

A Brief Investigation into the Origins of the Toyota Production System

July 2006

Draft 1.0

Art Smalley
President
Art of Lean, Inc.

Background

- There is unfortunately little that is well understood by most people about the historical development of the Toyota Production System. Mostly anecdotes and stories are used in explaining the various origins of the system.
- Some parties have claimed for example that Mr. Shigeo Shingo actually invented much of the Toyota Production System and was the teacher of Mr. Taiichi Ohno.
- Others that worked at Toyota during the era in question dispute this notion pointing out that Mr. Shingo basically taught a shop floor level training course for about two or three weeks per year on average between 1955-1980.
- There is ample material available in the form of books, timelines, historical records, interviews, and articles to look at that can shed light the matter for interested parties to study and form their own opinion.
- On the following pages I'll highlight what is verifiable about history of the Toyota Production System for interested parties to learn more. After a trip to Japan this summer I will create a more detailed investigation and comprehensive document. This initial effort will not focus on Henry Ford's influence, TWI materials, or the Quality movement which are all duly recognized by the company.

Outline

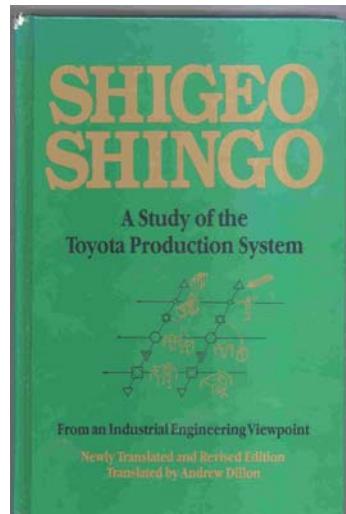
- Origins of TPS
- Jidoka
- Just-in-Time
- SMED
- The role of Mr. Shingo at Toyota
- Summary comments

Who developed TPS?

Perception voiced by some parties:

Mr. Shingo co-invented much of the Toyota production system with Taiichi Ohno including JIT, SMED, Kaizen and many other elements

Actual written statements by Mr. Shingo himself contradict this however



This book was written by a production engineer and is based on a detailed study of the Toyota production method. Hence, it may differ from the book written by Mr. Ohno, the originator of the system.

-Preface by Mr. Shingo in the English edition translated from the Japanese edition (page xxvi)

Who developed TPS?

Other written statements by Mr. Shingo



From preface pages 2-3:

私は昭和30年以来、トヨタ自工に於いて“生産技術講習会”を79回（昭和55年10月末現在）担当し、すでに約3,000人の受講生がいるのである

が、その間、一貫して

「改善のための“S. T. メカニズム”」

を実際に教え、かつ強調してきたのである。

この“約3,000人に及ぶ受講生”が、新しいトヨタ生産方式の底辺を支えてくれたであろうことを、堅く信じている。

Abbreviated translation – “I was in charge of teaching the P-course at Toyota Motor Company 79 times from 1955 until today in October 1980. Roughly 3,000 participants took my course. I have emphasize the Scientific Thinking Mechanism in instruction and I firmly believe that my teachings to these 3,000 people have helped to support the base for the Toyota Production System.”

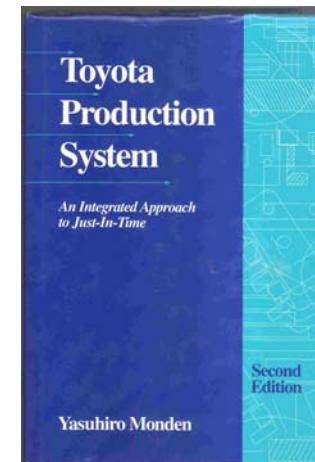
Who developed TPS?

Additional points of view – Prof. Yasuhiro Monden

This book is the fruit of much guidance and cooperation of many people to whom I am very grateful. Above all, I am grateful to the original founder of the Toyota production system, the late Mr. Taiichi Ohno (former vice president of Toyota).

Mr. Ohno shared generously his concept for the system and he authored the foreword to the first edition of this book. He was also my co-editor for a Japanese-language book titled *New Development of Toyota Production System*.

-Monden acknowledgements page xvii



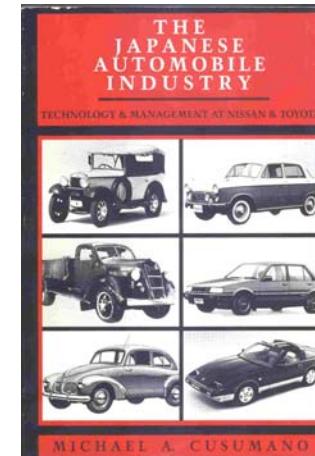
Additional point of view – Michael Cusumano

THE TOYOTA PRODUCTION SYSTEM

The individual most responsible for developing Toyota's system of production management after 1945, including the famous kanban, was Ōno Taiichi, an engineer without a college education but with a remarkable ability to analyze manufacturing operations and eliminate unnecessary practices or worker motions. He was born in 1912 in Dairen, Manchuria, the son of a Japanese ceramics technician who worked in the laboratories of the South Manchuria Railway.

-Cusumano text page 267

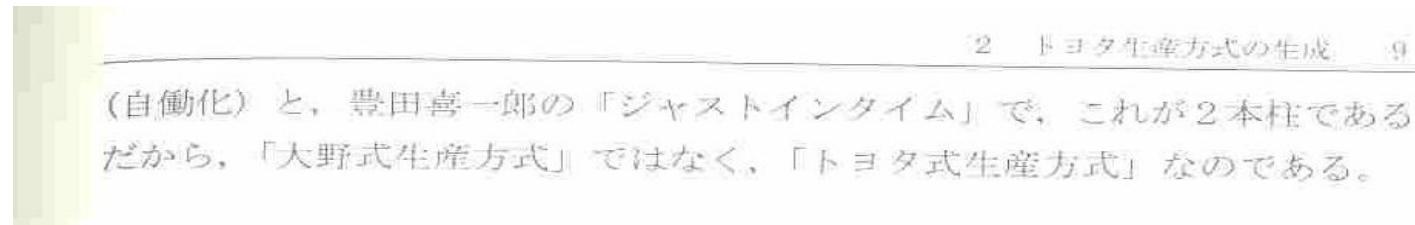
© Art of Lean, Inc.



Who developed TPS?

However consider this actual statement by Mr. Taiichi Ohno:

- トヨタ式生産方式の源流は、豊田佐吉の「不良品を作るのは仕事じゃない」



Title: Origins of
Toyota System

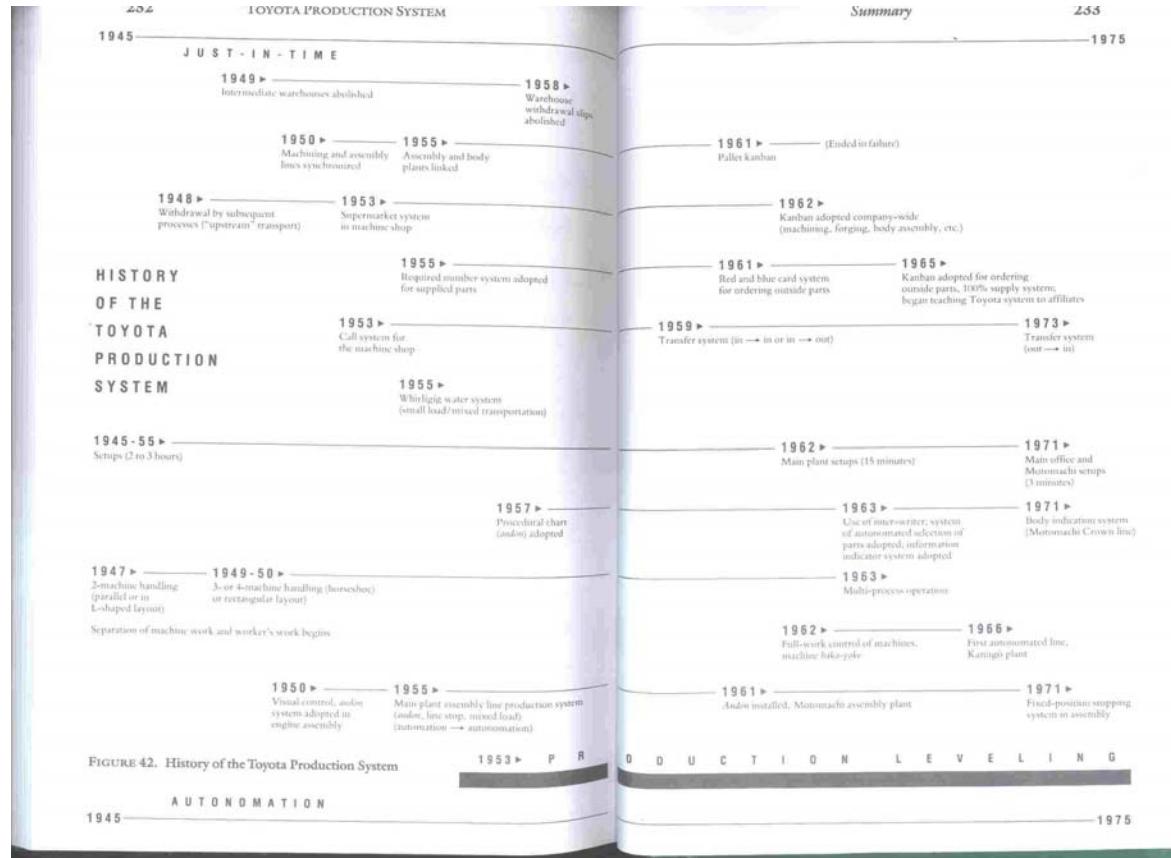
By Prof Fujimoto

Abbreviated translation – The origins of the Toyota Production System are the two pillars of “Jidoka” the concept established by Sakichi Toyoda and “Just-in-Time” the concept from Kiichiro Toyoda. Therefore it is the “Toyota” Production System and not the “Ohno” Production System*.

*Source: Pages 8-9 from Prof. Fujimoto’s book on the Origins of TPS in Japanese. Taiichi Ohno interview.

© Art of Lean, Inc.

TPS Development Timeline (English*)



JIT development between 1945 – 1955

- Creation of process flow 1948
- Synchronization of machining line 1948
- Withdrawal by upstream processes 1948
- Abolition of intermediate warehouses 1949
- Machining and assembly linked 1950
- Supermarket in machine shop 1953
- Call system for the machine shop 1953
- Machine shop kanban 1953
- Leveling machining line 1953
- Mixed material handling 1955
- Connection of machining plant and assembly plant by pull in 1955
- Establishment of formal supermarkets 1956

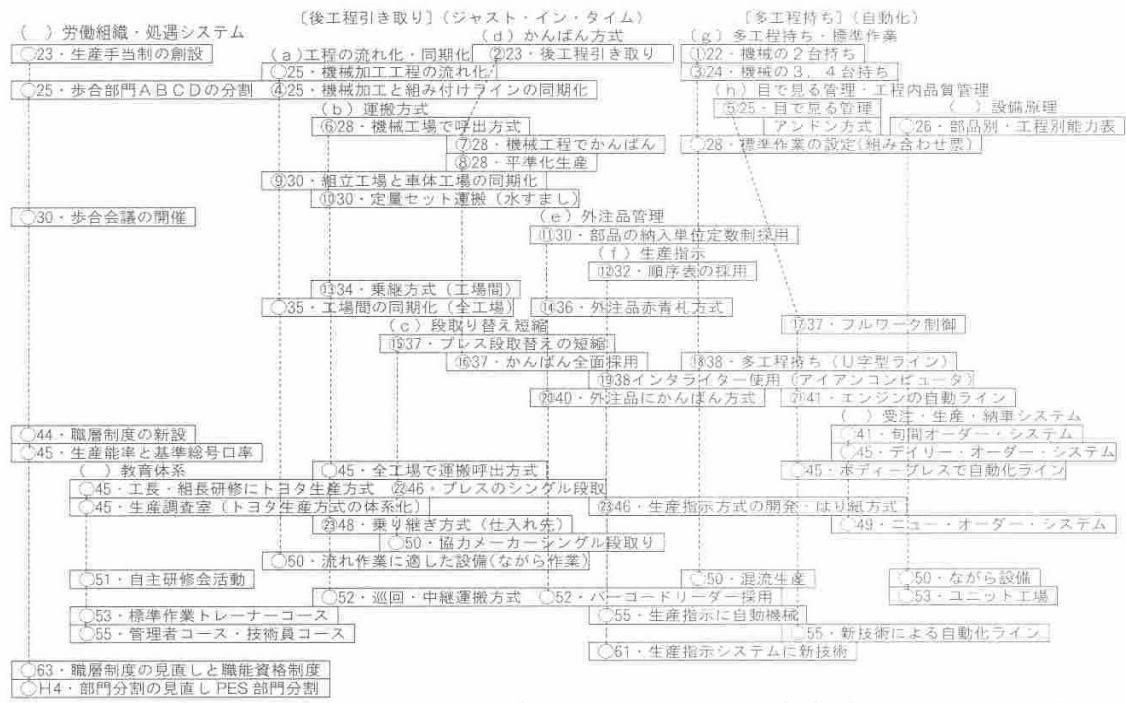
Most of this was driven first by Mr. Ohno in his machine shops from 1945-55 and then later in other parts of the company

*Source: Page 232 Shingo's book on TPS. Longer more detailed versions exist in Japanese.

It is difficult for Mr. Shingo to have invented JIT or TPS as some parties claim since much of it was well established at Toyota long before his arrival to the company in late 1955.

TPS Development Timeline (Japanese)

図4 トヨタ生産方式の諸手法の全体図 (①②…○については(注)を参照、数字は昭和年号を表示)



(注)『トヨタ50年史』資料編の年表「トヨタ生産方式の変遷」と『トヨタ式生産システム—基本編—』の「作業の仕方の移り変わり」より合成
 ①②は…は両者に共通にみられる手法。○○は『トヨタ50年史』で追加された手法——両年表の作成事情について、では佐武弘章『トヨタ生産方式の生成・発展・変容』序章を参照されたい。

JIT development 1945 – 1955

- Creation of process flow 1948
- Synchronization of machining line 1948
- Withdrawal by upstream processes 1948
- Abolition of intermediate warehouses 1949
- Machining and assembly linked 1950
- Initial supermarket in machine shop 1953
- Call system for the machine shop 1953
- Machine shop kanban 1953
- Leveling machining line 1953
- Mixed material handling 1955
- Connection of machining plant and assembly plant by pull in 1955
- Establishment of formal supermarkets in 1956

Most of this was driven first by Mr. Ohno in his machine shops from 1945-55 and then later in other parts of the company

Source: Page 104 Key Persons Speak about the Origins of TPS by Takahiro Fujimoto.

It is difficult for Mr. Shingo to have invented JIT or TPS as some parties claim since much of it was well established at Toyota long before his arrival to the company in late 1955.

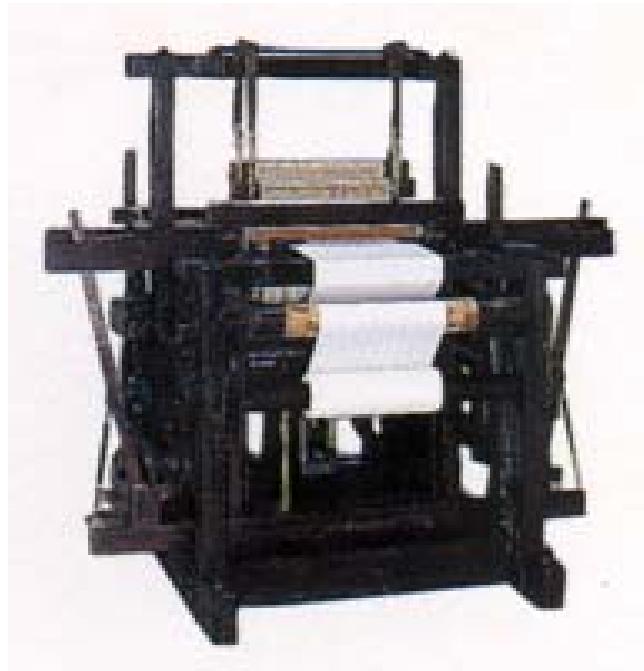
Sakichi Toyoda's Contribution - Jidoka



Sakichi Toyoda

- The term *jidoka* used in the TPS can be defined as "automation with a human touch." The word *jidoka* traces its roots to the automatic loom invented by Sakichi Toyoda, Founder of the Toyota Group. The automatic loom is a machine that spins thread for cloth and weaves textiles automatically.
- In the olden days, back-strap looms, ground looms, and high-warp looms were used to manually weave cloth. In 1896, Sakichi Toyoda invented Japan's first self-powered loom called the "Toyoda Power Loom." Subsequently, he incorporated numerous revolutionary inventions into his looms, including the weft-breakage automatic stopping device, which automatically stopped the loom when a thread breakage was detected, the warp supply device, and the automatic shuttle changer. Then, in 1924, Sakichi invented the world's first automatic loom, called the "Type-G Toyoda Automatic Loom (with non-stop shuttle-change motion)" which could change shuttles without stopping operation.
- The Toyota term "*jido*" is applied to a machine with a built-in device for making judgments, whereas the regular Japanese term "*jido*" (automation) is simply applied to a machine that moves on its own. *Jidoka* refers to "automation with a human touch," as opposed to a machine that simply moves under the monitoring and supervision of an operator. Since the loom stopped when a problem arose, no defective products were produced. This meant that a single operator could be put in charge of numerous looms, resulting in a tremendous improvement in productivity.
- http://www.toyota.co.jp/en/vision/production_system/jidoka.htm

Sakichi Toyoda's Contribution - Jidoka



**The first step towards
Jidoka!**

**This is an image of the 1896 self
propelled loom built by Sakichi that
detected when a thread broke and
stopped the machine automatically**

Sakichi Toyoda's Contribution - Jidoka



This is the G Type Power Auto Loom built and patented in 1924. It combined the following ideal elements:

- 1) It stopped when a thread broke (first part of Jidoka)
- 2) It was automated which allowed workers to run multiple machines (the second part of Jidoka)
- 3) People forget this was also the world's first non stop shuttle change machine – in other words it had key elements of SMED capability built into it.

Kiichiro Toyoda's Contribution - JIT



*Founder
Kiichiro Toyoda*

Drawing on his experience of introducing a flow production method using a chain conveyor into the assembly line of a textile plant (completed in 1927) with a monthly production capacity of 300 units, Kiichiro Toyoda also introduced this method into the body production line at Toyota Motor Company's Koromo Plant (present day Honsha Plant), completed in 1938.:

http://www.toyota.co.jp/en/vision/production_system/origin.html

Kiichiro Toyoda's Contribution - JIT



*Founder
Kiichiro Toyoda*

- In the 1930s, intent on seeking out new applications for materials, parts and manufacturing technology, Toyoda frequently went to Tokyo to visit universities and research institutes. Following each visit, he would immediately write a memorandum to his staff, requesting them to change a material or manufacturing method.
- Unfortunately, overall efficiency was not as good as expected because the output differed among the various processes. Undeterred, Kiichiro wrote the words "**Just-in-time**" on a banner and hung it on the wall. "People talk about having missed the train just by a minute," he said, but of course it's possible to miss a train just by a second. What I mean by 'Just-in-time' is not simply that it is important to do something on time, but that is absolutely essential to be precise in terms of quantity and not, for example, produce something on time but in excess, since excess amounts to waste," he said.
- "An automobile consists of thousands of parts, each one essential for building flawless, complete vehicles," Toyoda said. "It is no easy task to coordinate their assembly. Without perfect organization of the assembly process, even a mountain of parts fails to become a vehicle. For the task of coordinating the assembly of thousands of parts, we must design a unique pattern of control and organization. Unless we establish a unique pattern of control and organization, no amount of financial resources will be sufficient."

http://www.toyota.co.jp/en/vision/traditions/may_jun_04.html

Mr. Ohno's Contribution – Supermarkets



Taiichi Ohno

- Of all places, it was the American supermarket that inspired Taiichi Ohno's famous **Kanban System** on the production line. In the early 1950s Ohno observed how customers only picked up the number of items they needed from the grocery store. In turn, the supermarket replenished the supply — at the right time and in the required amounts. This got Ohno thinking about how to eliminate waste on the production line.
- Back then, parts moved to the next stage as soon as they were completed. Employees didn't communicate with each other about their needs. But Ohno realized it would be more efficient if an employee in the later stage of the process informed a worker in the previous phase how many parts he needed and when. With Ohno's "supermarket formula," only enough parts were produced in the former phases to replace what was used in the next.
- At first, parts shortages and line stoppages happened frequently because floor employees weren't used to the method. But Ohno didn't worry. He emphasized the importance of locating the cause each time a problem occurred. It then became clear to the person in charge of each stage that there was an urgent need to adjust the production speed and improve the process.
- The **Kanban System**, later established in all Toyota factories, helped to ease Ohno's philosophy into a working practice. Under this setup, employees created signboards, or *kanban*, to transfer information between processes such as the number of parts that had to be filled. The Kanban System eventually helped the production flow function more smoothly, a fact reflected in quality and productivity. *Kanban* took on many forms as part of the Just-in-Time System. In the end, pointing out errors and providing countermeasures became key to achieving kaizen in all the activity areas, from production to sales and marketing.

Summary TPS/JIT Development at Toyota

- Mr. Ohno and Toyota literature officially credit Kiichiro Toyoda in 1937 for the start of JIT in Toyota although it was still rudimentary in its form
- Between 1943-48 Mr. Ohno experimented with reversing the flow of information and not pushing material in his machine shop
- In 1948 the machine shop began reducing buffer inventory and production lot sizes as well.
- In 1948 a pilot supermarket was attempted. It was refined and implemented widely by 1956 in both the machine and assembly shops
- In 1954-55 Toyota worked at adding certain suppliers to the idea of the supermarket and JIT delivery
- Kanban was initially trialed at Toyota in the machining department in 1953 and then finally established more widely by 1956
- Mixed sequence scheduling and leveling of production began in the mid to late 1950's

-Michael Cusumano, History of the Japanese Automobile Industry pages 275-280

Comments:

- 1) Most people don't realize the extent of the work done on TPS and JIT between 1945-1955 by Mr. Ohno and others. Mr. Shingo did not participate in these endeavors at all in Toyota and was reportedly highly surprised when he saw them in late 1955.

Summary TPS/Jidoka Development at Toyota

- Mr. Ohno and Toyota literature credit Sakichi Toyoda for development of Jidoka on his patented auto loom. Refinements were made resulting in the famous Power G loom in the 1920's.
- Between 1948-1950 Mr. Ohno rearranged work areas so that workers could handle multiple processes instead of just one machine.
- Mr. Ohno and other managers began to follow the principle of Jidoka on machines initially by removing handles, adding stop switches and valves, centralizing lubrication to eliminate hand work, and having a special grinding room deliver tools to the line ready for use
- One man could operate up to 17 machines in 1953 although the average was between 5-10 in the machine shop.
- Employees were given authority to stop the line in 1950 and responsibility for source inspection
- In 1957 "stop the line" was refined by adding the first Andon lights. Yellow to request assistance and Red to show a line stop situation

-Michael Cusumano, History of the Japanese Automobile Industry pages 275-280

Comments:

- 1) Most people don't realize the extent of the work done on TPS and Jidoka between 1945-1955 by Mr. Ohno and others. Mr. Shingo did not participate in these endeavors at all in Toyota and was reportedly shocked when he saw them in late 1955.

TPS Summary (JIT and Jidoka)

- Looking objectively at the historical facts, Mr. Shingo's own statements, and comments from Toyota managers it is apparent Mr. Shingo played essentially no role in any initial TPS formulation.
- There is no record by Toyota or Mr. Shingo of his involvement in JIT or Jidoka internally in the 1940's 1950's and 1960's despite various parties assumptions to the contrary
- Toyota's official history and others credit Kiichiro Toyoda with starting JIT in 1937 and Sakichi Toyoda for Jidoka decades earlier. Others authors such as Michael Cusumano in English and numerous other sources in Japanese document this point as well.
- With JIT Mr. Ohno comments that he just extends upon earlier work by adding reverse information flow, supermarkets, kanban, and leveling.
- What others do correctly cite however is some involvement in JIT activities by Mr. Shingo in the late 1970's an early 1980's in the Toyota supply base (confusingly to some these companies have Toyoda in their names such as Toyoda Boshoku and Toyoda Gosei).
- Most of this work was done however by the Operations Management Consulting Division (OMCD) group in Toyota starting in 1973 and continuing onward.
- Merely "contributing" to isolated workshops in the late 1970's or early 1980's about 30 years after Mr. Ohno's main implementation program inside Toyota should not be construed as "inventing" JIT by any objective party.

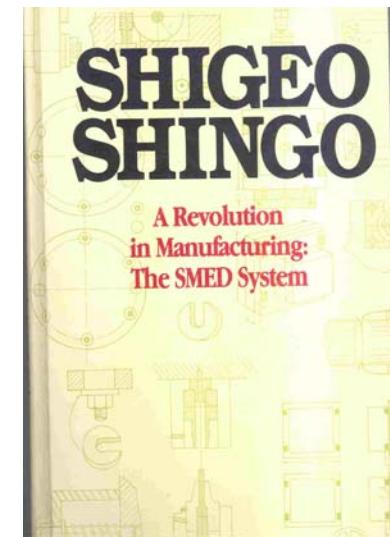
Who developed SMED?

Perception by some parties:

Mr. Shingo invented SMED and was requested by Mr. Ohno to implement it inside Toyota, and reduce change over time to under 10 minutes. He then introduced his revolutionary concept to the world.

Actual statement by Mr. Shingo

In 1969 I visited the body shop at Toyota Motor Company's main plant. Mr. Sugiura, the divisional manager, told me they had a 1,000 ton press that required four hours for each set up change. Management had given Mr. Sugiura clear instructions to better that time. Together with the foreman and plant manager I set out about seeing what could be done. We took special pains to distinguish between internal and external set up time. After six months we succeeded in cutting set up time to 90 minutes. When I revisited the shop later Mr. Sugiura had some rather startling news for me. Management had given him orders to further reduce set up time to less than three minutes! For an instant I was dumbfounded at this request. But then an inspiration struck why not convert internal set up time to external set up time? A number of thoughts followed in rapid succession. One a conference room board I listed eight techniques for shortening set up times. Using this new concept we were able to achieve the three minute goal after three months of diligent effort. I named this concept SMED. **SMED was later adopted by all Toyota plants and continued to evolve as one of the principle elements of the Toyota Production System.** Its use has spread to companies throughout Japan and all around the world.



-Shigeo Shingo 1983
Page 24-25 Fundamentals of SMED

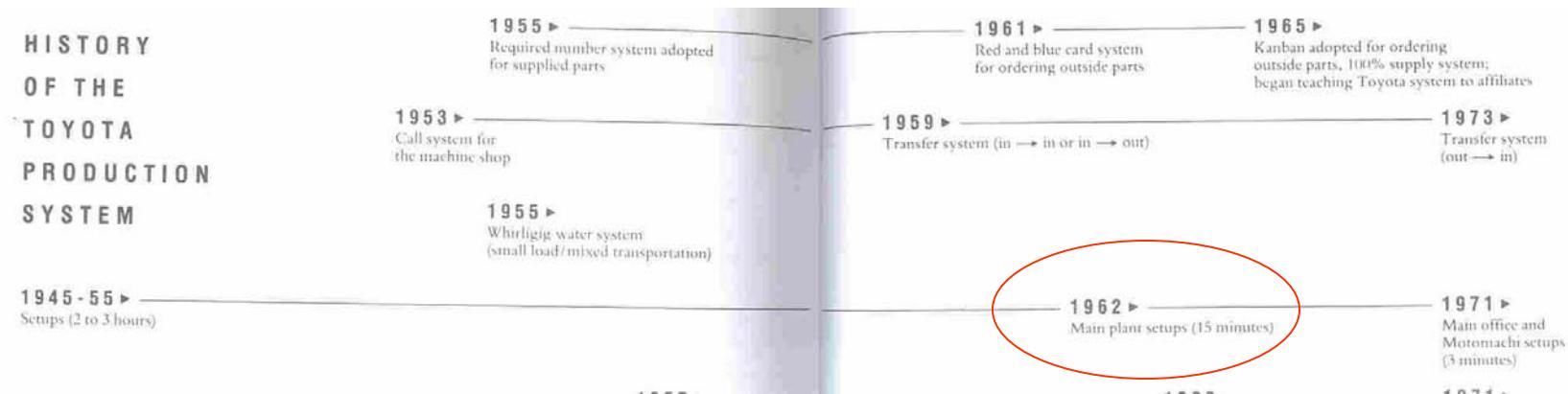
Who developed SMED?

Problems in Mr. Shingo's account of events

- 1) Mr. Sugiura was a famous production control manager in Toyota and he created the actual calculation method for kanban sizing. He never worked in the body department as a divisional manager however. Mr. Shingo is mistaken somehow on this account (Isao Kato & others)
- 2) Furthermore **average press changeover time was already down to 15 minutes company wide in the body shop in 1962** or seven years before Mr. Shingo claims to have invented SMED (see following pages for sources). Single minute machines also existed at this time.
- 3) For some reason Mr. Shingo indicates he visited the body stamping shop for a SMED event. Related parties in Toyota however point out that he actually visited the forging shop for his SMED experience in Toyota in 1969. The visit was also at his own request and not directly Mr. Ohno's according to different internal parties.
- 4) Regardless Mr. Shingo did indeed participate on a SMED event in Toyota in 1969. However, **this machine was apparently one of the last machines to be converted to single minute capability** in the company and not the first as he mistakenly somehow assumes and implies.
- 5) Lot reduction and set up time reduction had actually been ongoing in TPS since 1945 when Mr. Ohno became manager of the machine shops in Toyota (see following pages and TPS timelines).
- 6) The key breakthrough in Toyota in set up reduction time was the purchase of rapid changeover stamping machines from the Danley corporation in the U.S. in 1955 before Mr. Shingo even visited the company for the first time. This purchase coupled with simple analysis techniques paved the way for shorter changeover times in the company which was 90% complete (average 2-3 hours to 15 minutes) by 1962 in stamping (see following pages)

SMED Timeline (English)

Source: Page 232 Shingo book on TPS*



Comment: It seems difficult for Mr. Shingo to have “invented” SMED in 1969 and then later spread it in Toyota as claimed if the company already had documented average performance of 15 minutes or less company wide in 1962*. This timeline is even included in Mr. Shingo’s study of TPS and is a shortened adaptation of a more detailed Japanese version the company created many years ago. The 15 minute average by 1962 is noted also in many other books and interviews in Japanese.

SMED Development at Toyota

It is one of the great ironies in the history of production management and technology transfer that the idea of rapid set up, in addition to the time and motion studies that the Japanese used to cut cycle times and idle times were American. Ohno first saw Danley stamping presses with rapid die-change features on a trip to the U.S. in the mid 1950's (1955 to be exact) and purchased several of those machines for the Motomachi body shop.

-Michael Cusumano, History of the Japanese Automobile Industry page 285

Comments:

- 1) It has been voiced by Toyota insiders that indeed the Danley equipment and lot size reduction work they were already doing was the key to achieving 15 minute performance company wide by 1962.
- 2) Cusumano also notes that Shingo started visits to Toyota in 1955 and he mistakenly assumes it is for set up reduction work (he cites Mr. Shingo's book for this belief). As Mr. Shingo himself points out however even in his own books he taught the P-course starting in 1955 and had his personal SMED breakthrough in 1969 (both verified by Mr. Isao Kato whose department organized his visits).

SMED Historical Perspective at Toyota



Veteran managers at Toyota point out that the G type auto loom from 1924 was famous for its non-stop zero shuttle change over time.

The Platt Brothers Ltd. who bought the patent to the loom called it a “magic loom” partly due to this feature.

-The Life of Kiichiro Toyoda (page 165 Japanese edition)

Retired Toyota managers also like to point out that cutting tool change times in the engine plant on machine tools were all less than 10 minutes at Mr. Ohno's insistence by the mid 1950's. The operators also changed their own tools unlike in the U.S. Toyota did not call this action by any special name

Mr. Shingo's Contribution to SMED

- 1) In hindsight it appears that Mr. Shingo's primary contribution to SMED is the codification of a series of steps to analyze set up work especially the distinction between internal and external work. He deserves proper credit for the framework and the introduction to the outside world. Mr. Shingo explained 3 stages of development in his view of events.
- 2) Stage 1 - In hindsight Shingo writes in 1983 that he had been "thinking" in his own words about SMED since 1950 when the distinction came to his mind regarding internal versus external work at Toyo Industries (became Mazda).
- 3) Stage 2 - In 1957 he further makes a "dramatic" improvement in set up time at Mitsubishi Heavy Industries. Note: This helped to produce a 50% reduction in ship build time from 4 months to 2 months but it was not the only contributing factor.
- 4) Stage 3 – He then assumes that he achieves and invents SMED by working briefly in a workshop on a 1,000 ton press at Toyota which later attained single minute performance. **Unfortunately he does not realize or mention that other machines at Toyota were already at this level of performance. Set up reduction efforts in Toyota started in the late 1940's and continued for 30 years driven by Mr. Ohno and other parties without Mr. Shingo's involvement.**
- 5) Mr. Shingo was indeed the first to publish a book on the principles of SMED and provide examples of set up reduction work in 1983 for the outside world to study the method.
- 6) This book helped convince many companies outside of Japan to embark upon set up reduction. In Japan however the book was not as successful or widely read probably due to the fact that Toyota and other companies had already reduced set up times dramatically on their own in the 1950's, 1960's, and 1970's long before this book was published.
- 7) Mr. Shingo still deserves much credit for his work on developing the methodology for conducting SMED just not for the reasons typically assumed and mentioned by most parties.

SMED Summary

- 1) It is puzzling to key people in Toyota just how much Mr. Shingo's SMED book in 1983 seemed to confuse the basic facts regarding the situation.
- 2) Toyota managers from the period are perplexed why he failed to properly mention Toyota's own work in set up reduction or the fact that set up times company wide were already 15 minutes in 1962 and long before his personal breakthrough. Single minute machines already existed inside Toyota at this point and probably in other companies as well.
- 3) Some people have speculated that Mr. Shingo was simply unaware in 1969 about the actual status of set up reduction in the Toyota. This is entirely possible given the rather limited role he actually played in TPS formulation.
- 4) There is a person or two still alive from the actual 1969 SMED event at Toyota that Mr. Shingo outlines. I will see what I can do to contact those persons this summer to shed some more light on the actual situation.

What was Mr. Shingo's Role at Toyota?

Perception by some:

Mr. Shingo was Taiichi Ohno's teacher and he co-developed the Toyota Production System.

Comments:

There are a lot of verbal anecdotes and tales told about how Mr. Shingo developed TPS, taught Mr. Ohno personally, and developed much of the system. Unfortunately all of this is however disputed by different managers at Toyota, historical records, and neutral parties. Adding to the confusion are the contradictions in Mr. Shingo's own writings as evidenced in the previous pages.

Mr. Shingo's Role at Toyota

Sample written statements by Shingo (1/2)



From preface pages 2-3:

私は昭和30年以来、トヨタ自工に於いて“生産技術講習会”を79回（昭和55年10月末現在）担当し、すでに約3,000人の受講生がいるのである

が、その間、一貫して

「改善のための“S. T. メカニズム”」

を実際に教え、かつ強調してきたのである。

この“約3,000人に及ぶ受講生”が、新しいトヨタ生産方式の底辺を支えてくれたであろうことを、堅く信じている。

Abbreviated translation – “I was in charge of teaching the P-course at Toyota Motor Company 79 times from 1955 until today in October 1980. Roughly 3,000 people took my course. I have emphasize the Scientific Thinking Mechanism in instruction and I firmly believe that my teachings to these 3,000 people have helped to support the base for the Toyota Production System.”

Mr. Shingo's Role at Toyota

Sample written statements by Shingo (2/2)



Page 12:

(A) 多数台持ち作業との出会い

機械をふやすということは、決って“人と機械をふやす”ということではない。“人はふやさないで、機械のみをふやす”ということである。私が昭和30年に、トヨタ自工でP講習を行った際、もっとも驚いたことは、「1人で、多くの機械を受持っている」ということであった。その当時、機械工場に「機械=3,500台、作業者=700人」ということで「1人、平均5台」を受持っていたり、最大は26台受持っているものもある、と聞かされてびっくりしたものである。

Abbreviated translation – (A) My encounter with multi-process handling

“Increasing machines does not mean increasing manpower and machines. In other words increase machines without increasing manpower. I started teaching the P-course in Toyota in 1955. The most astonishing thing I observed was “one person handling multiple machines”. In the machine shop there were 3,500 machines and 700 operators. On average one person was thus handling 5 machines. The maximum case I heard about was where one person was handling 26 machines and I was very surprised.”

Early Training Courses* in Toyota

- Training Within Industry (TWI) Courses - Started in 1951 continues today
 1. Job Instruction
 2. Job Relations
 3. Job Methods -- Replaced in 1955 by the **P-course** training
 4. Job Safety -- Added by Toyota to the above courses
- **P-Courses taught by Mr. Shingo** – Started in 1955 and continued until 1980
 1. Motion analysis
 2. Time study analysis
 3. Operational analysis
 4. Process analysis
- TQC related courses (Starting around 1962 with the TQC program)
 1. QC Circle activity
 2. Basic problem solving
 3. Statistical quality control
- Standardized work training – establish in the early 1950's and refined up until 1978
- Kaizen training course – formalized in 1978 and replaced the P-course
- Role of a Supervisor – formalized in 1970 and continues today
 1. Role of a Team Leader
 2. Role of a Group Leader

*This list primarily reflects the courses aimed at the supervisor and engineers in manufacturing at the plant level according to former Manager of Training and Development Mr. Isao Kato.

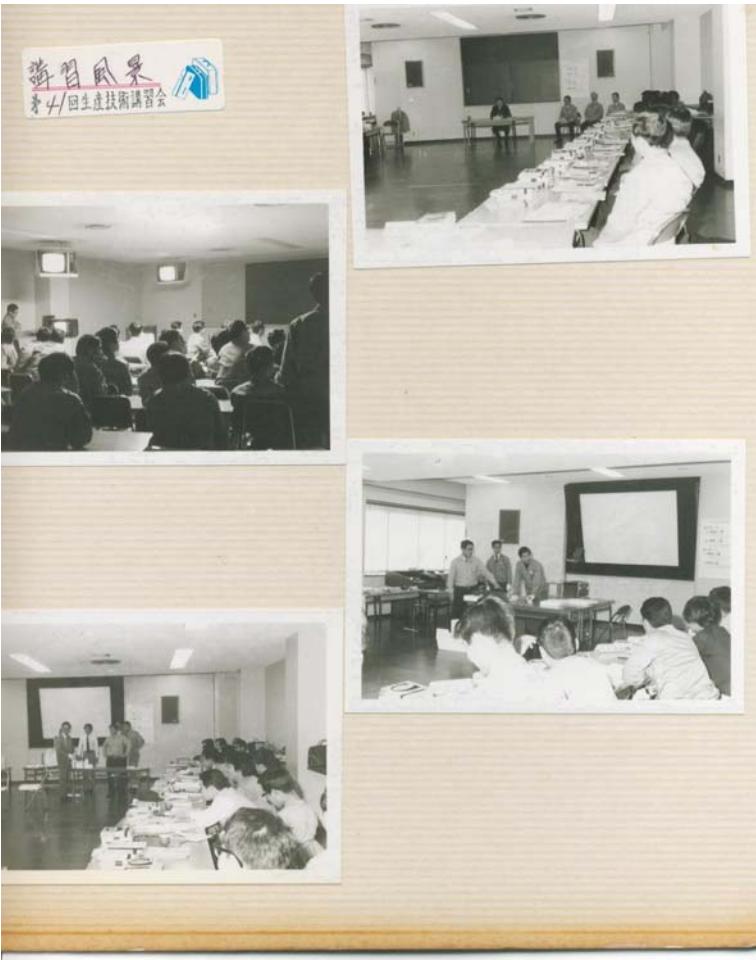
Shingo's P-Courses at Toyota (1955-1980)

- 1) Motion analysis
- 2) Time study analysis
- 3) Operational analysis
- 4) Process analysis

These four courses along with the scientific method for improvement formed the basis for Mr. Shingo's Scientific Thinking Mechanism (STM) and training:

- Identify the problem
- Establish a goal
- Identify better means (via using the tools listed left)
- Propose and evaluate
- Implement improvement

Sample Pictures from the P-course at Toyota*

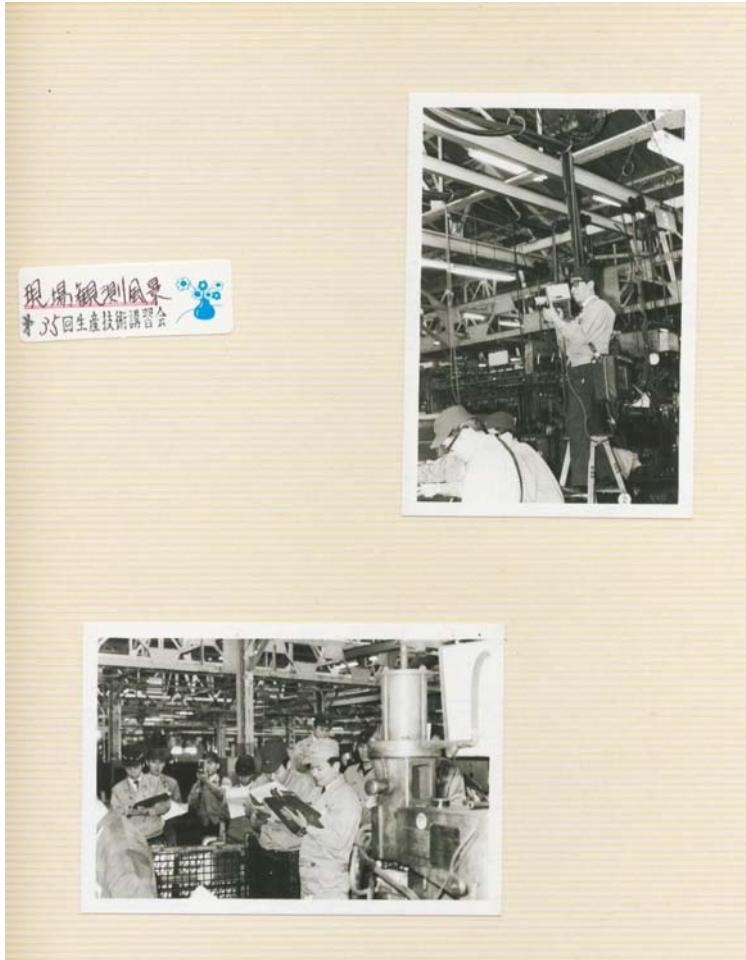


Mr. Shingo's typical classroom set up from a shot of the actual 41st P-course taught at Toyota.

© Art of Lean, Inc.

*Pictures courtesy of Isao Kato former Education and Training Manager, Toyota Motor Corporation

Sample Pictures from the P-course at Toyota*



Typical shop floor observation
work done as part of the 35th
P-course seminar

© Art of Lean, Inc.

*Pictures courtesy of Isao Kato former Education and Training Manager, Toyota Motor Corporation

Sample Pictures from the P-course at Toyota*



Mr. Ohno drops in on one of the P-course seminars to have lunch, hear an update, and to provide advice to the group.

© Art of Lean, Inc.

*Pictures courtesy of Isao Kato former Education and Training Manager, Toyota Motor Corporation

P-Course Outline: Time Study Analysis

Day	AM Session	PM Session
Day 1	-How to view and think about kaizen -Discussion of analysis methods	-Time study basics
Day 2	-Time study: Main subjects -Shop floor observation & practice	-Summary of observation results
Day 3	-Time study: Additional items analysis and discussion	-Additional item shop floor investigation practice
Day 4	-Time study: Additional items analysis and measurement	-Time study: Additional items analysis and measurement -Investigation into kaizen plan
Day 5	-Results summary and presentation on main subject and additional items from time study	-Wrap up and closing

P-Course Outline: Motion Analysis

Day	AM Session	PM Session
Day 1	<ul style="list-style-type: none">-How to think about kaizen-Steps for kaizen-Step 1: Problem discovery-How to discover problems	<ul style="list-style-type: none">-Step 2: Study the current condition-Study of motion analysis-Prep for studying motion analysis on the shop floor
Day 2	<ul style="list-style-type: none">-Step 2: continued-Practice motion analysis on the shop floor	<ul style="list-style-type: none">-Summarize results of motion analysis-Study of the results
Day 3	<ul style="list-style-type: none">-Step 3: Idea generation focus for kaizen	<ul style="list-style-type: none">-Ways to generate improvement ideas-Practice shop floor observation
Day 4	<ul style="list-style-type: none">-Presentation of kaizen ideas from the shop floor observation	<ul style="list-style-type: none">-Step 4: Creation of kaizen plan-Step 5: Regarding implementation of kaizen plan
Day 5	<ul style="list-style-type: none">-Desk top practice examples and kaizen	<p>How to proceed with kaizen on the shop floor</p> <p>Overall summary</p>

P-Course Outline: Operation Analysis

Day	AM Session	PM Session
Day 1	-Types and categories of IE analysis -Operation analysis	-Operation analysis & shop floor observation practice
Day 2	-Operation analysis and investigation	-Operation analysis and investigation -Wrap up observations
Day 3	-Operation analysis presentation and results summary	-Work sampling practice -Wrap up and closing

P-Course Outline: Process Analysis

Day	AM	PM
Day 1	-How to think about plant kaizen -Process analysis – Subject analysis	-Process analysis – subject analysis investigation and observation
Day 2	-Observation practice -Summary	-Process analysis – Process work -Explanation and investigation
Day 3	-Process analysis – Inspection work -Explanation and investigation	-Process analysis – Conveyance work -Investigation and analysis
Day 4	-Process analysis – Idling delays -Investigation and analysis	-Process analysis wrap up for main subjects and additional items
Day 5	-Desk top practice for process analysis	-Shop floor kaizen activities -Wrap up and closing

Shingo's Role at Toyota

Statements by Isao Kato*

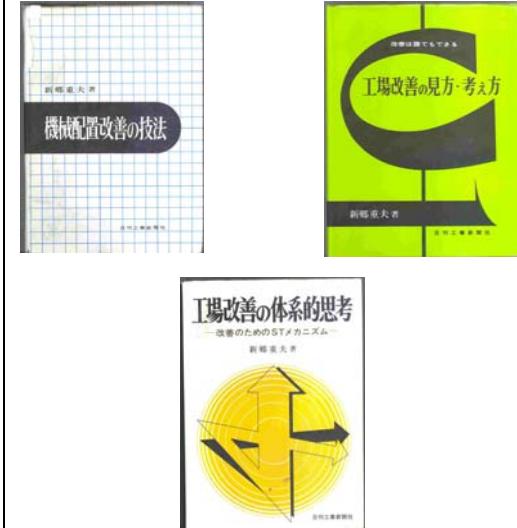
- Mr. Shingo was indeed responsible for teaching the P-course at Toyota over three decades or about 80 times for nearly 3,000 people
- The P-course however was a basic shop floor training course for engineers and some supervisors in the manufacturing plants. It was not aimed at management.
- There were four different basic P-courses (Motion, Time, Operation, and Process analysis). The courses had nothing to do however with fundamental TPS concepts such as JIT, Jidoka, Kanban, Standardized work etc.
- The P-courses were just a part of the overall production training curriculum. Also taught by others such as myself were Job Instruction, Job Relations, Job Safety, Problem Solving, Standardized Work, Role of the Supervisor, and other courses as well.
- Mr. Shingo only met with Mr. Ohno on about 4-5 occasions for actual formal meetings and detailed discussions between 1955-80 inside of Toyota Motor Corporation. There were a few other brief encounters on the shop floor and a few more probably after both left Toyota.
- Mr. Shingo received a copy of the first TPS manual created by Mr. Cho, Mr. Sugimori, and others in 1973. Initially he did not think much of it. As the company improved however he studied it in more detail and in 1980 then wrote his book, "A study of the Toyota Production System from an Industrial Engineering Viewpoint".
- The title of his book is correct – it is a "study" of the Toyota Production System and he did not create any part of the system himself. He spent on average 2-3 weeks per year at Toyota and 80-90% of his time was teaching the P-course. He also clearly states in the book his opinion that Mr. Ohno is the originator of the system.

© Art of Lean, Inc.

*Former manager Education Training and Development, Toyota Motor Corporation. He managed Mr. Shingo's visits to Toyota for close to two decades. He also developed most of the supervisor training material in Toyota of which the P-course is but a small subset.

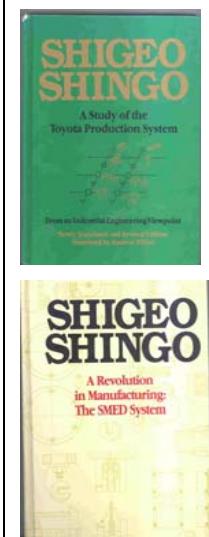
Sample Shingo's Publications

Early Shingo Publications (1955-1980)



- These are three of several books written by Mr. Shingo between 1955-1980 that were the basis for his teaching of the P-course at Toyota and published by Nikkan Kogyo
- Unfortunately the titles are out of print due to lack of demand for them and are thus no longer available. Additionally the contents were never fully translated into English. Only a few excerpts exist translated in other works.
- It is through these books and a couple others that Toyota and the Japanese are mostly acquainted with Mr. Shingo
- I have read these books and others and they do not form any basis for TPS. The contents cite a few observed Toyota examples but are mainly process kaizen improvement methods

Later Shingo Publications (1980 and Onward)



- These are two of the several books that Mr. Shingo wrote after leaving Toyota which were translated into English and made available by Productivity Press for the western world.
- The green book is his "study" of the Toyota production system between 1973-1980 after being given a copy of the first internal TPS manual in 1973. He indicates in the preface that he did not create the system however.
- The white book is his codification of SMED methods in 1983 reflecting back on his career and work. Unfortunately there is mistaken information in the white book and he fails to mention that Toyota was already at 15 minute average performance as far back as 1962 before his participation in a workshop in 1969.
- Neither of these books are widely read in Japan although they are highly influential and useful in the U.S. and beyond
- Other books by Mr. Shingo published after 1980 that available in English are Key Strategies for Plant Improvement, The Non-Stock Production System, Zero Quality Control and several others as well via Productivity Press.

Summary Comments

- I do believe that Mr. Shingo deserves a lot of credit for his hard work and contribution to the body of knowledge regarding production improvement.
- In particular he served as a fine author, consultant, and instructor to many companies including Toyota Motor Corporation
- Unfortunately his actual work at Toyota and hypothesized role in the development of TPS has been exaggerated by some parties. Despite several anecdotes there is little evidence that supports any claim Mr. Shingo co-developed central parts of TPS such as JIT, Continuous Flow, Takt Time, Jidoka, Kanban, Standardized Work, etc. or other topics. Even his role in SMED development appears in hindsight much more of a codifier than a creator. Most of TPS was actually quite developed and implemented in many places before he first visited the company in late 1955.
- Much of this is widely known in Japan due to broader availability of his materials and greater understanding of his relationship with Toyota. Overseas it is less well understood due to distance, language, and other differences.
- None the less Mr. Shingo is a great contributor to the understanding of Toyota's production system especially in the western world. Through the translation of his books at Productivity Press many were able to study about TPS through his eyes and lectures.
- Further study should be performed on the role of Mr. Shingo at Toyota and TPS. I will contribute to this effort through obtaining his P-course material and interviewing remaining members of the era inside Toyota as possible.
- This are of course many additional influences on TPS development noted by Toyota Motor Corporation such as Henry Ford's system, Training Within Industry material, and Quality related topics that I have not attempted to include at this point