

Lesson Four:

Using “Pull” Systems to Reduce Lead Time and Excess Production

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A. Key Learning Points

1. A true one-piece flow system would be a zero inventory system where goods appear solely when they are needed by the customer.
2. Lean businesses try to minimize inventory, - but lean businesses also maintain small, strategic inventory buffers to maintain or level the flow and to protect against interruption of product or service delivery.
3. Most lean businesses use some type of pull/replenishment or “kanban” system to organize and manage a small, strategic inventory of parts; the pull/replenishment or kanban system is a compromise between the ideal of one-piece flow and the traditional push business.

B. Real World Examples and Considerations for Practitioners

1. A true one-piece flow system would be a zero inventory system where goods appear solely when they are needed by the customer.

In a one-piece flow system: (a) each part is produced or assembled correctly one part at a time all the time and (b) no part is transferred to the next downstream workstation until the part is actually requested.

One-piece flow is typically very successful when:

- The physical workspace is configured to enable and assure smooth, timely transfer of parts from one workstation to the next;
- The time required at each workstation is very short;
- The time required at each workstation and the complexity of each individual task at every stage of production is reasonably balanced to assure continuity of flow.

Although one-piece flow can be very attractive in theory, the potential efficiencies will be squandered if:

- laborers spend too much time walking or moving parts between stations;
- the cycle times at each workstation become so long that any interruption in flow will in turn lead to lengthy interruptions in throughput and productivity;
- the complexity of production or assembly varies so much between work stations that it creates significant variation in continuity of flow;
- one or more suppliers are unreliable.
- the current or potential consumer demand for the product our service greatly exceeds the supply.

2. Lean businesses try to minimize inventory, - but lean businesses also maintain small, strategic inventory buffers to maintain or level the flow and to protect against interruption of product or service delivery.

Even a good thing, when overdone, can become harmful, as can be the case when businesses eliminate inventory altogether.

The smartest and most profitable lean businesses maintain small, strategic inventory levels throughout the supply chain and in finished goods that enable them to:

- Anticipate and respond to welcome spikes in customer demand;
 - Hedge against unstable or rapidly increasing costs or unpredictable interruptions in the supply chain;
 - Plan for and conduct preventive maintenance or facility and equipment upgrades;
 - Maintain continuity in staffing levels and productivity of their workforce;
 - Plan for and conduct regular training and development for their workforce;
 - Present a small strategic inventory of finished goods as business assets on the corporate balance sheet
3. Most lean businesses use some type of pull/replenishment or “kanban” system to organize and manage a small, strategic inventory of parts

The pull/replenishment or kanban system is a compromise between the ideal of one-piece flow and the traditional large-batch “push” business.

In the 1940s Toyota began studying US supermarkets to understand and analyze how they managed to anticipate, plan, stock and replenish goods based on customer demand. Supermarkets, and fresh meat and produce in particular, are great case studies for lean management methods because a profitable supermarket only stocks what it can sell and supermarket customers only buy what they need when they need it because they are confident in an uninterrupted supply of goods and produce.

In the 1950s Toyota began to create a type of supermarket for parts and materials within its factories. Toyota purchased a strategic inventory of parts and supplies based on its calculations of Takt Rate or customer demand. And employees at each work station withdrew the parts and supplies they required as needed on-demand to maintain continuity and efficiency throughout the vehicle assembly process.

In a pull/replenishment system a very small strategic level of inventory is built and maintained in bins at selected points in the production process. When a downstream customer takes away specific items they are replenished. If a customer does not use an item, it sits in a bin but is not replenished. When the strategic inventory is depleted, the downstream customer uses a simple card or “kanban” as a signal to order the upstream supplier to refill the bin with a specific number of parts or send back a card with detailed information regarding the part and its location.

Here is a simple example of a pizzeria that uses a “three bin” replenishment or kanban system. In this system there are three bins:

The first bin is used by the pizzemaker. It includes the dough, cheese, tomato sauce and specialty toppings required to make three pizzas.

The second bin is prepared by the assistant pizzemaker who is responsible for ordering, purchasing, storing and organizing all of the pizzamaking supplies, equipment and associated materials.

The third bin is prepared by the pizzeria's supplier.

In most pizzeria, each bin has a removable color-coded card that includes the details of the products, supplies, parts and other relevant information for each bin – this is the “Kanban” card. “Kanban” means “signboard” or “billboard.” In a replenishment or “pull” system, a lean business uses Kanban to signal the need for specific items.

The pizzamaking process begins downstream when the pizzamaker uses the materials in his bin to make three pizzas. Once the pizzamaker's bin is empty, he passes it upstream to the assistant pizzamaker.

The assistant pizzamaker now reads the pizzamaker's kanban card and replaces the pizzamaker's empty bin with a new bin that is replenished with the required dough, cheese, tomato sauce and specialty toppings to make the next three pizzas.

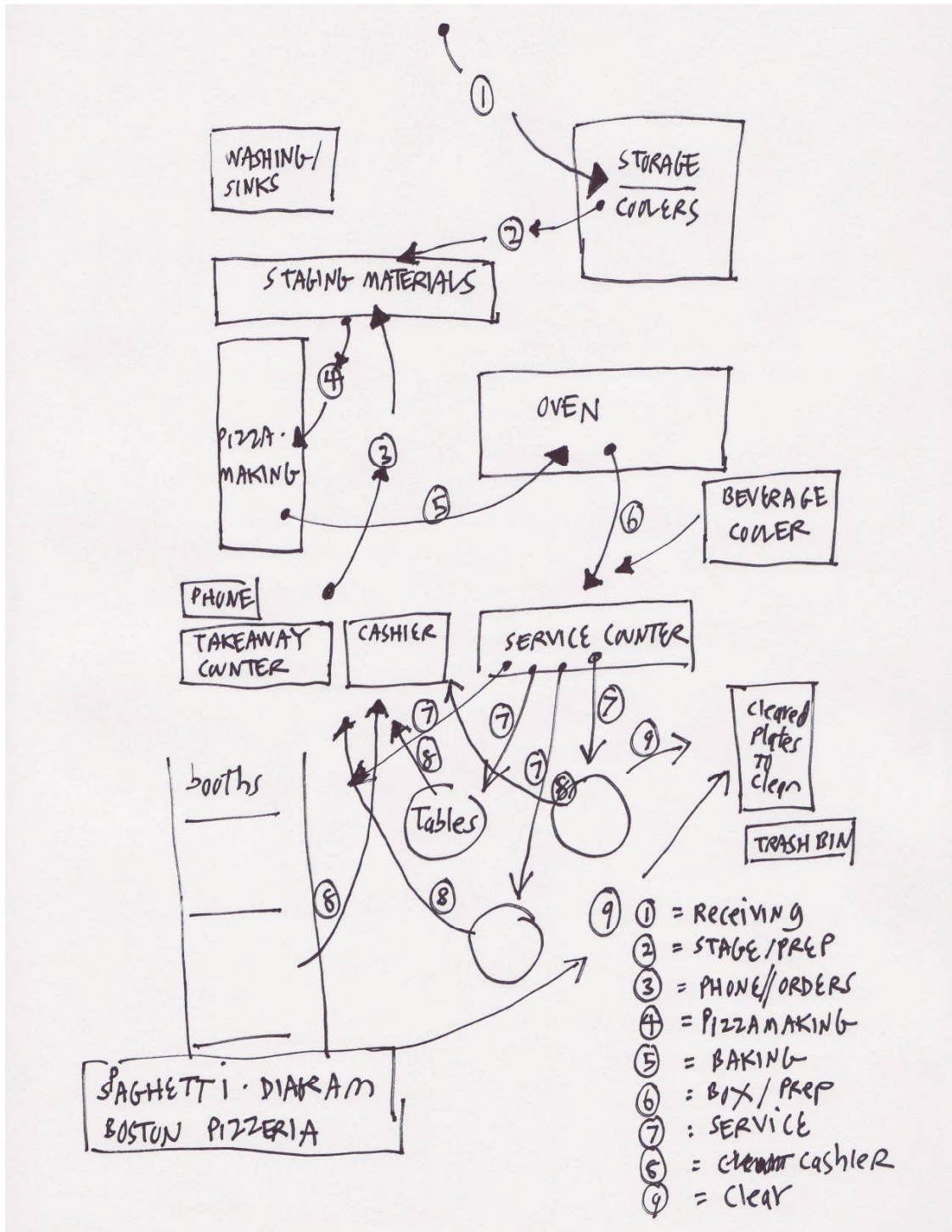
To assure continuity in daily business, the assistant pizzamaker now contacts his supplier and sends him the kanban card or empty bin that is a signal or purchase order for the supplier to replenish the pizzeria with the specific items that are now required based on actual demand for pizza from today's customers.

On a grander more complex global scale, today's most profitable businesses, like Walmart, use technology to connect suppliers with point-of-purchase information from cashiers at each store to signal to suppliers in real-time the need to restock or replenish specific items when the small in-store inventory is drawn down to critical levels.

C. Lean Toolbox:

Successful lean businesses design and use physical space sensibly and efficiently. Continuous flow requires strategic configuration of work stations that encourage smooth, timely transfer of goods and services throughout the supply chain.

The Transportation or “Spaghetti Diagram” on the next page shows how a Boston pizzeria mapped the flow of supplies, materials, information, production and service at its ristorante on Massachusetts Avenue.



A Sample Spaghetti Diagram or Transportation Map

- D. Recommended Reading Assignment & Highlights – All selections are from Jeffrey K. Liker and David Meier, *The Toyota Way Fieldbook*. Chapter 5, p. 80-110.

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“The terms ‘pull’ or ‘pull system’ are often used interchangeably with flow. It should be understood that , like flow, pull is a concept, and the two are linked, but not the same. Flow defines the state of material as it moves from process to process. Pull dictates when material is moved and who (the customer) determines that it is to be move.” P. 94

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“Many people are confused about the difference between the ‘push’ and the ‘pull’ method. Some erroneously think they are ‘pulling because the material continues to move or flow. It is possible to flow without having pull. There are three primary elements of pull that distinguish it from push:

1. **Defined:** A defined agreement with specified limits pertaining to volume of product, model mix, and the sequence of model mix between the two parties (supplier and customer).
2. **Dedicated:** Items that are shared between the two parties must be dedicated to them. This includes resources, locations, storage, containers, and so forth, and a common reference time (takt time).
3. **Controlled:** Simple control methods, which are visually apparent and physically constraining, maintain the defined agreement.” P. 94

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“The most common perception of lean is that it is about ‘just in time’ – the right part, the right amount, the right time, the right place. As we see, there is a lot more to it. The key to eliminating waste is creating flow, and the principles of pull require the production in a ‘just in time’ manner The main point is not that you either use on-piece flow or you’re not lean. The point is that the focus should be on waste elimination. If you have a replenishment process, take out the kanban and stress the system. If you have a FIFO (first in, first out) lane, reduce the lane by one piece and it will force continuous improvement.” P 108-109.

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