Chapter 7
Evolution of the Japan Automobile Manufacturing Foundation Using Dual Global Engineering Model

ABSTRACT

Today, digital engineering is bringing about radical changes in manufacturing. To advance the evolution of Japan automobile manufacturing foundation, this study mentions the New Japan Production Management Model (NJ-PMM) that surpasses conventional JIT practices in order to re-construct world-leading management technologies. On a concrete target, the author focuses on the strategic development of Dual Global Engineering Model (DGEM) by possessing the New Japan Global Production Model (NJ-GPM) and New Japan Global Manufacturing Model (NJ-GMM) surpassing JIT. The effectiveness of DGEM was verified through the actual applications to automobile manufacturing in Toyota and suppliers.

INTRODUCTION

Recently, Japanese Production System, which is typified by the Toyota Production System (TPS) has been further developed and spread in the form of internationally shared global production systems such as Just in Time (JIT), and therefore it is no longer a proprietary technology of Japan (Ohno, 1977; Womack et al., 1990; Amasaka, 1988, 2002, 2007a). Furthermore, today, digital engineering is bringing about radical changes in the way manufacturing is carried out at manufacturing sites (Amasaka, 2007b; Amasaka, Ed., 2007; Amasaka and Sakai, 2010).

To overcome this issue, it is now necessary to re-construct world-leading management technologies so that they will be viable even for the next generation of automobile manufacturing which is represented by the Total Production System based on core principle for the New Manufacturing Theory (NMT) based

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on New JIT principle (Amasaka, 2002, 2007a, 2014, 2019a, 2020a; Amasaka et al., 2008). By concrete deployment for automobile global production employing NMT, the author has created the New Japan Production Management Model (NJ-PMM) in Toyota.

With this mind, as the keys to successful global production, this study mentions the evolution of Japan automobile manufacturing foundation in order to develop NJ-PMM named Advanced TPS that surpasses conventional JIT practices (Refer to Chapter 6). On a concrete target, the author focuses on the strategic development of Dual Global Engineering Model (DGEM) by possessing the New Japan Global Production Model (NJ-GPM) and New Japan Global Manufacturing Model (NJ-GMM) surpassing JIT (Amasaka and Sakai, 2011; Amasaka, 2020a,b,c). The aim of DGEM is to realize a highly reliable production system suitable for global production by reviewing the production process from production planning, preparation and manufacturing through production itself and process management.

Specifically, first, six core management technologies of NJ-GPM consist of the TPS Layout Analysis System (TPS-LAS), Human Intelligence-Production Operating System (HI-POS), TPS Intelligent Production Operating System (TPS-IPOS), TPS Quality Assurance System (TPS-QAS), Human Digital Pipeline (HDP), and Virtual-Maintenance Innovated Computer System (V-MICS) (Amasaka and Sakai, 2011). Similarly, second, six core management technologies of NJ-GMM consist of the Intellectual Working Value Improvement Management Model (IWV-IMM), Partnering Performance Measurement Model (PPMM), Strategic Stratified Task Team Model (SSTTM), Intelligence High-cycle System of Assembly Maker Production Process (IHS-AMPP), Strategic Quality Management using Performance Measurement Model (SQM-PMM), and Working Value Evaluation Model (WVEM).

Concretely, the author has verified the effectiveness of DGEM through the actual applications of automobile manufacturing in Toyota and suppliers (Amasaka et al., 2008; Amasaka, 2015, 2017a, 2019a,b,c; Amasaka, Ed., 2012, 2019).

NEED FOR ADVANCES IN GLOBAL MANUFACTURING ENGINEERING

The Demand for Advances in Manufacturing Technology

The environmental changes that surround today's manufacturing industry are truly severe. It is vital for Japanese manufacturing not to fall behind in the advancement of management technologies. In order for manufacturers to succeed in the future world market, they need to continue to create products that will leave a strong impression on customers and to offer them in a timely fashion (Amasaka, 2002).

At present however, the TPS which is representative of Japanese manufacturing, has been further developed and spread in the form of internationally shared global production systems such as JIT and Lean System and therefore it is no longer a proprietary technology of Japan (Hayes and Wheelwright, 1984; Doos et al., 1991; Womack and Jones, 1994; Taylor and Brunt, 2001). It is not an exaggeration to say that what will ensure Japanese manufacturers' success in global marketing is the realization of simultaneous achievement of QCD (quality, cost and delivery)–ahead of their competitors (Amasaka, 2004a, 2007a,b, 2008).

The urgent mission for Japanese manufacturers is to reconstruct world-leading, uniquely Japanese principles of management technology, which will be viable even for next-generation manufacturing as the evolution system of JIT (Amasaka et al., 2008; Amasaka, 2009, 2014; Amasaka and Sakai, 2010). To