The Origin and Development of Firm Management

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Abstract: This paper examines the historical origin and diffusion of management practices. Despite their centrality in modern world, the concepts of "management" developed fairly recently. Only with the Industrial Revolution, due to the increased firm size, owners needed a management structure to coordinate activities across different plants. Management soon became the subject of numerous studies in economics, sociology and psychology to maximize firm productivity. The first large-scale program of management practices diffusion was developed in the US during WWII: offering such training to US firms involved in war production boost their performance for at least ten years. After WWII, the US exported its management principles to Europe, where they have large and persistent effects on small firm productivity, and to Japan, where they interacted with the local economic conditions and originated the "kaizen Japanese management", which aims at "*continuous improvement*" in firm performance.

I. Introduction

American firms are known to be the most productive in the world (Bloom et al., 2012). Companies such as GE, Apple, IBM, McDonald's, and Walmart are icons of business. U.S. business schools, which train top-level managers of these firms, dominate global rankings. However, this has not always been the case: during the 1980s Japanese firms using the principles of the Toyota inspired Lean Manufacturing System were considered the world's most productive (Appelbaum and Batt, 1994).

Productivity not only varies across countries and decades. Large and persistent productivity spreads across firms are observed even *within* countries and sectors. For

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instance, within narrowly-defined US manufacturing industries, the most productive establishments make almost twice as much output with the same input as the least productive ones (Syverson, 2004). This ratio is even larger in developing countries: in India and China, for example, it is close to five (Hsieh and Klenow, 2009). At the aggregate level, it has been estimated that differences in productivity account for at least 30 percent of the differences in average per capita income across countries (Hall and Jones, 1999; Jones and Romer, 2009).

What can explain such outstanding variations in firm productivity? One natural explanation is that they depend on "hard" technological innovations, as incorporated in patents, or in firm adoption of new machinery and information and communication technologies (ICT). Another important factor, however, could be "soft" technologies, like management, which can be thought both as practices (the management systems that firms put in place) and people (the CEO and other managerial talent that firms acquire).

Management can affect firm productivity through three main channels: technology, efficiency, and human capital. Good management can identify and adopt new production techniques, shape the investment, financial and organizational practices, which, in turn, help firms to get as close as possible to the technological frontier. In this sense, management can be seen as a *technology* as it raises productivity. However, even in the absence of technological progress, better management can allocate the *existing* resources more efficiently, for instance, through production planning, inventory control and by making fewer mistakes in the employment of physical capital. Finally, good management may make firm human capital more productive, by hiring and retaining the best workers, by providing performance-based incentives, as well by allocating them to the most appropriate "tasks". The interaction between these channels allows firms to remain on and push forward the technological frontier.

While management is central in the current economic and policy debate, systematic analysis of the effects of managerial practices on firm performance has been relatively recent for two main reasons. First, management is a fairly complex phenomenon, hard to be defined and measured. However, works focusing on specific measurable practices

have documented a strong correlation between their adoption and firm productivity (Bloom and Van Reenen, 2007). Second, establishing a causal relationship between management and firm performance is challenging: more productive firms may simply adopt better management practices. Recent studies have overcome this issue by randomly providing free managerial consulting to companies through randomized control trials (RTCs). The results of such experiments indicate that adopting managerial practices causes positive and sizeable effects on the outcomes of medium and large firms (Bloom et al., 2013; Bruhn, Karlan, and Schoar, 2018).

In face of the advancement of the empirical research, fundament questions about the links between firm management and productivity remain open. What drives the early adoption of management practices? Does such adoption permanently raise firm productivity? Does good management diffuse to low-productivity firms and across countries?

This article adopts an economic history approach to answer these questions. Specifically, it draws an historical analysis of management – from early development of managerial practices in the US to their subsequent diffusion in the Europe and Japan – focusing on its impact on within-country productivity. The historical context offers key advantages in understanding the effects of management on firm performance compared to a modern setting. First, it allows to study in which context managerial practices early developed and offers a long-time span to evaluate their effects. Second, the implementation of historical policies encountered many idiosyncrasies, that determined a natural variation in firm management adoption. While modern randomized control trials can provide an exogenous variation in practices implementation, they could hardly replicate the large scale of these two interventions, as well as the variety of firm size and sectors involved. Finally, for evaluating the effectiveness of these programs, US experts recorded detailed information about participating firms and practices adoption, usually not collected or released due to confidentiality issues.

The rest of the article is organized as follows. Section II describes the origin of "firm management" and "managerial practices" in the US between the end of the 19$^{\text{th}}$

century and the early 20th century. Section III examines the role of managerial practices in the US mobilization during World War II. Section IV discusses the impact of the export of managerial practices to European economies during the 1950s. Section V analysis the birth of the Lean Production in Japan and how it is rooted in the US managerial practices developed during WWII. Finally, Section VI offers some conclusive remarks.

II. The Origin of "Firm Management" and "Managerial Practices"

Prior to the Industrial Revolution, there was no concept of "management" as we think of it today. Most businesses were small operations, averaging three or four people. Owners frequently labored next to employees, knew what they were capable of, and closely directed their work. The dynamics of the workplace changed dramatically with the Industrial Revolution, especially with the rise of big businesses in the United States. In the 1840s, the large size of the new railways and telegraph companies created the need of a managerial hierarchy to supervise several operating units in different parts of the country and to coordinate and monitor their activities (Chandler, 1977). The subsequent higher speed and volume of the distribution brought a revolution in marketing and workers started to be trained and awarded with bonuses to increase their productivity. Towards the end of the century, firms realized the importance of professional managers to improve their performance, which, in turn, led to the creation of the first business schools. Professors and business school graduates contributed to the development of consulting industry. The first management consulting firm was funded in the late 1890s by Arthur Little, a MIT professor. Edwin Booz, a graduate of the Kellogg School of Management at Northwestern University, funded Booz Allen Hamilton in 1914. At the time, however, those firms mostly focused on technical research, rather than consulting in a modern sense.

The early 20th century saw the rise of the first management and organizational theories with the goal of maximizing workers' productivity. Frederick Winslow Taylor

in his book *The Principles of Scientific Management,* published in 1911, argued that labor productivity could be increased by optimizing and simplifying jobs and with the elimination of unnecessary physical movement by workers. He further suggested matching a worker to a particular job that suited the person's skill level and then training the worker to do that job in a specific way.

Soon afterward, two industrial engineers, Frank and Lillian Gilbreth, came up with the idea of filming workers to analyze their motions, creating a new technique: the micromotion study (Lancaster, 2004). The examination of these visual records showed not only that workers developed their own peculiar ways of performing a task, but also that unnecessary motions caused employee fatigue. The Gilbreths compared methods and working conditions across various plants and industries, and used this evidence to create a standardized best practice. For instance, they redesigned the repetitive task of brick laying by reducing the motions for each brick laid from 18 to 4.5, so that the worker's productivity went from 120 to 350 bricks laid per hour (George, 1972). This, in turn, substantially improved worker welfare by reducing stress, fatigue, and boredom.

In the same years, Henry Ford, the founder of the Ford Motor Company, was working to mass-produce automobiles at affordable price. Ford had the idea of keeping the costs low by relying on a diverse network of auto part suppliers and manufactures. However, during the assembly stage, the body of the car would be fixed into a stationary position as workers brought and added individual parts and to the vehicle. Each car was produced by teams of skilled laborers, and, working together, these groups collectively spent over 12 hours assembling each car. This process was still very expensive and time-consuming. Ford turned to study Taylor's scientific management theory into his production techniques and as 1908 progressed, began to incorporate it. Eventually, he hired Taylor himself to observe his workers and determine the most-efficient and time-saving methods for increasing the company's productivity. Implementing Taylor's theory during the assembly stage, Ford determined that the larger parts of the car should remain stationary, while the smaller parts should be brought to the vehicle as needed. This strategy sped up the production process

significantly, but not enough to meet Ford's ultimate goal of producing cars at peak levels of efficiently. To further reduce his cars' building time, Ford had his laborers remain stationary in an assembly line as the body of the car was moved through individual workstations. Workers would pull the car, by rope, through one workstation after another, allowing each worker to perform his specified task before moving the car to the next station. This process was repeated until the car's construction was complete. With unnecessary motion eliminated, the worker, following a machinelike routine, became far more productive: the time it took to build a car from was reduced from more than 12 hours to two hours and 30 minutes, allowing car mass-production to begin.

Increasing worker productivity and production efficiency became a nationwide priority during WWI. Specifically, when the US entered WWI, there was a great need of ships: the country had 37 steel shipyards and 24 wood shipyards employing 50,000 people, but the defense department needed ten times that (Huntzinger, 2005). Many experienced workers were enlisting, so, although manpower was available, it was untrained in ship building. Charles Allen, a vocational instructor had developed an industrial training method prior to WWI, organized in four-steps: 1) Preparation; 2) Presentation; 3) Application; 4) Testing (or Inspection). The purpose of "preparation" was to get the learner ready to be instructed, of "presentation" to instruct him, of "application" to check up errors, and of "testing" to give a final inspection of the instruction job. Therefore, in 1917 the Emergency Fleet Corporation asked Allen to head the training program it set-up to address the vast training need of the shipyard workers. The results were impressive: in a few months 500,000 workers were trained and at its peak a vessel was launched every 5.5 days (Dinero, 2005).

Despite their success during the war, the content of this training program did not immediate diffuse into the civil production in the interwar period. The reason behind this lack of diffusion is that the training targeted a specific industry mostly working on war-related products and that the program was launched towards the end of the war, so it was in operation for too little to generate spillover effects. Nevertheless, the 1920s and 1930s were crucial decades for the buildout of management as a "science".

First, those years created the conditions for the development of modern consulting firms. Second, management was at the center of detailed studies and experiments to examine its effect on productivity.

The first pure management consulting company was McKinsey & Company, founded in Chicago in 1926 by James McKinsey, an accounting professor from the University of Chicago. The consulting industry benefitted from the Glass-Steagall Banking Act in 1933 that required a clear separation between commercial and investment banking. Due to this act, commercial banks were no longer allowed to have non-banking activities, including the management consulting activities they conducted, which opened the market for independent consulting firms (McKenna, 1995). As a consequence, while the initial root of consulting was technical research, based on the principles of scientific management and aimed at increasing efficiency in production, the new root was based on more diverse strategic and organizational approaches.

Regarding the relationship between management and productivity, in 1920 the Research Council organized a conference with representatives of labor organizations, capital, management, engineers, scientists, educators, economists, and sociologists to discuss how to reach the "optimal productivity" and how to deal with industrial personnel. Major concerns discussed in the conference regarded factory operations performed in plants, especially workers safety and underlighting. To provide a quantification of these issues, in a period between 1924 and 1933, six studies were performed at the Hawthorne plant of the Western Electric Company (Gillespie, 1991). Under the guidance of Elton Mayo,[1] these experiments examined the relationship between light intensity and employee productivity; tested in workers were more productive while working in separation or in team, and if they were responsive to financial incentives, and investigated the status distinctions and social relations in the workplace.

[1] Mayo's previous experience involved workers at a Philadelphia textile mill, that had been experiencing a high rate of turnover. He believed that the repetitive work in the spinning department gave rise to mental abnormalities in the workers. The introduction of rest periods helped reduce turnover (Mayo, 1924).

The first set of studies, the "illumination experiments", carried out between 1924 and 1927, were the most influential. These experiments varied the amount of light in the workplace to examine how such variation influenced productivity. Surprisingly, even when the light returned to the original condition, worker productivity continued to rise. This effect, known as the "Hawthorne effect", diffused the idea that workers respond not only to changes in their working conditions, but also to the feeling that these changes are happening, and led to the development of a new field of study, the industrial psychology. However, a recent work challenges the results of these studies. Levitt and List (2011) were able to find and collect the incredibly high volume of data produced by the illumination experiments and analyzed them using the modern econometric techniques. They find little evidence of the Hawthorne effect. In fact, all lighting changes occurred on Sundays, the only off day for workers, and productivity was higher on Mondays than on Fridays and Saturdays. Output on Mondays was equally high, however, whether or not a lighting change occurs on that particular Monday. Digging more into the design of the experiment, Levitt and List (2011) also document that productivity increases in the areas that were part of the experiments were much greater than for the plant overall, that output tended to be higher when experimental manipulations were ongoing relative to when there was no experimentation, and productivity was more responsive to experimenter manipulations of light than naturally occurring fluctuations, consistent with the idea that it was not the light itself, but rather the manipulation of the light that mattered.

Subsequent experiments aimed at studying the effects of working conditions and incentives on productivity. To do so, five workers assembling magnetic relays were separated from the main shop and moved to the Relay Assembly Test Room. Researchers collected and analyzed a significant amount of data,[2] and found the workers were more productive during the experiment than before. The increased productivity could have been driven by the fact that in the Relay Assembly Test

[2] This data included detailed information on mechanical records of worker output, a daily record of comments made by researchers and study members, observers' logs of work activity, results of periodic medical examinations of workers, and interview transcripts.

Room, workers in a smaller group could more directly affect their group-based compensation, compared with 200 assembly workers in the main shop, or could have been a consequence of isolation of a small group. To test these competing explanations two derivative studies were launched. In the first one, a new relay group with a small-group-output incentive plan was arranged on the shop floor, but without being isolated from the other workers. Productivity quickly increased by 12 percent but leveled off for the duration of the study. In the second one, a group of workers did not receive a different incentive plan but were placed in a separate room. Group output increased in the early phase of this project by 15 percent. However, the investigators also realized that external factors had a much more significant effect on productivity than any of their interventions. For instance, when rumors about the possible transfer of some jobs away from Hawthorne appeared, productivity began to drop significantly. The conclusion from the derivative studies was that the wage incentive had some role in the productivity increase, but that it certainly did not completely explain the productivity increase in the Relay Assembly Test Room.

The management and investigators were impressed with the great potential of workers if they were given proper conditions. But they were uncertain about what these conditions might be. For that reason, from 1928 to 1930 they interviewed around 21,000 employees. The interviews were then analyzed and classified by the articulated complaints. Interviewers made a number of interesting findings. For instance, management was aware of many of the complaints, but out of context, complaints were misleading. However, understanding the personal and economic background of the workers made possible a much richer appreciation of the importance of a given complaint. The interview program also suggested there was a great motivational value in directly asking workers for their opinions and perceptions and listening closely to their responses, as well as recognizing the relationships between workers' work and non-work lives.

Finally, in the last study, researchers investigated the role of the status distinctions and social relations in the workplace by looking at 14 workers in three different jobs who worked together to produce wired equipment for use in switches. The results

revealed the existence of an informal culture, through group norms and activities such as informal leadership patterns, restriction of output, group discipline, friendship, job trading, and cooperation.

Overall, the Hawthorne studies were among the first experiments which employed randomization in a modern sense (Duflo, Gleneerster, and Kremer, 2008). Moreover, researchers collected an impressive amount of data, ranging from hourly performance charts to interviews with 21,000 employees. Unfortunately, the poor design of the experiments, the limited sample size, and the analysis of the data without the use of the proper statistical tools, as noted by Levitt and List (2011), strongly limit what we can learn from these nine-year studies.

However, based on the interpretation given at the time, the Hawthorne experiments confirmed the importance of human resources management, but also drew attention to factory operations and production organization to boost productivity. These three set of practices were seen as the good "bundle of managerial practices" to be taught to firms, as it happened during WWII, and exported abroad, as in Europe and Japan in the war aftermath.

III. Management Practices during WWII

WWII was a watershed in the development and large-scale adoption of management practices. WWII immediately appeared more challenging than WWI. From the onset of WWII in September 1939, many U.S. companies started receiving an increasing number of war-related orders, especially from France and Britain, that were well in excess of their productive capacity (TWI Bulletin, 1940). As the war escalated, it became apparent that if United States had joined the war, the situation would have become even more critical. A great fraction of men of working age would then be called up to serve, depriving the workforce of many productive employees.

In this context, increasing firm production and productivity became a national priority and the US government responded to this need by promoting the first world large-scale program of managerial practices diffusion: the Training Within Industry (TWI) program. The TWI program was a voluntary government-sponsored service that offered free in-plant management training to U.S. firms involved in war production between 1940 and 1945. It encompassed interventions in "bundle of managerial practices" examined in the Hawthorne experiments, called J-modules. The Job- Instructions (J-I) module taught supervisors and managers how to establish standard procedures for operations, the Job-Relations (J-R) module how to manage and motivate workers, and the Job-Methods (J-M) module how to introduce improvements to current production processes. Remarkably and differently from WWI, the US faced an unprecedented war mobilization and responded to it even before formally entering WWII with a program that targeted all war contractors operating in different sectors and of a different size.

While the initial plan of the U.S. government was to train all the 11,575 U.S. applicant firms in all the three J-modules, limited funding and personnel constraints made this goal unreachable. As a result, while only 7 percent of applicants received training in all J-modules, 48 percent did not receive any training at all, and the others received either one or two J-modules training (Figure 1). The large scale of the program, the size of firms involved and some idiosyncrasies in its implementation offer an ideal setting to study if the managerial training improved firm performance, whether the impact persists in the long-run, and whether "good management" generate spillovers on other companies.

Bianchi and Giorcelli (2020) collected and analyzed historical archival data on applicant companies and their financial information over a 20-year period. A comparison between firms that applied and eventually participated in the TWI program and firms that applied but did not participate in it (Figure 1), that were statistically similar in the five years before the training, indicates that participating businesses had substantially higher productivity and profitability than non-participating ones after it (Figure 2). This performance difference persisted and

continued to increase for at least ten years, increasing the productivity gap between US companies. An analysis of the specific type of training received shows that trained firms achieved higher productivity by improving only the managerial practices related to the specific J-module received. Moreover, managerial practices were complementary: receiving one type of training can decrease the cost of further improvements in other managerial areas, making it easier for trained firms to keep getting better over time.

Notably, trained firms were able to sustain their increased productivity in the long run even in the face of high turnover of top managers after WWII. In fact, between 1945 and 1955, between 4 and 73 percent of trained managers left their respective firms. However, the TWI program had a strong firm-specific component that stayed within the firm after many trained managers left. This aspect is an important difference between the TWI program and the training program implemented during WWI. While the latter trained workers directly, the former taught firms how to train managers that in turn were asked to train the rest of managers and workers. As a consequence, trained firms may have been able to retain the benefits of the TWI program by training the large number of newly hired managers and/or workers on the importance of the J-modules, even if many top executives who were at the firm at the time of the TWI program were leaving. Moreover, trained firms could have started relying more heavily on internal talent, already exposed to the TWI training, to replace departing managers.

Finally, the TWI program generated positive spillover effects on the supply chain of trained firms. Specifically, after applicants received the training, their upstream and downstream firms started becoming more productive. Remarkably, trained applicants and the firms in their supply chain improved similar management practices, which suggests that there was a transfer of managerial knowledge from the trained firms. Conversely, there were no sizable spillover effects on companies located close to trained firms, but not commercially related to them.

With the end of WWII, the TWI program in the US was dismissed. While a hope of the government was to generate a private demand for consulting service, the huge expansion of US economy after WWII did not incentivize firms to do so. Moreover,

US companies were facing low international competition since the manufacturing base of many other countries was completed destroyed by the war. However, the content of the TWI program was exported to Europe and Japan, as examined in the rest of the paper.

IV. Management Practices after WWII: the European Case

At the end of WWII, European economies were war-torn. The GDP was, on average, 70 percent lower than in 1938 (Boel, 2003). For both political and economic reasons, the US decided to help the recovery of many Western countries in the late 1940s (Boel, 2003). While most aid was represented by money transfer, the diffusion of managerial knowledge – as well as the technology transfer –were an important component of such intervention.

Specifically, the US aid to Europe in the late 1940s and 1950s were grouped under the so-called Marshall Plan. The Marshall Plan was an economic and financial aid program, to help 17 Western and Southern European countries recover from World War II (Boel, 2003). It was in operation from 1948 to the end of the 1950s. Between 1948 and 1951, when it was officially known as the European Recovery Program (ERP), it transferred approximately $130 billion (in 2010 USD) to Europe (Eichengreen and Uzan, 1992) to help rebuild war-devastated regions, remove trade barriers, and prevent the spread of Communism (Hogan, 1987). During the first months of the ERP, the United States realized that European firms were characterized by lower labor productivity than US plants (ECA, 1949) and US observers argued that this difference was largely due to the lack of a "managerial mentality" (Segreto, 2002). A 1949 US Bureau of Labor Statistics (BLS) report on Italian plants stated:

> *Workers are not trained by the firms, and the flow of work and the employees operations are not carefully studied and integrated.* [...] *The insufficient critical allocation of labor, and the accumulation of numerous small losses in efficiency*

determine an excess of workers per output, estimated between 50 percent and 400 percent. [...] *Plants are not well-organized and often work areas, lighting, and ventilation are not adequate. There is less* (*compared to the US*) *thorough maintenance of machines.*

In 1949, after visiting several factories across Europe, James Silberman, the BLS chief of productivity and technology development, claimed that inefficiencies in management were a more severe problem than war damages (Silberman, Weiss, and Dutz, 1996). Similarly, Ewan Clague, the BLS commissioner, stated that "productivity levels in the United States were more than twice those in Great Britain, and more than three times those of Belgium, France and other industrial countries of Europe" (Boel, 2003).

In 1950, to improve the productivity of European firms, the US government introduced the Productivity Program. All countries that participated in the ERP were also part of this program, which lasted from 1952 to 1958. During this time, the United States organized study trips for European managers to US plants, followed by consulting sessions of US experts at European firms. Managers were taught modern management practices, based on the TWI method, already diffused among large US firms during WWII.

Could managerial practices be exported? Did they boost productivity of smaller businesses as the European ones? Giorcelli (2019) examines the effects of the Productivity Program on performance in the context of Italy. In order to test whether also smaller businesses could benefit from the implementation of management practices, the United States authorities originally intended to roll out the Productivity Program in Italy in two phases: first, a pilot program, which, if deemed effective, would be followed by nationwide implementation. However, after all firms eligible to participate in the pilot phase applied to the program, there was a substantial budget cut and only a subset of firms (from narrowly-defined Italian geographical areas) participated in the program. The empirical analysis is based on a comparison between eligible firms which eventually were part of the program and eligible ones that were

excluded because of the budget cut. The adoption of US managerial practices had long-lasting effects on the performance of these small and medium-sized firms. Such establishments increased sales and productivity (Figure 3, Panel A), and were systematically more likely to engage in import-export activities. Over time, they also moved to more complex and structured organizations. Specifically, a substantial fraction of them became professionally-managed, instead of remaining family-managed. Moreover, while the number of managers as a fraction of total workers increased, the turnover of trained managers was very low: 88 percent of them were still working in the same firm 15 years after the training trips, which can contribute to explain the long-lasting results. A possible interpretation of such results is that, if firms are able to improve their management, the effects are highly cumulative, as the organizational and human capital channels amplify the initial impact of "better management". This could explain why within-country productivity spreads remain large and persistent in the long run.

Out of more than 6,000 firms initially eligible to apply for the program only 60 percent of them did so. Why was it the case? The setting allows to look at performance of applicant and non-applicant firms and compare them. Larger firms, with higher sales and productivity were more likely to apply for the Productivity Program, compared to firms that did not apply. There are at least three explanations for the fact that "better" firms were more likely to apply for the program. First, smaller and less productive firms may not have realized they needed assistance, and therefore did not apply. Second, firms that were very far below the frontier may have thought that the Productivity Program would not lead to any improvement, given the differences between them and US companies. Firms that did not apply might have had liquidity constraints. Even though the program paid for the study trips, there was an opportunity cost in filling out the application and, later, for sending managers to the United States or for purchasing new machinery. Thus, even if the expected net present value of participating in Productivity Program was positive, firms may have decided not to apply.

A comparison between the results of the TWI program in the US during WWII and the Productivity Program in Italy in the 1950s shows that the adoption of managerial practices produced long-lasting effects on outcomes of both very large and small and medium-sized firms. Moreover, these findings do not appear determined by historical or geographical context, indicating that managerial practices can be exported and easily adapted to different production environments.

While the Productivity Program's main focus was management training, the United States also introduced a loan program to help Italian firms renew their capital stock. Loans granted to firms were restricted to the purchase of technologically advanced machines produced in the United States (ICA, 1958) and not sold in Europe. US machines commonly used in the production process were more productive than European ones. For example, in the beverage industry, US bottle-washing machines were able to wash and sterilize up to 200 bottles per minute. European machines took 3 minutes to wash 50 bottles, and did not provide sterilization (Dunning, 1998). Giorcelli (2019) further shows that firms which received US loans, and therefore bought the more productive machinery, improved their performance, but the effects were short-lived (Figure 3, Panel B). When the life-cycle of the machinery, estimated around 10 years, finished, there were no additional productivity gain. Both in the short run and the long run, larger firms benefitted more from new machinery than smaller businesses. For those firms the adoption and use of new machinery was easier, since they already had a scale of production relatively more similar to the US companies. Finally, firms that both sent their managers in the US and bought the new machinery had a larger and more persistent productivity gain than the sum of the two single interventions. Overall, these results suggest that the causal impact of technologically advanced capital goods on firm performance does not persist over time if it is not accompanied by proper managerial training. Moreover, they indicate that, while management appears to be easily transferable, technologically advanced capital goods may require a more similar firm size or scale of production between sending and receiving countries to be effective.

V. Management Practices after WWII: the Japanese Case

The aftermath of WWII also witnesses a strong influence of the US management way on Japanese firms. The US Occupation authorities, led by General MacArthur, quickly realized that due to the near complete destruction of the Japanese industrial base, civil unrest was very likely to happen. Instead of severe punishment, they recognized that rebuilding Japanese industry was critical. The members of MacArthur's Occupation leadership were aware of the TWI Service and its success in the US. They felt that this program was exactly the type of initiative that would help support the rebuilding and infuse democratic principles in Japan on a national level. Therefore, they created an Economic and Scientific Section (ESS) group tasked with the goal of improving Japanese management skills.

While the export of US managerial principles may look similar to the European experience under the Marshall Plan, there were important differences. In fact, Japanese firms did not merely adopt US managerial practices, but they were able to adapt and improve such techniques based on the local needs. This in part depended on cultural factors. For instance, the first firm in which the TWI methods were experienced was Aisin Seiki, a Toyota Group company and one of Toyota's biggest suppliers (Huntzinger, 2005). Given some difficulties in communication between US and Japanese managers and engineers the *learning-by-doing* component of the TWI methods became particularly important. However, part of the successful adaptation was due to specific conditions of Japanese firms. Japanese managers soon realized their own goods were shoddy by international comparison. Moreover, after the war, they could not afford the wastage of raw materials that post-production inspection processes brought about and were consequently looking for techniques to help them address these problems. Instead of encouraging large, radical changes to achieve desired goals, the TWI methods recommended that organizations introduce small improvements, preferably ones that could be implemented on the same day. The major reason was that during WWII there was neither time nor resources for large and innovative changes in the production of war equipment. The essence of the approach came down

to continuously improving the use of the existing workforce and technologies. The idea of finding the optimal process through continuous improvements generated the "kaizen Japanese management", which, in fact means "*continuous improvement*."

Another important difference with Europe goes back to the role played by Edward Deming. Deming was a professor of statistics at New York University's Graduate School of Business Administration (1946–1993), and taught at Columbia University's Graduate School of Business (1988–1993). In 1927, he got to know Walter A. Shewhart of the Bell Telephone Laboratories who had developed the concepts of statistical control of processes and the related technical tool of the control chart. Deming had the idea of applying statistical methods to industrial production and management, not only to manufacturing processes, but also to the processes by which enterprises are led and managed. More specifically, Deming produced 14 points which have gained widespread recognition, and which are central to the quality movement and his philosophy of transformational management. He developed a theory of variation – that special causes of variation are usually easily attributable to quickly recognizable factors such as changes of procedure, change of shift or operator, but that common causes will remain when special causes have been eliminated (normally due to design, process or system). These common causes are often recognized by workers, but only managers have the authority to change them to avoid repeated occurrence of the problem. Deming estimated that management was responsible for more than 85% of the causes of variation.

In 1947, Deming was involved in early planning for the 1951 Japanese Census. During his experience in Japan, he worked closely with the Union of Japanese Scientists and Engineers (JUSE). JUSE members had studied Shewhart's techniques, and as part of Japan's reconstruction efforts, they sought an expert to teach statistical control. Therefore, the Civil Communications Section (CCS) developed a management training program that taught statistical control methods as part of the overall material.

From June–August 1950, Deming trained hundreds of engineers, managers, and scholars in such techniques and concepts of quality. He also conducted sessions for top

management, including top Japanese industrialists such Akio Morita, the cofounder of Sony Corp. Deming's message to Japan's chief executives was that improving quality would reduce expenses, while increasing productivity and market share.

One of the firms that was able to best merge together the TWI principles and the Deming's quality control techniques was Toyota. As described in Womack et al. (1990), in 1950, Eiji Toyoda, the nephew of its founder, participated in a three-month visit to the Rouge plant of Ford in Dearborn, Michigan. At the time, the Dearborn facility was Ford's most complex and largest manufacturing facility. It produced nearly 8,000 cars per day while Toyota only produced 2,500 cars each year. After studying Ford's production system, Eiji Toyoda understood that the mass production system employed by Ford cannot be used by Toyota. The Japanese market was too small and diverse for mass production. The customer's requirements ranged from compact cars to the most luxurious vehicles. Ford's mass-production system focused on the amount of production. Toyota's Taiichi Ohno, realized that the best way to manufacture in volumes far smaller than were common in the U.S. or even Europe was to increase the "flexibility" and utilization of the key elements in their manufacturing systems-equipment, workers, and suppliers. They also sought to lower, as much as possible, investment needed for in-house personnel, factory or warehousing space, and variable costs such as in-process or finished-goods inventories. While individual Japanese automakers made these changes with varying degrees of success and in different years, all pursued three basic policies.

Before 1950 at Toyota and in the mid-1950s at Nissan, managers introduced the "just-in-time" (JIT) concept for in-house production (or assembly) and deliveries of components. This required several departures from U.S. practices. Faster setup times for machine tools and stamping presses (techniques first written about in the U.S. and incorporated in American equipment such as Danly stamping presses) meant that each piece of equipment could be used for different models or components without long waiting times. Tighter synchronization between subassembly production, parts deliveries, and final assembly increased equipment utilization and reduced in-process inventories, while mixed scheduling of different components or models on single

machines or assembly lines avoided specialized but underutilized equipment and workers. Finally, broader job specifications allowed managers to get by with less workers through shifting people to different jobs as needed at any given moment.

These modifications appear to have resulted in higher productivity as workers learned how to operate several different machines simultaneously, and did much of their own machine maintenance, janitorial work, and inspection, especially in times of slow demand. The discipline imposed by the just-in-time pace, reduced buffer stocks of extra components, and the small-lot production philosophy also tended to improve quality Because workers could no longer rely on extra parts or rework piles if they made mistakes, they paid more attention to what they were doing. Since they made only a few parts at a time for the stations immediately ahead of them, rather than large lots to store in inventory for weeks or months, more rapid throughput on the line also led to rapid "feedback" between stations regarding process problems or defects. Small lots thus seem to have improved learning rates and reduced defectives, both of which resulted in higher yields – another boost to productivity (Cusumano, 1985).

Thanks to Deming's work in Japan and Toyota's success, an increasing number of Japanese manufacturers adopted the TWI and quality-control system in the 1960s and experienced unprecedented levels of quality and productivity. The improved quality combined with the lowered cost created new international demand for Japanese products. It is widely thought that the revolution in Japanese manufacturing management was a key determinant of the economic miracle of the 1970s and 1980s.

Until the late 1970s, despite the success of US management techniques in Japan, few American companies were systematically using them. Only in the late 1970s the US became aware of Deming's achievements in Japan and during the 1980s Deming himself along with Japanese managers started bringing Japanese managerial techniques back to the US. In his American seminars during 1980, Deming talked of the need for the total transformation of the Western style of management. Over the years, a few American companies requested Deming's assistance. Ford Motor Co. was among the first to hire Deming to reshape its manufacturing operations. One result of

that collaboration was Ford's revolutionary Ford Taurus, which became one of the best-selling cars of all time. Other U.S. firms that turned to Deming for help included Xerox Corp., Procter & Gamble Co., AT&T Inc., and *The New York Times*. At the same time, US managers visited Japanese firms in order to learn the "Japanese management way".

Over the 1990s, US labor productivity growth, which stagnated during the 1980s, started growing again. Between 1995 and 2006, US labor productivity grew by 2.2 percent, compared to a mere 1.4 percent increase in Europe. What was the role of management in explaining this rise? According to Bloom, Sadun, and Van Reenen (2012), a substantial part of this effect is explained by the earlier adoption of information technology by the US multinationals, which in turn were doing better in "people management" practices, such as promotion, rewards, hiring and firing. This finding offers further evidence the management matters.

VI. Conclusions

Evidence from economic history offers insights on the long-term effects of management practices on firm performance and about their diffusion within and across countries. On the within-country side, the adoption of managerial practices has large and long-lasting effects on firm productivity, which could contribute to explain the enormous productivity spreads among firms operating in the same country or even in the same sector. On the across-country side, management practices appear easily transferable to different contexts, historical periods, and firm size, highlighting the importance of policies that aims at spreading management knowledge.

To what extent these historical findings can be applicable to today's firms? Although production processes have evolved tremendously since the mid-20th century, the concept of "good management", perhaps surprisingly, has changed substantially less. For instance, the TWI principles are still taught today in the manufacturing, healthcare, and service industries worldwide, and they look similar to the business

principles advised by recent RCTs (see, for instance, Bloom et al., 2013). Moreover, the historical results are relevant for far more than just one industry, or for a few industries that might have disappeared or shrunk in today's economy, and encompassed enterprises of different sizes.

Managerial practices are diffusing these days faster than ever and the number of countries involved has dramatically increased around the world. Between the 1950s and the 1970s, the diffusion of "good management" mostly happened among developed countries, with managerial practices being exported from the US to Europe and Japan, and then back from Japan to the US. In the 1990s, the spread of practices touched Latin America, and more recently it has involved Asian and African countries. An important role in this diffusion have been played by consulting companies. Since the 1950s onwards consultancies expanded their activities considerably in the United States and in Europe, and in the later decades in Asia and South America. In the late 1990s, the consulting industry blossomed, driven by a broad array of factors, such a strong global economy, increases in computing power, penetration of emerging markets, privatization, globalization, and the Information and Communication Technology Consulting practice.

Given the importance of management and its large effect on firm performance, it is crucial for governments to understand how to scale-up interventions that aim at improving firm managerial practices. Iacovone, Maloney, and McKenzie (2019) point to the potential of group-based approaches as a pathway to scaling up management improvements in the context of Colombia. Evidence from economic history could also be helpful in shaping modern public policies that focus on firm productivity, by showing that management practices can be diffused and improve performance of firms despite their size, sector, and geographical area.

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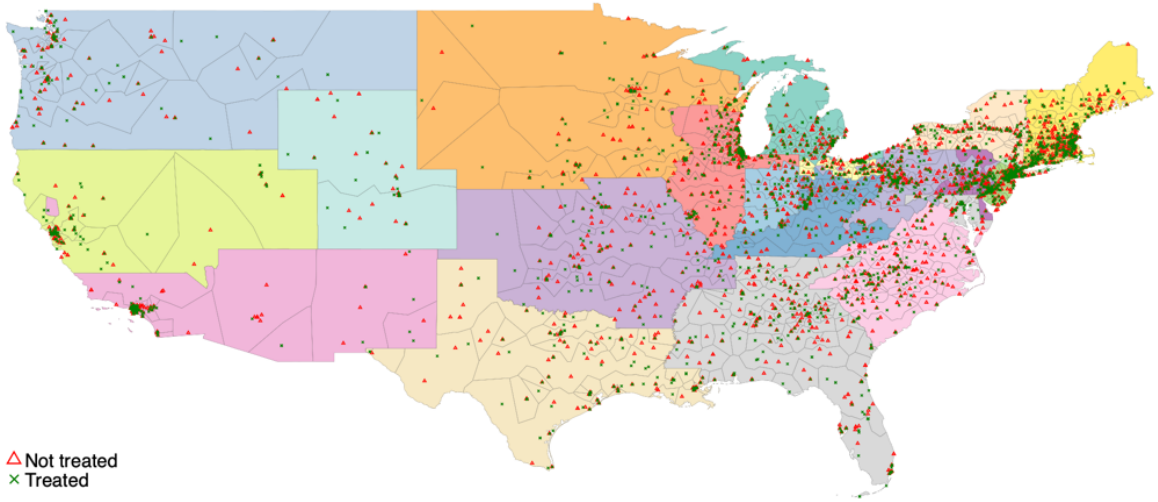
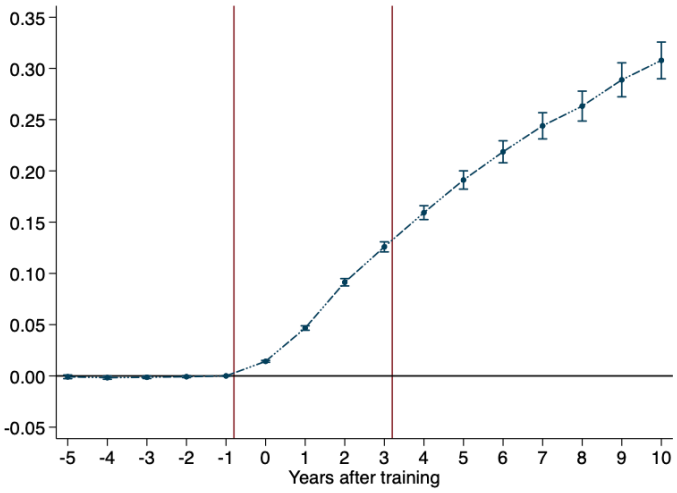
Figures

Figure 1: US War Contractors Involved in the Training Within the Industry Program



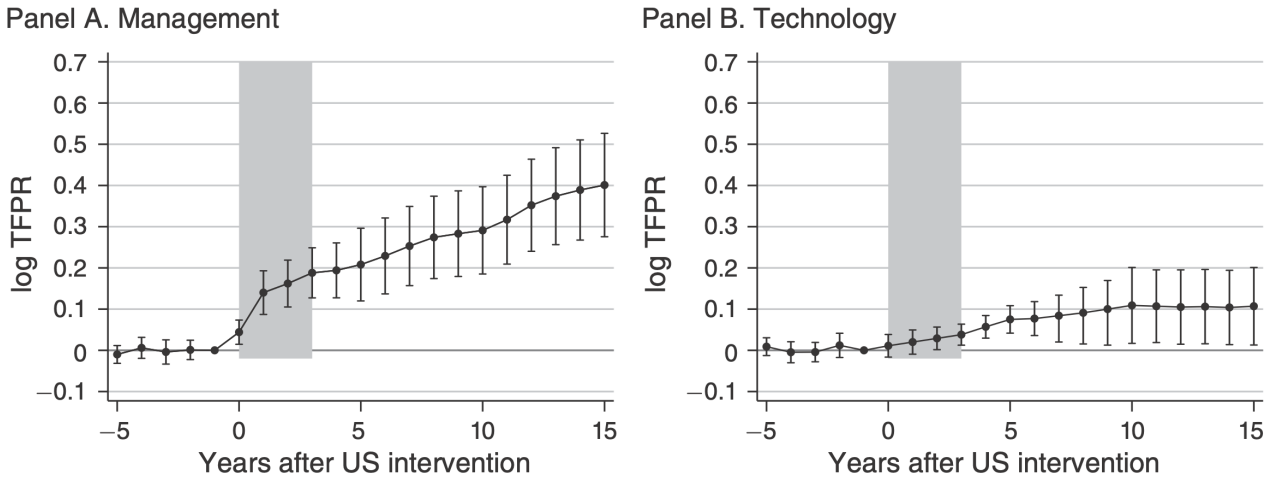
Notes: Map of the 22 TWI districts the TWI divided the US in. The borders within the 22 districts identify the 364 subdistricts, the level of aggregation at which the TWI program was delivered. Applicant firms are divided in 6,056 companies that received the TWI training (green crosses) and 5,519 ones that did not receive the TWI training (red triangles). *Source:* Bianchi and Giorcelli (2020).

Figure 2: The Effects of the TWI program on Firm Productivity



Notes: Productivity is measured by TFPR computed with the Ackerberg, Caves, and Frazer (2015) method. The sample includes applicant firms that either received only one TWI training or no training at all. The vertical bars denote 95 percent confidence intervals. The first vertical red line identifies the beginning of the TWI program. The second vertical red line identifies the end of World War II for most applicant firms. *Source:* Bianchi and Giorcelli (2020).

Figure 3: Effects of the Technical Assistance and Productivity Program on Firm Produvtivity



Notes: The US intervention year is normalized to zero, and the gray shaded area corresponds to the three-year follow-up period in which US experts monitored trained firms. Productivity is measured by TFPR computed with the Ackerberg, Caves, and Frazer (2015) method. *Source*: Giorcelli (2019).