

# Improving Throughput/Business System Models

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## **The Toyota Production System as a Model**

Soon after World War II, the Toyota Company decided to address its reputation as a low-quality manufacturer. Taiichi Ohno, a Toyota plant manager, observed that waste in human effort, materials and time were the obstacles to higher quality, faster, less costly production. Ohno envisioned a waste-free system of work and spent the next four decades developing the Toyota Production System (TPS). Today, Toyota is not only the undisputed quality leader in its industry; it is the undisputed low-cost producer, able to respond to market demand with lightning speed, and the envy of manufacturers worldwide.

In the 1980's, the Massachusetts Institute of Technology conducted a sweeping study of the global automobile industry to determine, document and disseminate why Toyota was the best-in-class over Western automobile manufacturers. In their 1990 book, *The Machine that Changed the World*, James P. Womack, Daniel T. Jones and Daniel Roos coined the term "lean manufacturing" to describe the Toyota Production System and introduced the ideas behind "lean techniques" to auto-manufacturing. Womack went on to study 50 companies both inside and outside the automobile industry and found that when TPS was used as a benchmark, many industries achieved breakthrough results including:

- ◆ Improving service and product quality
- ◆ Reducing cost
- ◆ Reducing the time to deliver products or services to customers
- ◆ Improving safety for customer and employees
- ◆ Engaging employees and improving morale

## **Translating TPS for Healthcare**

The current business backdrop for healthcare is somewhat similar to what Toyota faced when they began their lean journey: scarce resources, an economy that cannot afford the traditional way of producing a service, and no clear models for how to re-invent the work. Against this backdrop lean thinking began to appear in the healthcare industry in the mid-1990's. One lean thinker was Bob Dryden, senior executive in charge of operations for the Boeing Commercial Airplane Group in Seattle, Washington. In 1995, Dryden was Chairman of the Board of Trustees for Overlake Hospital Medical Center not far from Boeing's Renton Washington assembly plant. He convinced Ken Graham, Overlake's CEO, to hire consultants from Boeing's lean initiative. Not long thereafter, staff from Overlake Hospital were learning lean manufacturing principles alongside Boeing machinists on the 777-airline assembly line. This was one of many "experiments" in the translation of TPS principles to healthcare taking place in the United States from 1995-1998.

A sampling of TPS principles includes the following.

### **TPS Practices**

1. Eliminate waste
2. Redesign for continuous flow
3. Ensure quality at the source
4. Standardize operations
5. Make it visual
6. Engage and respect everyone's expertise

### **Eliminate Waste**

The mantra of a lean organization is to “relentlessly search for and eliminate waste”. Waste is defined as anything that uses resource but does not “add value” from the end user's perspective.

This hyper-vigilant focus on waste achieves increased speed of throughput from the time a customer--patient or referring physician-- requests a service to the time the service is provided. Because waste elimination requires a hard look at error prone characteristics of processing (hand-offs, rewriting information), better quality and safety are common by-products of waste reduction.

To have a shared view of what constitutes waste, the following definitions are useful.

## Types of Waste

Types of Waste	Healthcare Examples
<b>Over-processing</b>	Excessive checking and inspections Duplication of documentation Delivering meals for discharged patients Excessive and complex steps for moving patients across organization boundaries
<b>Correction</b>	Catching and correcting errors of all types Apologizing to patients for wait times Time spent finding lost test results or paperwork Searching for anesthesia supplies
<b>Inventory</b>	Excessive inventory of supplies Insurance claims in process Inventory of scheduled OR cases Inventory of case carts waiting for surgery to start
<b>Wait Time</b>	Patients waiting for clinic visit Patients waiting for in patient bed Staff waiting for specialized service to arrive Time patient waits in queue for any type of service
<b>Search Time</b>	Time spent looking for information, people, supplies and equipment.
<b>Transportation</b>	Multiple handling steps and needless movement of material and information.
<b>Space</b>	Storage of unneeded items excess inventory or the general “mess” that builds up over time. Excess space required due to inefficient process flow.
<b>Complexity</b>	Complex process flows. Organization boundaries which introduce inefficiencies and frustrate patients

Analysis of healthcare processes, similar to processes in other industries, shows that roughly 80-99% of time spent is on “waste” or non-value added activities. Improvement focused on the “relentless search for waste” therefore focuses on removing non-value-added steps versus doing value added steps “faster”.

### Redesign for Continuous Flow

Once the value-added steps in a process are differentiated from the wasteful, non-value-added steps, the principle of continuous flow can be applied. While Operative Services organizations have a strong bias for moving work through functionally defined work areas (first to check-in, then to registration, then to pre-op, then induction and finally the OR), continuous flow principles challenge this model and work to eliminate as much wait time and as many handoffs and transportation steps as possible.

### Ensure quality at the source

TPS uses a variety of methods for eliminating errors. The best known is “mistake proofing” which devises both low and high tech methods for ensuring that errors cannot be made. Technical innovation in the design of medical devices has produced many mistake proofing breakthroughs. Less well known are the mistake proofing strategies used by process improvement teams applying TPS principles for “low cost or no cost” solutions including: elimination of steps, reduction of handoffs, and standardization of work and implementation of visual systems. The goal of TPS is to never pass on an error to the next step in the process and if an error is made, to identify and correct the error as close to the point it was made as possible.

## **Standardize Operations**

Standard Operations is a foundation of the reliability of the Toyota Production System. This is perhaps one of the most challenging principles to put into practice in academic medicine, yet one of the most critical. The following are some of the common arguments against standardization.

- All patients are different and therefore we can't use standard methods
- Standardization stifles creativity and ignores the "art" of medicine
- Standardization minimizes use of our clinical judgment
- As a training institution, we are obliged to teach people multiple ways to do things

Anesthesia providers need to decide whether these comments are "myth or reality". For proponents of TPS, the answer is clear. Without standardization a process cannot have stable predictable output. An unstable, unpredictable process is more difficult to improve than one that achieves consistent predictable results.

## **Make it Visual**

Many simple frustrations make the "day in the life of an Anesthesiologist" unproductive or unsafe. The benefits of good visual system are that everything is in its place where you need it, when you need it and in the right quantities. Implementation of visual systems begins by attacking the "mess" in a work area and removing unneeded items. Then,

through the use of signs, supply and equipment location markers, work-in-process locators, production rate indicators and work stoppage lights anyone in the area can ascertain the pace and quality of work performance in a given area. Time wasted on searching for items or people is eliminated, allowing everyone to focus on "value added" work.

## **Engage and respect everyone's expertise**

TPS is a "people engagement" strategy which relies heavily on a methodology called a Rapid Process Improvement Workshop, also known as a "Kaizen Event". This one week workshop engages representatives from the work area to analyze and observe work processes, apply TPS principles and implement the improvement within the week. The powerful combination of focused physician and staff engagement and immediate application of new ideas is a remarkable catalyst for achieving improvement in any setting.

## **Suggested Reading**

Jeffrey Liker. The Toyota Way. McGraw-Hill, 2004.

“Lean Health Care? It Works!” Industry Week, Nov 11, 2003.

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