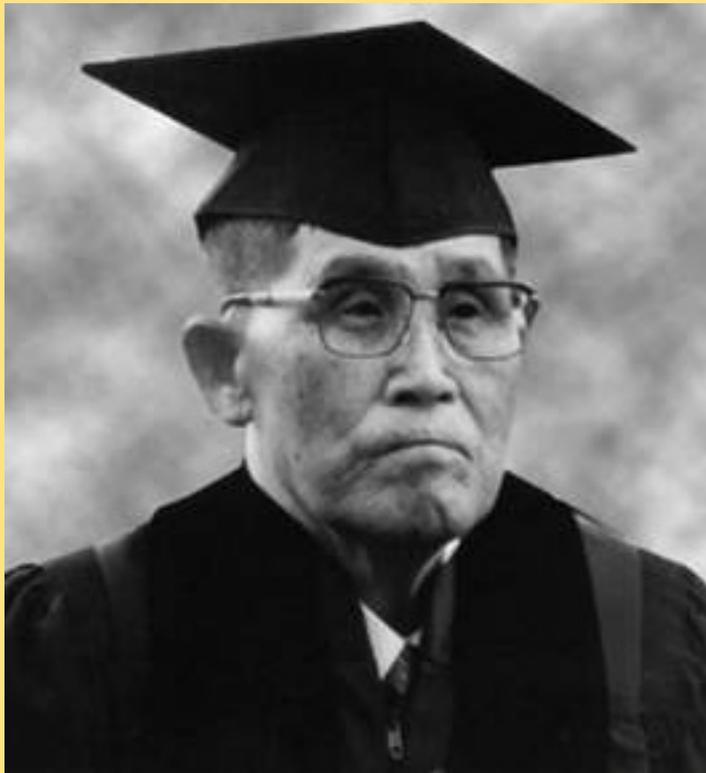


The Impact of Dr. Shigeo Shingo on Modern Manufacturing Practices



IE 361

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Introduction

Poka-Yoke Techniques to Correct Defects

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Source Inspection to Prevent Defects

=

Zero Quality Control (<http://crunch.ivey.uwo.ca>).

This famous equation is the essence of Zero Quality Control Concepts formulated by the Japanese quality guru, Dr. Shigeo Shingo. Dr. Shigeo was one of the greatest influences on Japanese quality control and his contributions to quality improvement revolutionized the Japanese industrial sector and consequently influenced the industries in the west. In comparison to other quality gurus famous in the western hemisphere, Dr. Shigeo's name is generally less familiar. However, the impacts of his principles form the backbone of modern manufacturing fundamentals.

Biography

Dr. Shigeo's expertise was a result of his vast experience and knowledge in what can be called modern day industrial engineering. His first major accomplishment came about in 1930 when he introduced scientific management to Taipei Railway Company in order to reduce cost of operations. However, it was not until 1951 when he first encountered the concept of "statistical quality control". In view of this new concept, he immersed himself into researching close to 300 companies to gain a better understanding of the subject.

By 1959, Dr. Shigeo had gained notable fame as an "engineering genius" from his work in developing Just-In-Time (JIT), and consequently the Toyota Production System. In addition, by focusing on production rather than management alone, he was able to establish himself as a reputable Industrial Engineer. One highlight of his approach towards efficient manufacturing can be shown in his work with Mitsubishi Heavy Industries from 1956 to 1958. While working with Mitsubishi, he was able to reduce the setup time of the hull assembly on a 65,000-ton super tanker from 4 months to 2 months, setting a new record in shipbuilding (<http://www.dti.gov.uk>).

In 1961 Dr. Shigeo incorporated his knowledge of quality control to develop the 'Defects=0' concept. This concept is also commonly known as poka-yoke or mistake

proofing. This concept was successfully applied to various plants and set records of over two years of totally defect free production in some operations. By 1970, Dr. Shigeo developed perhaps the most revolutionary concept in manufacturing called “Single Minute Exchange of Dies”. This concept was integrated into the JIT/ Toyota Production System with a significant reduction in operating costs. Up to the time leading to Dr. Shigeo’s demise in 1990, many industries worldwide adopted his principles to successfully improve productivity and reduce both part defects and work in process inventory (<http://www.dti.gov.uk>).

Key Teachings

During his lifetime, Dr. Shingo Shigeo acted as an international consultant to some of the world’s largest companies such as: Toyota, Bridgestone, Peugeot, AT&T. The greatest impact of Dr. Shingo Shigeo’s teachings can be classified into the three concepts listed as follows:

- Just In Time (JIT).
- Single Minute Exchange of Dies (SMED).
- Zero Quality Control

(<http://www.library.tuiasi.ro/ipm/vol12no12/mechanical.html>).

Using his key teachings, many modern day manufacturing companies have realized substantial profits. The impacts of his teachings are discussed in detail below.

JIT

The Just in Time manufacturing concept was founded in part due to the contribution of Dr. Shingo Shigeo and Mr. Taichii Ohno of Toyota Motor Co. from 1949 to 1975. During this period, Dr. Shigeo took charge of industrial engineering and factory improvement training at Toyota Motor Corporation. This is commonly referred to as JIT or the Toyota Production System. The essential element in developing JIT was the use of the Ford System along with the realization that factory workers had more to contribute than just muscle power (http://www.strategosinc.com/just_in_time.htm?source=overture).

According to the American Production and Inventory Control Society (APICS), JIT can be defined as:

"A philosophy of manufacturing based on planned elimination of all waste and continuous improvement of productivity. It encompasses the successful execution of all manufacturing activities required to produce a final product, from design engineering to delivery and including all stages of conversion from raw material onward. The primary elements include having only the required inventory when needed; to improve quality to zero defects; to reduce lead time by reducing setup times, queue lengths and lot sizes; to incrementally revise the operations themselves; and to accomplish these things at minimum cost."

(http://www.inventorysolutions.org/def_jit.htm).

The basic essence of JIT has been implemented to the new "continuous improvement" or "lean manufacturing" wave in the industry today. The primary objective in implementing JIT to a production facility is to obtain a competitive advantage and increased productivity by eliminating the following seven types of wastes:

- Waste from overproduction
- Excess Transportation
- Excess Inventory
- Waiting Time
- Processing Waste
- Wasted Motion
- Waste from Production Defects

In applying these simple concepts, a company can realize monetary savings. The use of statistical process control helps assure that the outcome of production is consistently met with desired results.

SMED

Dr. Shingo Shigeo, as part of JIT, also pioneered the concept of Single Minute Exchange of Dies. SMED was developed in order to reduce the fixed cost associated with the setup and changeover of dies. The basic elements driving the SMED concept are to reduce the setup time of dies, which directly result in smaller batch sizes for parts. A smaller batch size translates as lower costs associated with work in process inventory storage. This concept is especially beneficial as it allows the manufacturing system to quickly adjust to engineering design changes with very little costs. In addition, SMED allows for higher machine utilization and in turn results in higher productivity.

Dr. Shigeo's approach to developing the SMED concept was to isolate and identify the setup time as two entities: internal setup time and external setup time. According to him, a simple approach to achieving a quick setup and changeover of the dies can be done in the following steps:

- Separating internal and external setup as it is existing
- Converting internal to external setup
- Streamlining all aspects of the setup operation

(<http://www.geocities.com/parthadeb/smed.html>).

Many companies that conduct stamping operations in a manufacturing environment have found success by implementing this principle into their existing improvement programs.

Zero Quality Control

Dr. Shigeo Shingo's Zero Quality Control (ZQC) techniques make use of the following engineering principles:

- 100 percent inspections done at the source instead of sampling inspections
- Immediate feedback from successive quality checks and self checks
- Poka-yoke designed manufacturing devices

The Zero Quality Control concepts are based on a theoretically ideal scenario. However, by using these principles and concepts, quality improvements can be made. Dr. Shigeo's basic idea was to implement mistake-proofing devices in the assembly line to eliminate the possibility of defective operations. In addition, his emphasis on targeting the root cause of defect (source defect) whenever a defect occurs, virtually eliminates the need for statistical process control.

In 1977, Matsushita's Washing Machine manufacturing facility went for a one-month period with zero part defects. This example reinforced Dr. Shigeo's theories by illustrating the potential improvements that are made possible by implementing Zero Quality Control principles. Although Dr. Shigeo realized that statistical quality control could aid in elimination of defects, he argued that by using sound manufacturing and

process engineering practices, defects could be removed from processes without the use of many statistical tools used in most quality control techniques (<http://www.pori.tut.fi/spic/files/quality/esitykset-2001-11-29/shingo-paper.pdf>).

Conclusion

Dr. Shingo Shigeo was perhaps the greatest contributor to modern manufacturing practices. While his name has little recognition in the western hemisphere, his teachings and principles have formed the backbone of efficient engineering practices. In applying his experience and expertise in the field of industrial engineering, Dr. Shigeo was able to provide a better way of life for both the operators and the corporations. His policies have gained reputation through results in manufacturing among the companies that have implemented these teachings.

In view of his contributions, Utah State University founded the Shingo prize for excellence in manufacturing in 1988. This prize promotes world-class manufacturing and recognizes companies that achieve superior customer satisfaction and business results, and has been compared as a Noble Prize for manufacturing (<http://www.shingoprize.org>). It is undoubtedly the kind of recognition that is deserved by one of the world's prominent industrial engineers – Dr. Shingo Shigeo.

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