Chapter 3
Foundation of the Toyota Production System:
JIT Fundamentals

ABSTRACT

The Japan production technology principle that contributed most to the world in the latter half of the 20th century was the Japanese-style production system typified by the Toyota Production System named Just in Time (JIT) and Lean System. The Toyota Production System aimed to improve product quality while pursuing maximum efficiency through the application of total quality management (TQM) into the manufacturing process, as well as applying the principle of cost reduction. In this chapter, the author introduces the core concept, basic philosophy, and development of the Toyota Production System of the manufacturing management in Toyota.

CORE CONCEPT OF TOYOTA PRODUCTION SYSTEM

In this section, JIT fundamentals that reformed the automobile manufacturing of Toyota are discussed. The basic principles and on-site implementation of manufacturing using the Toyota Production System, which has been adopted as a core concept of the world's manufacturing, will be illustrated here (Amasaka, Kurosu and Morita, 2008).

What is known as the JIT system, a Japanese production system typified by the Toyota Production System, is a manufacturing system that was developed by the Toyota Motor Corporation (Ohno, 1977; Toyota Motor Corporation, 1987). The basic philosophy of Toyota Production System is built upon the ideas of the company founder, Sakichi Toyoda, and his business mottos, (1) Be ahead of the times through endless creativity, inquisitiveness, and the pursuit of perfection, (2) A product should never be sold unless it has been carefully manufactured and has been tested thoroughly and satisfactorily. The philosophy also reflects Kiichiro Toyoda's ideas of improvement through inspection, (1) Grasp the demands of consumers firsthand and reflect them in your product, and (2) Investigate the product quality and business operations and then improve them.

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These are the basic concepts of JIT which aims to realize "quality and productivity" simultaneously by effectively applying TQC (Total Quality Control) and TQM to the automobile manufacturing process. It also pursues maximum efficiency (optimal streamlining, which is called a Lean System) while also being conscious of the principles of cost reduction, and thereby improving the overall product quality (Ohno, 1977: Toyota Motor Corporation, 1987: Amasaka, 1988, 2002a). In JIT implementation stage, it is important to constantly respond to the customers' needs, promote flawless production activities, and conduct timely Quality, Cost and Delivery (QCD) research, as well as put it into practice (Amasaka, 2002a, 2008a). Therefore, Toyota has positioned Toyota Production System and TQM as the core management technologies for realizing "reasonable manufacturing" and these management technologies are often likened to being the wheels of an automobile (Amasaka, 1989, 1999a, 2000, 2002a: Hayashi and Amasaka, 1990). In Figure 1, these management technologies have been placed on the vertical and horizontal axes. As shown in the figure, the combination of these technologies reduces large irregularities in manufacturing to the state of "tiny ripples" where the average values are consistently improved in the process.

This strategy is an approach used by reasonable corporate management in which the so-called "leaning process" is consistently carried out. As indicated by the vertical and horizontal axes in the figure, when the hardware technology of the Toyota Production System and software technology of TQM (TQC) are implemented, the statistical quality control (SQC) is to be effectively incorporated to scientifically promote QCD research and achieve constant upgrading of the manufacturing quality (Amasaka, 2008b). The Aim of Toyota Production System is to create a highly functional production system that offers better products at lower prices more quickly through the timely application of QCD activities for strengthening Value Engineering (VR) using Value Analysis (VA) (Amasaka, 1988, 2009a). Another point is that TQM and SQC are the foundations of maintaining and improving the manufacturing quality, and both have also historically served as a basis for the advancement of JIT (Amasaka, 2003, 2004a).

In this way, the basic concept of JIT and the lean system approach have reformed the automobile manufacturing process used at Toyota. As a result of the JIT effectiveness has been recognized on a worldwide scale and it is now regarded as the "core concept of manufacturing" (Hayes and Wheelwright, 1984: Roos, et al., 1990: Womack and Jones, 1994: Taylor and Brunt, 2001).

BASIC PHILOSOPHY OF TOYOTA PRODUCTION SYSTEM

Simultaneous Realization of Quality and Productivity via a Lean System

The basic principle of manufacturing via the TPS (1) is lean system production. As shown in Figure 2. In this system manufacturing is conducted via *one-by-one* (single part) *production* and its aim is to achieve is the simultaneous realization of quality and productivity (Amasaka, 1988,

The first basic principle of manufacturing is thorough quality control by means of one-by-one production. As Figure 2(a) illustrates, this system of one-by-one production on a manufacturing line using an assembly conveyor gives the assembly worker the ability to conduct a self-check on each piece. If a defective item comes to their assembly point from the previous process, they can then stop the conveyor and detect the defect without fail. Therefore, the assembly workers can provide 100% quality products to the downstream processes. It is obvious that compared to lot production, this system can considerably improve the detection of from a probabilistic viewpoint. In this context, the one-by-one production is