



# **METHODS AND TOOLS FOR BUSINESS PROCESS MODELING**

## **MODULE 2 – BUSINESS PROCESS SIMULATION**

**Dr. Fabiana Pirola**

***Case Study***

***Business Process Simulation***

# Exercise - Arena Simulation modelling

## DESCRIPTION OF THE PROCESS

The process that should be mapped is a service maintenance process for truck. The process works as following. The customer arrives at the workshop (2 customers every 4 hours) and is received by a receptionist. Then the workshop foreman performs an initial diagnosis of the truck, provides a general quotation and schedules the intervention. At its turn, the truck occupies one of the two available workspaces and it is exposed to three different maintenance activities and, if there are not any additional problems, it is checked and brought back to customer. If there are unplanned problems, or the final check doesn't show a proper condition, another maintenance activity is carried out.

## DETAILED DESCRIPTION OF THE PROCESS

The process follows in sequence the activities in the table below. In addition for each kind of activity the duration (a triangular distribution) is provided.

Name	DelayType	Time Units	Min	Value	Max	Resource allocated
Customer reception	Triangular	Minutes	5	10	15	Receptionist
Verify type of maintenance	Triangular	Minutes	1	2	5	Receptionist
Record customer request_1st diagnosis	Triangular	Minutes	5	10	20	Workshop foreman
Print quotation and documentation	Triangular	Minutes	15	20	30	Receptionist
Scheduling	Triangular	Minutes	3	7	10	Workshop foreman

After that phases the truck is assigned to one of the two workspace and then to one of the available mechanics. Then the following activities are performed.

Name	DelayType	Time Units	Min	Value	Max	Resource allocated
Activity 1	Triangular	Minutes	60	85	105	Mechanic
Activity 2	Triangular	Minutes	50	70	95	Mechanic
Activity 3	Triangular	Minutes	65	75	105	Mechanic
*MNG unplanned problems 1	Triangular	Minutes	15	60	120	Mechanic

\* This activity is performed only in case there are additional problems with the truck (10% of cases).

Finish maintenance	Triangular	Minutes	7	10	12	Mechanic
Test	Triangular	Minutes	10	15	30	Workshop foreman
**MNG unplanned problems 2	Triangular	Minutes	15	60	120	Mechanic

Deliver truck to customer	Triangular	Minutes	5	10	10	Workshop foreman
Closing Activities	Triangular	Minutes	12	15	25	Receptionist

\*\* This activity is performed only in case that after the test there are additional problems with the truck (5% of cases).

**NOTES:** When one truck is placed on a workspace it isn't moved until the end of the maintenance. The workspace is released before delivering the truck to customer. In addition, the mechanic assigned to the truck performs all the maintenance activities. The mechanic is released before the test performed by the workshop foreman.

### ***RESOURCES INVOLVED***

The resources involved in the process are the following:

- Workspaces: 2
- Receptionist: 1
- Workshop foreman:1
- Mechanics: 4

In order to make the model easy, resources should be considered with a fixed capacity =1

### ***REPLICATION PARAMETERS***

The simulation model should be run 8 hours per day for a replication length of 1 year for 5 replications.

### ***SIMULATION RESULTS***

The main elements that should be monitored in the simulation model are the following:

- Scheduled utilization of the human resources;
- Scheduled utilization of the workspace;
- Customer waiting time;
- Total lead time calculated between the customer arrival at the workshop and the exit of the truck from it.
- Number of completed maintenance intervention in 1 year.

### ***IMPROVEMENT ACTIONS***

Considering the results obtained from the simulation what actions could be done to improve the performance of the process?

# Exercise – Improvement actions

## **SUGGESTED IMPROVEMENT ACTION**

From the simulation results the evidence is that the mechanics have a lot of idle time. The main reason behind this is the availability of only two workspaces. For this reason, every time there are two trucks in the workspaces, two mechanics are idle.

One possible suggestion to solve the problem is to have two mechanics working in parallel in each workspace (the truck maintenance activities are performed by two mechanics in parallel). Doing this the duration of each activity will be splitted between two technicians as follow:

Name	DelayType	Time Units	Min	Value	Max	Resource allocated
Activity 1 op 1	Triangular	Minutes	30	45	55	Mechanic 1
Activity 2 op 1	Triangular	Minutes	20	30	45	Mechanic 1
Activity 3 op 1	Triangular	Minutes	40	45	60	Mechanic 1
*MNG unplanned problems op 1	Triangular	Minutes	15	60	120	Mechanic1
Finish maintenance	Triangular	Minutes	7	10	12	Mechanic2
Activity 1 op 2	Triangular	Minutes	30	40	50	Mechanic 2
Activity 2 op 2	Triangular	Minutes	30	40	50	Mechanic 2
Activity 3 op 2	Triangular	Minutes	25	30	45	Mechanic 2
*MNG unplanned problems op 2	Triangular	Minutes	15	60	120	Mechanic2
Finish maintenance op 2	Triangular	Minutes	7	10	12	Mechanic2

\* This activity is performed only in case there are additional problems with the truck (10% of cases).

## **RESULTS**

How does the situation change with this improvement?

Compare the results considering the indicators used before, namely:

- Scheduled utilization of the human resources;
- Scheduled utilization of the workspace;
- Customer waiting time;
- Total lead time calculated between the customer arrival at the workshop and the exit of the truck from it.
- Number of completed maintenance intervention in 1 year.