

Simple and Complex High-Mix, Low-Volume (HMLV) Production Units

By

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Abstract

There is a lot of diversity among industries described as high-mix, low-volume (HMLV) production units. HMLV units make different products. Some HMLV units are simple systems involving one or more production lines which make products one after another. Other HMLV units are more complex than simple production lines and lean manufacturing methods are yet to be proven to be effective for managing production in those units. In this article, HMLV units are categorized into two groups.

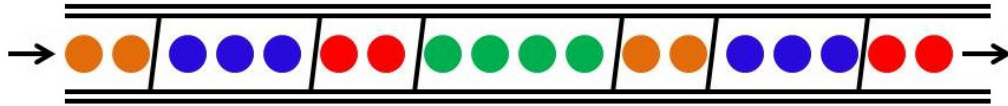
A conversation with lean manufacturing professionals over the scope of TPS methods for efficient control of high-mix, low-volume (HMLV) production may quickly become a passionate and emotional discussion with a lot of disagreement. The disagreement may arise mainly due to different perceptions of HMLV production.

Some industries make a large variety of products in small quantities in response to numerous orders of different nature placed by their customers. Those are usually known as high-mix, low-volume (HMLV) production units. There is a lot of diversity in this group of industries with respect to the flow of orders on shop floor and the diversity can cause some misunderstanding in a discussion on HMLV environment.

Some products in a HMLV production unit may have regular demand while some other products may have sporadic demand. The demand for each product may or may not be stable over time. In many cases, it is possible to group most of those products into product families based on process requirements. All products within a family have the same process requirements. In some HMLV units, it is economically viable to create separate production cells (with dedicated resources) for product families. Production management for the product family will be relatively simple, easy and efficient, if the cycle times for any operation are homogeneous and resource requirements are the same across all products within the family. However, it is not necessarily true for every product family of every HMLV unit. The HMLV situation that is often addressed by Lean professionals is somewhat similar to this simple case.

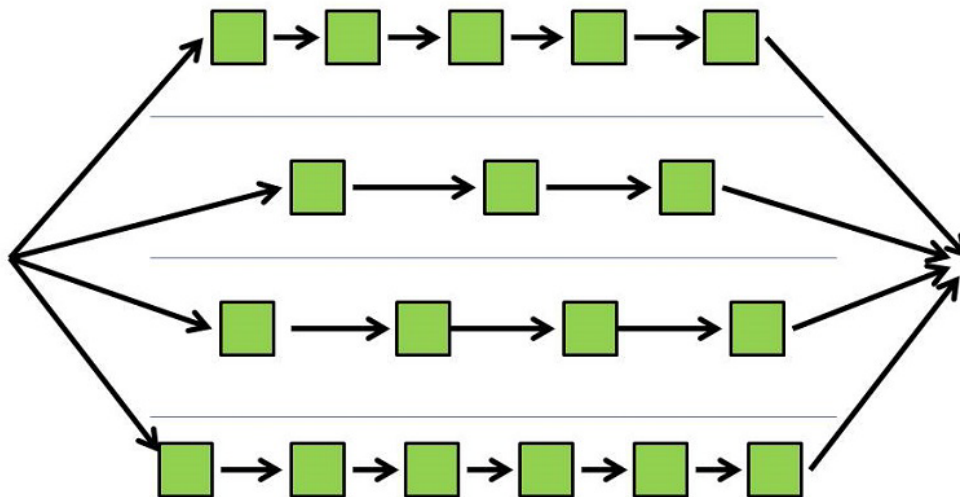
HMLV production units can be broadly categorized as two groups, Group 1 and Group 2. In Group 1, a production unit is one or more production lines each of which makes products one after another. The units in this group can be further classified into the following types:

- a). A single production line that makes a specific type of product with some variations in product characteristics like color, dimensions, etc.
- b). A single production line that makes a few similar products, each with some variations in product characteristics like color, dimensions, etc.
- c). A single production line that can make a large variety of products, each with or without variations in product characteristics like color, dimensions, etc.
- d). A set of parallel production lines each of which is like one of the above three types.



Production line making different products one after another

In each of the above cases, any production line makes products strictly one after another. For example, a production line that makes a variety of wrenches is a HMLV system belonging to Group 1. We face some difficulty with production planning in some parallel-line production systems where a product may be made on anyone of a subset of existing production lines. It is likely that each individual line will make similar products one after another with variation only in product characteristics.



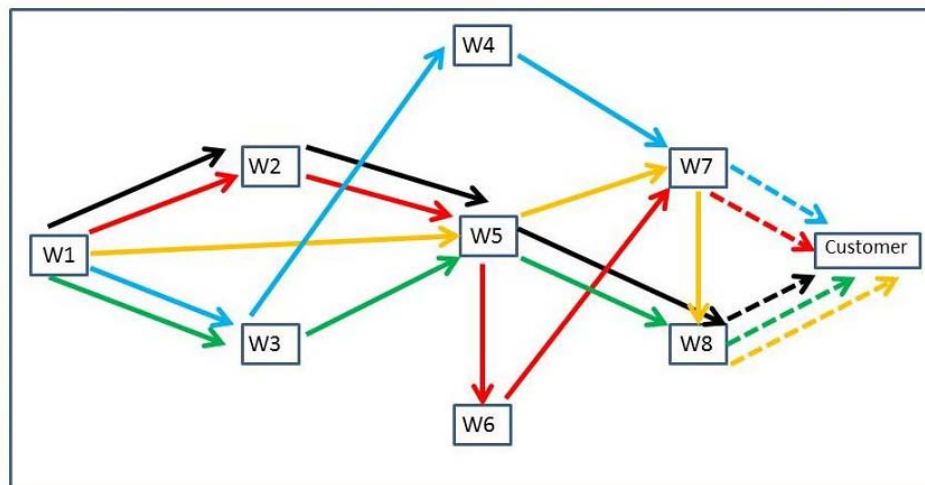
Parallel Production Lines for Different Products

In Group 2, a production unit consists of a few work centers with many features like:

1. Distinct products may have distinct routings and different process time and resource requirements, that is, they may pass through different sequences of work centers for different process times
2. There are multi-purpose resources (multi-functional machines and multi-skilled workers) which can be used to perform a variety of operations (one at a time usually)
3. Products may simultaneously progress through the system to meet respective due dates while competing for resources at common work centers
4. A product may simultaneously pass through two or more work centers for different operations
5. A product may visit a work center more than once for different operations.

Group 1 is amenable to lean manufacturing methods for production control and management. Most often, Lean experts and consultants refer to this group as HMLV units while promoting those methods in HMLV environment.

Group 2 is quite complex for controlling and managing production. Lean methods are not yet proven to be effective for Group 2. Currently, this group consists of numerous industries which include machine shops, fabrication shops, forge shops, print shops, makers of tools/dies/molds, furniture manufacturers, etc. In fact, most of them are small and mid-sized job shops under the control of authoritative customers.



Products with routings through different sequences of work centers

We must try our best to simplify and transform any industry in Group 2 into an industry in Group 1. This may not be economically viable always. In the absence of such simplification, rigorous and scientific scheduling solutions can be tried to improve the control and management of complex HMLV production. There are many good scheduling software tools like [Schedlyzer](#) for this purpose.

The above analysis of HMLV systems may be useful in a general discussion on methodology for control and management of HMLV production.

A sequel to this article is "[Control of A High-Mix, Low-Volume Production Line Involving Multi-Skilled Workers](#)".

The author, Dr. Prasad Velaga of [Optisol](#) has more than 18 years of experience in developing powerful, scientific scheduling solutions for complex, HMLV production systems.