

Applying Lean Concepts in a Warehouse Operation

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1. Introduction

This presentation shows how a warehouse operation can be improved using lean concepts and techniques. Warehouse improvement requires optimizing material flow, order picking, replenishment, and dock operations. Although many traditional lean techniques may be difficult to apply, the concepts of improving material flow and eliminating waste can be used to make significant improvement in warehouse lead time.

Many lean practitioners consider the term warehouse and lean to be mutually exclusive. However, regardless of how fast inventory is turned, warehouses will always exist to allow a company to deal with variations in customer demand. The key is to reduce the non-value added steps in the warehouse as much as possible and to improve velocity and flow. Implementing a lean warehouse starts with value stream mapping. After the current state value stream map is created, improvements can be easily developed to eliminate extra material handling, excessive travel time, and time spent looking for products. Various lean improvement techniques such as material flow analysis, quality improvement, and application of the 5Ss can be used. A warehouse improvement example is presented to show how warehouse lead time, order picking time, and material handling can be reduced by 50% using lean concepts.

2. Evaluating the Warehouse

Over the past few years the production areas have been upgraded without a corresponding enhancement of the warehousing activities. Companies are now experiencing problems with the warehouse and distribution areas keeping pace with the product as it is received from the various processing areas. Space utilization, material handling, and data collection are just some of the challenges that arise. There has been a trend of increased labor to support the warehousing requirements.

Where do you start? In order to understand where to start the implementation of lean concepts in the warehouse, one of the most useful tools is the *value stream map*. The value stream is the set of all specific actions, both value added and non-value added, that are needed to take a product through the information and production flows of a manufacturing operation (1). The value stream map follows the production path from beginning to end and shows a visual representation of every process in the material and information flows. The maps show the linkage between information flow and material flow for a product family. Most times the warehouse shows up on a value stream map as simply an inventory triangle and shipping. This makes it difficult to evaluate the waste that is occurring within the warehouse. It is necessary to show the process within the warehouse including operations such as receiving, palletizing, putaway, order picking, order staging and preparation, truck loading, and shipping. A concept warehouse value stream map is shown in Figure 1.

Simplified Warehouse Value Stream Map

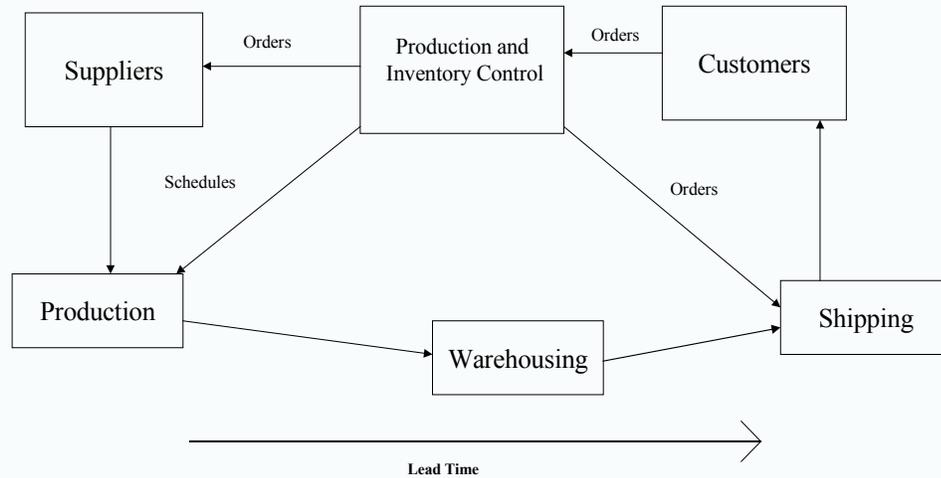


Figure 1

3. Warehouse Value Stream Map

The current state value stream map shows how the warehouse currently operates and serves as the foundation for the future state changes. The map starts with the shipping area and works back through the warehouse process to the production area and to the suppliers. You need to start with one product family otherwise the map will be too complicated. It is also useful to track a product family order through the warehouse operation.

The production control information flow is shown to determine how the warehouse processes are being scheduled and controlled. At the bottom of the map, the total process time and lead time are calculated for a typical product family unit or order. Figure 2 shows a completed warehouse current state map.

The current state value stream map serves as the starting point for developing the future state. The current state value stream map shown in Figure 2 revealed a number of opportunities to reduce lead time and processing time in the warehouse, including the following:

- reduction in material handling time in order picking, putaway, and palletizing
- reliability issues with the strapping and metal detection machines
- reduction in truck loading time
- reduction in time spent checking inventory location and aging

Using the current state map, the goal in developing the future state map is to make the flow continuous and to eliminate as much waste as possible. Lead time is shortened as much as possible by implementing lean techniques. The flow in the future state map is built around the takt time, or how frequently a unit must be completed to meet customer demand. Takt time is simply the available working time per shift divided by the rate of customer demand per shift.

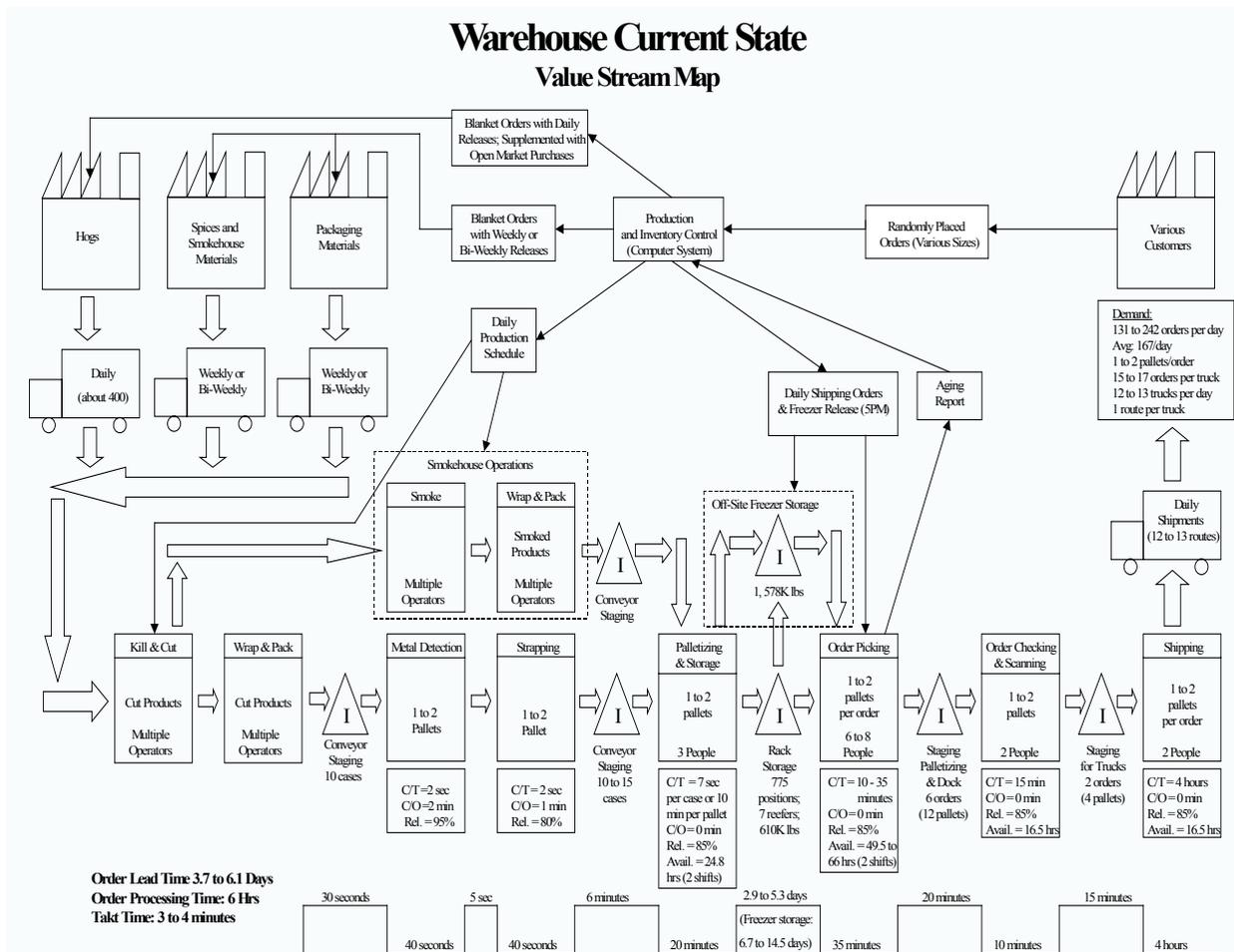


Figure 2

Figure 3 shows the future state map after improvements have been implemented in the warehouse shown in Figure 2. The process steps and information flows highlighted in red show the improvements from the current state map. Some of the improvements are as follows:

- new ergonomically designed palletizing station that reduces wasted motion and errors
- accurate labeling and zoning of the warehouse racks to reduce time spent looking for products
- use of barcode cases labels to track all cases and pallets in the warehouse
- re-organization of the rack storage to place high moving products on lower rack levels and closer to the shipping dock
- use of radio frequency bar code scanners and a warehouse management system (WMS) to obtain real time inventory data and pick sequences to reduce order picking time and errors. Figure 4 shows a process flow diagram of this improvement.
- reduction in warehouse job categories and extensive cross training

The lean improvements, implemented in this warehouse, reduced order processing time by 50% and lead time by 25%.

Warehouse Future State

Value Stream Map

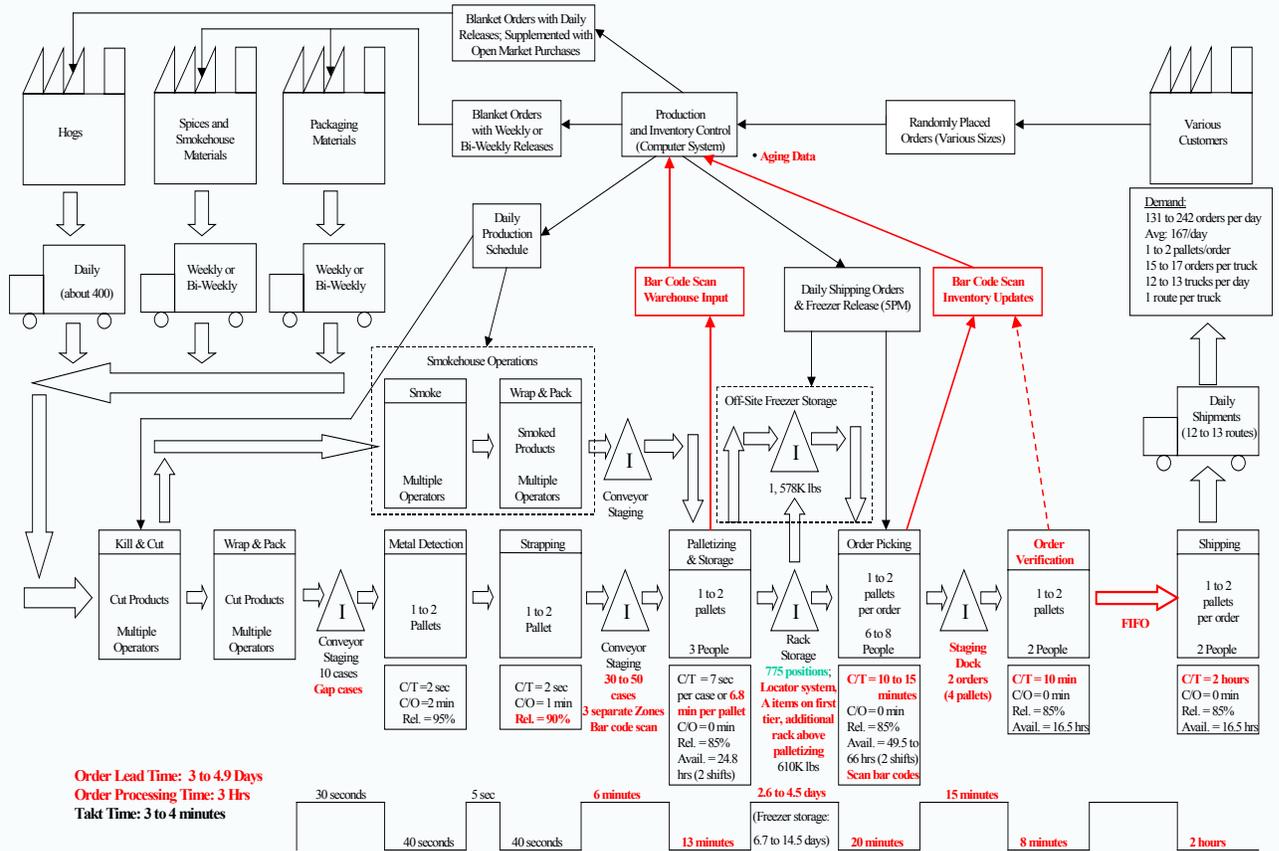


Figure 3

FUTURE STATE ORDER PICKING FLOW

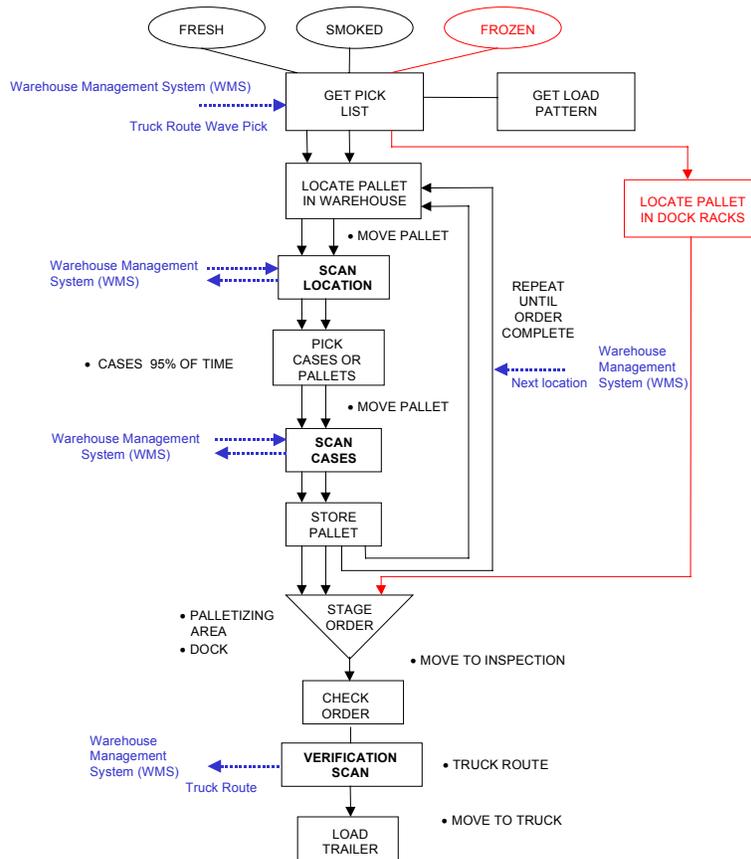


Figure 4

4. Implementation and Planning

When the warehouse future state value stream map is completed, an implementation plan must be developed to convert the current state into the future state. Once the improvements are identified, a time-sequenced list of improvement projects can be made. A brief goal and the expected improvement should show for each project. The projects should be given a relative priority so that the most important projects can be scheduled first. The plan should be established to complete the majority of the projects within three to six months. A number of the improvements in the case study fell into this category. Organizing the warehouse improvement projects in this manner can make it easier to include them in the capital planning process if new process equipment is required. Some of the improvements in the case study require warehouse expansion which will take a year or more to plan and to get final management approval. The financial benefits of implementing the warehouse improvements shown on the future state value stream map can also be calculated, including an estimated payback period.

5. Summary

Lean concepts can be successfully applied to a warehouse environment. Value stream mapping can be a valuable tool for developing and implementing warehousing lean improvement projects. The process of creating the value stream map helps to train the warehouse team on lean techniques and to reveal opportunities to reduce waste. Some of the traditional lean techniques such as cellular manufacturing and setup time reduction may not be applicable to most warehouse environments. However, once the value stream map has been developed, the waste in the warehouse process can be easily identified and eliminated using

- improved order processing and tracking
- reduced material handling
- improved inventory organization
- cross training
- quality tracking

Using lean concepts can lead to significant reductions in warehouse order processing time and lead time while improving inventory and order processing accuracy.

Biographical Sketch

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Mr. Garcia, a registered professional engineer, served seven years in the U.S. Navy submarine force after graduation from the U.S. Naval Academy. After completing his military service, he obtained his Master of Engineering in Industrial Engineering from the Rochester Institute of Technology. In addition, he has 14 years of varied industrial experience in engineering, quality assurance, and operations management. He has worked for Mobil Chemical Company, Burroughs Corporation, Spectra Graphics, and the Department of Defense. His experience includes planning and implementing plant expansions in manufacturing, warehousing and materials handling systems. He has been responsible for Quality Assurance and Customer Service for multi-plant operations; engineered, justified and installed major manufacturing equipment systems; and has successfully managed manufacturing operations with staffing into the hundreds.

As a manufacturing engineering consultant for the past 14 years, Mr. Garcia has worked and managed projects involving material handling improvements, plant layouts and relocation, packaging line design and installation, and quality improvement. He has been involved with many lean manufacturing implementations involving setup reduction, cellular manufacturing, and value stream mapping. He has assisted in the development of manufacturing improvement strategies for national and international companies. His projects have been in the chemical, food, pharmaceutical, electronics, defense, and consumer products industries.

Mr. Garcia is a senior member of the Institute of Industrial Engineers (IIE) and American Society for Quality (ASQ). He is also a certified Systems Integrator (IIE), Quality Engineer (ASQ), and Quality Manager (ASQ).

References

1. Shook, J., Rother, M., 1999, *Learning to See: Value Stream Mapping to Create Value and Eliminate Muda*, The Lean Enterprise Institute, Brookline, MA.