An Exercise to explain how to evaluate

Takt Time
Yamazumi Chart

for lines with a shared machine

Everybody involved in Lean Project knows how to evaluate information (i.e. Takt Time, Yamazumi Chart, Staffing) for a single family of products that goes on singles machines. See Sketch 1.

Sketch 1 - Common Model

For the model in Sketch 1 it is easy to apply the Lean Model and calculate Takt Time etc. But how to deal with the model reported in the Sketch 2?
In the Sketch 2 the company has 2 families of product that goes on different machines apart for the machine sketched with the red round.

Let us imagine the company working 5 days a week on 1 shift of 8 hours with 30 minutes of lunch break.

Let us suppose the following request from the customer:

Customer Request of Family 1 Products = 200 pcs
Customer Request of Family 2 Products = 100 pcs

Calculate the takt time is the first step. What we suggest is to evaluate the takt time for every Family of products.

Takt Time Family 1 = 2250 min / 200 pcs = 11.25 min.

Takt Time Family 2 = 2250 min / 100 pcs = 22.5 min.

Let us now label the processes for the Family 1 with the Cycle Time

Process A  C/T = 10 min.
Process B  C/T = 5 min.
Process C  C/T = 4 min.
Process D  C/T = 7 min.
Process E  C/T = 4 min.

and for the Family 2 with the Cycle Time

Process 1  C/T = 13 min.
Process 2  C/T = 11 min.
Process 3  C/T = 13 min.
Process 4  C/T = 10 min.
Process 5  C/T = 7 min.

To verify if the machines are capable to satisfy the customer request it is necessary to draw the Yamazumi Chart.
As is possible to verify in any case the cycle time is over the Takt Time. In a “normal” situation this could be a good situation. Probably just a warning for the process A, too close to the Takt Time.

With a number of machines dedicated to “one” family this situation allow to verify that the machines can satisfy the customer request.

But in this case the machine of the “Process C” is shared. Are we sure that the machine is capable to satisfy the customer request?

To answer the question we would like to introduce the concept of capacity.

The capacity of one machine is the maximum number of pieces the machine can produce in a determined period.

In particular for this case:

The machine work 450 minutes / Day.

In the ideal day (with no problem) the machine can produce

Family 1 = Available time / Cycle Time = 450 Minutes / 4 Minutes = 112,5 Pieces / Day

or

Family 2 = Available time / Cycle Time = 450 Minutes / 13 Minutes = 34,6 Pieces / Day

If the company want to follow the “Lean concept” to produce every part every day the daily production should be:

40 Pieces of Family 1
20 Pieces of Family 2

Let us suppose a Set-up time to switch from Family 1 to Family 2 = 30 min.

**Machine time for this mix** = 40 pcs * 4 min + 20 * 13 min + Set-Up = 450 min.

Even if the Yamazumi chart say us that we are in a “confortable” situation for the Process “C” the machine is at the limit of is capacity!

If we suppose a Cycle Time for the “Process C” in family 1 higher than 4 min. (for example 7 minutes) all the processes are under the takt time but the machine cannot give all the pieces requested for lack of capacity.

40 pcs * 7 min + 20 * 13 min + Set-Up = 570 min. (Request) > 450 min (Available)

In this case it not possible to reach the goal!

So take care of the capacity if the machines are shared among different families.