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New Evidence on the Origins of Quality Circles

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Abstract

Purpose: The purpose of this paper is to examine the contribution of Benzaemon Inoue and Sumitomo Electric Industries (SEI) in the early development of what came to be known as quality control (QC) circles. This paper analyses archival records including journals, books, documents such as the SEI Deming prize-winning submission of 1962 and private letters sent by Benzaemon Inoue to the author Kenneth Hopper.

Methodology/Approach: This paper uses the analytically structured history approach. This methodology is used to interpret and document history as an analytic historical narrative and must describe such things as causation, events and concepts. In addition, the narrative must be framed in the context of the time when the events took place.

Findings: There are three main findings: firstly, that SEI first developed QC circles and won the 1962 Deming Prize based on QC circles; secondly that SEI used societal and cultural conditions in Japan to encourage participation by the workers in improving quality; and thirdly, that the most important method of participation for SEI was suggestion systems.

Research limitations/contributions: The primary data for this paper have been drawn from various archival records, which are for the most part not peer reviewed. Wherever possible, triangulation of evidence has been undertaken to mitigate the inherent risk of bias. The main contribution is an evaluation of the roles of Benzaemon Inoue and SEI in the early development of QC circles and total quality management (TQM).

Originality/value: The originality of this paper lies in examining Benzaemon Inoue's and SEI's contribution to the development of QC circles. The importance in the history of quality management of their Deming Prize winning submission of 1962 has been underestimated.

Keywords: Quality Control, QC Circles, Sumitomo Electric, Business History

Introduction

Much of the development of the idea of quality control (QC) circles is generally attributed to Kaoru Ishikawa, a professor at Tokyo University who died in 1989 (Hindle, 2008) and the first company in Japan to introduce QC circles was thought to be the Nippon Wireless and Telegraph Company in 1962 (Adam, 1991; The Economist, 2009). However, this paper contends that much of the literature around the development of QC circles ignores the earlier contribution of Benzaemon Inoue and Sumitomo Electric Industries (SEI).

In 1920 the Japanese company Sumitomo Electric started operating as a subsidiary of Sumitomo Group and in 1939 it was renamed Sumitomo Electric Industries (SEI, 2018). This article argues that following the Second World War and, more specifically, during the period 1945-1962, SEI was instrumental in the development of QC circles (Ishikawa, 1985; Kondo, 1993). It also explains how QC circles were first documented in the SEI's winning submission to the 1962 Deming Prize (JUSE, 2015).

In the immediate post-WW2 period, Japanese products were of such poor quality that they could not be sold internationally. QC circles were fundamental in improving the quality of Japanese manufactured products, thereby boosting exports and earning much-needed income for the country (Ishikawa, 1985). This income enabled the Japanese economy to develop from devastation to become the second largest economy in the world within a relatively short period of time (Ishikawa, 1985; Kondo, 1993; Dahlgaard et al., 2008). The development of QC circles has been associated with initiatives undertaken by the Allied occupying force (Kondo, 1993). Amongst these initiatives were the Training Within Industry (TWI) programme, the Management Training Programme (MTP) and the less well known Civil Communications Sector (CCS) Training Programme (Hopper, 1985; Kondo, 1993). In addition, the visits of Deming (1986) and Juran (1978) are well documented (Kondo 1993; Dahlgaard et al., 2008).

SEI took part in all these initiatives because its factories had been severely damaged during the Second World War and it needed to rebuild to survive (Inoue 1982b; Manchester, 2008; Pilling,

2014). The leader in the TWI, MTP and CCS initiatives at SEI was Benzaemon Inoue. Inoue, who was born in Kyoto in 1906, graduated from the Electrical Department of Tokyo University in 1930 (Inoue, 1979b). He joined SEI as an electrical engineer in 1930, and by 1949 he was an assistant manager of the Osaka works (Inoue, 1979b). He stayed with the company until just after SEI won the Deming prize in 1962, and in 1963 he transferred to Sumitomo Rubber Industries (SRI) (Inoue, 1979b), where he subsequently became President, then Chairman and finally a counsellor to the company (Inoue, 1979b). It is his time at SEI, however, and the development of QC circles, which is important for this article.

SEI was willing to be involved in the CCS, TWI and MTP because the company believed Japan had lost the Second World War due to inefficient management practices. Specifically, Inoue claims in a 1980 letter to Kenneth Hopper that the Americans had two advantages over the Japanese: firstly, their knowledge of industrial management; and secondly, the fact that the American management methods, as taught in the CCS course, were systematised, which made them easy to teach and to learn (Inoue, 1980c). Inoue argues that systematisation needs the collaboration of academia and business, which is what led to the development of ‘scientific management’ (Kimball, 1913; Lansburgh, 1923; Alford, 1932).

In 1945, in an attempt to catch up with the Americans, SEI tried to implement the Taylor system (Taylor, 1903, 1911) by themselves (Inoue 1982b). They started by training all young employees based on scientific management principles, and in particular teaching them method improvement through time and motion study (Gilbreth and Gilbreth, 1919). Inoue states that one important adaption of the Taylor system was the introduction of suggestion systems (Inoue, 1982a). While suggestion systems were not part of Taylorism, they were an important element of the evolved version of scientific management (Ellis et al., 2017a).

While SEI were trying to implement Taylorism, the CCS section of the American occupying force was planning a course to improve the quality of communications equipment needed to rebuild the Japanese telecommunications industry. Inoue became a significant supporter of the course and implemented most of its contents at SEI (Hopper, 1985). He felt that the course was so significant, not only for SEI but for all Japanese businesses, that he later called this CCS course the “light that illuminated everything” (Inoue, 1982b; Hopper and Hopper, 2009). The

course was a significantly evolved version of Taylor's scientific management (Alford, 1932; Ellis et al., 2017b).

After the Americans left Japan in 1951, Inoue had the CCS course translated into Japanese and, together with a manager from Mitsubishi Electric, Takeo Kato, presented the course to several hundred Japanese companies (Inoue, 1982b). By 1962 Inoue had become general manager of SEI and was responsible for SEI's winning submission to the Deming Prize. That same year is significant, as 1962 is credited by several writers as the start of total quality management (TQM) (Ishikawa, 1985; Kondo, 1993; Dahlgaard et al., 2008).

The events leading up to 1962 are discussed in a series of letters between Inoue and the author Kenneth Hopper (Hopper and Hopper, 2009). Hopper was introduced to Inoue through a meeting in New York arranged by the management consultant Peter Drucker. Drucker introduced Hopper to Charles Protzman, one of the authors of the CCS training course, and Takeo Kato, the senior leader in Mitsubishi Electric who, with Inoue, had trained Japanese companies in the CCS course (Inoue 1982b). Through Protzman and Kato, Hopper was introduced to Inoue. The correspondence between Inoue and Hopper starts in early 1979 and continues to 1985, with most letters being exchanged between 1979 and 1982. The letters from Inoue are translated from Japanese, by his secretary Miss Nomura but also by managers at Sumitomo Rubber Industries (SRI) in New York and Los Angeles.

The main purpose of this study is to analyse the Inoue letters. The article is structured to support its aims, as follows: after this introduction, there is a short section on the methods used. Next is a section on the CCS course and discussion of the influence of scientific management. The following section describes the elements present in SEI which supported the development of QC circles. These elements are derived from Inoue's letters and include a discussion on the nature of Japanese society, which Inoue credits as an enabler of QC circles. A discussion follows on how SEI applied for and won the 1962 Deming Prize. Finally, there is a section on the findings and limitations of this study.

Methods

This paper uses as its sources archival data in the form of journals and books written at the time of events, together with personal letters and pictures sent between Inoue and Hopper. This article is written as an analytically structured historical narrative (Rowlinson et al., 2001), meaning that the researcher has analysed the source documents and constructed the narrative to include context, events, causation and the actions of the actors themselves as revealed in those documents. As with any personal correspondence, a researcher must be aware of bias on the side of the writers, here in particular Inoue and Hopper. A challenge in the research was that some of the documents referred to in the correspondence have been lost and so the historical record is incomplete. While historians allow for educated guesses in such instances (Arnold, 2000), in this article, the authors have only described events for which the historical record is complete and, wherever possible, can be triangulated.

Some of the documents are only available in Japanese, for example, the SEI submission which was a 38-page document (SEI, 1962). In addition, this document was written in an old style of Japanese, not the modern language. These documents have been professionally translated into English by a Japanese translation company, based in Tokyo, Japan.

The CCS Course and the Influence of Scientific Management

When the Allied occupying force landed in Japan after WW2, the Japanese economy was devastated. Its 1946 industrial output was estimated to be less than 25% of the 1943 output (Sharpe, 2004), and 75% to 85% of manufacturing capacity for communications equipment had been destroyed (Protzman, 1950). More specifically, Inoue states that most SEI factories had been lost and the number of employees had fallen from 15,000 before the war to just 5,000 post-war (Inoue, 1982b). The American occupying force needed to communicate with the people of Japan, and hence it became a priority to re-establish the communications which had been destroyed (Hopper, 1985).

Hopper and Hopper (2009) describe how the US Army Signal Corps, under MacArthur's command, created the CCS. The CCS team, led by Frank Polkinghorn, comprised civilian

engineers mostly on loan from Bell Labs and its subsidiaries, although it also included Homer Sarasohn, a radio engineer from Massachusetts Institute of Technology (MIT) and Charles Protzman, a manufacturing expert who worked for Western Electric (Fisher, 2009). By the end of 1948, the CCS team was assembled, but there was no directive to actively help improve Japanese companies. In 1949 Homer Sarasohn went to MacArthur and requested a change in the CCS mandate to one of pro-active support for the development of Japanese manufacturing in the communications industry (Hopper, 1985; Ghappelburg, 1986). With approval from MacArthur, Sarasohn and Protzman spent two and a half months writing a training course on modern US management methods for Japanese managers in electronics manufacturing companies (Hopper 1982, 1985; Hopper and Hopper, 2009). The result was *The Fundamentals of Industrial Management* (Sarasohn and Protzman, 1949) which became known as the CCS training course. The training course, which was based on a significantly evolved version of the 'scientific management' approach, was presented twice by the Americans (Hopper and Hopper, 2009; Ellis et al., 2017b).

Hopper, in their exchange of letters, asked Inoue several times for his impressions of the CCS course (Hopper, 1979a, 1979b, 1979c). Inoue replied that he considered the course to be the most important seminar for Japanese management at that time, suggesting it was the first time they had been taught the principles of management (Inoue, 1979a). This statement is backed up by Morris-Suzuki (1994), although contradicted by Wada (1995) and Tsutsui (1998).

Despite Inoue's enthusiasm for the CCS course, he felt that the wrong audience was present for the quality training aspect of it (Inoue, 1980f). The CCS course was for company presidents and no others were allowed to attend (Inoue, 1980f). Inoue felt that this was a mistake and more technical staff should have been allowed to attend the quality training. He further believed that Deming and Juran had a bigger impact on improving quality in Japan, as they trained the correct people in the organisation (Inoue, 1980f). He confirmed that NEC was being trained in QC methods in 1948, (by the CCS engineer Magill) before the CCS course (Protzman, 1950; Wada, 1994). Inoue met with the general manager of NEC, Koji Kobayashi, and then asked one of his engineers to study QC methods, but by the time of the CCS course he was already aware of statistical quality methods, if not an expert (Inoue, 1982c).

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Inoue felt strongly about the importance of the CCS course. He gave approximately 250 CCS lectures himself, and was chairman of the Osaka CCS committee for 20 years (Inoue, 1981b). In 1982 he noted that the CCS course brought all the elements of management together and was a “light that illuminated everything”.

The CCS course was not the only American initiative accepted by SEI; Inoue describes how the company also readily absorbed the TWI and MTP programmes (Inoue, 1982c). Inoue considers why the TWI and MTP programmes continued while the CCS declined., and observes that the TWI was for foremen, the MTP for the middle managers and the CCS for senior managers. As a senior management course, the CCS seminar was limited to the internal management of the company and Inoue suggests that, with increased globalisation, the senior managers’ focus shifted to issues external to the company while internal responsibilities were transferred to middle management (Inoue, 1980c). The importance of the CCS course can be inferred from Inoue’s replies to Hopper’s letters and specifically his perception that CCS “illuminated everything”. Receiving the training, however, was only one part. Certain elements needed to be in place to ensure that the training was absorbed and implemented. The next section describes these elements and their importance in developing QC circles together with the training given by the Americans.

SEI Elements and the Development of QC Circles

From analysing the letters Inoue sent to Hopper, it is possible to identify the key elements that Inoue believed supported the development of QC circles at SEI. These elements were interlinked and came together at the right time in SEI. The overriding element was the way in which Japanese society developed from a feudal society to an industrial one. The legacy of the Tokugawa Shogun (1603-1868) (Frédéric, 2002) involved three specific elements: firstly, the *daimyō* (feudal lords) structure which, in Inoue’s opinion, was similar to the line and staff organisational structure, which SEI used to great effect; secondly, the feeling of collectiveness or belonging within the industrial organisation and the consequent loyalty to the clan; and finally, the fraternal relationships developed in particular by the foremen with their subordinates at SEI.

While all these elements existed in SEI, without a leader in place to take advantage of them, the advances in QC might have taken longer or never even happened. Despite Inoue's modesty, in a 1980 letter to Hopper the chairman of the SEI board, I Sakamoto, describes his contribution to SEI as "a locomotive which pulled the company through that difficult time when everything had to be rebuilt from the war devastated industrial wasteland" (Sakamoto, 1980). These three main elements are now discussed further, starting with the transformation of Japanese society from a feudal society to an industrial society.

The Tokugawa Shogun legacy and its relation to a line and staff organisational structure

For the transformation of Japanese society from feudalism, we have a description from Hall (1965) and Noda (1970). They describe the roles in society during the Tokugawa Shogun as: clan chiefs, samurai, farmers, craftsmen and merchants, the chiefs being the *daimyō*. As Japan industrialised, the *daimyō* remained as governors. The samurai became administrative and government employees and the craftsmen and merchants became the factory managers and workers (Noda, 1970). The farmers were the only group that remained the same as during the Tokugawa Shogun. Noda further notes that the most important element that did not change was the affinity to the clan, which became an affinity to the company (Noda, 1970). In 1981, in an exchange of letters with Hopper, Inoue suggests that the *daimyō* structure was similar to the 'line and staff' organisation structure which grew out of the scientific management movement (Emerson, 1912). In this structure, the line is self-directing, but within the constraints of the general goals and policies of the company (Sarasohn and Protzman, 1949). The staff function provides specialist assistance to the line when needed.

Two books describing line and staff organisation were translated into Japanese after 1950. The first was *Top Management Organization and Control* by Holden et al. (1941) and the second was *The Management Guide* (Hall, 1948). The latter was actually the management guide of the Standard Oil Company and describes itself as an organisational and administrative aid (Hall, 1948). Inoue argues the *daimyō* structure was effectively line and staff, with the *daimyō* running a self-directing line structure of samurai, merchants, craftsmen and farmers (Inoue, 1980f). The Tokugawa Shogun legacy thus meant that workers were used to a line and staff structure, it was normal to be part of a clan and SEI was able to get workers to participate

willingly in making quality and process improvements. SEI being the clan, this collective element is discussed next.

Inoue's view on collectiveness

In response to a question raised by Hopper relating to an article by Nobuo Noba (1970), Inoue describes an advantage of Japanese management as collectiveness within an organisation and a sense of rivalry towards other companies (Inoue, 1980a). Inoue's view is also supported by Winsbury (1970) and Takamiya (1970). Inoue does not explicitly refer to the Japanese concept of *'uchi/soto'*, which can be translated as 'inside/outside the group' and concerns the rivalry with other companies, but it would be hard not to apply this interpretation given its importance in Japanese culture (Maynard, 1997). The significance of collectiveness is endorsed by Abegglen (1958), Winsbury (1970) and Noda (1970), and is extended by Inoue with an example which demonstrates competition between plants in implementing QC circles and suggestion systems. This is something Inoue describes as a common Japanese motivation (Inoue, 1980a), using the idea to explain the relationship in SEI between foreman and subordinate, which is described in the next section. This relationship becomes very important in the implementation of QC circles, but the critical element was moving to a line and staff organisation.

The role of the foreman in SEI

In support of his idea of collectiveness, Inoue maintains that in the previous 50 years (1930–1980) human relations in Japanese plants have not changed unduly (Inoue, 1980b). He suggests that the role of the foreman has modified from being someone who simply gives orders to the workers to someone who actively works alongside and supports the workers in making improvements in the business. However, the idea of the foreman as a big brother within SEI has not changed (Inoue, 1980b). Abegglen describes this foreman / subordinate relationship as paternal, a father / child relationship where the foreman feels responsible for his workers inside and outside of work (Abegglen, 1958). He further goes on to explain the mutuality of the arrangement between company, management, foreman and subordinates, consistent with the concept of collectiveness. There were, however, changes to the tasks assigned to the foreman

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which facilitated the improvement process. Inoue explains the role of the foreman before 1951 that comprised:

- a) Personnel administration of his subordinates
- b) Process control
- c) Manufacturing technology
- d) Maintenance and improvement of machinery

Inoue states that after 1951, staff departments took over a, b, and d. This change happened as SEI changed its entire organisational structure to follow the line and staff method (Holden et al., 1941). Inoue also confirms that after the CCS he believes many companies in Japan adopted the line and staff approach (Inoue, 1980f). Inoue also personally implemented it in the main company, Sumitomo Metals (Inoue, 1980f). Critically, the free time released by introducing line and staff was used by the foremen to implement TWI and quality control (Inoue, 1980e). In addition, the foremen now became involved in defining production standards, which led to greater acceptance and improved standards (Inoue, 1980e).

The training for the foremen in QC methods included learning how to prepare process control charts. The foremen in turn gave quality training to the line every morning for five minutes, including training the workers to identify bad parts themselves (Inoue, 1980e). Inoue describes the remarkable results which were achieved in this way (Inoue 1980e). He states that the foremen, after being trained, then started to improve processes and the production methods by themselves and the yields increased significantly (Inoue 1980e). By drawing on the clan mentality and the line and staff organisation structure, SEI was able to encourage participation by the foremen and line employees in improving production processes. The teams were for the most part self-directing within the constraints of the company policies.

The change was only possible because it engaged everyone in the company from the top management downwards. This engagement derived from the fact that these quality initiatives were part of company policy (Inoue, 1980e). Even though the process of policy deployment might indicate a top-down management approach, Inoue argues that it was actually the opposite, as the line was empowered within the policy to submit suggestions to the top management for approval (Inoue, 1980f). By describing how policy influenced execution,

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Inoue alludes to a process that became known as ‘catch-ball’ (Tennent and Roberts, 2001; Hines et al., 2008). He implies that many of these suggestions cost little or no investment, so approval was given, even to experiment (Inoue, 1980f). In another example of the remarkable achievement at SEI, Inoue notes that only basic QC training was given, but the foremen took it upon themselves to further develop and implement QC circles (Inoue, 1981a). Inoue goes on to quantify the improvement, stating that while the training costs millions of dollars, the return was hundreds of millions of dollars (Inoue 1980e).

The 1962 Deming Prize

Professor Kondo, in his 1993 book, gives a good description of how the Deming Prize is awarded and its structure (Kondo, 1993). In 1962 SEI won the Application Prize, for which the judges look for quality control that is present across the entire company and not just in the manufacturing department (Kondo, 1993).

In a conversation and e-mail exchange with the author, Hopper described how he found out about the importance of the 1962 SEI Deming Prize submission. Inoue invited Hopper to visit him in Japan during September and October 1979 (Inoue, 1979b). The trip was to include several factory visits, accompanied by Inoue, but unfortunately, Inoue was taken ill soon after Hopper arrived in Japan and could not accompany Hopper on his tour. However, he asked Professor Yoshio Kondo to meet with Hopper and on September 14th 1979 they met at Hopper’s hotel. Professor Kondo described to Hopper the importance of the 1962 SEI Deming Prize-winning entry and referred to it as “epoch making”. Professor Kondo, who became an eminent figure in the quality movement, was also one of the 1962 Deming Prize judges and described how SEI had encouraged participation right through the organisation, introduced QC circles and made quality the responsibility of the line.

Once Inoue recovered and was able to communicate with Hopper again, the question of QC circles became the key topic (Inoue, 1980, a,b,c,d,e). Inoue reiterated the importance of fraternity in the organisation, which developed through the idea of a job for life and sharing in the good and bad times, and suggested that this fraternal loyalty to the company was critical for developing QC circles (Inoue, 1980c). He further states that in 1947 SEI started a ‘Job Improvement Prize System for Workers’ (Inoue, 1980c). At first, the prize went to individuals,

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but over time the number of group applications increased. Inoue observes that this suggestion system resulted in the birth of QC circles in 1962 (Inoue 1980c). Inoue believes that the implementation of the suggestion system was a critical element in the development of QC circles (Inoue, 1982a). He furthermore states that SEI was the first company in Japan, to his knowledge, to implement suggestion systems (Inoue, 1982a).

SEI's journey to the Deming Prize began in 1956 when Inoue took up the position as Senior Managing Director (Inoue, 1980c). After consultation with the company president, it was decided to apply for the Prize. The Deming Prize examiners, Professors Kondo and Ohba, wanted to see a company-wide implementation of quality that stretched beyond the manufacturing department and so Inoue took the overall lead for the Deming Prize submission. He adopted the phrase "Company-wide QC as a whole" for the Deming Prize Initiative (Inoue, 1980c).

The critical changes that Inoue made were based on a suggestion from an unnamed colleague, that the foremen should be taught the elementary techniques of QC and then they should lead their teams to improve, as described above (Inoue 1980c). This was a fundamental change from the typical view that QC should be done by a specific quality department. Inoue believed he was taking a risk as he felt that Professors Kondo and Ohba held the traditional western view of the importance of a quality control department (Inoue, 1980c). However, in the end Professor Kondo supported Inoue (Kondo, 1993).

Of the 38 pages in the SEI submission for the Deming Prize, approximately 30 are devoted to explaining how SEI started with a suggestion system and how this evolved into QC and QC circles and how QC became part of company policy and philosophy (SEI, 1962). One table from the document gives an idea of the success of the suggestion system.

Figure 1 - No. of Improvement Proposals per Factory Sumitomo Electric 1959–1961

Factory	1959	1960	1961
Osaka	1,089	1,091	1,668

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Itami	230	626	571
Nagoya	151	83	126
Yokohama	-	-	-
Total	1,470	1,800	2,365

(SEI, 1962)

Note: The Yokohama plant only opened in May 1961, so no data was available. The purpose of the table was to indicate that the number of suggestions almost doubled between 1959 and 1961.

Inoue himself provides an additional success measure, noting that by 1962 there were about 200 QC circles in operation in SEI (Inoue, 1980e). To further illustrate how successful the implementation of QC circles was, Inoue states there were about 200 foremen, so each foreman had implemented a QC circle for his section (Inoue, 1980e). Professors Kondo and Ohba believed that the SEI submission was exceptional, and awarded SEI the Prize.

Subsequently, QC circles took hold: after 1962, they were promoted by the JUSE throughout Japan and later spread across the world (Ishikawa, 1985; Kondo, 1993). This article has attempted to demonstrate that SEI and Benzaemon Inoue were major contributors in that process.

Findings and Limitations

When a possible gap in the history of an important subject like QC circles became apparent to researchers, there was a degree of scepticism. Why was there so little evidence of SEI's contribution? However, further research seems to suggest that while Inoue tried to communicate the importance of that contribution through Hopper, Inoue's own modesty and Hopper's personal challenges prevented the story being told until now. However, Inoue felt it so important that he asked one of the judges of the 1962 prize to meet with Hopper in his absence. On the basis of Inoue's correspondence with Hopper, this article asserts that SEI had begun to use QC circles in advance of other Japanese companies. This is confirmed by Professor Kondo and supported by evidence from Inoue and within the SEI 1962 Deming Prize

winning submission. While Inoue acknowledged the influence of the American post-WW2 reconstruction initiatives and in particular the CCS course, this article has demonstrated that SEI used societal conditions in Japanese businesses to develop quality control beyond the American teaching.

The second finding concerns how SEI started QC circles. Based on the letters written by Inoue to Hopper, this article suggests that SEI utilised the concept of collectiveness prevalent in Japanese culture to encourage engagement and participation in production process improvement and in particular improvement in quality. This collectiveness was particularly important to the foreman and his subordinates and has been described as a fraternal or even paternal relationship. In addition, SEI changed the organisational structure, which freed up the foremen. They then trained the foremen in TWI and QC methods, including process charts.

The third finding is that SEI used suggestion systems to encourage participation. These systems are associated with Lean, Toyota and post-WW2 Japan, but their history is much older (Cusumano, 1985; Womack et al., 1990; Rother, 2009). Morris-Suzuki and Tsutsui state that suggestion systems were introduced as part of an evolved Taylorism that came to Japan in the 1920s (Morris-Suzuki, 1994; Tsutsui, 1998). Suggestion systems are, however, older still, having been documented as successfully implemented in the National Cash Register Company (NCR) in the United States in the late 1890s (Ellis et al., 2017a). It is therefore less surprising that SEI introduced suggestion systems but, when implemented in conjunction with a line and staff organisation structure and a company collectiveness that encouraged participation, the result was QC circles. The results obtained were astonishing and began the concept of TQM, which ultimately became a world-wide movement. Despite Inoue's contribution, he remained a humble man; he himself did not believe he had made a contribution to Japanese society and preferred to be recognised for his work as an electrical engineer (Inoue, 1980d). He even asked not be named in a book outlining his contribution if such a book were published during his lifetime (Inoue, 1980d).

As with all research there are limitations to be considered. These events were described from Inoue's point of view, and as Inoue is not alive, interpretation by the authors was required. In addition, the historical record is incomplete, as letters and supporting documents which are referred to are no longer available. Lastly, documents including the 1962 Deming Prize entry

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have been translated and the authors are unable to verify the accuracy, although all steps were taken to ensure a reliable translation.

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