

# Decoding The DNA of The Toyota Production System

## *Corporate Culture In Lean Manufacturing*

Quarterman Lee  
August 23, 2003

### **The Essence of Lean Manufacturing**

Many manufacturers imitate the Toyota Production System or its variant, Lean Manufacturing. Most improve their operations but few approach the efficiency and quality achieved at Toyota.

The usual list of elements and techniques such as kanban, workcells and SPC do not capture the essence. Such lists, including our own, are manifestations of an underlying approach and attitude, part of Toyota's Corporate Culture.

In an article for the Harvard Business Review, Steven Spear and H. Kent Bowen identify aspects of Toyota's Corporate Culture that help Toyota renew, adapt and prosper year after year.

The authors contend that one central tenet of this corporate culture is responsible for JIT and Toyota's continuing success. That tenet is:

***ALL work processes must be controlled, scientific experiments, constantly modified and improved by the people who do the work.***

This unspoken, unrecognized belief gives rise to unspoken, unrecognized rules for work processes and behavior. Spear and Bowen identified four such rules. They also identified an over-arching rule, included here as rule # 5. The table below summarizes.

Each rule derives from hypotheses about the production process. If the hypotheses are correct, there are no problems. When problems arise, as shown by the indicators, the operation is fixed according to the responses.

The rules imply two distinct, simultaneous but interconnected processes:

- **A production process that makes product.**
- **An improvement process that makes the production process better and better.**

The rules are not absolute dictums but, guides, and ideals. Even Toyota has not implemented them for every case. Moreover, these rules for Toyota's business and may not apply directly to others

### **Rule # 1**

Specifications document all work processes and include content, sequence, timing and outcome.

Rule #1 is one of the most important and least understood of the rules. At Toyota, each process is specified with detailed instructions. For example, when assemblers install seats with four bolts, the bolts are inserted and tightened in a precise sequence. Every worker installs them in the same way, every time.



***This regimentation increases the linkage between the way work is done and the results.*** If everyone worked in different ways, the link would be broken or obscure.

How do we reconcile such regimented work with the experimentation and concern for individuals that is supposed to be a part of the system? The answer is that while individual workers cannot vary the process, teams are **required** to actively analyze, experiment, change and improve the process.

Rule #1 links closely with the widespread use of TQM, SPC and associated problem-solving tools. If workers do not possess those skills, Rule #1 is pretty much worthless and even counterproductive.

### **Rule # 2**

Connections with clear YES/NO signals directly link every customer and supplier.

This implicit rule gave rise to kanban, Direct Link and other lean scheduling. It tells us that every operation should send its products to subsequent "customers" directly using methods and algorithms that are clear and precise. It precludes separate warehouses and separate people or departments whose only function is inventory management.

### **Rule # 3**

Every product and service travels a single, simple and direct flow path.

Toyota's U-shaped workcells are the ultimate manifestation of this rule. It means that every piece of finished product has been through the same equipment and precisely

the same process. It improves consistency, makes trouble-shooting easier and simplifies material handling and scheduling.

### **Rule # 4**

Workers at the lowest feasible level, guided by a teacher (Sensei), improve their own work processes using scientific methods.

Rule #4 ties closely with Rule #1. It prevents Work Instructions from becoming moribund memorials rather than living guides. It enlists the entire workforce in the improvement (Kaizen) efforts.

### **Rule # 5**

Integrated failure tests automatically signal deviations for every activity, connection and flow path.

This is the concept of Jidoka or Autonomation. It prevents products with unacceptable quality from continuing in the process. The manifestations of this rule are many, varied, imaginative and unique to the process. Examples are detectors for missing components, automatic gages that check each part and visual alarms for low stocks.

### **References**

SPEAR, Steven and BOWEN, H. Kent, "Decoding the DNA of the Toyota Production System.", Harvard Business Review, September-October, 1999.

DAVIS, Stanley M., Managing Corporate Culture, Ballinger Publishing, Cambridge, Massachusetts, 1984.

## ***The Unspoken Rules of Toyota***

		<b>Rule</b>	<b>Implied Hypotheses</b>	<b>Problem Signals</b>	<b>Responses</b>
<b>1</b>	<b>How People Work</b>	Specifications document all work processes and include content, sequence, timing and outcome.	<ul style="list-style-type: none"> <li>- The person or machine can perform the work as specified</li> <li>- If the work is done as specified, the product is defect-free.</li> </ul>	<ul style="list-style-type: none"> <li>- The work procedure varies from specification</li> <li>- Defective Products</li> </ul>	<ul style="list-style-type: none"> <li>- Improve training</li> <li>- Improve Process Capability</li> <li>- Modify the work specification</li> </ul>
<b>2</b>	<b>How Work Connects</b>	Connections with clear YES/NO signals directly link every customer and supplier.	<ul style="list-style-type: none"> <li>- Customer requests have a known, specific volume and mix.</li> <li>- The supplier can respond to requests.</li> </ul>	<ul style="list-style-type: none"> <li>- Responses do not keep pace with requests.</li> <li>- Supplier is idle waiting for requests.</li> </ul>	<ul style="list-style-type: none"> <li>- Determine true mix and demand.</li> <li>- Determine true supplier capability.</li> <li>- Retrain, improve or modify.</li> </ul>
<b>3</b>	<b>The Physical Arrangement</b>	Every product and service travels a single, simple and direct flow path.	Every supplier in the flow path is required and suppliers not on the flow path are not required	<ul style="list-style-type: none"> <li>- A person or machine is not needed.</li> <li>- Unspecified supplier performs work.</li> </ul>	<ul style="list-style-type: none"> <li>- Determine why supplier was unnecessary; redesign flow.</li> <li>- Determine reason for unspecified supplier; redesign flow.</li> </ul>
<b>4</b>	<b>How To Improve</b>	Workers at the lowest feasible level, guided by a teacher (Sensei), improve their own work processes using scientific methods.	- A specific change causes a specific, predictable improvement in productivity, quality or other parameter.	- Actual result varies from expected result.	<ul style="list-style-type: none"> <li>- Determine why the actual result differed from the prediction.</li> <li>- Redesign the change.</li> </ul>
<b>5</b>	<b>Problem Alarms</b>	Integrated failure tests automatically signal deviations for every activity, connection and flow path.	- Automatic alarms prevent defects or sub- standard performance.	<ul style="list-style-type: none"> <li>- Defects are passed through to the next operation.</li> <li>- Performance is sub-standard</li> </ul>	-Analyze and institute new or improved alarms.

**Note:** In the table, "Supplier" refers to an upstream operation in a process stream, which may be inside or outside the facility. "Customer" refers to the downstream operation.