

If you have done lean – why should you do Six Sigma?

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Lean production, popularly known as the Toyota Production System, consists of a set of methods and tools that have grown out of a uniquely Japanese experience in streamlining their work processes. Lean production methods have an intrinsic appeal to management because they are simple and can be implemented directly by front-line employees without too much dedicated support of the top management team. It is easy to encourage such a change management system because it focuses more on management encouragement for worker execution, rather than direct management involvement in creating and reviewing improvement projects. Indeed, a lean system can almost run on automatic pilot once the workers are convinced by management that it wants this system and when it regularly and actively encourages its workers to participate.

TPS was built as an ‘eclectic’ system – with the learning provided by observation and experience using a core pragmatic rule: if an idea or concept works, then Toyota just does it! The feature that makes TPS work effectively is that it is embedded into the organic structure of Toyota – its genetic code or the DNA of the Toyota corporate culture. When examining or studying TPS, it is necessary to study the parts, but in doing so one must always remember that the whole system is greater than the sum of these parts. This is similar to anatomical study of the body. For instance studying the heart may help in learning how a human body operates; however, the detailed knowledge of just the heart does not fully describe how a body operates. To understand the total picture of how TPS operates, one must apply what Jim Collins and Jerry Porras call the genius of “AND” logic in their book *Built to Last*.¹

An example of implementing a management system based on TPS can be observed in the experience of General Electric. Over the course of two decades Jack Welch, the former CEO of GE led the company in an extended business improvement process that drove the company to the top of American industry. I described this journey in a previous article as a three-stage elimination cycle: eliminate unproductive business variety, eliminate low to no-value from work processes, and eliminate variation in the remaining activities.² This three-stage process applies the lean principles of TPS in the first two stages of the cycle of improvement, but it adds Six Sigma on top of the TPS principles and methods in the final stage in order to improve consistency of the value-adding processes. Indeed, GE returned to a lean emphasis after it had accomplished six years of improvement efforts using Six Sigma methods!³

Is General Electric unique in its application of the TPS lean methods? Not really, in fact many of the things GE has done were already being done at Toyota, but under the overall umbrella of the TPS rather than being singled out as a new Lean initiative or as doing Six Sigma. Toyota has embedded Six Sigma into the normal skills and competence of both

its middle managers and supporting engineers to the point where its methods are organic and genetically the same as TPS. In a prior study of distinctions between Japanese Total Quality Management (TQM) and Six Sigma, I wrote about the overlap in the methods of TQM that are taught to engineers in Japan through the Japanese Union of Scientists and Engineers (JUSE) and the methods that are taught to Six Sigma Black Belts. The overlap in these two programs was approximately 95% by topic. The major exception between the two programs was the Six Sigma problem-solving process DMAIC (an acronym which stands for Define-Measure-Analyze-Improve-Control), which was first designed as an incremental improvement over the Japanese implementation of the PDCA (Plan-Do-Check-Act) cycle that was derived for use in JUSE training from the prior work of both Dr. Walter A. Shewhart and Dr. W. Edwards Deming.⁴

When these two methodologies are studied side-by-side, a number of distinct similarities in the philosophies and methods of Six Sigma and TPS may be observed. Indeed, in an article in Harvard Business Review, the authors advise that TPS has three rules for design and one for improvement. The three rules they offered for work process design were:

- “All work shall be highly specified as to content, sequence, timing and outcome.
- “Every customer-supplier connection must be direct and there must be an unambiguous yes-or-no way to send requests and receive responses.
- “The pathway for every product or service must be simple and direct.”

The rule that describes work process improvement is:

- “Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest level in an organization.”⁵

These rules are parallel to the standard Six Sigma principles of work process design and improvement and can illustrate the way Six Sigma concepts have been embedded into the TPS system:

- Six Sigma defines improvements in the control phase where it describes how the improvement is implemented as a Standard Operating Procedure that specifies the requirements or objectives, content of work, measures for progress assessment, the cycle time and deliverables of the process. These elements are all part of a sound Six Sigma business process control system.
- Six Sigma seeks to understand customer requirements by mapping requirements that are critical to satisfaction of the customer to work elements that are critical to the creation of this level of quality and seeking improvement in these factors. In a Six Sigma project the connection between these customer deliverables and work process factors is measured as a direct transfer function ($Y = f(X)$, where the Y is the output variable specifying the customer requirement and the X is the process factor that delivers it) and defined using operational definitions to assure that the agreement on the use of key terms is unambiguous and that everyone has the same agreement about their understanding of the meaning of the quality attributes.
- Six Sigma methods study how to make work processes flow without any ‘hidden factories’ which increase variation, produce waste, and add cost. Value stream

- maps are used to reduce cycle time and focus on a total approach to improvement and delivery of consistent process performance.
- Improvements at Toyota are under the direction of production engineers who will study the implications of the improvement and test it prior to its application in the full-scale production system. The training of these engineers is similar to that of a JUSE quality engineer (95% overlap with the Black Belt program). The role of an engineer in the TPS process is to support the front-line change process and to aid the work team in making improvements. In Six Sigma this is exactly what the Black Belt does with their scientific method called DMAIC.

So, let's return to the question, are the set of lean methods a substitute for Six Sigma? The answer is no, they are not a substitute, rather the two methods are complementary as is represented by the current thinking that combines them as a "Lean Six Sigma" work improvement process (see, for instance the 2005 Annual Reports of General Electric and Xerox). In reality Six Sigma methods provide the technical infrastructure around which a lean system can be operated effectively for sustained periods. At Toyota, they have made a seamless implementation of Six Sigma within the context of TPS. Without incorporation of the Six Sigma methods into lean production processes chronic technical problems and cross-functional business problems may not be completely resolved. In summary, it simply makes no sense to standardize and mistake-proof the performance of a process that has too much variation! While lean production methods can be used by everyone in a production environment, Six Sigma methods tend to be used by specialists and are used to supplement the continuous improvement (kaizen) work of the front-line teams. Thus, if you've done lean – you are really ready to sustain your improvement by working on the way to manage variation. It only takes a few well-trained people to add Six Sigma to a lean production process; however, lean production requires the total involvement of the entire direct labor workforce in order to implement it effectively.

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Footnotes:

¹ James C. Collins and Jerry I. Porras, *Built to Last* (New York: HarperBusiness, 2002), pp. 43-45.

² Gregory H. Watson, "Cycles of Learning: Observations of Jack Welch," *Six Sigma Forum Magazine*, November 2001, pp. 13-17.

³ Jeffrey R. Immelt, "Letter to Shareholders," *General Electric 2005 Annual Report*, p. 9.

⁴ Gregory H. Watson, *Managerial Distinctions between Six Sigma and TQM* (Tokyo: Japanese Union of Scientists and Engineers, 2001), Lecture 5.

⁵ Steven Spear and H. Kent Brown, "Decoding the DNA of the Toyota Production System," *Harvard Business Review*, September-October 1999, pp. 96-106.