Cooperation for Problem-Solving: The History of Quality Circles in Japan

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This article aims to review the history of small group activities (quality circles, QCs) at Japanese enterprises, thereby identifying factors that have enabled small group activities to be sustained in Japan for a long period of time. In this article the term "small group activities," or "quality circles" (QCs) refers to continuous activities by groups composed of a small number of members belonging to the same workplace, with the goal of solving problems in operations. QCs, originated from quality control among manufacturing industry in Japan in the early 1960s under the name "QC Circles." They became widespread from the latter half of the 1960s, and also attracted attention abroad in the 1980s, when they experienced their heyday. Despite a decline in their implementation rate from the 1990s on, quite a few enterprises continue to employ QCs as of 2020. QCs are not simply circles (small groups) of people working together, but are implemented using standardized and simplified problem-solving tools and procedures that render problem-solving process visible, promoting information sharing among rank-and-file members and enabling them to refer to case studies of good practices at other enterprises and in other industries. There are several means for improvement of propagation and promotion of QCs at a nationwide level, such as specialized journals and books, training programs in competencies required for QCs provided by enterprises and promotional organizations, and in-house and external conferences for presentations. Not only promotional organizations but also cooperation among enterprises through branches in various regions of Japan have contributed to popularization, information exchange, and development of new methods. It can be said that a wide variety of mechanisms have been used to sustain QCs.

I. Introduction

This article aims to review the history of small group activities (quality circles, QCs) at Japanese enterprises, thereby identifying factors that have enabled small group activities to be sustained in Japan for a long period of time. In this article, the term "small group activities," or "quality circles" (QCs) refers to continuous activities by groups composed of a small number of members belonging to the same workplace, with the goal of solving problems in duties. It encompasses the activities known as QC (Quality Control) Circles, Zero Defects (ZD) programs (see note 5), and self-management activities. Therefore, the focus of this paper is not on small groups in general (Homans [1992] 2018), but specifically on small group activities in the above sense, regardless of its formality.

QCs, which emerged in Japan in 1962, gained widespread popularity mainly among manufacturing workplaces, and drew attention both in Japan and overseas in the 1970s and the 1980s, as did other aspects Japanese-style management. During this era, economic conditions in Japan were among the best in developed countries, and the international competitiveness of Japanese products was high. Undergirding this international competitiveness were Japanese production systems (Fujimoto 2003; Nakamura 1996) as embodied by the Toyota Production System and Japanese management as represented by the "three sacred treasures" (lifetime employment, seniority-based wage increases and promotions, and in-house labor unions), and QCs involving skilled workers on-site also drew attention.

QCs drew attention, for one thing, because the high quality of Japanese products was thought to be achieved by "building in quality" through these QCs (Udagawa et al. 1995). Another, partly because they were seen as carrying out measures through integration of planning and execution, which diametrically opposed to the dominant labor management paradigm in Western countries at that time (separation of planning from execution), in which skilled workers on-site concentrated on manufacturing operations while work method formulation and improvement was entrusted to in-house specialists (Nitta 1977).[1]

It has been pointed out that QCs have not only direct effects on improvement of operations, but also indirect effects such as improvements in interpersonal relations, problem recognition and competency in operations, leadership ability, and sense of accomplishment (Nitta 1988, 29–80). At the time alienation of the labor force because of monotonous work, such as separation of planning and execution, was regarded as a social issue in various countries, and solutions were being sought. QCs, in which skilled workers on-site are involved in solving operational problems, were also regarded as a case in overcoming alienation of the labor force (The Ohara Institute for Social Research, Hosei University 1986).

Thus, while QCs are understood as one of the mechanisms underlying Japanese production systems and the high skill of workers, there are also skeptical views of their effectiveness. These skeptical views are related in part to the positioning of QCs as an activity in which skilled workers work "voluntarily" outside of routine operations.

One view holds that the high skill level of skilled workers is realized through routine operations, rather than QCs (Koike 1991, 67–68), and another that crucial improvements are made not by skilled workers but by specialist technicians and supervisors addressing routine operations (Nomura 1993, 121–127). In addition, there are observation reports on the reduction of QCs to mere formalities (Ihara 2003, 64–88; Ōno 2003, 120–126), and that QCs are used to promote meritocratic intensification of labor among skilled workers in the name of "autonomous" activities (Kumazawa 1980a, 1980b).

Even if we accept these skeptical views, they do not explain why QCs have been deployed in Japan for so long and are still implemented at many enterprises to be implemented even in 2020. Therefore, in this paper, we look back on the history of QCs in Japan and examine the reasons for their longevity, from the vantage point of the mechanisms underpinning these QCs.

II. What are QCs?

QCs, in the sense described in the previous section, originated with QC Circle activities recommended by the Union of Japanese Scientists and Engineers (JUSE) in 1962. "QC" in "QC Circle" is an acronym for "quality control," and as this suggests, QCs are rooted in that field. Statistical quality control based on the methods of statistical science were introduced into Japan in earnest after World War II. Since then JUSE, together with several other organizations, has promoted the adoption of quality control through various approaches such as training and publications.

As the use of quality control methods progressed at manufacturing sites, site supervisors called for publication of easily understandable magazines in addition to specialized journals for engineers.[2] In response to this, publication of the monthly magazine *Gemba to QC* (*gemba* meaning "site") commenced in 1962. QC Circles were conceived as supervisor-led sessions where skilled workers studied quality control using the magazine (Nonaka 1990). The magazine was later renamed *FQC* and then *QC Circle*, and as of 2020 continues to be published as a specialized journal covering QCs, with a monthly circulation of 16,000. Also, JUSE established a QC Circle Headquarters and launched a QC Circle Headquarters Registration System at various companies. This registration system transitioned to an online system in 2006.

QCs are positioned as one element of Total Quality Control (TQC) or Company-Wide Quality Control (CWQC) involving all employees in all divisions, which has been widespread in Japan since the 1960s (Ishikawa 1984; Kogure 1988). In the 1980s, influenced by Japanese TQC, the term TQM (Total Quality Management) came to be used in the United States. TQM extends the scope of management beyond quality of products and services to areas of management quality such as customer satisfaction and employee satisfaction. In Japan, the term TQM has been commonly used in place of TQC since the 1990s (TQM Committee 1998).

Kaizen is a Japanese word referring to continuous, step-by-step improvements that solve operational problems (Imai 1988). While QCs are counted as one *kaizen* approach, they are not synonymous with *kaizen*, which is a broader term encompassing the 3S (*seiri*, *seiton*, *seiso* – sometimes translated as "Sort, Set in order, Shine") and 5S (*seiri*, *seiton*, *seiso*, *seiketsu*, *shitsuke* – 3S with the addition of "Standardize" and "Sustain") and other improvements carried out individually by personnel in charge.

III. Growth, decline, and evolution of QCs

1. Implementation rates of QCs as seen in the "Survey on Labour-Management Communications"

QCs were widely adopted in the late 1960s, and in the 1980s they were the subject of international attention, making it appear that they were in their heyday. Table 1 shows the implementation status of QCs at business establishments from 1972 to 2004 by size of enterprise, based on the Ministry of Health, Labour and Welfare (formerly the Ministry of Labour) "Survey on Labour-Management Communications." Simple one-to-one comparisons cannot be made across time as a whole because the category of sizes of enterprises surveyed differ. However, changes in implementation status can be tracked for sizes of enterprises that can be compared from 1977 onward.

First, it is notable that "5,000 or more" (83.7%) and "1,000–4,999" (74.8%) had the highest implementation rates in 1984, while the highest implementation rates in 1989 were for "300–999" (53.6%) and "100–299" (49.2%). It is evident that QCs in Japan were most actively implemented in the 1980s. This situation, in which QCs reached their peak in the 1980s, applies not only to Japan but also overseas (Cole 1999).

W. Edward Deming, who was among those who introduced quality control to postwar Japan and was the namesake of the Deming Prize, became widely known in the United States when the NBC (National Broadcasting Company) TV program "If Japan Can, Why Can't We?" was aired in 1979.[3]

In the 1990s and after, the popularity of QCs had passed its peak and the implementation rate declined. Due to the impact of Japan's long-term recession, praise for Japanese-style management seen overseas as well as

domestically in the 1980s waned in the 1990s, and this was accompanied by a trend toward rethinking Japanese-style management, with which the decline in the implementation rate of QCs is evidently aligned.[4] However, in Table 1 it can be seen that quite a few business establishments were still implementing QCs as of 2004. The implementation rates for that year were: "5,000 or more" at 42.8%, "1,000–4,999" at 55.9%, "300–999" at 35.2%, "100–299" at 33.7%, "50–99" at 25.7%, and "30–49 people" at 10.9%.

As with other practices characteristic of Japanese-style management, the larger the enterprise, the higher the implementation rate of QCs in any survey year. After 2004 the question about implementation rate of QCs was removed from the "Survey on Labour-Management Communications," so it is not possible to obtain clear data for these years. Nevertheless, as of this writing in 2020, many enterprises are still implementing QCs.

2. Changes in QCs at enterprises: Toshiba Yanagi-cho Factory as a case study

Next, based on my paper (Ogawa 2005), I will look at the change in QCs over the same period as Table 1 as seen in an enterprise case study. The case in question is that of QCs at the Toshiba Yanagi-cho Factory. Toshiba is among the enterprises that introduced quality control activities soon after World War II. The Yanagi-cho Factory primarily produced power meters and household appliances, but it later changed its name and then closed in 2005. This one factory is symbolic of the rise and fall of the entire Japanese electrical equipment and appliance industry.

The factory introduced ZD (Zero Defect) activities[5] in 1965 as a means of introducing improvement proposals, and then launched "Wide ZD Activities" focusing on small group activities in 1970. The name was changed to "WZD Activities" in 1975, and these activities continued until QCs as defined in this paper were eliminated throughout Toshiba in 1998. Since 1998, Six Sigma (explained later in this paper), a quality improvement program originating in the US, was introduced as part of the company's management reform efforts.

Table 2 summarizes changes in the number of types of methods used per presenting circle in the Conference Proceedings of in-house presentations at the factory on Wide ZD Activities and WZD Activities. In QCs, simple and standardized tools and procedures are used to solve problems. The average number of methods used per presenting circle was calculated at intervals of approximately five years (or four years, only in the case of 1995–98). By examining increases or decreases, it is possible to measure how widespread given methods were at the level of circles at the site. In addition, by calculating the coefficient of variation (= standard deviation / average), it becomes possible to understand how much standardized the guidance on the

Table 1. Implementation status of QCs at business establishments (by size of enterprise)

(Unit: %)

| Year | Total for all enterprise sizes | 1,000 employees or more | | 300–999 employees | | 100–299 employees | 50–99 employees | 30–49 employees |
		5,000 employees or more	1,000–4,999 employees	500–999 employees	300–499 employees			
1972	39.7	69.4		55.4	43.5	35.8	—	—
1977	40.4	58.2	48.8	38.4		31.0	—	—
1984	60.2	83.7	74.8	53.0		49.0	—	—
1989	52.1	76.0	64.2	53.6		49.2	39.9	—
1994	47.9	69.6	60.8	51.4		41.3	39.3	—
1999	39.5	63.3	53.4	44.5		42.4	30.8	20.4
2004	30.9	42.8	55.9	35.2		33.7	25.7	10.9

Source: Ministry of Health, Labour and Welfare (prior to 1999, Ministry of Labour) annual "Survey on Labour-Management Communications."

Note: "—" indicates categories outside the scope of the survey.

Table 2. Changes in the number of types of methods used per presenting circle at in-house presentations at factories (1970–98)

Fiscal year	70–74	75–79	80–84	85–89	90–94	95–98	70–98
N	25	32	54	56	54	48	269
Average	0.40	0.53	1.54	2.50	4.11	4.00	2.47
Standard deviation	0.69	0.83	1.37	1.48	1.47	1.35	1.92
Coefficient of variation	1.732	1.560	0.892	0.591	0.359	0.339	0.779

Source: Prepared by the author based on the WZD *Conference Proceedings* for each edition of the Toshiba Yanagi-cho Factory Wide ZD Presentation Conferences.

Notes: 1. Presentation Conferences for which the contents of presentations are unknown are excluded from the data.
2. The methods covered are the Seven QC Tools(cause-and-effect diagram, Pareto chart, graphical tools [excluding line graphs], histograms, line graphs, check sheets, scatter diagrams, control charts), the New Seven QC Tools (relation diagram, tree diagram, matrix data analysis, process decision program charts), radar charts, Taguchi methods, and FMEA/FTA.
3. The values of average and standard deviation in the table are rounded off, and the values of coefficient of variation are calculated based on the original values of average and standard deviation, not on their values rounded off in the table. Therefore, the values of coefficient of variation do not match with those calculated based on average and standard deviation in the table.

method utilization for the factory as a whole was. There are 13 methods covered.

The average number of types of methods used continued to increase from fiscal year1970–74 (0.40 types) to fiscal year1990–94 (4.11 types). Although the number of types during 1995–98 (4.00 types) fell slightly from the preceding 1990–94 period, it is valid to say that the average continued to increase from fiscal year 1970 to 1998. Therefore, the data shows that at the Yanagi-cho Factory, the use and understanding of methods permeated to the level of circles, that is, to the employees on-site who were members of circles.

The coefficient of variation of the number of types of methods used consistently decreased from fiscal year 1970–74 (1.732) to fiscal year 1995–98 (0.339). This suggests that at the factory, guidance on use of these methods provided to on-site employees who are circle members became increasingly standardized. In other words, it can be said that the framework of guidance was strengthened, such as through development of education and training systems for the entire factory, rather than leaving responsibility for activities to circles or to their direct supervisors.

Targets of improvement covered by the factory's QCs become more multifaceted year by year, though those topics are not detailed in this paper. QCs originated with quality control, and "ZD" is short for Zero Defects, indicating that in the early 1970s the target area of improvement was primarily defect reduction. While defect reduction has remained a central theme since the latter half of the 1970s, a significant percentage of circles making presentations dealt with themes of man-hours reduction, productivity improvement, skill education, cost reduction, and standardization. This illustrates the ways in which QCs had expanded beyond quality control to a wide range of activities aimed at *kaizen* for duties by the 1980s.

In the 1990s, an increasing number of circles aimed to establish and standardize management in routine operations, rather than carrying out problem-solving only within the scope of QCs' target areas. By formulating operational standards sheets and operational instructions sheets, and using checklists, efforts to prevent recurrence of problems targeted for improvement were procedurally incorporated into these target areas. In the late 1980s only about 10% of the circles making presentations implemented such initiatives, but in the 1990s about 90% of presenting circles began carrying them out.

The chronological change in QCs described above suggests a gradual shift from activities that emphasize QCs' role in boosting employees' awareness of areas requiring improvements and their motivation, to activities that emphasize contributing to the performance of routine operations based on management policies. It is

difficult to improve performance of routine operations just by solving problems through autonomous activities based on circle members' knowledge and experience. In fact in the 1990s, QCs were often implemented with the support of engineers at the Yanagi-cho Factory.

3. Efforts by promotional organizations from the 2000s onward

In the 2000s, QC Circle Headquarters, an organization promoting QCs, began to reconsider the ways in which QCs should be conducted in Japan, with declines in the implementation rate and the change and diversification of activities. This section examines this reconsideration in the form of a summary of my earlier paper (Ogawa 2011). In 2002, QC Circle Headquarters announced the "Evolved QC Circle (e-QCC) Vision."[6] This vision had two main points: one was to position QCs as activities integrated with operations, and the other was to promote QCs at workplaces other than manufacturing sites and in industries other than the manufacturing industry, without being constrained by the conventional frameworks of the past. These two points had already been set forth by QC Circle Headquarters in their future dissemination and management policy for QCs, based on the actual conditions of activities at enterprises and business locations.

The "autonomy" of QCs was often the focus of critical examination by skeptics, and there was a trend toward positioning QCs not as "autonomous" activities by circle members but as activities integrated with duties, as seen in the case study of Toshiba Yanagi-cho Factory in the preceding section. It can be said that in the 1990s, when the heyday of QCs had passed, QCs began to quietly evolve into activities integrated with duties, rather than being expected to be "autonomously" conducted by circle members. In terms of improving sales and customer satisfaction, as in sales departments, it is necessary to involve managers in activities. Thus, this naturally made QCs directly linked to the management structure.

The move toward deploying QCs beyond manufacturing sites and the manufacturing industry was already seen in the 1980s, when QCs were at their peak. In terms of background that relates to the expansion to non-manufacturing workplaces and non-manufacturing industries in the early 2000s, I should mention not only changes in industry and occupational structure, but also recognition that the direct application of the methodology of manufacturing sites to other departments and industries during the heyday of QCs did not go well. At various QC conferences, administrative, sales, and service departments held presentation competitions and reviewed presentations separately from manufacturing sites.

The conventional form of QCs was implementation in a single workplace on a continuous basis, as defined in this paper. The e-QCC Vision was disseminated in light of the fact that small group activities were also carrying out problem-solving activities across multiple workplaces and in non-continuous forms. There are actually four types of group problem-solving activities: in addition to the standard "single workplace and continuous," there are also "multiple workplaces and continuous," "single workplace and discontinuous," and "multiple workplaces and discontinuous." Specifically, at some hospitals, circles are organized thematically, and there are cases where members experience activities in other circles even if activities are discontinuous.

IV. Candid feature articles on QCs in specialized journals

1. "Revive, the QC Circle"

Under these circumstances, *QC Circle*, the specialized journal of QCs, published a special feature called "Revive, the QC Circle" in 2004. This feature disclosed names of enterprises, business locations, and candidly discussed the hiatus and difficulties that hit QCs from the 1990s onward, also, the reduction of their activities to mere formalities in the 1980s during what was ostensibly the heyday of QCs, and the adverse effects thereof and efforts to overcome them. In those articles, statements indicate that the seeds of declining implementation rates of QCs from the 1990s onward were already germinating in the 1970s and 1980s. This section excerpts the contents of this special feature, again summarizing my previous paper (Ogawa 2011).

The "Revive, the QC Circle" article embodied the stance of promotional organizations such as JUSE and

QC Circle Headquarters, as well as enterprises that had been implementing QCs since the 1990s, toward facing the current situation and pursuing reforms. It also illustrated how members of the *QC Circle* editorial board and the enterprises and business locations interviewed remained strongly attached to QCs. The following excerpts are representative descriptions from the article, classified as (i) reduction of QCs to formalities, (ii) enterprises' reconsideration of QCs, and (iii) quality issues and QCs.

2. Reduction of QCs to formalities

The phenomenon of QCs being reduced to formalities or "getting stuck in a rut" did not begin in the 1990s. As mentioned above, the following statements suggests that there have been many workplaces where QCs had become ghosts of their former selves even in the 1970s and 1980s, when QCs were the focus of much attention.

(About the workplace in 1988) I started out studying the basics of QC Circle activities, and since then I have been involved in these activities over the long term. However, the attitude around the factory at the time was basically something like "This is just one of those things we have to do, right?" This partly reflects the fact that everyone at the factory was quite busy, but I also think there were not many managers or supervisors who approached these activities proactively. (Inoue 2004a, 50)

At the time (the 1970s), most company workplaces were still controlled by strict hierarchical relationships. However, when I joined the QC Circle at this company, I was told that I was free to speak my opinion. It was a novel and rewarding experience, trying to make improvements while holding discussions without regard to position.... However (because enthusiasm for QC Circles subsequently declined), if I went to presentation conferences even at that time, although of course there were people who really gave it their all, close to half of the presentations felt quite contrived. Like people were making presentations for presentations' sake. (Inoue 2004b, 45)

(Although I was consulted in 2000 to play a leading role of the 2003 district manager company of the QC Circle Tokai branch Aichi district), if I become a leader of the district manager company, the responsibility is great, and I am supposed to make QC in-house activities suitable for it. However, what I felt when I saw the company-wide presentation conference the previous year was, even though it seemed to be doing what it ought to have been done on the surface, that the contents were quite hollow. I had the impression that most of the presentations were for presentations' sake, and they did not convey much enthusiasm. In such a situation, I wondered if the district manager company would work. (Inoue 2004d, 49)

Small group activities originally valued autonomy, and it had worked well for a while. However, at some point people started taking these autonomous activities for granted and leaving everything up to workers on site. Although the activities continued but reduced to mere formality, I feel that their content became impoverished and they gradually turned into ghosts of what they had once been (in the late 1990s). (Inoue 2004f, 48)

3. Enterprises' reconsideration of QCs

As already discussed, as the long-term recession starting in the 1990s took hold, the theoretical underpinnings of Japanese-style management were increasingly reconsidered including QCs. From the statements quoted below, it is evident that enterprises were re-examining the way QCs should operate, or replacing them with other management improvement programs. On the other hand, it seems that people closely tied to manufacturing sites, such as those in charge of in-house promotion of QCs or in charge of manufacturing divisions, were perplexed by these developments. Also, we see feedback from employees on-

site trying to protect the continuation of activities against changes in enterprises' policies toward QCs.

> (In the 1990s) Japan was in an era of economic stagnation and low growth, and I believe this gave many enterprises momentum to re-examine how QC Circle activities ought to operate. This was the case at our company as well, where the management proposed that activities should be updated somewhat. (Inoue 2004c, 49)

> The manufacturing division manager's thinking was clear (with regard to the company-wide policy of switching to introduction of other management improvement programs). He firmly told us that he would continue with small group activities for quality control as before because they played an important role in the field of manufacturing, increasing motivation to improve the work, training effectiveness, and job satisfaction. I completely agreed, and there were no differences of opinion among employees on site. (Inoue 2004e, 51)

> With the top-down introduction of (other management improvement programs), small group activities also came to be led by the management, and the sense of them as voluntary activities was diminished. The essential features and appeal of small group activities were originally that they gave people a sense of accomplishment through free exchange of opinions within the group and engaging in activities together based around a common theme, but that has been weakened. Recently, young people tend to avoid being very deeply involved with organizations and colleagues. As the number of dispatched workers and so on in the workplace is increasing, generating more active communication is a major challenge. (Inoue 2004h, 51)

4. Quality issues and QCs

In the late 1990s and early 2000s, a series of scandals relating to quality issues caused an uproar in Japanese society. As a result, as of 2004 QCs were being repositioned as activities to prevent quality problems before they occur. Skeptical views on the effectiveness of QCs are found not only in the labor studies literature, but also in practice in the field. However, we can also find commentary that reaffirms QCs' contribution to the prevention of quality issues, and a paradigm shift that caused management to turn its attention to QCs once again.

> (When in-house QC presentation conferences have not been held) As a manufacturing division manager, I myself did not think that the cancellation of the QC program would have such an impact. However, product quality issues increased, and I had to go and apologize in person to customers several times. That made me start rethinking things. (Inoue 2004b, 46)

> In places where employees gather, such as for New Year's greetings, a newly appointed president often stresses that "quality is first, and we cannot compete in the market without it." The significance of quality has become more apparent than ever before, and as a result, employees' awareness of it has grown. Without a doubt, it has been a driving force in our efforts to implement small group activities. (Inoue 2004g, 53)

V. QCs and new quality improvement programs

In the 1990s, new programs relating to quality control and QCs were introduced in Japan, as overseas. Two examples already mentioned are TQM and Six Sigma. Below, I briefly outline three programs: the ISO9000 Series, Six Sigma, and TPM (Total Productive Maintenance).

The ISO9000 series was established in 1987 as one of the International Organization for Standardization (ISO) standards. The core standard of the series is ISO9001, which requires enterprises and business locations

to keep written records of quality assurance-related matters. Therefore, it should be noted that ISO9001 does not specify particular methods for quality control. The number of enterprises and business locations acquiring ISO9000 series certification has increased in Japan since the 1990s. ISO 9001:2015, a 2015 revision, is also designated as JISQ9001:2015 under the Japanese Industrial Standards (JIS) system (Japanese Standards Association 2016).

Like TQM, Six Sigma is a management improvement program influenced by Japanese quality control practices and devised in the United States. Also like TQM, Six Sigma aims to improve not only the quality of products and services, but also the quality of all aspects of management. The "sigma" in Six Sigma refers to the Greek letter σ, the symbol for standard deviation, and signifies aiming for extremely low defect rates (Harry and Schroeder 2000). Six Sigma is not restricted to activities carried out in a single workplace on a continuous basis, like QCs defined in this paper, and encompasses discontinuous activities across multiple workplaces, such as projects and task forces.

TPM is a program of equipment maintenance activities with all employees' participation, which originated in Japan, specifically at Nihon Denso (today known simply as Denso) in 1971. Thus, while TPM is not a new management improvement program, it is regarded as one that both competes with and complements QCs as defined in this paper. TPM shares common points primarily in the Japanese manufacturing industry, and in stress of employee participation and circles; it is similar to Japanese TQC, TQM, and QCs. However, TPM does not emphasize members' "autonomy," and activities are implemented as part of routine operations. Also, TPM basically promotes activities by forming circles at various levels within the organizational hierarchy, such as the company-wide level, business location level, and the divisions, department, section, and group levels (Japan Institute of Plant Maintenance 2018).

In 2012, QC Circle Headquarters changed the official term "QC Circle activities" to "QC Circle activities (small group improvement activities)" in order to comprehensively express the various forms of group activities described above (QC Circle Headquarters 2012, 49). The Japanese Society for Quality Control (JSQC) also uses the term in the title of its *Guidelines for small group improvement activities* (JSQC 2015), private-sector standards established in 2015 (Murakawa 2018).

VI. Mechanisms underpinning QCs

1. Standardized and simplified tools and procedures

As described above, QCs are not simply small numbers of people gathering to engage in activities, but involve utilizing standardized and simplified tools and procedures, aiming to "render visible" the problem-solving process. The Seven QC Tools and the New Seven QC Tools are collections of simple methods packaged together as a group (Ogawa 2000). The original Seven QC Tools consist of (i) cause and effect diagrams, (ii) Pareto charts, (iii) graphical tools, (iv) check sheets, (v) histograms, (vi) scatter diagrams and (vii) control charts (Hosotani 1988), but stratification, an approach to the analysis of data by group, may also be included here. Of the Seven QC Tools, the six methods other than (i) are simple statistical methods.

The Seven QC Tools were in virtually their current form by the late 1960s. The New Seven QC Tools, proposed in March 1977, consist of (i) affinity diagram,[7] (ii) relation diagram, (iii) tree diagram, (iv) matrix diagram, (v) arrow diagram,[8] (vi) process decision program chart, and (vii) matrix data analysis.[9] With the exception of (vii), a statistical method, these are approaches to organization of linguistic data (Nayatani 1988).

Meanwhile, "QC Stories" is a standardized practice for problem-solving procedures and techniques used at each stage of the procedure (Yatsu 1988). Standardization of procedures makes it possible to improve the efficiency of problem-solving activities, the quality of presentations on activities, and the attainment of concrete ends. In addition to the problem-solving type of QC Story, the task-achieving, measure-implementing, and "preventing problems beforehand" types are also proposed models for QC Stories. Through these tools and procedures, information can be shared among members of QCs, and good practices at other enterprises and in

other industries can be referenced.

2. Media, training, and presentation conferences

Widespread promotion and greater understanding of QCs through publications such as the specialized journal *QC Circle* and manuals is encouraged. Training in the required knowledge for QCs is carried out within enterprises and business locations, using these publications or original educational materials, while promotional organizations also provide training and carry out quality control certification and QCs guidance certification programs for QCs guidance. In addition, the activities are being ameliorated nationwide through presentations on QCs inside and outside companies.

3. Regional inter-enterprise cooperation

The QC Circle Headquarters has branch offices (9 chapters) in various parts of Japan, and some branch offices have district offices as subordinate organizations.[10] Through the branch and district offices, enterprises and business locations in the area volunteer to cooperate in dissemination and promotion of QCs. While administrative mechanisms and content of projects differ depending on the branch or district, the most major event for any branch or district is the hosting a presentation competition. Circles that have implemented outstanding activities are selected from local enterprises and business locations, and asked to make presentations at the competition. From among these, particularly excellent circles are selected to participate in national or further competitions.

Branches and districts are run mainly by secretaries appointed by enterprises and business locations. Duties of the branch or district are handled as a part of the operations of the enterprise to which the secretary belongs. In addition to presentation competitions, various conferences are planned including training for secretaries, QC training for other enterprises, business location tours, workshop-style presentations, study sessions for QC management involving development of new methods, and briefing sessions for managers. Through the planning and administration of these conferences, personnel in charge of QCs at enterprises are provided with opportunities to exchange information (Ogawa 2012). In addition, the editorial board of the journal *QC Circle* is appointed with consideration for balance among branches. Inter-enterprise cooperation is promoted within regional units, making it possible to deploy QCs throughout Japan.

VII. Conclusion

While the implementation rate of QCs in Japan declined after their 1980s heyday, activities were still underway at the time of writing this in 2020. It should also be noted that QCs have not followed a consistent trajectory since they first emerged. Even during their peak period, some enterprises found QCs problematic, while others strengthened their implementation efforts. Since this peak period ended, both implementing enterprises and promotional organizations have continued flexibly responding to changes in industrial and occupational structures, facing the rise of new management improvement programs.

The reasons QCs have been maintained in Japan for such a long time would be that their operational practices have constantly evolved, and that they have been supported by versatile mechanisms. Additionally, QCs do not consist simply of members gathering to engage in activities, but have been underpinned by standardized and simplified tools and procedures, a range of media, training, and presentation competitions, and cooperation among enterprises in regions. Also, the relevant parties at enterprises have recognized that the issues labor researchers have criticized should be overcome. The constant emergence and overcoming of issues have made it possible to sustain QCs as they evolve over the long term.

The word "cooperation," the Japanese translation of which is *kyodo* (lit. "working together"), features prominently in *The Functions of the Executive* (Bernard [1938] 1968). Looking back over the history of QCs and the mechanisms that underpin them, QCs' functions and their activities are sustained through frameworks

for cooperation at multiple levels across multiple enterprises, not only at the micro-level of group activities in the workplace, but also at the meso-level of regions and the macro-level of Japan as a whole.

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Notes

1. What is described in this paper as "integration of planning and execution" is expressed in Nitta (1977) as "non-separation of conception from execution."

2. A previous paper of mine (Ogawa 2000) interprets the process of QCs' emergence from the quality control field in Japan as that of formulating layered education and training of quality control.

3. This TV program introduced Japanese QCs from the perspective of workers' participation in management. The program has been posted and is viewable on the YouTube channel of The Deming Institute, an organization that aims to disseminate Deming's management philosophy. Accessed April 20, 2020 at https://www.youtube.com/watch?v=vcG_Pmt_Ny4, which was aired on June 24, 1980, NBC White Paper.

4. The April 2011 issue of the *Japanese Journal of Labour Studies* ran a special feature entitled "What happened to that debate?" including an article on "QC Circle activities" written by a quality control expert (Nakajo 2011). The feature is emblematic of the decline in interest in QCs in Japan's labor research field.

5. ZD activities originated from a management improvement program launched by US defense contractors in 1962. They were first introduced in Japan by NEC Corporation, which had already introduced small group activities, and subsequently they were popularized and promoted by the Japan Management Association. See the JMA Consultants Inc. n.d. "ZD (Zero Defects)." Accessed April 20, 2020. https://www.jmac.co.jp/glossary/2016/09/tpm-zd.html.

6. The Union of Japanese Scientists and Engineers. n.d. "e-QCC advocated by QC Circle Headquarters." Accessed April 20, 2020. https://www.juse.or.jp/business/qc/attachment/eQCC.pdf.

7. Also widely known as the K-J method.

8. Also widely known as PERT (Program Evaluation and Review Technique).

9. Also widely known as principal component analysis.

10. As of 2020, there are 9 chapters and 36 district offices in Japan. See the Union of Japanese Scientists and Engineers. n.d. "QC Circle Activities (Circle-Based Improvement Activities)." Accessed April 21, 2020. https://www.juse.or.jp/business/qc/01.html.

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