticism**—giving only objective and sincere criticism, and following it with viable alternatives
- **Making sure that all members understand the decisions reached**—Clarifying to eliminate the chance for doubt—agreeing all details at the meeting, so that decisions can be implemented without complications
- **Making sure that members' objections are expressed only during meetings**—not letting them outside of meetings

5-4 The Role of the Leader in Conducting Meetings and Presentations

The Role of a Leader in QC Circle Meetings

- PREPARATION
  - -Determines the objective of the meeting
  - -Seeks supervisor's approval to hold the meeting
  - -Determines time and place of the meeting
  - -Informs members of time and place of the meeting
  - -Prepares an outline to guide the discussion
- DURING THE MEETING
  - -Opening the session
  - -Leads the discussion
  - -Moderates the discussion
  - -Documents the discussion
  - -Checks progress of Circle against master plan

During Preparation

5-4-1 Preparation

- Determines the objective of each meeting

  Since meetings are usually held for an hour only, the objectives must be very specific and clearly stated. For example, the objective of the first meeting is to be able to select the process to focus on and list the possible problems pertaining to it.

- Prepares an outline to guide the discussion

  1. What topics are to be covered?
  2. How much time should be given to each topic?

  The leader must be able to identify who among the members will be of help in achieving the objective of the meeting.

  In like manner, the leader must be able to identify who are likely to make it difficult for the group to achieve the objective of the meeting. In this case, the leader must consult the facilitator before the meeting on how to get the commitment of these members. The facilitator may also assist the leader during the meeting in handling difficult members.

It is important that any dissenting member be given a chance to explain his idea and that the leader and members listen attentively, so the group can arrive at common ground.

- Determines the usual time and place of meetings
  The usual time and place of meetings is normally determined at the start, when the Circle is organized; however, there are times when the agreed time is not followed, so in those cases it must be established through consultation with the members.

  When there is a change in schedule, the meeting room previously arranged may not be available, so the leader, with the assistance of the facilitator, may have to look for another place.

- Seeks the supervisor's approval to hold the meeting
  Any new time allocated for a meeting must be approved by a supervisor. It may be that the supervisor will not approve it, as is because of an urgent matter where everyone’s participation is needed. In this case the supervisor suggests an alternative schedule.

- Informs members of time and place of the meeting
  Although at the end of every meeting the leader reminds the members when the next meeting is, the leader still has to remind them again later.

During the Meeting

5-4-2 During the Meeting

- Opens the session
  The leader begins the meeting by stating the topic and connecting it with the previous topic, because it is important to show continuity in the discussions in order to sustain the members’ interest.

- Leads the discussion
  The leader guides the discussion in such a way that he creates an environment where discussion can take place freely, ensures that the group understands and accepts the objective of the meeting, stimulates the expression of ideas, ensures that every member has an opportunity to participate, keeps the meeting on track, clarifies comments, clarifies previously vague ideas, defines terms when necessary, and listens carefully to every idea. He must also be able to summarize the discussion points.

- Moderates the discussion
  The leader keeps the discussion on track by asking questions that are brief, simply worded, and related to one point only. If there is a need for a sequence of questions, they must be asked in logical order. It is important that the leader knows how to deal with different types of Circle members so the group does not get off track. The most common types of members are

the argumentative, the overly talkative, the shy, the disinterested, and the grudge-bearers.

- ✓ The Argumentative
  Such members' reasons for arguing are to oppose the leader. They are likely to split hairs over trivial matters, but here, the leader must stay calm. The leader can ask specific questions so as to draw out these members and turn them over to the group but must remember to keep the members from getting personal.

- ✓ The Over-talkative
  This member wants to do all of the talking. The best way to deal with this member is to have a rule in the group that no one should speak too long on any subject until everyone has had a chance to say something. When a member forgets this rule, the leader must tactfully interrupt and ask others to comment on the subject. The leader can say, "John, thank you for your ideas, can we ask the others what they think?"

- ✓ The Shy
  These members are usually withdrawn. The leader can draw out these members by asking them simple questions that they are sure to answer and praise them for answering. The leader can find something for them to do—for example, the leader can assign them to look for a venue for the case presentation to management and let them report on this during the meeting.

- ✓ The Disinterested
  The leader can ask for this member's opinion pertaining to some features of the meeting. For example, the leader can ask what the member thinks about the assigned task, or ask about non-work matters like if the member has seen the movie that is the talk of the town.

- ✓ The Grudge-bearer
  These members carry personal grudges against certain members. It is best that the leader avoids discussion about their grudges and asks the facilitator to intervene outside the meeting if the grudge persists.

● Documents discussions

The leader ensures that discussions during meetings are documented. This is the role of a secretary, a role that is rotated among the members every meeting so that everybody gets to experience how to document important points in a discussion. It is recommended that Circle members are provided with notebooks so each member is encouraged to take notes. For easy reference, a format for writing minutes of Circle meetings is provided by the QC Circle Office as follows.

Figure 63 **Minutes of QC Circle Meeting**

Time: July 7 (Mon) 08:30a.m.－09:00a.m.
Place: Meeting Room, Emcee: Taro Yamada
Participants: Members—All present
Theme: Reduction of time to retrieve common tools

Agenda: Current Status Grasping

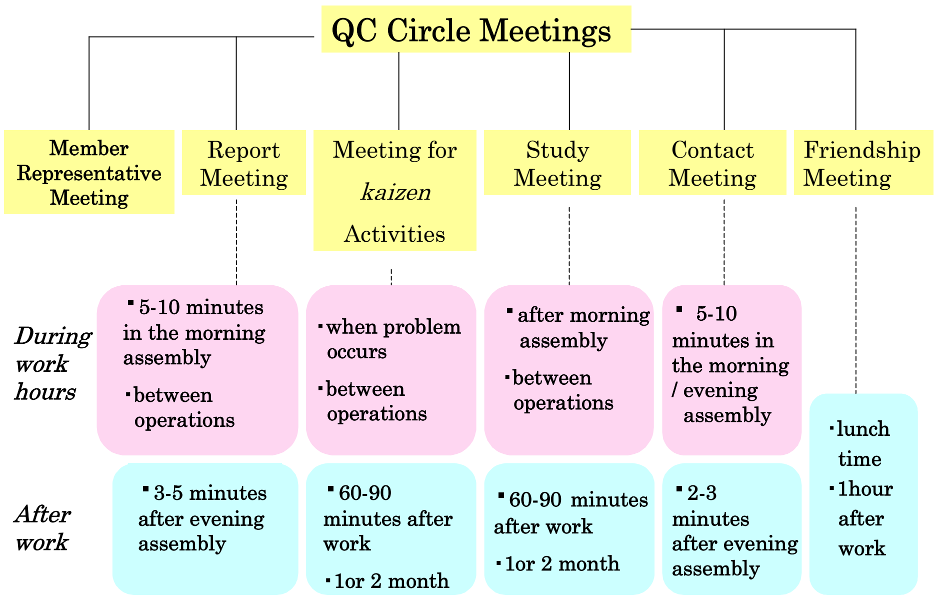
1. ____________________
2. ____________________
3. ____________________

Next meeting: July 14 (Mon)
Agenda: Goal Setting

- Checks progress of Circle against master plan
  The Circle leader keeps track of the progress of the group by regularly asking the members where they are compared with the plan they formulated at the start of their Circle activities.

  A check of each member's accomplishments will do the group well in ensuring that they are on track. If this is not done, the Circle may find itself overly extending its timetable for completing a project, and this is one reason that members lose their enthusiasm.

Figure 64 When to Have a QC Circle Meeting



	Member Representative Meeting	Report Meeting	Meeting for *kaizen* Activities	Study Meeting	Contact Meeting	Friendship Meeting
During work hours		▪5-10 minutes in the morning assembly ･between operations	･when problem occurs ･between operations	▪after morning assembly ･between operations	▪ 5-10 minutes in the morning / evening assembly	･lunch time ･1hour after work
After work		▪3-5 minutes after evening assembly	▪60-90 minutes after work ･1or 2 month	▪60-90 minutes after work ･1or 2 month	▪2-3 minutes after evening assembly	

6 Benefits and Impediments

There are many benefits attributed to the QC experiences of members, leaders, facilitators, and management of companies that have adopted the QC Circle concept as a management tool. It is important to note that the QC Circle activities will bring both tangible and intangible benefits to the company and its employees. Being actively involved in improving processes to ensure the quality of products and services as demanded by customers will contribute not only to solving problems in the workplace but also to increasing the capacity of the Circles' leaders and members. Nonetheless, we cannot neglect that there are impediments to success as well; and these are described in the last part of the chapter.

Benefits from QC Circle Activities

The benefits from QC Circle activities can be classified into intangible and tangible benefits. The intangible benefits are those that are qualitative—for example, we cannot say that teamwork was improved by 50 percent; we can only provide manifestations of improved teamwork, such as noting that attendance in meetings improved by 80 percent. Even though improvement in attendance is quantifiable, it is not equivalent to improved teamwork; it is just a manifestation. Tangible benefits, on the other hand, are those that can be quantified—for example, reduction in the defect rate from 50 percent to 10 percent.

For better appreciation of intangible benefits gained from QC Circle activities, the question of, "What is in it for me?" must be answered. The question has many variations—for example, "What is in it for the company if it has QC Circles?" A corollary question is "What is in it for management, for the Circle leader, and for the Circle members?"

6-1 Benefits for QC Circle Members

Why is QC Circle good for its members?

- **Transformation of oneself into a thinking human being**
- **Development of self-confidence**
- **Establishment of closer relationships with colleagues**
- **Improvement in customer orientation**
- **Understanding of the requirements of the customer**
- **Improvement in commitment to the goals of the company**
- **Establishment of a better relationship with management**

- Transformation of oneself into a thinking human being
  The operators come to realize that they are not just *doing* but also *thinking* human beings. And as thinking human beings, they discover that they have something to contribute to the way work is being done.

They discover during Circle meetings that they and other members have ideas. When a member gives an idea and it is accepted, he feels accepted and this encourages him to give more ideas; thus, a spiraling of ideas happens.

- Development of self-confidence
  Every step in the QC Story contributes to the development of all members' self-confidence. They develop confidence as they learn to give their ideas on problems they have in the work area; as they collect data, analyze it, and translate it into actionable information; as they make decisions on what is the major root cause of their problem; and as they weigh their options as to the best solution to their problem.

  They develop confidence as they monitor the effects of their solution; as they make judgment as to the effectiveness of their solution; as they decide on what needs to be done so as to make the improvement permanent through standardization; and as they decide on what problem to tackle next.

  Their creative juices are unleashed, so one sees Circle members blooming with pride during management presentations.

- Establishment of closer relationships with colleagues
  As they get to communicate more with their colleagues, they form closer relationships. They come to understand what each other is doing, and how their work is interrelated.

  The closer relationship is also manifested in non-Circle activities that they do together, such as eating meals, drinking coffee, going to the movies, swimming, bowling, and so forth. In other words, they develop a relationship that extends beyond work.

- Being customer focused
  The QC Circle provides members with an opportunity to see the company from management's perspective: stature of the company, competitiveness, public perception of the corporate culture, and so on.

- Understanding of the requirements of the customer
  Most importantly, members learn the requirements of the customer. They realize that everything they do will contribute to the quality of the product or service that goes to the customer and are reminded that the ultimate goal is ensuring that the customers are satisfied with the product or service throughout its lifecycle.

  As an example, the USABLE Circle, a Circle of the Urban Development Authority of Singapore, said in their case presentation during the International Convention on QC Circles (ICQCC) held in the Philippines in 1999 that "Higher customer satisfaction was achieved as decisions (on development applications for change of use of land) are released earlier. We received thirteen compliments compared to four for the same period last year."

- Commitment to the goals of the company
  Their being customer-focused brings personnel to another level of commitment, a commitment to the attainment of the goals of the company.
  They know that every defective product delays delivery and may cause the customer to stop buying from the company. They know that every call that is not answered may be an opportunity lost, and that a customer complaint or request not handled well may mean customer dissatisfaction that can lead to losing the customer. They know that every wasted raw material may make the product more costly, thus priced too high for the intended customer to afford it. They know that coming late to work will delay the delivery of a service or the production of a product. In sum, the members have a greater awareness of the importance of their work in the organization.

- Establishment of a better relationship with management
  Because of management's recognition of their contribution, the relationship between management and the operators is improved. There is a change in attitude—not just in the attitude of the operators towards management but also in the attitude of management towards operators.

  The change in attitude starts with management believing that the people who are closest to the job know best how to improve the job.

  Management used to think that operators may not really care for the company, but when they see that the operators are viewing their work as a meaningful activity giving them self-satisfaction, enriching their professional knowledge, and helping them win the respect of their colleagues and superiors, their attitude towards the operators changes.

  Here are some example QC Circle presentations from national or international conventions.

  1. From the *MEMS Quality Circle of Pasar Corporation*, located in Isabel, Leyte, Philippines (presented in the 1996 national convention in Manila, Philippines)
     a. The Circle members exhibited improved confidence in solving problems.
     b. Circle members' skills in using QC tools improved.
     c. Members learned to accept criticism as part of QC Circle activities.

  2. From the *Work Club of the Electrical* and *Mechanical Services Department of the Government of Hong Kong Special Administrative Region* (presented in ICQCC'99 held in Manila, Philippines)
     a. Our spirit in providing *quality customer service* was acknowledged by our customers.
     b. The staff benefited from the opportunity to exchange experiences and knowledge.
     c. Customer and staff satisfaction improved.

3. From the *Watch 3 Circle of Yazaki Torres Manufacturing, Inc, Philippines* (presented in ICQCC'99 held in Manila, Philippines)

Figure 65

Circle Criteria	Points Before QC Circle Activities	Target Points	Points After QC Circle Activities
Teamwork	3	6	6
QC Circle knowledge	3	6	7
Communication ability	2	4	5
Ability to solve problems	2	4	6
Self confidence	3	6	7

4. From the *Southern D'Light Circle of the Engineering-Electrical/Instrumentation Section of Manila Electric Co., Philippines* (presented in the ICQCC'99 held in Manila, Philippines)

   We learned additional knowledge in air conditioner repair and we learned to solve complex problems.

5. From the *TOTAL CONTROL TEAM of Petronas Carigali, Malaysia* (presented in the ICQCC'99 held in Manila, Philippines)
   Their communication, presentation, computer skills, and knowledge of the English language were improved.

LoveMe
BuyMe

A QC Circle meeting in an airline company (Photo by JUSE)

6-2 Benefits for Circle Leaders

In every way that the members benefit from QC Circle activities, so too do the leaders.

What are the benefits for a Circle Leader?

- **Development of group skills**
- **Development of analytical skills**
- **Development of interpersonal skills**

- Development of group skills
  The effectiveness of meetings depends greatly on the group skills of the leaders, who prepare the meeting agenda, often a new experience. The leaders get to summarize points discussed, keep the discussion on track, and get the members to formulate codes of ethics that the leaders use when desired behaviors are not manifested—like when people don't finish their assigned tasks on time.

- Development of analytical skills
  The leaders lead their Circles to their objectives, and in the process develop a questioning attitude. They ask about what, who, why, when, where and how (5W1H) all the time, and through this behavior are able to make colleagues become analytical too.

  The leaders get to encourage the members to make paradigm shifts: to think that there is always a better way.

- Development of interpersonal skills
  The leaders learn how to seek consensus instead of imposing their ideas. They learn how to read members' non-verbal communications. They seek clarification all of the time. They learn the value of not putting down people, of giving credit to individuals, and of not feeling assaulted by the behavior of difficult members.

  The leader learns to use words that don't hurt the feelings of others. They learn how to establish win-win situations in times when members strongly contradict each other. In the process they act as counselors.

  They learn how to remain positive about and composed in meetings, keeping only positive thoughts on their minds and not bringing to meetings whatever problems they have outside the Circle.

  Thus, leadership in the QC Circle is a very good opportunity for the frontline operators to prepare themselves for supervisory responsibilities. Such is the case of a bank in the Philippines where the frontline operators can become supervisors if they pass an officer-training program. The requirements for acceptance to this training program include proving leadership capabilities. For leaders to be considered for the officer-training program, their Circles must successfully complete a project for improvement and present it to management.

Such experience also prepares Circle leaders to become community leaders—for example, in initiating programs to encourage proper disposal of rubbish, improve security, and controlling the populations of stray animals. And younger Circle leaders can organize sports festivals for the youth during vacations.

6-3 Benefits for Facilitators

What are the benefits for facilitators?

- **Development of training skills**
- **Development of coaching skills**
- **Development of coordinating skills**

Development of training skills

Facilitators learn how to convince Circle members of the benefits of learning new skills, to do training needs analysis, and to design training programs.

As a trainer, they learn how to present ideas in a clear manner so that the members can easily understand the topic. They prepare visual aids and handouts that are concise, pleasant to the eye, legible, and easy to understand.

They have to know what questions to ask and how to ask them when they want to check the level of the understanding of the members.

They have to balance concepts with actual applications. They can't be perceived as bookish—that is, when they teach, they should know the actual situation in the workplace and use examples that are relevant to the members.

They learn how to make their sessions fun-filled, because a very formal atmosphere inhibits creativity. By visiting other companies, going to school libraries, and attending seminars and conventions they equip themselves with treasure chests full of exercises on how to energize groups.

Development of coaching skills

As a coaching function, facilitators show leaders how to accomplish what they set out to do. For example, they have to show new Circle leaders how to prepare a meeting agenda. Coaching is done by asking a lot of questions—questions that help the leader to think.

Coaching, in this sense, is more guiding than instructing. For instance, instead of telling leaders what their agendas are, they ask thought-provoking questions such as, "What is your objective for conducting this meeting?" or "How much time do you generally need to review previous meetings' agendas?"

Facilitators do a lot of coaching. They coach the leaders on how to manage meetings, how to get support from difficult members, how to collect data and summarize them into actionable information, how to document discussions, and so forth.

The coaching happens before and after the meeting and not during meetings, otherwise the leader's credibility with the members could be tarnished. Thus, facilitators are the persons behind the successes of leaders.

Development of coordinating skills

Facilitators make sure that the things needed by a Circle are available. In the process, they learn how to coordinate with other units in the company, in obtaining another department's data, for instance.

Facilitators also coordinate with management, and this task requires them to think like management. They must anticipate management questions and be prepared to answer them. One frequently asked question is "What is the status of your Circle's activities?"

In their coordinator roles, facilitators have to blend diplomacy and psychology with their managerial skills.

6-4 Impediments to Progress in QC Circle Activities

Leading a Circle towards the completion of its activities is not an easy job. Several factors have potential to hinder progress, and once the leader overcomes them, his self-esteem is boosted. The more common of these factors are as follows.

Impediments to Progress in QC Circle Activities

- Leader can't motivate members
- Leader lacks knowledge of QC Circle concepts, tools, and techniques
- Leader lacks group skills
- Lack of time
- Circle can't seem to get anywhere
- Solution the Circle chooses is not effective
- Circle thinks there are no more problems to solve
- The facilitators are too busy

- **Leader can't motivate members**

  The leaders themselves may be hindrances to the progress of QC Circle activities, especially in cases where they were not chosen by the members, but by their supervisors. Ideally the leaders are selected by the members, but in some companies, the supervisor or the manager appoints the leader when the person selected by the members does not want to be a leader and no one wants to volunteer to become a leader. In some cases, the person is not well liked by the members and this becomes a leadership issue. Such persons are not very effective in motivating the members to actively participate in Circle activities.

What the facilitator can do to help is to spend time with the leader before the Circle meeting to prepare him for the meeting. Preparation means not only knowing what to discuss in the meeting and having the materials for discussion ready but also knowing how to discuss it and how to get members who don't like him very much to participate in the discussion.

Also, after the meeting, the facilitator again meets with the leader to evaluate how he feels about the meeting, what he did well and what he did not do well, and together they formulate means to address remaining issues.

- **Leader lacks knowledge of QC Circle concepts, tools, and techniques**
  Leaders lacking in knowledge of QC concepts, tools, and techniques, have difficulty in leading discussions, and this may result in their Circles focusing too long on one theme. When this happens, the members lose their enthusiasm.
  One way to eliminate this impediment is for the leader to list the subjects that are not too clear to him, including specific questions he has, and discuss them one-on-one with the facilitator. He should also have a self-study plan.

- **Leader lacks group skills**
  This is one factor that is difficult to eliminate because group skills can only be learned practically. It can be eliminated over time with a lot of help from the facilitator.

  A more experienced facilitator will point out after every meeting how the leader could have handled a very difficult question from a member, how he could have moderated a very talkative member, or how he could have generated more ideas from the members. In essence, the leader has to do a lot of self-assessment and draw up plans for self-improvement in each meeting.

  Not being able to bring a group to the completion of a project can be frustrating, and in some such cases the leader is tempted to quit trying. Some companies realize that leaders can also help each other, so they organize regular meetings for them. In these meetings they thoroughly discuss their difficulties and possible countermeasures. Such meetings are very helpful in the sense that the leaders are able to vent their frustrations. And when they realize that other leaders have similar situations, they begin to feel better and are emboldened to implement the countermeasures arrived at by the group.

- **Lack of time**
  The ideal frequency of meetings is once a week for one hour. Normally a usual meeting day is set when the Circle is organized. However, the Circle is not

always able to meet as planned. If the agreed day is going to be missed (say on a Wednesday), the makeup meeting must be rescheduled for as soon as possible (no later than Friday). Otherwise, the Circle will lose its enthusiasm.

There are also times when it is impossible to hold meetings, even rescheduled ones, because of workload. In such cases, some leaders go around and ask the individual members for their input. He summarizes their ideas and relays the information to all the members. So the next time they meet, they have a new agenda based on the ideas generated through this approach.

Some leaders are very creative. If they can't hold a meeting, then they put up a big sheet of paper on the wall and ask that as the members come up with ideas, they add them to the list. In one branch of a bank, for instance, such a sheet is posted on the wall of their cafeteria. As the members think of ideas while having lunch, they write them immediately—in time filling the paper.

- **Circle can't seem to get anywhere**

  There is a tendency for beginning QC Circles to choose a big problem. They jump at the chance to solve a problem that has long been besieging them, not knowing in some cases that it is beyond their capacity to solve. They get stuck and don't know how to proceed.

  Some companies allow the facilitator to lead the QC Circle in such cases, while also requiring the Circles to define the start and end of the process they chose to study—that is, the source of the problem. In this way, it is easy to check whether the problem is something they can solve or not.

- **Solution the Circle chooses is not effective**

  Some Circles have difficulty in coming up with solutions to their problems. One reason is the members are not used to being asked to think of better ways to do the work, so the tendency is to be contented with obvious solutions that are not effective.

  Naturally, Circles are discouraged when they see the problem not improving in spite of having implemented their "solutions." If such a situation is allowed to persist, some members will start skipping meetings and the Circle will be in danger of dying.

  The facilitator comes to the rescue by encouraging the Circle to review what happened. Sometimes it is a question of poor implementation. At other times, the area they chose to address was not the most critical one; so, even if the solution is very good, the effect is lost because the most critical cause remains unsolved.

  Situations like these have actually prompted some companies to conduct creative thinking sessions for Circles that are about to formulate solutions to their problems. Such sessions are conducted by facilitators who have attended creative thinking training outside the company.

- **Circle thinks there are no more problems to solve**
  When a Circle is about five years old, its members get a feeling of having solved all the problems in their workshop. A closer look, however, will show that there are other opportunities for improvement. In such cases, because management has a broader perspective of problems—from a company-wide point of view—they either provide a list of problems from which the Circles can choose or, in some cases, have a supervisor or someone in department management tell the Circle what problems to solve.

- **Facilitators are too busy**
  In companies in which supervisors are the facilitators, the facilitating role can be overstrained because too many Circles are assigned to one facilitator. Ideally there should be one facilitator for every two Circles, but in some instances, a facilitator has four to six Circles to assist.

  Some companies address this impediment by having their facilitators meet the leaders once a week to find out how they are doing instead of meeting with each Circle.

  In one company, a facilitator who was assisting six Circles, designated the most senior leader among those Circles to act as an *assistant facilitator,* assigning three Circles to him. This move gave the selected leader another opportunity to develop his potential, boosted his morale, and made him work hard to assist the three leaders put in his charge.

7 A QC Circle Case Example

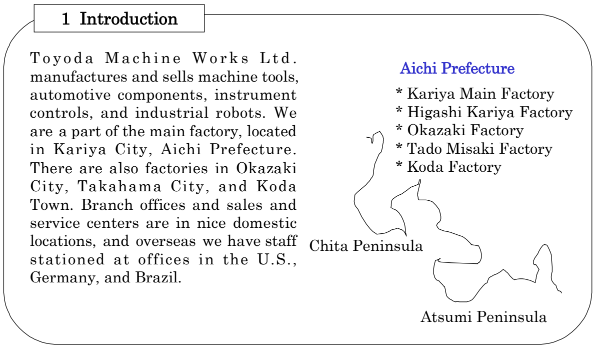
The following is based on presentation No. 205 in the *1,906th Tokai Region QC Circle Competition*, held in 1987. The numbered (1–18) presentation slides depicted here are English translations, by this handbook's authors, of the actual Japanese slides. The accompanying explanations are based on the authors' understanding of the presentation.

THEME

Reduction in Time to Retrieve Common Tools

Toyoda Machine Works Ltd.

Shinji Fukushima
Shinobu Kondo



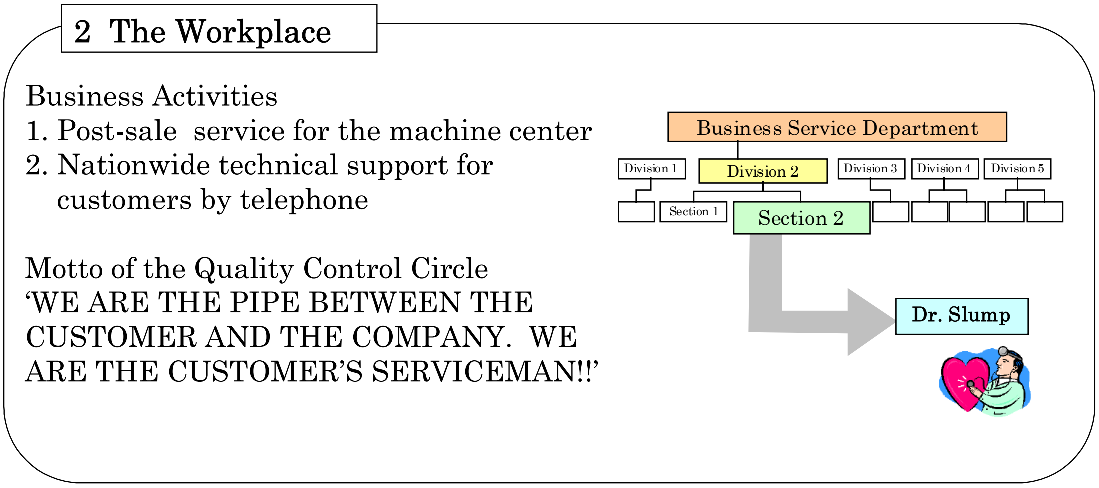
1 Introduction

Toyoda Machine Works Ltd. manufactures and sells machine tools, automotive components, instrument controls, and industrial robots. We are a part of the main factory, located in Kariya City, Aichi Prefecture. There are also factories in Okazaki City, Takahama City, and Koda Town. Branch offices and sales and service centers are in nice domestic locations, and overseas we have staff stationed at offices in the U.S., Germany, and Brazil.

Aichi Prefecture

* Kariya Main Factory
* Higashi Kariya Factory
* Okazaki Factory
* Tado Misaki Factory
* Koda Factory

In nationwide conventions, audiences come from various companies and industries, with different backgrounds. Therefore, a presentation normally starts by introducing some information about the company and its history. If the company is in the manufacturing sector, the Circle also provides a brief introduction of its products and services.



2 The Workplace

Business Activities
1. Post-sale service for the machine center
2. Nationwide technical support for customers by telephone

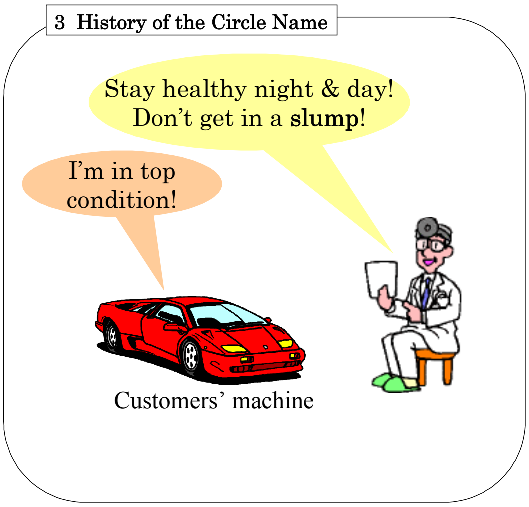
Motto of the Quality Control Circle
'WE ARE THE PIPE BETWEEN THE CUSTOMER AND THE COMPANY. WE ARE THE CUSTOMER'S SERVICEMAN!!'

Business Service Department
Division 1
Division 2
Division 3
Division 4
Division 5
Section 1
Section 2
Dr. Slump

Then the Circle explains about its workplace, answering the question, "What are the main activities and the vision and mission of the QC Circle activities?" The composition of the Circle will be also introduced—"When was it established? What are the ages of its members? What is the average age?" and so on.

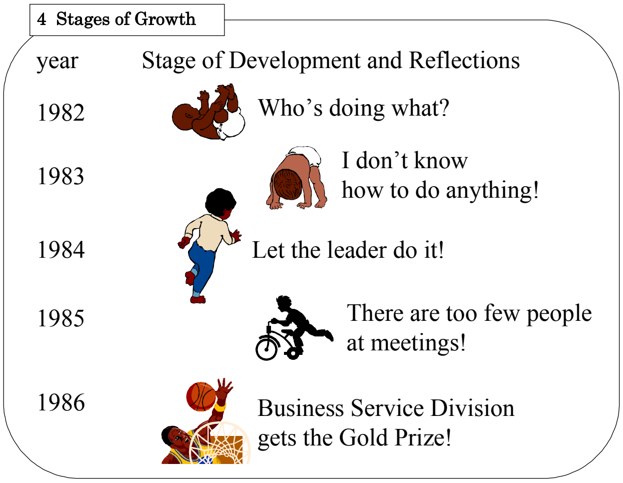
Introduction of the Quality Control Circle		Circle Name: Dr. SLUMP	
Registration No. of Group	1,454,348	Date of Establishment	March 1, 1983
Members	7	Meetings Held per Month	4
Average Age	27.7	Meeting Duration	2 hrs
Maximum Age	41	Meetings Held (Outside/Inside) Working Hours	Outside
Minimum Age	21	Number of Themes Addressed	13th theme
(Name of Office) TOYODA MACHINE WORKS LTD: Sales & Service Division			

3 History of the Circle Name


Stay healthy night & day! Don't get in a **slump**!
I'm in top condition!
Customers' machine

In some cases, the Circle relates how its name was derived. In the case of Dr. Slump, its name was chosen as a reflection of the members' wishes and ideal goal to keep QC Circle activities healthy—that is, to keep the activities from slumping.

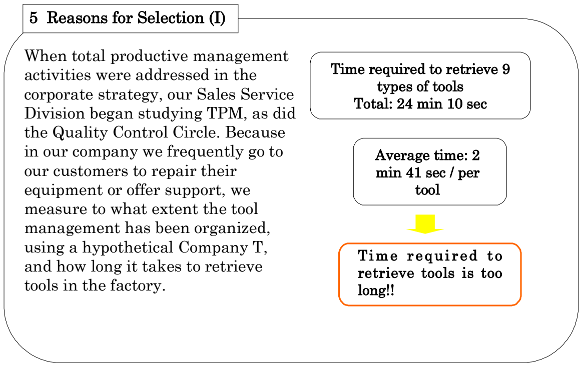
4 Stages of Growth



year	Stage of Development and Reflections
1982	Who's doing what?
1983	I don't know how to do anything!
1984	Let the leader do it!
1985	There are too few people at meetings!
1986	Business Service Division gets the Gold Prize!

Then the members describe the chronological steps their QC Circle has taken. In the case of Dr. Slump, when the Circle was first established, the members did not really know everyone's individual role. In other words, they did not know who was playing what role in their activities. In the following year, the Circle had some problems of not knowing what to do. They were not yet familiarized with QCC tools and techniques, and therefore had difficulties in understanding the QCC procedures.

In 1984, Dr. Slump's third year of operation, members neglected some basic aspects of QCC: they were a bit bored with their activity and tended to leave all the tasks to the leaders. As time went by, the situation got worse, and in 1985, the Circle faced critical problems, as members started to avoid the meetings. Yet the Circle somehow overcame the problem in 1986 was awarded the Gold Prize at the general meeting.



5 Reasons for Selection (I)

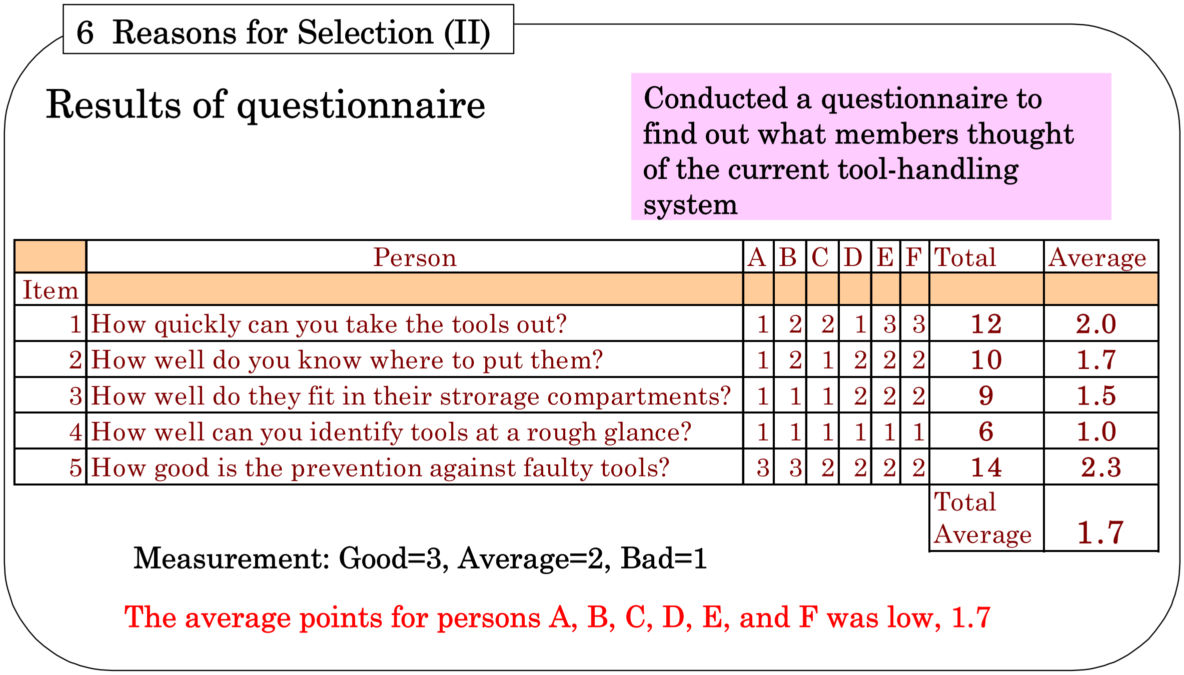
When total productive management activities were addressed in the corporate strategy, our Sales Service Division began studying TPM, as did the Quality Control Circle. Because in our company we frequently go to our customers to repair their equipment or offer support, we measure to what extent the tool management has been organized, using a hypothetical Company T, and how long it takes to retrieve tools in the factory.

Time required to retrieve 9 types of tools
Total: 24 min 10 sec

Average time: 2 min 41 sec / per tool

Time required to retrieve tools is too long!!

After introducing background information about the company and the Circle's activities, the Circle starts presenting their main theme for the convention in the form of the QC Story. First, they present the reason they chose the theme and how it is related to the company's quality management activities. In the case of Dr. Slump, they started the QCC as a part of TPM, based on its framework, decided which problem areas the QC Circle would address.



6 Reasons for Selection (II)

Results of questionnaire

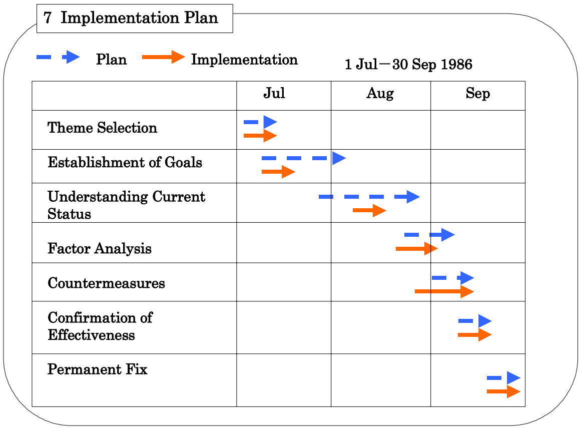
Conducted a questionnaire to find out what members thought of the current tool-handling system

	Person	A	B	C	D	E	F	Total	Average
Item									
1	How quickly can you take the tools out?	1	2	2	1	3	3	12	2.0
2	How well do you know where to put them?	1	2	1	2	2	2	10	1.7
3	How well do they fit in their strorage compartments?	1	1	1	2	2	2	9	1.5
4	How well can you identify tools at a rough glance?	1	1	1	1	1	1	6	1.0
5	How good is the prevention against faulty tools?	3	3	2	2	2	2	14	2.3
								Total Average	1.7

Measurement: Good=3, Average=2, Bad=1

The average points for persons A, B, C, D, E, and F was low, 1.7

The next step in the presentation is for Circle members to use hard data to rationalize their theme selection, because selection based simply on leaders' emotional appeals is inappropriate. The Dr. Slump members conducted a questionnaire to see to what extent the employees were satisfied with the way the tools were organized. They found that the employees' satisfaction level was very low in every aspect of the management of tools.


7 Implementation Plan

After covering their theme selection, Circles present the schedules they developed to solve their problems. Often the flows are presented for both the planning stage and the actual implementation. Comparing the two flows at the end of the activities provides tips for the planning and implementation processes of the next phase or theme to come.

8 Goals

1. Time to take out common tools:
2 min 41 sec

Reduce time to under 1 min

2. Graded average score: 1.7

Raise average score to 2.5

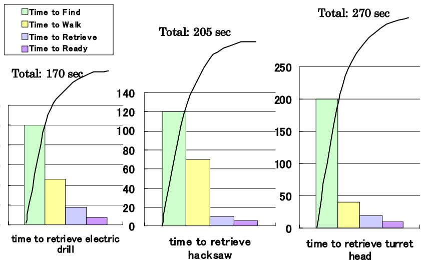
With the theme having been selected, the next step in the schedule is the establishment of goals.

9 Grasping the Current Status

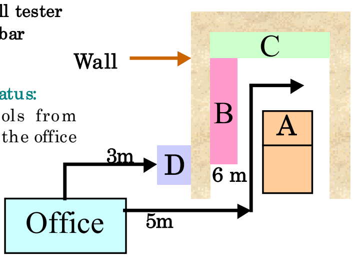
We asked Mr. A to retrieve some tools (predetermined) in three categories (standard, common, and measurement) while we timed him.

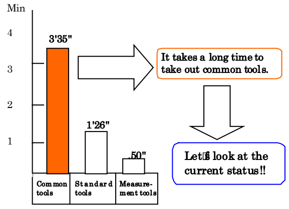
	Standard Tools			Common Tools			Measurement Tools		
	A	B	C	D	E	F	G	H	I
Retrieval Time	1'40"	1'30"	1'10"	2'50"	3'25"	4'30"	50"	40"	60"
Average Time	1'26"			3'35"			50"		

A 5mm wrench
B 17mm spanner
C cross-recess screw driver
D electric drill
E hacksaw
F turret head
G level
H small tester
I test bar



Method of Measuring Current Status:
Time to take out specified tools from shelves A to D and carry them to the office

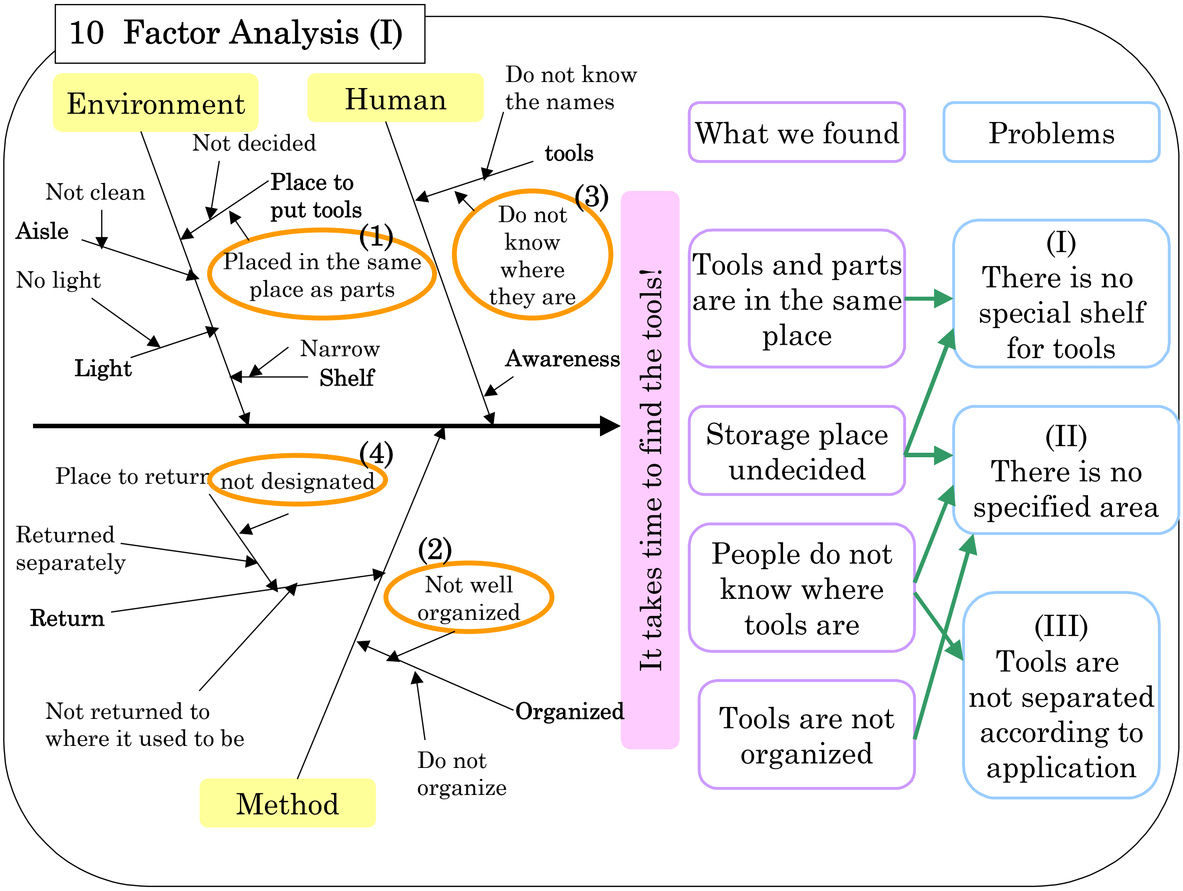




Average time taken to retrieve tools

After the goal is set, members present their actual understanding and analysis of the current status of the problem, aiming at seeing the extent of the problem in as much detail as possible. In the case of Dr. Slump, the Circle measured how long it took to retrieve each tool from its shelf. There are various tools in the workshop, so the Circle timed the retrieval of every tool. After they identified the tools that were the most difficult to retrieve, the Circle looked into the procedures in more detail-to see which steps took the longest time. They measured the time required to walk and find a tool, take it from its shelf, and take it to the work area and put it on the desk, ready for use.

The measurements suggested that the retrieval time for common tools was the longest, at 3 minutes 35 seconds, whereas that for standard tools was 1 minute 26 seconds and that for measuring tools was 50 seconds.



10 Factor Analysis (I)

Environment
Human
Method
Not decided
Not clean
Aisle
Place to put tools
(1)
Placed in the same place as parts
No light
Light
Narrow
Shelf
Do not know the names
tools
(3)
Do not know where they are
Awareness
(4)
Place to return not designated
Returned separately
Return
Not returned to where it used to be
(2)
Not well organized
Organized
Do not organize
It takes time to find the tools!
What we found
Problems
Tools and parts are in the same place
Storage place undecided
People do not know where tools are
Tools are not organized
(I) There is no special shelf for tools
(II) There is no specified area
(III) Tools are not separated according to application

After the current status is fully analyzed, members will try to identify the problem's real causes and effects, using a cause and effect diagram—one of the seven QC tools. From the diagram, four critical causes are identified: (1) tools and parts are in the same place; therefore, it takes time to find the needed tool, (2) the places to store tools are not well designated; so, tools are stored at random, not systematically by kind, (3) people simply do not know where the tools are, and (4) an organized method for storing the tools does not exist.

Then members think of the real, critical causes of the problem. Dr. Slump isolated three: (I) there is no special shelf for tools, (II) there is no specific area for storing these tools, and (III) tools are not separated according to usage.

11 Countermeasures (I)

Effectiveness

	Problems	Countermeasures	Who	When	
1	(I)	Designate shelves A and B as special tool shelves	Miharu	Aug. 3	○
2	(II)	Label boxes with tool names, and organize	Kondo	Aug. 15	○
3	(III)	Separate and arrange tools into categories: 1, 2, and 3	Yamada	Aug. 15	○

Note: The circles designate satisfactory effectiveness.

Through discussion, members identify the countermeasures to the problems, who is in charge of implementing each countermeasure, and by when the task should be accomplished. As for problem I in the case of Dr. Slump, shelves A and B are to be designated as shelves for special tools only, and Mr. or Ms Miharu is to be in charge. Other countermeasures are organized to solve problems II and III.

12 Confirm Effectiveness (I)

(1) Time required to retrieve common tools (secs)

	Person					
	A	B	C	D	Average	Evaluation
Electric drill	45"	40"	45"	35"	41.3"	○
Hacksaw	50"	55"	45"	40"	47.5"	○
Turret head	55"	60"	50"	45"	52.5"	○
					47.0"	○

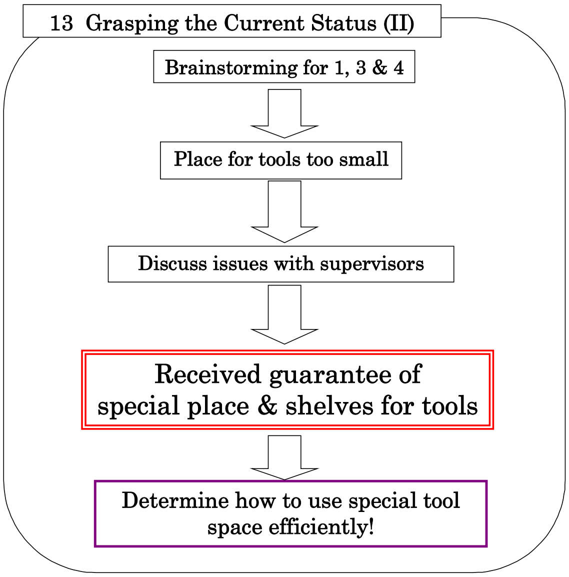
(2) Questionnaire

Good=3, Average=2, Bad=1

		Person								
	Question	A	B	C	D	E	F	Total	Average	Evaluation
1	How quickly can you retrieve the tools?	2	2	2	2	3	3	14	2.33	×
2	How well do you know where to put them?	2	2	3	2	3	3	15	2.50	○
3	How well do they fit in their strorage compartments?	2	2	2	2	2	2	12	2.00	×
4	How well can you identify tools at a rough glance?	1	1	1	1	1	1	6	1.00	×
5	How good is the prevention against faulty tools?	2	2	2	2	3	3	14	2.33	○
								Total	2.03	×

Note: The circles and crosses designate satisfactory and unsatisfactory effectiveness, respectively.

After members take countermeasures to the problems, they look at their effectiveness. Dr. Slump took two approaches to measure the effectiveness: (1) by taking the average rate of time and (2) by having employees answer a questionnaire. The Circle also set thresholds for satisfactory evaluations: time less than one minute for the first and an average score of more than 2.5 for the second. Among the four people timed in retrieval of common-type tools, the average time was 47 seconds, far less than the previous time of 3 minutes 35 seconds and under the goal. As for the 5-question questionnaire, however, the overall average score given by the six respondents was 2.03, which was below the goal that the members had set. These results indicated that even though the time to retrieve tools had been greatly shortened, the operators' satisfaction in working in the environment had still not met the targeted level.


13 Grasping the Current Status (II)
Brainstorming for 1, 3 & 4
Place for tools too small
Discuss issues with supervisors
Received guarantee of special place & shelves for tools
Determine how to use special tool space efficiently!

Having the initial results in hand, the members set about improving the conditions to get satisfactory responses to questions 1, 3, and 4 of the questionnaire. They started by brainstorming and found that members felt that the places for storing the tools were too small, making it too difficult both to get and to return them. They decided to get advice from their supervisor, who agreed to arrange for new special shelves in which the operators could organize their tools. With that settled, the operators were free to see how they could design the space for most efficient use of the tools.

14 Factor Analysis (II)

Evaluation points: 3-Yes
2-Normal
1-No

To use the special tool space efficiently we need to;

	No.	Possible solutions	effect	possibility	Combined rating
Improve the environment	1	Make storage area brighter	2	3	5
	2	Facilitate cleanliness and tidiness	1	3	4
	3	Use keys	2	3	5
Improve the methods	4	Make able to tell tools apart by looking	3	3	6
	5	Make able to know who took what	3	3	6
	6	Make able to take out in one motion	3	3	6
	7	Distinguish such that anyone can tell what's what	3	3	6
	8	Label tools by name	3	3	6
Sort out tools	9	Designate place	3	2	5
	10	Sort out necessary tools	2	3	5
Provide training	11	Train staff on how to arrange tools	2	2	4
	12	Return tools	2	1	3

Policies are necessary for possible solutions with combined ratings of 5 or 6.

Having obtained additional space for storing special tools, the Circle members began discussing how to use it efficiently. They first identified what kinds of elements could affect the efficiency and listed possible solutions, dividing them into four categories: (1) environment (2) methods (3) sorting of tools, and (4) training. Then they rated each possible solution in terms of its probable effectiveness and the possibility of putting it into practice. As shown above, those with combined ratings of 5 or 6 were selected as possible solutions worth implementing.

15 Countermeasures (II)

No.	Topics in Practice	Countermeasure	Person	Due date	Grade
1	Make storage area brighter	Use flashlights	Matsumoto	Sep. 20	○
2	Use keys	Use metal fittings	Miharu	Sep. 20	○
3	Make able to tell apart by just looking	Separate and color-code the tools	Kondo	Sep. 20	○
4	Make able to know who has what	Place name card in space after taking tool	Fukushima	Sep. 20	○
5	Make able to take out in one motion	Put opening in middle	Kondo	Sep. 20	○
6	Give better viewing of the tools	Label tools	Yamada	Sep. 20	○
7	Label tools by name	Label tools and their boxes	Fukushima	Sep. 20	○
8	Designate place	Separate common tools from special tools	Yamada	Sep. 20	○
9	Store the tools in proper places	Store necessary tools in sets of same-type tools	Miharu	Sep. 20	○

After members identify the possible solutions to focus on, they decide on measures for implementing them. Again, members here decide who will be responsible for carrying out the task and by when. For example, *make storage area brighter* is one possible solution that got a combined rating of 5. Therefore, the members looked for measures to increase the brightness and decided that the best way was to *use flashlights*. Mr. or Ms. Matsumoto was put in charge of this and was expected to complete it by September 20. The other possible solutions were handled in a similar manner.

16 Confirm Effectiveness (II)

Time required to retrieve common tools (secs)

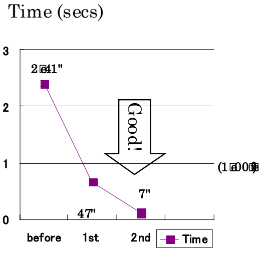
	Person					
Item	A	B	C	D	Avg.	Evaluation
Electric drill	25"	28"	26"	23"	25.50"	◎
Hacksaw	22"	23"	20"	20"	21.25"	◎
Turret head	30"	33"	29"	30"	30.50"	◎
					25.75"	◎

Questionnaire evaluation ratings

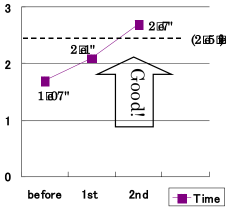
Good=3, average=2, bad=1

	Person								
Question	A	B	C	D	E	F	Total	Avg.	Evaluation
Could take out quickly	2	2	3	3	3	3	16	2.66	○
Have place designated to return tools	3	2	3	3	3	3	17	2.83	○
Organized in proper order	3	3	3	3	3	2	17	2.83	○
Can tell tools apart by looking	2	3	3	3	2	3	16	2.66	○
Elimination of faulty tools	3	3	2	2	3	3	16	2.66	○
								2.72	◎

We easily surpassed the goal!



Time required to retrieve tools



Questionnaire evaluation

After implementing the new measures, the Circle examines their effectiveness in exactly the same manner as was done in the first confirmation. For Dr. Slump the second results were much better than the first. The average time to retrieve a tool was much shorter now, shortened by almost 60 percent. The answers to the questionnaire were also better, an average rating of 2.7. Thus, the Circle achieved its initial goals: less than 1-minute retrieval and an average rating of more than 2.5.

17 Permanent fix

No.	Item	Person who does it	Person responsible	Due date
1	Record status of tools on checklist at time of their return	All	Miharu	Time of return
2	Person responsible manages missing or faulty tools based on the checklist		Yamada	Weekend

Upon obtaining successful results, Circles plan how to maintain the improvement. In this case, the group came up with two points: first to *record the status of tools on a checklist at the time of their return*, and second to *assign a person responsible for managing missing or faulty tools based on the checklist*. In this way, the Circle can continuously maintain what they achieved in the second confirmation and produce better effects.

18 Future plan

1. Together with two additional members, we aim to master quality control methods more quickly
2. Keep standard tools (those issued to every individual) in good order and well organized
3. Use storage space efficiently as space becomes smaller with the increase in special tools

Lastly the Circle decides its future plan. In the case of Dr. Slump, they decided that all of the members will improve their technical knowledge in QC tools and techniques, that they will try to improve the organization of standard tools, and that they would utilize the storage space efficiently.

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