

## LEAN MANUFACTURING, VSM – 4

### Exercise

A company that produces metal items wants to improve its operational performances by using the Lean approach.

In particular, it wants to review a critical part of its production flow, the area of mechanical machining, which is composed of 4 production processes in series, all dedicated to metal item production. The production process of the metal component is described below.

A warehouse decouples the machining department from the previous heat treatment department. In this warehouse there is a stock of gross pieces ready to be machined which covers 2 weeks of demand.

The machining department is composed by 4 stages: drilling, milling, surface finishing and testing.

First, gross pieces are processed by drilling machine and then they move to the next milling stage.

The milling stage is composed by an automated work center that works on 3 shifts per day.

Once the unit is released from milling stage, it goes to the surface finishing stage.

After surface finishing process, the piece moves to the last stage where it is tested.

If the piece results good at the testing stage it is stored in the warehouse that decouples machining department from the subsequent assembly department, on which the company has already done improvement interventions following the Lean approach.

In the current situation, stocks decouple each of the production stages.

The daily demand for the machining area is equal to 1200 items.

Stages 1, 3 and 4 work on one shift per day and each shift is 8 hours net.

Customer requires all the product variants every day.

Drilling machine requires a setup each time it changes the shape of the piece to be worked on.

There are 10 different possible product shapes.

The automatic work center in the milling stage requires a setup each time the piece changes shape or material (3 possible kinds of material) or size (2 possible sizes: large / small). Of course it's possible to make only 1 setup at a time on automatic control center.

The stage of surface finishing makes setup only depending on the material of the product, while the testing stage makes setup according to the size of the piece.

**1. Calculate the minimum EPE for each stage in the current situation**

**2. From the data shown in the table below:**

**a. propose a future state solution for the company from the structural point of view (where to put the pacemaker, where buffers, where cells)**

**b. Identify the minimal intervention so that the company may be able to deliver batch of 20 units to the warehouse before the assembly department.**

**3. How should be administered, according to Lean, a situation in which the machining area delivers to the assembly area batches of 20 units of the same product, while assembly area works with batches of 10 units of the same product? (model the situation and identify, justifying, the chosen solution).**

Stage	C/T	C/O	Uptime	Dedicated?	T.available
Drilling	15 sec	10 min	90%	yes	1 shift
Milling	60 sec	10 min (1 shape change) 10 min (1 material change) 10 min (1 size change)	95%	yes	3 shifts
Surface finishing	18 sec	6 min	95%	yes	1 shift
Test	20 sec	8 min	95%	yes	1 shift