LEAN MANUFACTURING, VSM2

EXERCISE 1

A company assembles tractors and receives from different suppliers kits and components needed for assembling finished products.
Currently, because of the low production volumes and the enormous range variety (it is assumed that each tractor is different from the other), the production configuration is a fixed position assembly.
This strategy takes advantage of the high degree of competence of the operators, who are able to perform all the steps required for assembling a tractor.
In the plant, there are 20 operators dedicated to assemble the tractors, two warehousemen in charge of outbound and inbound material handling and one person dedicated to the production planning.
The 20 operators are distributed in 10 cells that work in parallel. In each cell two operators work at same time on the same tractor unit.
There are two families of tractors in the company, which require different components and tools (mainly due to the technology of the equipment and the size of the components). The total processing time (work content) is 160 minutes for tractors of family 1 and 140 minutes for tractors of family 2.
Each work cell can assembly any version of the product.
Every day, basing on the previous day requests, the production planning defines the orders release for the different production cells, ensuring a quite uniform workload for each cell. For this reason, it releases workload to each cell with a mix of 50% family-1 products and 50% of family-2 products.
The time available for the daily production is 7.5 hours. The daily demand is constant and equal to 50 units, equally split among the two product families. Moreover, the demand for both families of product is constant in volume.
Each cell makes a setup every time it starts new unit production: set-up time is 60 minutes if production moves from family-1 tractor to family-2 tractor and vice-versa; set-up from family-1 tractor to another family-1 tractor is 10 minutes and setup from one family-2 tractor to another family-2 tractor it requires 15 minutes. Both operators in each cell make the setup activities in parallel.

1) In the current situation, can the company be sure of reaching the requested daily production without overtime?

2) During the last production meeting, plant director reported that there is tension and dissatisfaction within operators in the production plant. Indeed, assemblers are complaining that different stations are not well-balanced in their work content. Moreover, logistic operators are having difficulties in handling and in properly feeding (there are issues of mission components) materials to different station. Therefore, the management set the goal to improve efficiency. How will you reconfigure the production?

EXERCISE 2

A company manufactures mechanical products. The company works two different product types: standard product, managed with make-to-stock policy, and special product, managed with make-to-order policy.
The company produces standard units based on demand forecasts. Differently, since special units are highly customized products and every unit is different from another one, the production is based on customers' orders.
In the actual situation, stages are decoupled by inventory stocks.
The company works two shifts every day, except in the fourth department where it works three shifts per day. Each shift is 8 hours.
The average demand for standard products is equal to 85 units per day. There are four types of standard products. The average demand of special products is equal to 15 units per day and each special unit is different from the others.
The range of special products comes from a base of 5 raw material components, that are managed based on forecast in stage 1. The full customization of a special product is therefore made in downstream stages (stages 2, 3 and 4). Stage 1 works also other 4 raw material components (different than those for special products): one component for each type of standard product.
In production stages 2, 3 and 4 it is necessary to make 1 setup every time it starts a new special unit production.
Every time company changes product type production a setup is necessary.
The production flow passes through four stages, each led by one operator. In each stage there is only one machine. The data for these stages are given below.

	Stage 1	Stage 2	Stage 3	Stage 4
Standard CT (min/unit)	5	7	7	12
Special CT (min/unit)	7	8	11	10
Setup time (min/setup)	25	5	10	5
Availability	90%	85%	95%	90%
Dedicated	75%	100%	100%	100%
Number of shifts	2	2	2	3

1) In the initial situation described in the text, calculate the EPE for standard parts for each stage and the minimum batching for standard units so that the company produces every day 15 special units in unitary batches on stages 2, 3 and 4.

2) The company is willing to implement Lean techniques in order to improve the production process, keeping the same approach of make to stock for standard products and make to order to special ones.
Support the company in drawing its future state, highlighting information and material flows.
In sizing the improvements, you must ensure the company the ability to both deliver 15 special parts every day in unitary batch and have an EPE for standard products at maximum to 4 days in each stage.

3) How long does special order take to be delivered to the customer?