Origins of lean management in America

The role of Connecticut businesses

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Abstract

Purpose – The purpose of this paper is to provide a historical account of the significant role that Connecticut businesses and business leaders had in the spread of Lean management throughout the USA. The paper aims to describe what happens when managers do not understand and apply an important principle of Lean management.

Design/methodology/approach – Survey of published and unpublished records, as well as personal communications with key figures.

Findings – Establishes the role and importance of Connecticut businesses and business leaders in the discovery and dissemination of Lean management in America since 1979, external to Toyota and its affiliated suppliers.

Research limitations/implications – The accuracy of some past events necessarily relies on the recollection of key figures that were obtained by personal communications.

Practical implications – Describes how an important principle, "respect for people," was not understood by most management practitioners, thus hindering efforts to correctly practice Lean management and improve business performance.

Originality/value – The paper provides a historical account of Lean management in America, focusing on activities that occurred in the State of Connecticut post-1979. Description and relevance of a key area of misunderstanding among practitioners of the Lean management system.

Keywords Management technique, Lean production, Manufacturing systems, History, Automotive industry, United States of America

Paper type Research paper

Introduction

Toyota Motor Corporation is widely recognized for having created an important new management system that top managers of many manufacturing and service businesses now seek to emulate. Toyota's management system is variously referred to as "Toyota Production System" (Ohno, 1988a), "Toyota Management System" (Monden, 1993), "Lean Production," (Womack *et al.*, 1990) or "Lean Management" (Emiliani *et al.*, 2003). It is also commonly referred to as "Lean manufacturing" due to its origins in production and operations management (Shingo, 1981; Ohno, 1988a). However, this description implies a narrow focus and is now recognized as incorrect because Lean principles and practices can be applied to any organization. Thus, the emergent preferred description for this management system external to Toyota Motor Corporation is "Lean management."

The roots of Toyota's management system dates to the early 1890s, when self-taught inventor Sakichi Toyoda designed and patented a manually operated loom for weaving cloth that greatly improved worker productivity and the quality of the

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cloth (Kimoto, 1991; Togo and Wartman, 1993; Reingold, 1999; Wada and Yui, 2002). In the 1920s, Sakichi's son, Kiichiro, designed and patented many new loom features, including improved mechanisms invented by his father that would automatically stop the machine when a thread broke, thus avoiding the production of defective cloth (Kimoto, 1991; Wada and Yui, 2002). In part as a result of these innovations, key objectives of Toyota's early management practice have been characterized as "production efficiency by consistently and thoroughly eliminating waste", and "the equally important respect for humanity" (Ohno, 1988b).

Two people are widely credited for having created the Toyota Production System as it is known today: Ohno (1988a), who rose to the level of Executive Vice President of Toyota Motor Corporation, and Shingo (1985), a consultant to Toyota employed by the Japan Management Association, famous for his work on single-minute exchange of dies. Toyoda (1985), former President of Toyota Motor Corporation, and Saito Naichi also played key roles (Ohno and Mito, 1988; Womack *et al.*, 1990; Womack and Jones, 1996).

Both Kiichiro Toyoda and Taiichi Ohno were greatly influenced by American industrialists and their production and management practices (Ohno, 1988a; Toyota, 1988), but not by management theorists. By far the most influential person was Henry Ford, through his books *My Life and My Work* and *Today and Tomorrow* (Ford and Crowther, 1922, 1926). Another highly influential management practice was the "Training Within Industry Service" (TWI), a structured four-step program for training manufacturing workers – particularly supervisors (Huntzinger, 2005). TWI was created by the US government in the 1940s to increase wartime production. It came to Japan in the early 1950s (Fujimoto, 1999) as part of allied efforts to rebuild industrial infrastructure. Kiichiro Toyoda, Taiichi Ohno, and Shigeo Shingo were likely familiar with Taylor's (1911) book *The Principles of Scientific Management*. However, Taylor's work appears to have not made significant direct contribution to the evolution of Toyota's management system. It is more likely to have influenced Toyota managers through their understanding of Ford's system of production (Fujimoto, 1999).

While the influence of western industrial management practice is clear, it is very important to recognize that it is also rather limited. Toyota managers have, over generations, purposefully made many very important improvements to industrial management practice over time (Shingo, 1981; Ohno, 1988a; Womack *et al.*, 1990; Monden, 1993, 1998; Basu, 1999; Fujimoto, 1999), consistent with the dual objectives of "production efficiency by consistently and thoroughly eliminating waste" and "the equally important respect for humanity" (Monden, 1983; Ohno, 1988a). While these were the major drivers, Japanese business conditions and Japanese culture played recognizable but less significant roles (Ohno, 1988a; Nishiguchi, 1994; Basu, 1999; Fujimoto, 1999; Wada and Yui, 2002).

There is no direct connection between the theoretical development of western management thought over the last 100 years and the evolution of Toyota's management system. This reflects both a lack of formal management training among key personnel, as well as a strong belief among Toyota managers that they must be very practical, see reality clearly, understand the true nature of problems, and be willing to challenge existing paradigms (Shingo, 1981; Ohno, 1988a). These attributes were much more highly regarded among managers than theoretical analysis by them or others (Monden, 1983). In addition, there was a strong interest among Toyota

managers, since the days of Sakichi Toyoda, to develop production capabilities and management practices that were uniquely Japanese (Toyoda, 1985; Ohno, 1988a; Toyota, 1988, 2001; Wada and Yui, 2002) – including contributions of ideas and practices from Henry Ford and his colleagues, whom they greatly admired. Despite being Japanese, the principal architects felt that Toyota's management system could be applied to any type of business in any country (Shingo, 1981; Ohno, 1988a; Ohno and Mito, 1988).

Since the late 1970s, Lean management has become an important route for improving the performance of businesses in the USA – e.g. reducing costs, improving quality, reducing lead-times, increasing market share, developing new products and services, human resources, etc. (Imai, 1986; Monden, 1986). Practiced correctly, Lean management can help avoid decisions that result in undesirable trade-offs that negatively impact key stakeholders such as employees, suppliers, customers, investors, or communities. While many top executives today view the adoption of Lean management as critical and something they must understand and apply to help achieve long-term business success, it remains an obscure topic in undergraduate and graduate business school degree programs (Emiliani, 2004a, 2005a).

Ohno characterized the key objectives of Toyota's early management practice as "production efficiency by consistently and thoroughly eliminating waste," and "the equally important respect for humanity" (Ohno, 1988a). In 2001, Toyota Motor Corporation published an internal document titled "The Toyota Way 2001" (Toyota, 2001), which presents these two objectives as top-level company principles: "continuous improvement" and "respect for people." The 13-page document provides a detailed description of these two principles and reveals explicit and implicit beliefs that have long guided management thinking. While this document is not publicly available, most of what appears in it can be found in a recent trade book (Liker, 2004).

The "respect for people" principle has long been unrecognized, ignored, or misunderstood by most senior managers outside Toyota and its affiliated suppliers, even though Ohno and other Toyota personnel referred to it directly or indirectly in their writings (Kamiya, 1976; Sugimori *et al.*, 1977; Kato, 1981; Toyoda, 1985; Ohno, 1988a; Togo and Wartman, 1993; Kawahara, 1998; Togo, 1998; Okuda, 1999; Nishimura, 2000). Publication of "The Toyota Way 2001" document helped raise awareness of this principle external to Toyota Motor Corporation and its affiliated suppliers. The correct practice of Toyota's management system – Lean management – would require, at a minimum, acknowledgement and practice by management of both principles: "continuous improvement" and "respect for people." However, most managers practice only the first principle, "continuous improvement," which greatly limits amount of improvement that can be achieved (Aeppel, 2002; Emiliani *et al.*, 2003; Smalley, 2005; Bhasin and Burcher, 2006). It is the second principle, "respect for people," that enables the first principle.

Simultaneous application of both principles results in the elimination of waste, called "muda," in Japanese. Waste is defined as: activities (Ohno, 1988a) and behaviors (Emiliani, 1998) that add cost but do not add value as perceived by end-use customers (Womack and Jones, 1996). Eight distinct types of waste are recognized in the Lean management system. Effective implementation of Lean management results in the establishment of intra- and inter-organizational capability building routines and improved time-based competitiveness through the use of Lean principles, structured

processes, and supporting tools (Imai, 1986, 1997; Womack *et al.*, 1990; Nishiguchi, 1994; Fujimoto, 1999; Emiliani *et al.*, 2003). Major benefits include improved flexibility and responsiveness to rapid changes in customer requirements or when economic conditions deteriorate, employee involvement, and better financial and non-financial performance.

The purpose of this paper is to provide a historical account of the significant role that Connecticut businesses and business leaders had in the discovery and adoption of Lean management and subsequent spread of Lean management in the US, external to Toyota Motor Corporation and its affiliated suppliers. This historical account is noteworthy for the following reasons:

- existence of a critical mass of forward-thinking senior managers in a small geographic region;
- a high concentration of industrial activity related to implementing Lean management, particularly post-1986;
- lean management was implemented at established "brownfield" businesses rather than in new "greenfield" businesses, as is more commonly done;
- the success achieved by two Connecticut businesses in implementing Lean management;
- dissemination of Lean management by Connecticut managers as they moved to other businesses in the USA and abroad, and former managers acting as consultants;
- many important new contributions to the body of Lean knowledge that have emerged from management practitioners and area academics; and
- highlights the importance of recognizing and applying the "respect for people" principle to achieve improved outcomes.

Historical development

Among the earliest reporting in the USA that described Toyota's unique management system was a 1977 article in *American Machinist* (Ashburn, 1977). The first application of Toyota's management system in the USA was likely at a Kawasaki engine and motorcycle manufacturing facility located in Lincoln, Nebraska, between 1975 and 1978 (Butt, 1981). However, the overall level of awareness of Toyota's management system among US business leaders remained low until the early 1980s, when it gained increasing attention in the US business press (Monden, 1983; Monden, 1986; Womack *et al.*, 1990).

The focus of these early writings was mostly descriptions of operational aspects of the Toyota Production System designed to improve "production efficiency by consistently and thoroughly eliminating waste" (Ohno, 1988a). No direct or indirect mention is made to "the equally important respect for humanity" (Ohno, 1988a). Descriptions of Japanese human resource practices typically appeared as a separate topic, and were disaggregated into simpler elements (Drucker, 1971). In general, descriptions of post-World War II Japanese management practices were written by different authors whose focus was either operations management or human resources management, but not a tight integration of both – though there were some exceptions (Monden, 1983; Imai, 1986; Ohno, 1988a).

The State of Connecticut has a centuries-long history as a source for high-quality manufactured goods. Its economy rapidly transitioned from agricultural to manufacturing around the time of the US industrial revolution, c. 1780 (Grant, 1974; Porter and Miller, 2003). The state was home to Eli Whitney's cotton gin, Samuel Colt's Patent Firearms Manufacturing Company, Hitchcock chairs, Pratt & Whitney machine tools, Dexter paper products, Ensign-Bickford safety fuses, Seth Thomas clocks, Stanley Works iron door bolts, etc. and process innovations such as the assembly line. Today, Connecticut continues to have a high concentration of manufacturing activity, with nearly 5,500 manufacturing businesses in 2004 (DOL, 2005a). These include several large publicly owned multi-national corporations that manufacture sophisticated products such as helicopters, space suits, jet engines, nuclear submarines, and thousands of privately owned mid- and small-sized businesses, many of which support the state's largest corporations. In 2004, durable and non-durable goods manufacturing contributed 12.5 percent to state domestic product (BEA, 2005), and accounted for over 195,000 jobs (DOL, 2005b).

In general, manufacturing management in Connecticut, and elsewhere, had been governed by the "batch-and-queue" production method, which is defined as:

> ... a mass production approach to operations in which large lots (batches) of items are processed and moved to the next process ... where they wait in a line (queue) (LEI, 2003).

In almost every case, services are also delivered using the "batch-and-queue" method. The batch-and-queue production method is regarded as inferior because it requires much higher consumption of physical, financial, human, time, and natural resources (Womack *et al.*, 1990; Emiliani *et al.*, 2003), and is not able to respond quickly to changes in market conditions (Womack and Jones, 1996; Jones and Womack, 2002). While many companies experienced great success with batch-and-queue for decades, this way of managing a business became a burden as customer wants and needs changed more rapidly and as global competition intensified.

Connecticut's earliest involvement with Lean management began in 1979, when Bodek (2004, 2005) founded Productivity Inc., in Greenwich, Connecticut. Productivity Inc. was created to educate business leaders in Japanese industrial management practices. Its primary activities were publishing newsletters, distributing books, running national conferences and seminars, and organizing study tours starting in 1981, in which US business executives would visit Japanese companies to learn how they achieved such remarkable improvements in productivity and quality (Bodek, 2004).

Between 1980 and 1981, General Electric Co., headquartered in Fairfield, Connecticut, conducted benchmarking visits for its managers to manufacturing companies in Japan. These visits led to a training program conducted at a GE facility in Bridgeport, Connecticut, around 1981, and was marketed by Productivity Inc. (Bodek, 2005)[1]. Arthur Byrne, General Manager of a GE plant in Cleveland, Ohio, who would later become President of The Wiremold Company in West Hartford, Connecticut (Smith, 2000), implemented a just-in-time (JIT) production method at his facility in 1982 (Emiliani *et al.*, 2003), based upon the findings of one of his managers who participated in a benchmarking visit.

In 1984, Bodek (2004a) created a separate company called Productivity Press Inc. Productivity Press published and distributed English translations of dozens of

Japanese books written by management practitioners and consultants. These highly influential books, which included works by Ohno (1988a, b) , Ohno and Mito (1988) and Shingo (1981, 1985, 1986), described the Toyota Production System and other Japanese management practices. Productivity's books, workshops, and Japan study tours played a large role in bringing Lean to America. Today, the publishing arm of Productivity Inc. is located in New York City, while consulting arm of Productivity Inc. is located in Shelton, Connecticut (Productivity, 2005)[2].

In February 1984, Toyota Motor Corporation established a joint venture with General Motors Corporation called New United Motor Manufacturing, Inc. (NUMMI) in Fremont, California (Toyota, 1988; NUMMI, 2005). This became the first application of the Toyota Production System by Toyota Motor Corporation its affiliated suppliers in the US. Soon thereafter, the level of awareness of Toyota's management system among US businesses began to increase slightly (Monden, 1986).

In 1985, the US government funded a study at Massachusetts Institute of Technology called the "International Motor Vehicle Program" (Womack *et al.*, 1990). The study set out to determine why Japanese automakers were so much more productive and produced better quality products at competitive prices compared to the "Big Three" Detroit automakers. It was during this study that a graduate student named John Krafcik, who had been an engineer at NUMMI, coined the term "Lean" to describe Toyota's production system and how it yielded better results while consuming less resources compared to traditional batch-and-queue production (Womack *et al.*, 1990).

Soon other managers would begin to learn about Lean principles and practices and apply them in their businesses. In 1984, Danaher Corporation purchased The Jacobs Manufacturing Company of Bloomfield, Connecticut, from Chicago Pneumatic. Jacobs, a maker of truck engine brakes, was likely the first non-Toyota affiliated company in the northeastern USA to implement two key elements of Toyota's production system: JIT and cellular manufacturing, starting in late 1987 (Jacobs, 2005)[3].

Yoshiki Iwata, Chihiro Nakao, and Akira Takenaka were disciples of Taiichi Ohno. In 1987, these former industrial engineers and production managers from Toyota Motor Corporation formed the consulting company Shingijutsu Co., Ltd in Gifu City, Japan, to teach Toyota's production system to other companies (Shingijutsu, 2005a). Iwata, Nakao, and Takenaka's first consulting client in the USA was Productivity Inc., in 1987 (Shingijutsu, 2005b).

At a conference in Chicago in 1987, Heist (2005), Corporate Relations Manager at the Hartford Graduate Center (now called Rensselaer at Hartford) in downtown Hartford, Connecticut (Weaver and Swift, 2003)[4], met Imai (2005), President of the Kaizen Institute of America. Imai (1986) was speaking about his recently published book: *Kaizen: The Key to Japan's Competitive Success*. Heist thought Connecticut area business leaders would be interested in learning about the Japanese process for continuous improvement, and invited Imai and other kaizen experts to speak at the Hartford Graduate Center.

As part of the preparations for the May 1988 seminar, Heist (1988) solicited top managers from several Hartford-area manufacturing companies and asked them to consider hosting the in-plant kaizen portion of the seminar. The letter stated:

> [The Kaizen Institute] stressed that the company must have good labor-management relations and that the employees "under the gun" [during the kaizen] must be assured that their jobs are not in jeopardy – kaizen teaches how to improve, not destroy.

Importantly, kaizen was presented from the very beginning to Connecticut business leaders as a means for improving and growing a business, not as a way to reduce costs by cutting jobs. Doing so would violate the "respect for people" principle.

The May 1988 seminar featured talks by Imai (1988) and others, as well as presentations and hands-on activities led by Iwata, Nakao, and Takenaka from the newly-formed Shingijutsu Co., Ltd. Imai (1988), at the start of the seminar, presented the literal definition of kaizen as: "change for the better", in the context of multi-lateral improvement; i.e. non-zero sum gains among stakeholders. Presentations given later in the week by Iwata, Nakao, and Takenaka did not discuss this – though they were indeed fully aware of the true meaning of kaizen – and instead focused on introducing the technical aspects of the Toyota Production System.

Managers from manufacturing businesses across the USA attended the seminar, including two executives from The Jacobs Manufacturing Company, George Koenigsaecker (President) and Bob Pentland (Vice President of Operations). Koenigsaecker and Pentland were greatly impressed by what they had learned in the classroom and especially during the kaizen facilitated late one evening by Iwata, Nakao, and Takenaka at the Jacobs facility in Bloomfield. This was likely one of the first kaizens conducted in Connecticut. A few days later, they were able to convince a reluctant Iwata to provide kaizen consulting services to Danaher business units starting in the summer of 1988 (Koenigsaecker, 2005; Shingijutsu, 2005c)[5]. Danaher Corporation was Shingijutsu's first US-based industrial client.

Typically, Iwata, Principal of Shingijutsu Co., Ltd, did not explain in detail the full meaning of kaizen to the President or CEO of the US-based businesses that his company served (Doi, 2005). Instead, Iwata would tell top managers at the start of a consulting engagement, though an interpreter, that they must not lay people off as a result of productivity improvements achieved through kaizen, because doing so would undermine future efforts to improve. He apparently thought that expressing this simple, real-world, cause-and-effect relationship would be sufficiently persuasive to avoid outcomes that would be inconsistent with the "respect for people" principle.

However, it appears this advice from a consultant was commonly perceived by CEOs who did not fully understand kaizen as idealistic and inconsistent with the short-term business pressures they faced from influential stockholders (DeLuzio, 2005a) – pressure that at the time was steadily increasing for leaders of US-based publicly traded businesses. Therefore, most CEO's made statements to Iwata along the lines of: "I am the CEO, and you have never run a company. So do not tell me what I should do. I will do whatever I think is necessary". This reaction, though flawed, reveals three important items:

(1) CEOs' traditional ways of thinking about business, both technical and human aspects, is not ready-made for kaizen.

(2) CEOs did not quickly comprehend the importance of the "respect for people" principle.

(3) Many CEOs are accustomed to thinking in terms of simple short-term trade-offs; e.g. higher profits are obtained by reducing labor costs – versus the

> kaizen view, which is: labor is a valuable resource for determining how to reduce costs and improve products and services.

It also highlights the importance of immediately putting the "respect for people" principle into practice at the start of kaizen if a company expects to achieve authentic continuous improvement (Okuda, 1999). Despite the steady flow of cautionary statements from numerous informed sources, particularly since 1988, kaizen remains widely misunderstood and misapplied by management practitioners, especially in the USA, who continue to use it as a way to cut jobs (David, 1996, 2005; Holmes, 2001; Calnan, 2002; Gates, 2003; Nagy, 2003; Varnon, 2003; Haar, 2004; Sanchez, 2005). Not surprisingly, kaizen is usually perceived negatively by workers and other interested stakeholders, including educators and the media in Connecticut and elsewhere. The reputation of firms that use kaizen to lay off workers will suffer as well.

Mark DeLuzio joined Jacobs in 1989 as the Cost Systems Manager charged with establishing a new management accounting system consistent with Jacob's JIT production method. DeLuzio's, who would later become Vice President of the Danaher Business System office, led efforts to establish "JIT accounting" between 1989 and 1990. This was likely the first application of what is now known as "Lean accounting" (DeLuzio, 1993, 2005b; Fiume and Cunningham, 2003; Maskell and Baggaley, 2003). Danaher companies in Connecticut and elsewhere in the USA have, over the years, also made notable progress with regards to applying Lean principles and practices to product design and administration using the "Danaher Business System" (Danaher, 2005).

Shingijutsu consultants were hired by other Connecticut business a few years later. John Cosentino, Arthur Byrne's peer at Danaher Corporation, re-joined Hartford-based United Technologies Corporation (UTC) in late 1990 as President of Otis North America. Cosentino convinced his skeptical CEO, George David, in early 1991 to hire Shingijutsu Co., Ltd (Cosentino, 2005; Shingijutsu, 2005d)[6]. According to David (1998):

> It began for us with Shingijutsu at Otis in Bloomington, Indiana, in 1991 ... We moved to Pratt [& Whitney, in East Hartford, Connecticut] with Shingijutsu the following year, 1992.

The manner in which Shingijutsu's agreed to work with Pratt & Whitney, a unit of UTC that manufactures gas turbine engines, is noteworthy. Shingijutsu's was considering consulting with General Electric Aircraft Engines in early 1992. So John Cosentino arranged an "emergency meeting" between George David and Iwata to convince him that Shingijutsu Co. Ltd should instead work with Pratt & Whitney, GE Aircraft Engine's main rival (Cosentino, 2002). The meeting was held at The Wiremold Company in West Hartford, Connecticut, and Arthur Byrne, Wiremold's new President, played a key role in convincing Iwata to consult with Pratt & Whitney (Byrne, 2002; Fiume, 2002). In 2005, one of Shingijutsu's largest customers is General Electric Company.

Shingijutsu consultants later worked at other Connecticut-based business units of UTC, including Carrier Corporation in 1992, Hamilton Standard in 1993 (now called Hamilton Sundstrand), and Sikorsky Aircraft in 1995 (Shingijutsu, 2005b). A decade later, when asked by securities analysts what his biggest accomplishment had been at UTC, CEO George David (Courant, 2003):

> ... quickly mentioned the introduction of "lean" Japanese manufacturing techniques to UTC factories. "It has remade the company", he said.

In September 1991, The Wiremold Company (Smith, 2000; Wiremold, 2005) hired a new President, Arthur Byrne, from Danaher Corporation. Byrne, one of the two Group Executives at Danaher (Cosentino was the other), was hired in part because he had specific knowledge of how to implement JIT based on his prior experience at GE and through his overall responsibility for the Jacobs facility in Bloomfield, Connecticut. Byrne skillfully led a Lean transformation at Wiremold, with support from Shingijutsu consultants starting in early 1992, and a management team eager to learn new things. Byrne was one of the few senior managers in the US outside of Toyota group companies who at that time understood Lean as a comprehensive management system for the entire enterprise. Byrne and his team set out to apply Lean principles and practices to every facet of the business – human resources, finance, sales, marketing, engineering, MIS, etc. – not solely operations as is commonly done (Emiliani *et al.*, 2003). This had never before been attempted by a US-owned business.

Brief summaries of Wiremold's and Pratt & Whitney's Lean efforts were featured in the influential book *Lean Thinking*, published in 1996 (Womack and Jones, 1996). A detailed description of Wiremold's enterprise-wide Lean transformation was chronicled in a book written and published in Connecticut titled *Better Thinking, Better Results: Using the Power of Lean as a Total Business Solution*, published in 2003 (Emiliani *et al.*, 2003). This book is recognized by executives around the world as a practical blueprint for achieving a Lean transformation.

In 1994, the Connecticut State Technology Extension Program, called CONNSTEP, was created by the State of Connecticut to serve as an affiliate of the US Department of Commerce's National Institute of Standards and Technology manufacturing extension partnership (CONNSTEP, 2005a). The purpose of CONNSTEP Inc. was to help small manufacturers in the state improve their competitiveness. In 1997, CONNSTEP changed its focus from general methods of improvement to helping manufacturers "implement Lean Manufacturing techniques" (CONNSTEP, 2005a).

The many small- and mid-sized aerospace businesses located in Connecticut are part of an important economic cluster that began to face more intense global competition starting in the mid-1990s (Porter and Miller, 2003). So in 1999, a non-profit 501c (6) corporation was formed by area businessmen Doug Rose and Bill Evans called the Aerospace Components Manufacturers (ACM, 2005a, b). Its principal focus was the adoption by member companies of Lean principles and practices to improve competitiveness in the global aerospace market.

In 1999, ACM received funding from the State of Connecticut, Department of Economic and Community Development, to train managers and associates in Lean principles and practices (DECD, 1999, 2005a, b; Emiliani, 2004b). State funds were matched by member companies, which provided about 75 percent of the total funding. This unique approach to economic development and the expansion of competitive capabilities has been cited by many as a successful public-private sector partnership. Today, ACM lists over 40 member companies. The State of Connecticut continues to support small- and medium-sized aerospace and defense manufacturing businesses by providing financial assistance for workforce training in "lean manufacturing techniques" (DECD, 2005a).

Four Connecticut businesses have won the prestigious international Shingo prize for excellence in manufacturing (Shingo, 2005a)[7], including: Johnson & Johnson

(Southington) in 1994, Union Carbide (Danbury) in 1994, The Wiremold Company (West Hartford) in 1999, and Ensign-Bickford (Simsbury) in 2002[8]. Connecticut's manufacturing extension partnership, CONNSTEP Inc., is administering a new state-wide Shingo prize for excellence in manufacturing (CONNSTEP, 2005b)[9].

Since 2000, key elements of Lean management have spread to Connecticut service businesses, including: Kaman industrial technology (distribution) (Trombly, 2002); Phoenix wealth management (financial services) (Phoenix, 2003; IBRO, 2005); St Francis hospital (healthcare) (CBIA, 2002); Rensselaer at Hartford (higher education) (Emiliani, 2004c, 2005b), and Connecticut state government (Department of Labor) (Hasenjager *et al.*, 2001; Hutton *et al.*, 2004).

Various aspects of Lean management have also become important topics in undergraduate and graduate courses or degree programs in Connecticut's engineering and business schools, including: Central Connecticut State University, University of Connecticut, Fairfield University, University of Hartford, University of New Haven, Quinnipiac University, Rensselaer at Hartford, and Yale University. Because of Connecticut's long heritage of Lean management in area businesses, some courses are taught by former managers in addition to academics.

Discussion

Connecticut's links to Lean management stretch back over 25 years. While many Connecticut manufacturing and service businesses have in the past or are currently implementing Lean management, the early adopters – Jacobs and Wiremold – have become two of the best known examples of Lean management practice outside Toyota Motor Corporation and its affiliated suppliers. They can claim a significant level of improvement in business performance across a range of business, technical, and human factors. That is because top managers led the Lean transformation through direct participation and consistent application of both principles: "continuous improvement" and, either explicitly or implicitly, "respect for people."

Further, what makes Jacobs' and Wiremold's Lean transformations even more significant is that they occurred at established "brownfield" businesses, where Lean management is much more difficult to implement because it requires significant changes in thinking and day-to-day activities of associates and managers who have been immersed in conventional business practices (Emiliani, 2003; Emiliani and Stec, 2004).

In most other cases, managers in Connecticut, and elsewhere, applied only one principle, "continuous improvement," resulting in an undesirable hybrid batch-and-queue/Lean management system that is rife with conflicts between top management's stated goals in relation to company policies, practices, performance measures, and computer information systems that help inform people's day-to-day activities (Emiliani *et al.*, 2003; Emiliani and Stec, 2004).

While many people made important contributions (Womack and Jones, 1996), the historical record reveals the key people and events that contributed to the discovery and dissemination of Lean management in Connecticut, external to Toyota Motor Corporation and its affiliated suppliers:

- *Norman Bodek*, for creating Productivity Inc. in 1979 and Productivity Press, Inc. in 1984. Bodek's role in disseminating the Toyota Production System through newsletters, workshops, seminars, and study tours to Japan was significant. Perhaps of greater importance were the books that Productivity Press published,

which provided an inexpensive and easily accessible means to learn about the Toyota Production System. These books proved to be very influential among future Lean leaders such as Arthur Byrne of The Wiremold Company (Byrne, 2001)[10].

- *Alice Heist* of the Hartford Graduate Center, for inviting Imai, and Iwata, Nakao, and Takenaka to speak about kaizen, expertly organizing the seminar, and introducing area business leaders to kaizen and Shingijutsu Co., Ltd, in early 1988.
- *George Koenigsaecker* and *Bob Pentland* of The Jacobs Manufacturing Company, for convincing Iwata and his team to provide consulting services, and also for leading a well executed Lean transformation, principally in operations, from 1987 to 1992.
- *Art Byrne* and *Orry Fiume* of The Wiremold Company for leading a highly regarded enterprise-wide Lean transformation of a "brownfield" business from 1991 to 2002.
- *John Cosentino* for bringing Shingijutsu consultants into a major US multinational industrial conglomerate, UTC, in early 1991.

The business leaders that made this happen, as well as research papers and case studies produced by area academics and management practitioners (Emiliani, 1998, 2003; Emiliani and Stec, 2004; Fiume, 2004; Fransson *et al.*, 2004a, b, c; Arnheiter, 2005; Arnheiter and Maleyeff, 2005; Fransson, 2005; Grasso, 2005; Grasso *et al.*, 2005; Maleyeff, 2005), have resulted in many valuable new contributions to the body of Lean knowledge.

The books *Lean Thinking* (Womack and Jones, 1996); *Better Thinking, Better Results* (Emiliani *et al.*, 2003), and *Real Numbers* (Fiume and Cunningham, 2003) are Shingo Research Prize winning publications (Shingo, 2005b). The large number of scholarly papers produced and the success of these books reveal the fertile ground that has existed in Connecticut regarding the adoption of a new management system. These resources are being used by managers world-wide to help them achieve enterprise-wide Lean transformations and improve the competitiveness of manufacturing and service businesses, as well as government and non-profit organizations.

The critical failure in the disseminating knowledge related to the correct Lean management practice has been non-existent, inconsistent, or incomplete representation of the importance of the "respect for people" principle, despite clear writings and presentation of Lean management, kaizen, and related processes and tools by Toyota managers and other knowledgeable people. Indeed, simple logical arguments would reveal that authentic "continuous improvement" is not possible without "respect for people." This was understood by the leaders of Jacobs and Wiremold, led by Koenigsaecker and Byrne, respectively – years before it was made explicit in "The Toyota Way 2001" document (Toyota, 2001) – through their reading of books by Ohno and Shingo, and the training they received from Shingijutsu consultants recently retired from Toyota Motor Corporation and its affiliates. The challenge for other leaders is to comprehend what "respect for people" really means.

Some of the above mentioned resources that have recently entered the literature emphasize the importance of "respect for people" principle. However, Lean

management is learned by doing, and not by reading, classroom lectures, or through distant theoretical analysis. So while these resources can be helpful, top company managers seeking to practice Lean management must apply both "continuous improvement" and "respect for people" in everyday management practice if they expect to achieve their stated goals and also be seen by followers as credible leaders.

Summary

This paper presented an historical account of the discovery, adoption, and dissemination of the Lean management system among Connecticut businesses staring in the late 1970s to establish the interests and actions of key participants, and resultant outcomes. Many of the key participants made substantial contributions to further understanding various aspects of Lean management among managers in America and elsewhere. While most Connecticut businesses achieved poor or modestly favorable outcomes, two early adopters – Jacobs and Wiremold – experienced significant improvement across a wide range of indicators.

This account also highlights a significant opportunity missed by most top managers in their adoption of Lean management. It was, and remains today, the application of the "respect for people" principle. It is noteworthy that from the very beginning, the focus of the business press and also among most top managers was "continuous improvement" – specifically the operational methods used to achieve improvements in productivity and quality, reductions defects and lead-time, cost savings, etc. while the creators of Lean management, people from Toyota, simultaneously focused on "respect for people." As both principles are put into practice, their application must be improved upon over time as top manager's understanding of them deepens.

A future challenge for educators is to ensure that Lean management is taught as a comprehensive system of management that embodies two key principles, not one, and that the management system evolves as people improve their understanding of both the obvious and hidden interconnections between corporate purpose, company strategy, and Lean principles, processes, and tools (Nishiguchi, 1994; Basu, 1999; Fujimoto, 1999; Emiliani *et al.*, 2003; Liker, 2004).

Top managers who practice Lean management must make greater efforts to ensure they understand the true meaning of kaizen – "change for the better" – and the "continuous improvement" and "respect for people" principles, in order to achieve favorable financial and non-financial outcomes that benefit all key stakeholders. The only way managers can learn and understand Lean management is through direct participation in kaizen and other process improvement activities. This will also lead to a better balance between thinking and doing.

Management historians should benefit from this work by recognizing how certain aspects of the Lean management were selectively incorporated by most managers into existing batch-and-queue management practice, with little thought given to how this could affect their business or its stakeholders. The tendency to reduce lean management to short-term cost-cutting tactics or simple tools to add to manager's tool kit discounts the likelihood of confusion, lack of participation, and poor outcomes (Aeppel, 2002; Smalley, 2005), thereby corrupting a well-thought out and potentially beneficial management system. And when things do not work out, whom will historians hold accountable?

Notes

1. GE (2005), For about 20 years, GE's interest in Lean management has been uneven. GE's interest in Lean has increased greatly since 2004.
2. Productivity Inc. and Productivity Press, Inc. were combined in 1995 and then sold by Norman Bodek to The Kraus Organization, Ltd, in 1999. In 2003, Kraus divested the consulting business and retained the publishing business.
3. The name of the company was changed to Jacobs Vehicle Equipment Company in 1987. The company is commonly known as Jake or by the trade name JakeBrake®. Art Byrne recalls the date for implementation of JIT and cellular manufacturing as late 1986, personal communication, March 23.
4. The name was changed to "Rensselaer at Hartford" in 1997. Rensselaer at Hartford is a unit of Rensselaer Polytechnic Institute, Troy, NY.
5. Otis Elevator Company is headquartered in Farmington, Connecticut. Shingijutsu consulted at Otis' manufacturing facility in Bloomington, Indiana.
6. According to Shingijutsu's web site, their consultants started working at Danaher in 1989. The correct date is 1988.
7. Named after Dr Shigeo Shingo, and is administered by Utah State University's College of Business.
8. Conn (2005), Johnson & Johnson, recently known as Medex, is now owned by Smiths Medical, available at: www.smiths-medical.medex.com. Union Carbide is now a subsidiary of The Dow Chemical Company, available at: www.unioncarbide.com. The Wiremold Company is now a unit of Legrand Holding SA, available at: www.legrandelectric.com, owned in part by Kohlberg Kravis Roberts & Co., available at: www.kkr.com. Ensign-Bickford is now called Dyno Nobel, available at: www.dynonobel.com (accessed July 9).
9. The Connecticut Shingo Prize recognizes four levels of achievement in the application of Lean principles and practices.
10. The Productivity Press books that influenced Byrne the most were Shingo's *Study of Toyota Production System from Industrial Engineering Viewpoint and A Revolution in Manufacturing: The SMED System*, and Ohno's *Toyota Production System*.

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