

TECHNICAL AND ECONOMICAL ANALYSIS ABOUT THE IMPLEMENTATION OF THE ROBOTS IN MANUFACTURING PROCESS

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Abstract. This article presents an analysis realized in the inside of a manufacturing line: it's gonna be an evolution with the indicators(at the level of Gearboxes Departament – operational efficiency, ppm, FIP OC) by introducing industrial robots(ABB) in the line of Fix Gears manufactory. Furthermore, is essential for the manufactory line to be changed because the capacity it's gonna be increased(now are making 10.000 gearboxes per week and at the increase moment the capacity will be 12.000 gearboxes in each week). Also, in this Manufactory line exists security problems: the amount of oil is high on the ground and the operators are in great danger. For that, it's gonna be proposed diferent kinds of examples for having a great score in the measurement of the 5S indicator.

Keywords: operational efficiency, robots, gears, costs.

1. Quick presentation of Renault Mechanical Roumania

Renault Mechanical Roumania, situated on the industrial platform of Mioveni as a component of Mechanical and Chassy Dacia Factory, is producing gearboxes for Renault – Nissan Alliance. Those are used at the Renault factories in France(Maubeuge, Douai,

Sandouville), Japain(Oppama) and Turkey(Oyak).

The TL4 gearbox produced at Renault Mechanical Roumania is the first conceived and utilized in common by the Renault Nissan Alliance. It's a manually gearbox of latest generation, with six speeds capable to transmit 240 Nm, adapted to the new engines gas and diesel.

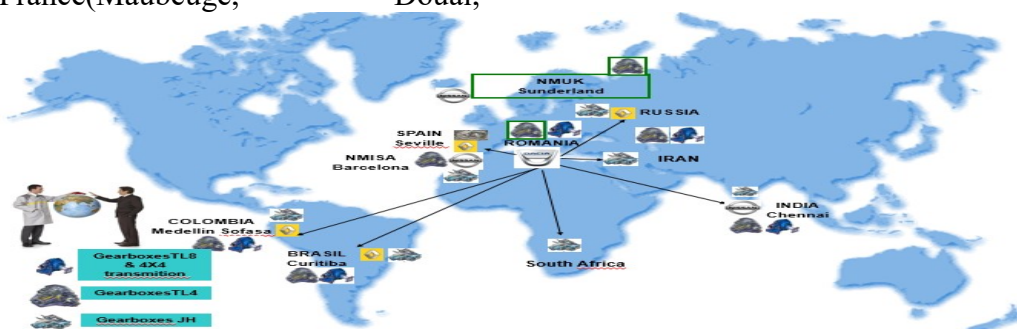


Fig. 1. Costumers of gearboxes produced in Dacia around the world

2. Current situation on the fix gears line

In the manufactory line of fix gears it's a variety of machines: Famar(Italy) and Murata(Japan) for turning process, Ekin and Aumat for broaching, Liebherr(Germany) for cutting, Sanyo and Werra for chamfering, Sicmat, Gleason for shaving, Icom(Italy) for washing the gears and Axorys for shocking

control. In fig. 2 it is presented an industrial location of the machines in the line with each workstation. The shocking control workstation is not in the drawing because is situated in the opposite part of the building (here are black gears, after treatment at high temperature).

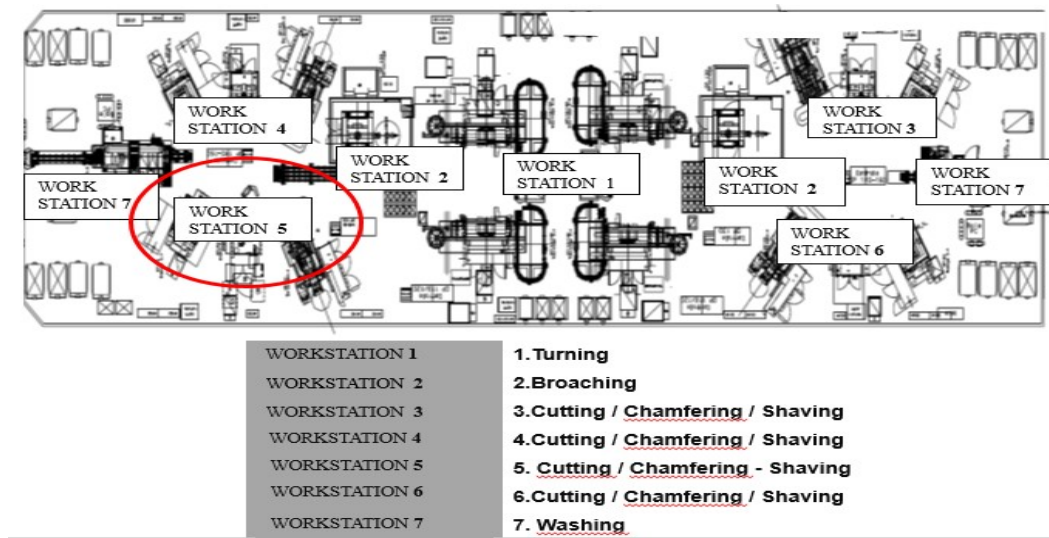


Fig. 2. Presentation of the fix gears line

The workstation 5 is in red. There are many quality problems (shoots on the toothings), cycling time and reliability (sensor problems, valv control). This is the reason why here it's gonna be introduced a robot.

In fig. 3 are the types of gears realized on this manufactory line. All in all, are 26 diversities for different kinds of gearboxes: TL4, TL8 and TS4 (the only one gearbox assembled automatically in Dacia).

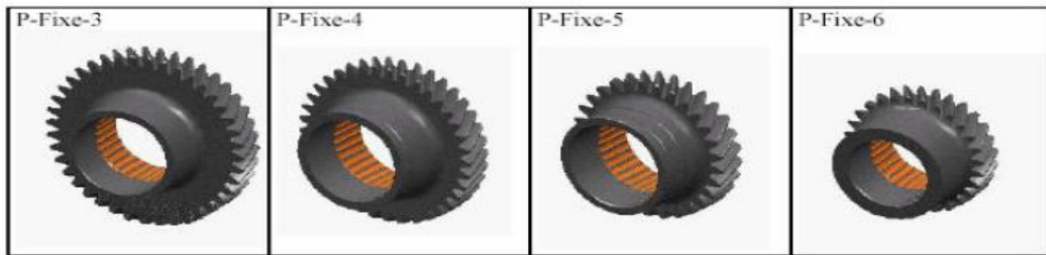


Fig. 3. Fix Gears

2.1. Indicator at level of Gearboxes Department

Operational efficiency(1) is one of the most important indicators. This is a report between the Tr(total time of work in 8 hours, excepting the breaks) and the Tcy(cycling time for the machine in cause) multiplied with the number of pieces realized).

$$OEE = Pieces * \frac{Tr}{Tcy} \quad (1)$$

In fig. 4 is the situation with the OEE. It is a decrease in the months March and April because the workerers were changed and there was real problmes with the machines. The target wasn't accomplished, neither the commitment. In September is gonna be introduced the robot in the workstation 5 and the estimation is that the value of the OEE will be 88%.

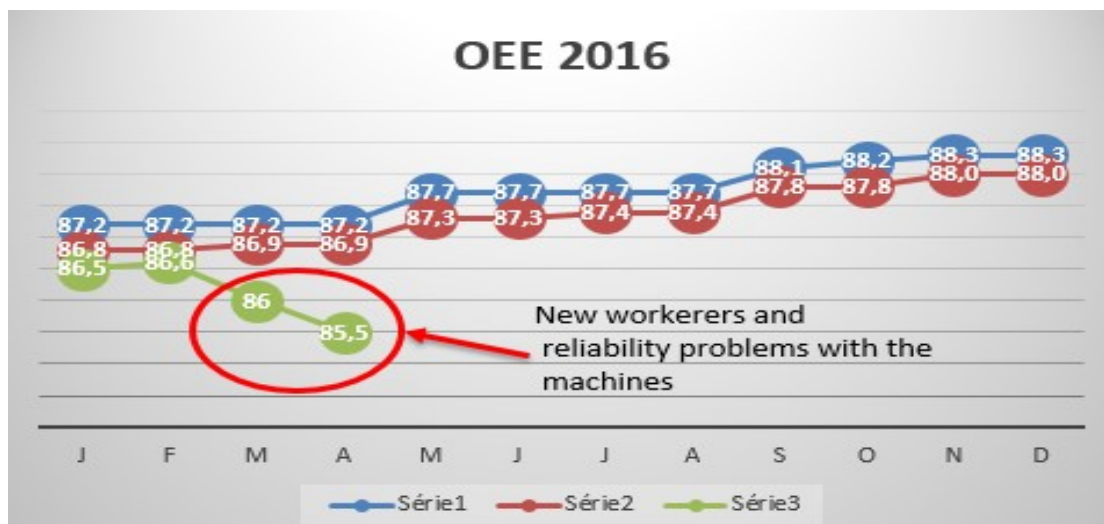


Fig. 4. OEE situation for 2016

Other important indicator is PPM(million per pices). The bad pices realized in the fix gears manufactory line are produced by the workstation 5. The actual value of the PPM is 4350 and the target in Septembre will be 3400.

FIP OC is the latest impacted indicator. The equipment necessary for the Gleason machine is expensive, also the interventions of the maintenance team(one time per day at least the maintenance team is at the machine and it's making adujstments).

It is essential for the Gearboxes Department to make this change(introduce robots) because the diference between others department is big.

2.2. Advantages of robots

Today, an estimated 90% of manufacturing tasks still can't be practically handled by traditional industrial automation – and many companies have outsourced labor to low-cost regions to complete those tasks. But as labor rates rise, and availability falls, manufacturers struggle to find cost effective ways of keeping up with quickly changing consumer demands.

Let's talk about the 10 reasons why robotics automation should be done:

- 1) Reduced operating costs - Robots enable to reduce direct and overhead costs, making a dramatic difference to competitiveness(Renault Mechanical Roumania has a big opponent: the Factory in Seville, Spain).
 - 2) Improved product quality and consistency - The inherent accuracy and repeatability of robots means the line can achieve a consistently high quality. Robots eliminate the problems associated with tiredness, distraction and the effects of repetitive and tedious tasks.
 - 3) Improved quality of work for employees – with robots, it is an improvement of working conditions for the staff. They will no longer have to work in dusty, hot and hazardous environment. In addition, by teaching them how to use robots they can learn valuable programming skills and do work that is more stimulating and challenging.
 - 4) Increased production outputs rates – robots can be left running overnight and during weekends with little supervision, so the output level will be increased and meet costumers order
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- deadlines. A robotic solution will not need time away from production for breaks, sickness or lapses of concentration.
- 5) Increased product manufacturing flexibility – Robots can add flexibility to the production line. Once programmed, they can easily switch between processes, helping to meet changes in product design or customer demand with the minimum of effort.
 - 6) Reduced waste – By using robots, it's gonna be an increasing quality of the products. The products finished on the first run to the standard required by customers and reduce the amount of breakages and waste produced as a result of poor quality or inconsistent finishing.
 - 7) Improved workplace health and safety – robots can take over unpleasant or health-threatening tasks that may be currently undertaken by manual workers.
 - 8) Reduce turnover and recruitment difficulty – good workers are becoming harder to find
 - 9) Reduced capital costs – By moving products faster in production, businesses can better predict the production rate and ensure a fast and efficient service is delivered.
 - 10) Save space in manufacturing areas- robots can be mounted in multiple configurations to help save highly valuable space in manufacturing areas.

In fig. 5 is a drawing of the robot that will be introduced in the manufacturing line.

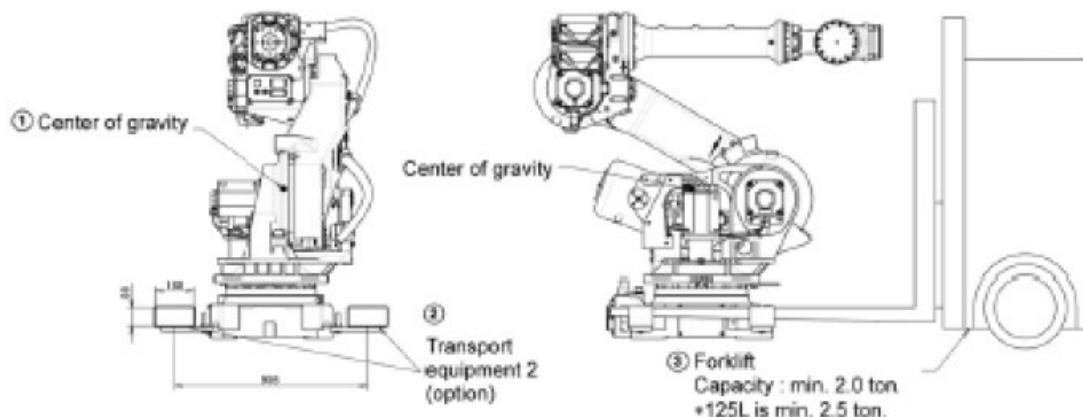


Fig. 5. Industrial ABB robot

2.3. 5S indicator

In present, the score of the 5S indicator on the fix gears manufactory line is 78% (the target is 88%). This is the reason why a technical solution is searched. The oil is on the ground and could be accidents. A blowing equipment will be installed in the same time with the robot at the Gleason machine in the workstation 5. After the shaving, the gear will be introduce in the blowing machine and the oil will pe eliminated. After that, the manufacturing process will continue without any intervention at the cycling.

3. Conclusion

After the introducing of the ABB robot in the fix gears manufactory line 3 workeres will be eliminated. Robots are financially affordable and offer long-terms savings(45.000 KEuro/ year, the cost of 1 worker is 15.000Keuro/year). After several analysis the indicators will achive the target and the profit of the company will increase.

All in all, those tehcnical solution offer the economical stability of Renault Mechanical Roumania and make the factory stronger to the competition.

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