
Implementing Toyota-Style Systems in High Variability Environments

by

Eduardo Lander

Doctor of Engineering in Manufacturing Oral Defense

Will be held on
Tuesday, January 9, 2007
at 9:00 a.m. in 2869 IOE Building

Chair: Jeffrey Liker, Professor, Industrial and Operations Engineering

Committee Member: Sebastian Fixson, Professor, Industrial and Operations Engineering

Committee Member: Izak Duenyas, Professor, Industrial and Operations Engineering (Professor Yavuz Bozer from Industrial and Operations Engineering will be sitting in at the Oral Defense for Izak Duenyas)

Committee Member: James Morgan, Director, Body Exterior and Stamping Engineering, Ford Motor Co.

Abstract:

The Toyota Production System has led to a movement of 'Lean production' focused on taking waste out of value streams. However, most applications have been to high volume, and relatively standardized products. Under this system work becomes highly standardized specifying to the second what the operator should do. Production is controlled through precisely sized buffers that pull items needed through the system. When possible, use of one-piece flow cells result in a completely balanced production line. The performance benefits of these systems are often remarkable, greatly improving quality, cost, and delivery simultaneously. But what of companies that are not making standardized products at high volume? Can they also learn from Toyota? These firms typically struggle when trying to implement Lean and the prevailing belief is that it does not work for them.

The research presented here focuses on this issue by looking at how Toyota-style systems can be developed and used in high variability environments. A framework is proposed to classify value streams according to the level of demand and task variability they face. One interpretation of Toyota's philosophy and its system is presented and a set of axioms are proposed to provide a logical foundation to the principles that define the philosophy. The use of Lean systems is analyzed in five case studies. In two of them the researcher led the transformation to Lean by helping develop a customized Toyota-style system in accordance with Toyota's philosophy.

The case studies show that Toyota-style systems can be used and are effective in firms operating under very different variability conditions. By focusing on Toyota's philosophy it is possible to modify the tools of TPS to fit the needs of the organization and produce the same kind of impressive results that are common to Lean implementations in high volume repetitive manufacturing. Finally, a method is proposed for developing Toyota-style systems by pulling improvements through the system.
