Scientific Management, the US Civil Communications Section (CCS) Training System and Their Impacts on Contemporary Management Thinking

Gery Ellis

Doctoral Researcher, Operational Excellence
Business School, University of Buckingham, Hunter St, Buckingham, UK. MK18 1EG
Email: 1600553@buckingham.ac.uk

Professor Pauline Found

Professor of Lean Operations Management
Business School, University of Buckingham, Hunter St, Buckingham, UK. MK18 1EG
Email: pauline.found@buckingham.ac.uk

Dr Maneesh Kumar

Reader in Logistics and Operations Management
Cardiff Business School, Cardiff University, CF10 3EU
Email : KumarM8@cardiff.ac.uk

Dr Jan Harwell

Senior Lecturer in Business and Management
Department of Business and Management, Oxford Brookes University, Wheatley, Oxford, OX33 1HX
Email: jharwell@brookes.ac.uk

Abstract

Purpose: The purpose of this paper is to explore the impact of Scientific Management on General Douglas MacArthur's Civil Communications Section (CCS) training system and subsequently on contemporary management thinking.

Design/Methodology/Approach: The design and methodology of this paper is to synthesise archival twentieth-century literature on Scientific Management and the CCS course using a combination of business history and social science methods. The approach taken was interpretative and the paper narrative in style.

Findings: The research demonstrates that very advanced theories coming from Taylorism and Scientific Management would not be out of place in operations management today. While Taylorism has generally been vilified, this research shows that there is enough evidence to suggest that some of the theoretical underpinnings of Scientific Management are still being used today in theories and concepts that underpin Quality, Lean, Agile and Operational Excellence, and will be expanded to explain the development of Industry 4.0.

Research limitations/implications: While the CCS course is mostly forgotten and under-researched outside of Japan, the importance of the course to the Japanese and to the industrialisation of the Japanese electronics industry is acknowledged (Goto, 1999). The contribution of this research is to challenge some of the accepted views in business history on the origins of Japanese manufacturing. Limitations???

Originality/value: This paper provides a comprehensive review of General Douglas MacArthur's Civil Communications Section (CCS) training system, its influencers and its impact. It contains previously unpublished archival material and insights from the original authors and commentators of that period.

Keywords: CCS, Lean Thinking, Scientific Management, Taylorism, Japanese Manufacturing

Paper Type: General Review

Introduction

In September 1945, Japan was not only a defeated country militarily but one where most manufacturing and industry had been destroyed. Industrial output in 1946 was less than 25% of that in 1943 (Sharpe, 2004). General Douglas MacArthur assumed command of the United States occupying force. His initial orders were:

1) To ensure that Japan will not again become a menace to the United States or to the peace and security of the world.
2) To bring about the eventual establishment of a peaceful and responsible government, which will respect the rights of other states and will support the objectives of the United States as reflected in the ideals and principles of the Charter of the United Nations. The United States desires that this government should conform as closely as may be to principles of self-government, but it is not the responsibility of the Allied Powers to impose upon Japan any form of government not supported by the freely expressed will of the people.

(United States Department of State, 1945, p. 423)

The challenges facing MacArthur were immense. Hopper and Hopper (2009) describe how the US Army Signal Corps, under MacArthur's command, created a Civil Communications Section (CCS) to re-establish and rebuild the communications infrastructure required by the US occupation forces to communicate (mainly instructions and orders) with the Japanese people. The CCS senior team, led by Frank Polkinghorn, comprised civilian engineers mostly on loan from the American Telephone and Telegraph Company (AT&T). Polkinghorn himself was from Bell Labs; the other main members of the team were Homer Sarasohn, a radio engineer from Raytheon and Charles Protzman, a manufacturing expert who worked for Western Electric, the manufacturing arm of AT&T. Sarasohn, in an interview with Fisher (2009), recalled how he was assigned "to assist Japanese communications equipment manufacturing industry to become a major contributor to a revived national economy" (Fisher, 2009, pp. 5-6).

With the team in place at the end of 1948, there was no directive to actively help improve Japanese companies, so Sarasohn went to MacArthur and requested a change in the mandate of the CCS to one of pro-active support for development of Japanese manufacturing within the telecommunications industry. Hopper (1985), based on an interview with Sarasohn, describes the meeting in detail, which resulted in a positive response for the CCS. Hopper (1985) further describes how Sarasohn and Protzman retired to a hotel in Osaka for two and a half months to write a training course for Japanese managers in the electronics manufacturing companies on modern US management methods (Hopper 1982, 1985; Hopper and Hopper, 2009; Ghappelburg, 1986). The result was 'The Fundamentals of Industrial Management' (Sarasohn and Protzman, 1949), which became known as the CCS Training Manual.

There are four main sections of the manual:

- Policy
- Organisation
- Controls
- Operations

Each section is broken down further and illustrates the importance placed by the CCS team on certain methods. The key sections are shown in Table 1.

Table 1. Sections of the CCS Manual (1949)

Policy	Organisation	Control	Operations
• Objective of the Enterprise • Administrative Policy • Management Policy • Leadership and Policy Enforcement	• Zones of Management • Design of Organisation • Forms of Organisation • Functions necessary to a Company o Engineering o Finance o Manufacturing o Marketing o Industrial Relations	• Types of Control • Application of Organizational Controls • Quality Control • Application of Cost Controls • Application of Supervising Control	• Organisation for Operations • Co-ordination within Operations

The nature of the topics reflects the audience. The attendees were primarily the chief executives of the organisation (Hopper, 1985). The CCS team believed leadership and implementing policies and controls to be the biggest gap in the skills of the chief executives. This view developed during many field visits to Japanese electronics manufacturers during the period 1946-1949 (Ghappelburg, 1986).

The course was presented twice in English (with a Japanese translator) – once in Tokyo in 1949 and once in Osaka in 1950 (Hopper, 1985). By 1950, the occupation phase of the post-war time in Japan was coming to an end and the CCS was being disbanded and personnel being returned to their companies, although Protzman did visit Japan again later in the 1950s (Hopper, 1985; Manchester, 2008). Despite only being presented twice in English, the course is credited by Benzaemon Inoue, an attendee of both courses and managing director of Sumitomo Electric, as kick-starting Japanese industrialisation (Hopper, 1982; 1985; Hopper and Hopper, 2009). Benzaemon Inoue's contribution to the spread of the CCS after the Americans left cannot be underestimated. Benzaemon Inoue took it upon himself to adapt the CCS course further to suit Japanese requirements (particularly concerning wages and bonuses (Goto, 1999)) and took the course around all of Japan over a ten-year period. Unfortunately, the researcher has been unable to find a list of all the companies Inoue trained using the CCS course material as much of the JUSE archive was destroyed during the 1990s, but these courses were not limited to the electronics industry (Goto, 1999).

The importance of the CCS course to researchers can be summarised as follows; firstly, outside of Japan the course is under-researched and yet key attendees of the course such as Benzaemon Inoue (a senior leader in Sumitomo Electric) credit the CCS directly with the industrialisation of Japan's electronics industry (Hopper, 1985); secondly, the rise of Japanese electronics manufacturers is well known but how they came to dominate is less well known; lastly, the course was offered by Japan Industrial and Vocational Training

Association, (JIVTA) regularly until 1972 and thereafter on an ad hoc basis until 1985 – this indicates its importance in training Japanese managers.

This paper discusses the origins and influences of US management theories on the CCS training manual and the impact that Scientific Management and the CCS course has had on contemporary management in Japan and the West.

Methodology

This paper merges methodologies from business history and social science. There has been much debate amongst business historians and organisational theorists on the advantages of integrating social science theories into business history (Scranton and Fridenson, 2013; Bucheli and Wadhwani, 2014; Rowlinson *et al*, 2014; Decker *et al*, 2015; Maclean *et al,* 2017). While neither group wants to suggest that this is an easy task, several articles have offered frameworks for doing so. This paper in particular uses the framework of Rowlinson et al. (2014) for categorising the type of paper and the importance on the content. Rowlinson et al. (2014) refer to dualisms of narrative and analytics as the two ways in which a business history article may be written. Within this dualism, they describe four sub-divisions: two narratives (corporate history and analytically structured history) and two analytics (serial history and ethnographic history). This paper is analytically structured, which means that after analysing the historical data, the written narrative must include examples of concepts, events and causation and context. This differs from a corporate history narrative, which is defined by Rowlinson et al. (2014) as corporate story-telling. In this article, Lean can be considered a concept and Scientific Management a theory.

The primary data for this paper comes from management journals and books written at the time or close to the time of the events in question. These papers, books and journals were found online through searches of archival storage entities such as The Haathi Trust, archive.org and Google Books. Secondary data comes from journals written after the events took place. The analysis itself takes the form of searching for key words, which could also be authors such as “Alford” and then snowballing through references to find relevant information; that is then cross-referenced as much as possible to other sources.

Yates (2015, p.279) compares historical and non-historical research methodologies. The main differences between historical and non-historical research can be extrapolated as: the emphasis on historical context, temporality (history has a future as well as a past) and the emphasis on static evidence such as documents and artefacts. Yates’ historical methods aligns well with Rowlinson *et al.’s* (2014) definition of analytically structured history.

Background Literature

The major theoretical underpinning of the CCS course is Scientific Management (Taylor, 1903, 1912). The evidence that Sarasohn and Protzman were heavily influenced by Scientific Management comes from several sources (Wood, 1989; Hopper, 1982; Tsutsui 1996, 2001) although the CCS course was based on a more humanised form of Scientific Management (Tsutsui 1996; 2001), which was being advocated as early as 1913 by Dexter Kimball (1913) and Henry Gantt (1916, 1919).

Scientific Management has been discussed and written about extensively. A search of Google Scholar using the words "Taylor – Scientific Management" reveals over 2,000,000 articles. The original contribution that this paper adds to the literature is its acknowledgement of the influence of Leon Pratt Alford on the development of a more humanised form of Scientific Management and Scientific Management's influence on the CCS team. Alford's book "The Principles of Industrial Management" (Alford, 1940) was a key source and heavily influenced the production of CCS materials.

What is less known is that on behalf of the American Society of Mechanical Engineers (ASME), Alford produced four reports over a thirty-year period that charted the progress of Scientific Management from 1912 until 1932 (ASME, 1912, Alford, 1919, 1922, 1932). Alford was considered a senior figure in the ASME organisation (Alford, 1932, p.7) otherwise he would not have been appointed to produce such important documents. These four reports together with his book (Alford, 1941) describe the development of Scientific Management up until the Second World War. Sarasohn and Protzman, both engineers, were likely to be influenced by these ASME promoted materials.

A review of the four reports (ASME, 1912, Alford, 1919, 1922, 1932) shows that Alford turned from being an initial sceptic to an influencer and then to a strong advocate of a more humanised form of Scientific Management. As described by Alford, the divergence of Taylorism and what came to be known as Scientific Management, and the subsequent development and evolution of Scientific management, represent two key themes of this paper. A timeline of key events leading up to the publication of the CCS manual is shown in Figure 1.

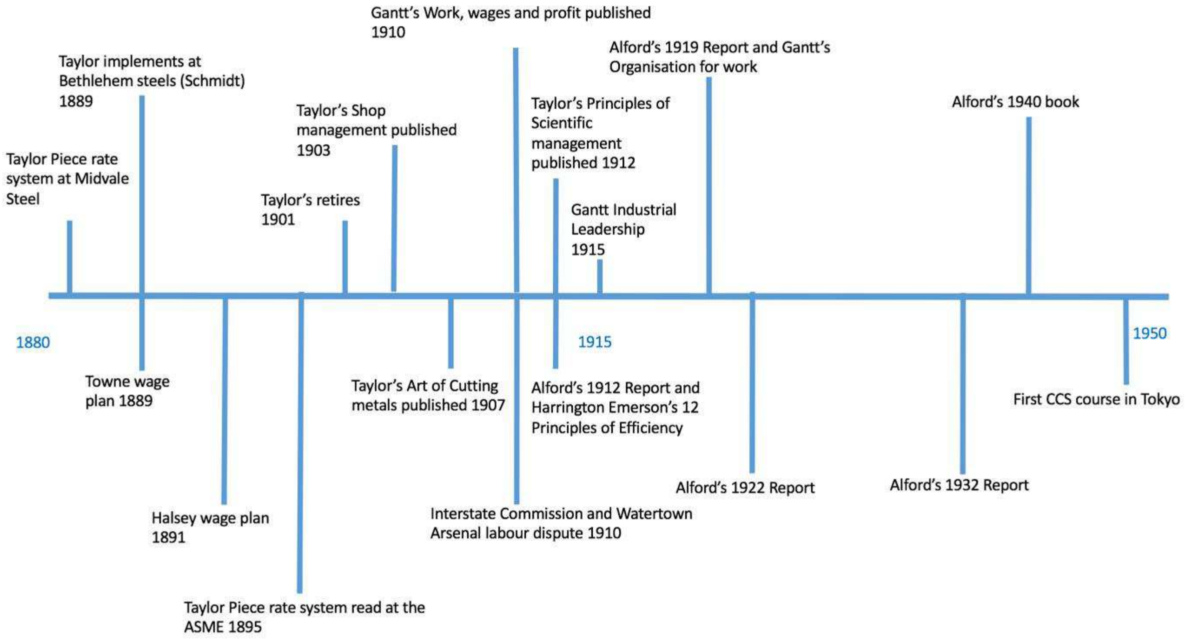

Figure 1. Timeline of Key Events between 1882 and 1949 leading up to the publication of the CCS Manual

Scientific Management

The origins of Scientific Management stem from Frederick Winslow Taylor's perception of workers not performing to their potential or "soldiering" as he calls it (Taylor, 1903, 1911). This elicited a desire to change when he found himself "soldiering" Drury, 1915).

Frederick Winslow Taylor, one of the founders of Scientific Management, was born into a wealthy Puritan family in Germantown, Philadelphia. He was prepared for Harvard but impaired eye sight and the depression of the 1870s led him to take a job as a labourer at the Midvale Steel Company despite his engineering apprenticeship. He was rapidly promoted at Midvale Steel but this experience as a labourer gave him first-hand experience of "soldiering". To detect if a man was "soldiering", Taylor needed to understand accurately what a man was capable of on his own and when using specific machines or tools. To determine this, he needed to be sure that the machines and man were operating at their true capacity. Taylor needed well-maintained machines and un-fatigued men. He felt that if a man was working at his true capacity, or even above, he should be paid a higher wage as an incentive to work at this speed. The first problem then became in determining what each worker's capacity was and how to calculate it. The second problem was how to calculate the wages to match the capacity. Working with Taylor at Midvale, and later Bethlehem Steel, was Henry Laurence Gantt who was born in Calvert County, Maryland. He also came from a wealthy family. He graduated with a master's degree in mechanical engineering from the same school (Steven's Institute) as Taylor (Alford, 1934).

There were several initiatives at that time to match productivity with wages. The Taylor piece rate system (Taylor, 1895) was argued by Taylor as being started in 1882, ahead of the Towne (1889) and Halsey (1891) plans. Additionally, Henry Gantt (1910) and Harrington Emerson (1912) were also developing wage systems. The reason for needing a new wage scheme was because the piece-rate system was unfair to workers and dis-incentivised productivity. In the case of wages, it appears that Taylor had the best of intentions (Taylor 1903), although other aspects of Scientific Management opened Taylor up to criticism. His view that only management could train workers and that all expertise should be in the hands of management was already being challenged during the early implementations of Scientific Management and in the 1912 and 1919 reports (ASME, 1912, Alford 1919). Gantt also realised that this was wrong and changed it in his implementations (Alford, 1934). Emerson did not support Taylor's view and stated that an organisational approach of line and staff where the "line" should be left to manage and to call for expert assistance from the "staff" only when needed is a better way (Emerson, 1912). As early as the report of 1919, it had been realised that more worker participation was needed to successfully implement Scientific Management (Alford,1919).

Discussion

The evidence above tells us that even before Taylor's death in 1915, the original concepts of Taylorism and Scientific Management were diverging, as others, such as Gantt and Emerson, adapted and advanced his theory. Alford provides an insight into this divergence in Scientific Management not through the typical Taylor lens of separating planning and execution but separating the welfare of the worker and process improvements to eliminate waste using the Scientific Method (Alford, 1919, 1922, 1932). If the two streams of worker welfare and process improvement run side by side then, this paper proposes that worker participation provides the bridge to bring the two streams together. The Alford papers from 1919 onwards and the discussions in each paper from 1919 onwards are generally split between improvements in process and worker welfare but there is little discussion of active participation by the workers in solving problems on the line (Alford, 1919, 1922, 1932). For this subject, further reading is required to find examples. Authors during the 1920s and 1930s who were involved in actively encouraging worker participation included Lillian Gilbreth (1914), Whiting Williams (Williams, 1920, Wren, 1987) and Allan Mogensen (1932).

The concept of worker participation is, however, just one of several themes in the CCS course manual that can be traced back through Scientific Management and forward into the quality movement, Lean, Agile and Industry 4.0. The other key themes in the CCS course manual with their roots in Scientific Management are: the elimination of waste, statistical process control of quality, business problem-solving using Scientific Methods, inventory control and minimising stocks and organisational improvements. The one area in the CCS course that still requires additional research is the development of policy and policy deployment. Policy development and deployment is prominent in the CCS course and Toyota famously advanced policy deployment and named it "Hoshin Kanri", but its roots in Scientific Management are less clear. Alford (1924, 1934) credits Gantt (1916) with policy development but Gantt devotes only a few sentences to the subject. Yet by 1949 and the coming of the CCS course, Sarasohn and Protzman described and devoted twelve full pages to policy development and deployment and additionally made it section one of the manual (Sarasohn and Protzman, 1949).

Alford's four papers (ASME, 1912, Alford, 1919, 1922, 1932) provide an insight into the development and subsequence divergence of Taylorism and Scientific Management over a thirty-year period. As early as 1922, Alford (1922) was writing that Taylorism had been superseded, and that this divergence continued up until the time of the CCS. Scientific Management was implemented in such companies as AT&T and Western Electric (Hopper and Hopper, 2009, Wren, 1987) and so the CCS team members would have been exposed to Scientific Management thinking before they were seconded by the United States Army to the CCS and explains why Scientific Management had such an influence on the course materials (Hopper, 1986; Tsutsui, 2001).

Findings

Sarasohn and Protzman were tasked by General MacArthur to teach certain companies in the Japanese electronics industry the best management methods available in the United States at that time (Hopper and Hopper, 2009). Sarasohn and Protzman had limited time (three months) to produce what became a 400-page course, and to tailor it to their audience (Ghappelburg, 1986). The material Sarasohn and Protzman used came primarily from five textbooks written by people Sarasohn and Protzman would have known, including Alford (1941) and Kimball (1913). Kimball was a Professor at Cornell University. Another textbook used in the CCS course called "Top Management Organization and Control" (Holden *et al*, 1941) became so popular that it was translated into Japanese. Paul Holden was a Professor at Berkeley University. The CCS team therefore did not have the time to develop new material so a key finding is that the CCS course contained material from authors they considered creditable and reflective of their own views on management; these books have as their basis Scientific Management theory.

The second finding is the key themes of the CCS course with roots in Scientific Management, namely; worker participation, the elimination of waste, statistical process control of quality, business problem solving using Scientific Methods, inventory control and minimising stocks and organisational improvements including organising for control. Policy development is also included as it appears in the CCS manual. Policy deployment is credited by Alford to Gannt (Alford, 1919). These themes can be applied to subsequent improvement methodologies indicating the influence of Scientific Management even today. It is perhaps unsurprising that the CCS should be influenced by Scientific Management but it was not clear that Scientific Management would become the standard management methodology when it first became widely known. Assocations such as the Manufacturers Association of the United States objected to Scientific Management due to the perceived costs of higher wages and actively fought against its implementation (Merkle, 1980; Kanigel, 2005).

Starting with the Quality movement, and any discussion needs to consider Deming and Juran. Deming was aware of the CCS not least because the CCS had requested an expert on SPC and when Shewhart was not able to attend Shewhart personally recommended Deming (Deming,1986; Hopper and Hopper, 2009).

Deming states: *""Management in some companies in Japan observed in 1948 and 1949 that improvement of quality begets naturally and inevitably improvement of productivity. This observation came from the work of a number of Japanese engineers who studied literature on quality control supplied by engineers from the Bell Laboratories then working on General MacArthur's staff. ...."* (Deming 1986, p4).

Deming's now famous Mount Hakone lectures expanded Sarasohn's knowledge of SPC and gave the Japanese greater depth into the statistics behind SPC (Deming, 1986). Following on from Deming in 1954 Joseph Duran also gave a series of lectures in more practical applications of Qualiy Control (Kolesar, 2008). Within the advances made by the quality management we find the key elements of Scientific Management such worker participation, such as Quality Circles (Ishikawa, 1985), which became TQM, then ZQC, Statistical Process Control (SPC) of quality, and business problem-solving using the Shewhart cycle (Shewhart, 1931) and adapted by Deming to the PDCA cycle (Deming, 1986). For further informaiotn on the evolution of TQM and the Quality Movement see Dahlgaard-Park (2015).

Continuing with the Lean movement (Womack and Jones, 2003) and focussing on the Toyota Production System (TPS) (Ohno, 1988), the key elements of waste elimination, quality control, worker participation, inventory reduction, policy development and deployment and organising for control are all found in the TPS. How much direct exposure Ohno had to Scientific Management is debatable; however, Ohno's assistant Shingo Shigeo implemented Scientific Management methods at the Taipei Railway Company in 1930 and acknowledged the influence that Scientific Management and specifically Frank and Lillian Gilbreth had on his management methods (Shingo, 1988).

We find similar themes to Lean in Agile (Christopher and Towill, 2001). Agile is in many ways like Lean but differs in its approach of providing each customer with an individual experience. Whereas even with multiple option sets, Lean is still often regarded as a method of mass, or batch, production. Agile, however, is still underpinned by worker participation, the elimination of waste, quality control and inventory control but with less emphasis on reducing and more on a collaborative supply chain. To be agile, companies need to be responsive and flexible to meet customer requirement. This is not achievable if the company's policy deployment approach is not integrated from top to shop-floor level.

Finally, to Industry 4.0. This paper suggests that for Industry 4.0 to work, the following key elements from Scientific Management need to be in place: quality control, worker participation (albeit with more support from technology), inventory control and the optimisation of inventory, again with more help from integrated technology and the delegation of certain decisions to systems. Companies still need effective organisations for control (arguably more so when decisions are delegated to machines) and need effective policies and policy deployment to ensure that their people and Industry 4.0 systems all align to the goals of the organisation.

The research demonstrates that many of the theories that are relevant in Operations Management today were being implemented nearly 100 years ago (Fisher, 2009), and that a lot of these theories are based on Taylorism and Scientific Management. Whilst Taylorism has often been criticised, this research shows that there is enough evidence to suggest that, although poor implementations of motion and time studies certainly had a negative effect, some of the theoretical underpinnings of Scientific Management are still being used today in theories that underpin Quality, Lean, Agile and Operational Excellence and will be expanded to explain the development of Industry 4.0.

To reinforce the links between Scientific Management and other management methods including the CCS a summary of the findings is in Table 4 below.

Table 4 Summary of the influence of Scienfic Management on other management methods.

Mangement Methods / Elements of Scientific Managment	CCS	Quality Movement	Lean	Agile	Industry 4.0
The Scientific approach to problem solving	∇	∇	∇	∇	∇
Waste reduction	∇	∇	∇	∇	∇
Worker participation	∇	∇	∇	∇	∇
Reduced Inventories			∇		∇

SPC Quality Control	∇	∇	∇		
Policy Deployment	∇		∇	∇	∇

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