A Study on Improving Logistics in a Production Enterprise in the Automotive Domain

A Muntean, M Întă and I A Stroilă

1Lucian Blaga University of Sibiu, Victoriei B-dul, no 10, Sibiu, Romania

Email: marinela.inta@ulbsibiu.ro

Abstract: In order to remain on the market and to overcome competition, companies need to develop and implement a strategy of continuous improvement. This is based on customer satisfaction needs, management based on realities and respect for people. In order to meet market requirements global road Faurecia Company uses a system called "Faurecia Excellence System", a system that promotes continuous improvement. FES system controls all activities of Faurecia, from research and development to sales including production and company functions and implements all 114 main procedures.

This paper examines the current activity and introduce the new methods to improve manufacturing processes. These new methods are based on some fundamental concepts, namely: a high level of stocks blocks resources and can mask other problems decreasing visibility and communication; product quality is essential and the goods must be produced only when needed using Kanban principle. Additional expenditure with purchased raw materials regarding storage until they are needed, identification and packaging for storage, inventory costs were reduced using a JIT based principle in purchasing. Thus, the paper proposes reorganizing production by reducing the level of stocks using JIT principle and production time. The application made in software Arena refers to simulating the fabrication process to reduce throughput time.
Introduction

Currently both customers and manufacturing companies put more emphasis on quality to remain on the market and to overcome the competition, they need to develop and implement a strategy on continuous improvement of processes, starting from JIT system [1].

Among most widespread continuous improvement models there are qualitative model PDCA (plan, do, check and act) figure 1, where:

- Plan (planning) - in the planning there is the identification of opportunity and plan for change;
- Do - implementing change (continuous improvement) on a small scale;
- Check - for checking data is used to analyze the results of changes and to see if it was made with some benefit;
- Act: if the change was successful it must be implemented on a large scale and continuous evaluate the results. If the change fails, the cycle must start again.

![Figure 1 Pan, do, check, act](image)

Even if the difficulty of applying the concept of "Just In Time" represents a risk, instead it can be successful and bring competitive advantages. One can say that "Just In Time- JIT" is an organizational philosophy, which assumes that production activities should be done with maximum precision so the inventories could be minimized, that being regarded as the greatest harm in the company because they lead to cost increase.
A high stock in a company hide production and communication problems. Thus, by applying the concept of JIT results in continuous improvement. Faurecia is a multinational conglomerate, operating worldwide and a European leader in manufacturing auto parts. The Group has 160 plants, approximately 60,000 employees worldwide and covers 35% of the European market in the field therefore the means of production optimization is an ongoing process, directly supporting the competitiveness of the automotive industry.

Faurecia Company specializes in the design, development and production of six main modules representing about 15% of the value of a car: seats, dashboard, doors, soundproofing, front bumper and exhaust systems, [2] table 1.

| Table 1. Auto parts produced by Farecia Group |
|---------------------------------------------|
| Dashboard | Door cover | Exhaust system |
| ![Dashboard](image1) | ![Door cover](image2) | ![Exhaust system](image3) |
| Seats | Front bumpers | Modules and systems |
| ![Seats](image4) | ![Front bumpers](image5) | ![Modules and systems](image6) |

Recognized as an architect of the car seat, Faurecia excels in designing and manufacturing components: frames, parts, foam covers, which then assembles them into complete seats, delivered in the shortest time customers (33 of factories producing chairs deliverer in Just in Time system). At Headquarters in the town Tâlmaciu hires more than 800 employees producing for the most popular models of cars: Audi, BMW, Toyota and Peugeot [3].
2. Quality system in the company

To meet automotive market requirements Faurecia Company uses a system called Faurecia Excellence System, a system that promotes continuous improvement [4]. Faurecia Excellence System presented in figure 2 is based on key attributes such as: leadership, development, production and customers and seeks to achieve excellence in terms of quality, cost and execution. It can be said that the system FES lead all activities of the company from R & D to sales including production.

![Faurecia Excellence System](image)

**Figure 2 Faurecia Excellence System [4]**

Using this work system, it is organized into autonomous teams making partnerships with suppliers, defining customer requirements and shipping at time quality products. By applying FES system each of the 238 production units strive to achieve the highest level.

The excellence is the result of integrating the latest Faurecia Group's expertise in the 5 Business Groups by applying best practices implemented by them. Faurecia elements of staff commitment to achieve business excellence consist of objectives for meeting the expectations of all stakeholders.
These objectives are:
• Key performance indicators system;
• Quality System Efficiency;
• Efficiency in Production;
• System Management and Development Program;
• Empower employees to achieve excellence.

In other words, Faurecia Excellence System is so constituted as to ensure the Group's development in all areas, focusing on customers, employees and shareholders, and job security is one of the key elements of the Faurecia Excellence System.

3. Application of the concept "Just in Time" at S.C. FAURECIA SEATING TĂLMACIU S.R.L

To adopt a JIT operational environment, the company must revise its current operating activities and introduce new ways of manufacturing. At the base of these methods are a few fundamental concepts, namely:

• product quality is essential;
• high level of stocks is an intangible resource;
• eliminate activities that do not add quality product;
• making products only when needed.
• well trained workers so that they participate in product quality and efficiency.

JIT concept applied to Faurecia Seating Talmaciu company has created an operational system containing the following elements:

• Maintaining a minimum level of stocks;
• Creation of a planning and production scheduling pull-through;
• The purchase of raw materials and manufacture as required in pools of small size;
• Fast and inexpensive adjustment of equipment;
• Creating flexible work cells;
• Maintaining high levels of product quality;
• The introduction of an effective system of preventive current repairs.

So:
✓ Maintaining a minimum level of stocks.
One of the objectives of the JIT operating environment is to maintain a minimum level of stocks. Faurecia Excellence System implemented at Faurecia Seating Talmaciu does not focus heavily on reducing and maintaining a minimum number of stocks. Raw materials are purchased and stored until they are needed, thus achieving additional expenditure to identify products with their packaging for storage, inventory and inspection personnel responsible for these tasks.

To reduce inventories, were eliminated factors leading to the increase in stocks such as quality defects, malfunctions of equipment, time control, etc. Improving performance at each of these levels is not a goal in itself, but rather a necessary condition for reducing stocks

✓ The creation of a planning and production scheduling pull-through.

At Faurecia Seating Talmaciu raw materials and subassemblies are not always purchased as needed, long-term products are manufactured and stored before receiving orders, thereby creating stocks. Production Application pull-through will help eliminate these stocks bringing us one step closer to JIT.

✓ Purchase of raw materials and manufacture as required in pools of small size.

In the pull-through method, the volume of orders received from customers determines production volume. Low inventory levels are maintained, but it requires more frequent adjustment of the equipment, resulting in more activity interruptions.

Long production processes, previously considered more efficient in terms of costs, are no longer appropriate in the JIT environment where goods are not produced to be stored.

✓ Fast and inexpensive adjustment of equipment

Equipment must be located in places most effective and similar products must be scheduled on common groups of equipment, and installation time required for adjustment can be minimized. Time control machinery can be reduced by creating work cells that will produce similar products while minimizing the adjustment of machinery.

✓ Creating flexible work cells

The biggest problem in the implementation of work cells to Faurecia Seating Talmaciu is to divide the whole production system. This problem can be solved by design and investment. The whole company has rearranged and equipment (machinery) are repositioned, modified or altered to allow production in cells.

The cost due to setup time can be reduced considerably by implementation of cells with similar products. An alternative to minimize this cost of cells implementation is to make a gradual transition in the layout. The cost must be justified by the economy that we do after the modified layout of cells.
These costs and risks can be evaluated, which is more difficult is to calculate and control the costs with the employees. Implementation of these cells involves employees training at Faurecia Seating Talmaciu.

Each of the members of a working cell should be able to work on every machine in the cell, this often means that employees should be "more functional". Therefore, cell implementation is better to be done in steps, both cellular and systems and the traditional operating simultaneously for a period of time.

There are many benefits of cellular production Faurecia Seating Talmaciu if the cells have been implemented correctly. Production processes become more balanced and productivity increases due to reorganization and cellular ordering.

During the crossing parts from one process to another, setup time and time between operations are reduced, resulting in a release of inventory. Production work cells combined with JIT also helps eliminate overproduction, producing goods only when necessary.

The result is reduced costs and better control of operations.

Figure 3 Working group
At Faurecia Seating Talmaciu there is a quality control department pretty well structured, which brought to the company its leadership in the market, so the raw materials and finished products are of the highest quality.

Faurecia launched the "Breakthrough Quick Response Quality Control Quality Hovering" (QRQC), that advanced planning quality control and rapid control of quality, figure 3.

But quality control is improved by adopting JIT environment thus providing a continuous improvement of products which are checked throughout the production process.

Introduction of an effective preventive current repairs.

When a company reorganizes its equipment in flexible cells, each unit of the cell becomes a part of it. If a machine breaks down, the entire cell stops.

Because products cannot be transferred to another machine while the machine is repaired, JIT operations require an efficient application of preventive current maintenance. Machine operators should take advantage of the work stoppage to perform routine repairs.

4 Case Study. Analysis of final assembling process agility by applying Just In Time in S.C. Faurecia Seating Talmaciu S.R.L

By applying a JIT system resulting not only reduce the level of inventory or production time, but also get high quality products.

Seat assembly is done on 2 different lines, one for the front seats and the other for the rear seats. Thus, the front seats assembly line includes 10 workstations for slides and control lever assembly on the production pallet to electrical harness, visual inspection and removing wrinkles and scratches in IR cabin to checking the electrical systems of seat. All this activity is served by 11 workers.

In the case of assembly line of rear seats we have 7 workstations served by 3 workers, where it performs the following operations: handling reinforcement backrest, “lach” assembly, pivot pin, seatbelt retractor and “feld-pad” by screwing, assembles backrest cover on the reinforcement and clasps it, removing creases by ironing, visual inspection for delivery to the customer.

The two assembly lines were designed for an output target of 1000 seats sets / day, i.e. 21,000 sets seats/ month, which means that every 104 seconds will be performed the covers for a set of seats.

Supply of the line lasts 60 minutes and move the trolley from one post to another lasts 10 seconds.
For the analysis agility of weaving (assembly of the seat covers) and final assembly line of the car seats value stream map was realized [5].

Analyzing the initial value stream map, it was found that:

- In case of weaving: \( Lead\ time = 3,2\ days \) \hspace{1cm} (1)
- In the case of the assembly line: \( Lead\ time = 7,5\ days \) \hspace{1cm} (2)

and the line takt is: \( Takt\_time = \frac{5\text{days} \times 4\text{week} \times 2\text{exchanges} \times 450\text{min}}{21000} = 0,857\text{min} \) \hspace{1cm} (3)

There are still points of bottleneck even if the assembly does not last too long. Given these identified nonconformities, the organization decided the creation of working group to solve these issues in a Kaizen site, proposing to improve solutions by implementation of Kanban and production cells.

As a solution for improvement is proposed in parallel manufacture of subcomponents for 8 hours, storing them in a supermarket and then transferred to the final assembly line and achieve production cell, as shown in the figure below.

For the analyze of the solution a model of the assembly line was realized in Arena software, figure 4 to simulate the process and compare it with the target of the company [6].

![Simulation model of improved assembly line using Arena software](image-url)
Restoring value stream map for the 2 lines resulted in a Cycle time = 79 sec line weaving, resulting in a 25% improvement with a respective Cycle time = 419 sec for the assembly line and an improvement of 12.5%, values are shows in figure 5.

![Image of value stream map]

(a) Seat covers  (b) Final assembly car seats

Figure 5 Changes of location and improvements resulting from implementation of JIT

The simulation was performed for the final assembly line, length of the run for a week (five days, two shifts, 450 minutes/shift) resulting a number of five replicas with the results shown in table 2.

| Setup time       | Unit | Before | After | Improvement |
|------------------|------|--------|-------|-------------|
| Total time       | min  | 60     | 4     | 92%         |
| Cycle time       | sec  | 104    | 79    | 25%         |
| Employees        |      | 3      | 1     | 65%         |
| Parts per employee |     | 22     | 48    | +113%       |
| Surface          | m²   | 25     | 15    | -40%        |
| Productivity     | %    |        |       | +115%       |

| Setup time       | Unit | Before | After | Improvement |
|------------------|------|--------|-------|-------------|
| Transit time     | min  | 50     | 4     | -96%        |
| Cycle time       | sec  | 479    | 419   | -12.5%      |
| Employees        |      | 11     | 8     | -28%        |
| Parts per employee |     | 90    | 103   | +14%        |
| Inmediate stocks |      | 80    | 10    | -90%        |
| Surface          | m²   | 90    | 77    | -13%        |
| Productivity     | %    |        |       | +14%        |

Table 2 Results of the simulation model

| Replication length, (min) | Replication number | Number out | Number of auto chairs set | Half width |
|---------------------------|--------------------|------------|----------------------------|-----------|
| 450                       | 1                  | 376        | 26.89                      |
| 900                       | 1                  | 874        | 114.35                     |
| 900                       | 2                  | 908        | 165.18                     |
| 2250                      | 1                  | 4326       | 936.31                     |
| 2250                      | 2                  | 4619       | 1269.65                    |
| 2250                      | 3                  | 5008       | 1317.29                    |
Queuing time for the replications are 0.14 – 1.69 minutes. Regarding the confidence level in Arena software this has the value of 95%.

The conclusion for the simulation is that the target could be achieved in a work program in twoo shifts, five days / week and overtime added.

5. Conclusions

This study is part of the completion and analysis of the current car seat assembly by simulating the production process using software Arena and making improvements to the manufacturing process.

By applying JIT under the two processes improved resource management at Faurecia Seating Talmaciu by reducing and maintaining a minimum level of inventories which led to lower cost storage, deterioration of product quality during storage, so the risk to produce inventories that can not be sold they have been avoided.

It was noted that after the integration of all assembly processes in flexible manufacturing cells decreased time during both assembly and auxiliary transport semi-assembly line at the final assembly line. This measure also led to lower surplus production and the elimination of intermediate stocks.

The new reorganization of assembly-line production allows operators to move from the main station where they operate any of the other positions when needed.

Can be seen from the graph shown in figure 6, that, expenses of payable inventories were reduced by at least 70% by applying JIT, in that they are received only when needed.
References

[1] Cheng T C, Podolsky S, 2007 Just in Time Manufacturing. An introduction, Ed. Springer-Verlag, New York, LLC, pp 44-62.

[2] Internal documentation from S.C.Faurecia Seating Tâlmaciu S.R.L

[3] Manual SMI Faurecia TAL-I-LSS-2016/RO

[4] Book of quality - S.C.Faurecia Seating Tâlmaciu S.R.L.

[5] Beju L D, 2013 Principiile fabricatiei agile, Editura Universităţii “Lucian Blaga” din Sibiu, Sibiu, pp.29-61.

[6] Altiok T and Melamed M, 2007 Simulation Modeling and Analysis with Arena, Elsevier Inc., ISBN 10: 0-12-370523-1, pp. 141- 163, 223-249

Acknowledgement

Article financed of research grants LBUS, no 1506/17.04.2015 with S.C. LINE SOFT S.R.L Sibiu company.