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# Performance of manufacturing system improvement by arena 10 simulation software

**Pandit Shamuvel V, Kamble Suyesh B, Shinge Mahesh S, Bhosale Swati G, Kadam Sunil J, Patil Amol V**

Asst. Professor, Department of Mechanical Engineering, BVC College of Engineering, Kolhapur, Maharashtra, India

**Abstract**

Production lines are flow-line production systems which are of great importance in the industrial production of high quantity standardized commodities and more recently even gained importance in low volume production of customized products. In Small Medium Enterprise (SME) manufacturing plant, production line gives high impact to the productivity of the company. Less of skill and knowledge in management in the company make the SME cannot compete to large company. The main objective of this paper is to improve the productivity of the specific production line in the medium scale industry using line balancing technique and analyzed results in Arena 10 software.

**Keywords:** Arena 10, simulation, production line, productivity

## 1. Introduction to ARENA 10.0

Several experiments have been carried out to validate the performance and capability of the spreadsheet model proposed here. A validation is performed by comparing the results of this spreadsheet model with those obtained through an existing analytical model a simulation model (ARENA). To obtain the results a model is developed using (ARENA10.0) simulation software. Arena 10.0 is a powerful simulation environment. Simulation software Arena 10.0 consists of modeling object templates which is called as modules and transactions that move among them which is called as entities and has a visual front-end. It built around (SIMAN) block-oriented language constructs and other facilities. Blocks are basic logic constructs that represent operations, such as (SEIZE) blocks that model seizing of a facility by a transaction entity, while (RELEASE) blocks release the facility for use by other transaction entities. Elements are objects that represent facilities, such as (RESOURCES) and (QUEUES) materials and methods.

## 2. Problem Associated with Company Existing Technique

The company manufactures different types of housings on the housing production line according to customer demand. On the housing production line housing number 39.468, housing number 3528, housing number 3.974, housing number 4H682 and housing number X1815822 housings are manufactured.

The production of housings carried out according to monthly demand from customers. Once the customers place order for any housing component, the production planning and control department schedule for monthly production. They divide monthly production requirement into weekly production requirement and weekly into daily production requirement.

Company was facing problem for delivering the flywheel housing product number (39.468) after increase in demand from their customer. After studying the past data of housing component such as, manufacturing process, resources required, work in process inventory and raw material inventory, we found problems regarding dispatch and inventory control for the component. The problems are listed below,

1. Problems associated with dispatch.
2. Problems associated with Work-in-process inventory.
3. Problems associated with Raw material inventory.

We have overcomes these problems by using line balancing technique and anlysed results in arena 10 simulation software

## 3. The Existing ARENA Simulation Model

The existing ARENA simulation model is created, which consists of seven machine resources; these resources are Turret Lathe 1, Turret Lathe 2, VMC 4, VTL 2, HMC 2, VMC 1, and Debarring and Chamfering shown in fig 9.1.

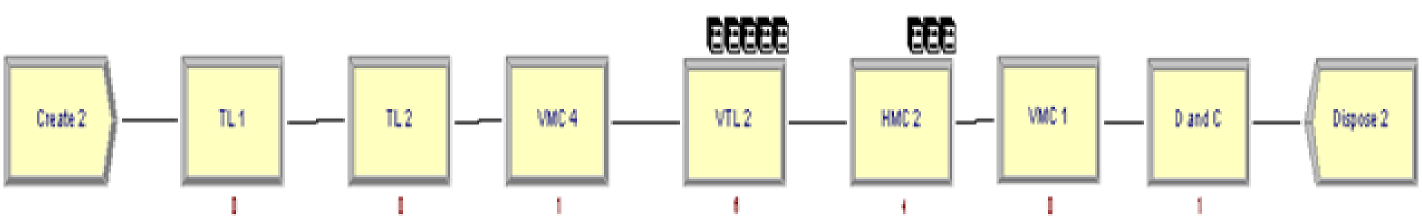


**Fig 1:** Existing ARENA Model

### 3.1 Result and Discussion Existing Model

The arena results are generated are as follows,

| **Number of housings in** | **Value** |
|---|---|
| Entity | 1 40.0000 |
| **Number of housings out** | **Value** |
| Entity | 1 31.0000 |

### 3.2 Resources Utilization

The table 1 shows instantaneous utilization the resources (Existing Simulation Model)

**Table 1:** Instantaneous Utilization (Existing Simulation Model)

| Resources | Schedule | Average | Half Width | Minimum Value | Maximum Value |
|---|---|---|---|---|---|
| Turret Lathe 1 | 1.0000 | 0.8090 | (Insufficient) | 0.00 | 1.0000 |
| Turret Lathe 2 | 1.0000 | 0.8090 | (Insufficient) | 0.00 | 1.0000 |
| VMC 4 | 1.0000 | 0.8989 | (Insufficient) | 0.00 | 1.0000 |
| VTL 2 | 1.0000 | 0.9371 | (Insufficient) | 0.00 | 1.0000 |
| HMC 2 | 1.0000 | 0.8789 | (Insufficient) | 0.00 | 1.0000 |
| VMC 1 | 1.0000 | 0.5697 | (Insufficient) | 0.00 | 1.0000 |
| Deburing & Chamfering | 1.0000 | 0.3135 | (Insufficient) | 0.00 | 1.0000 |

Percentage utilization of the resources (Existing Simulation Model) graphically represented in fig. 2

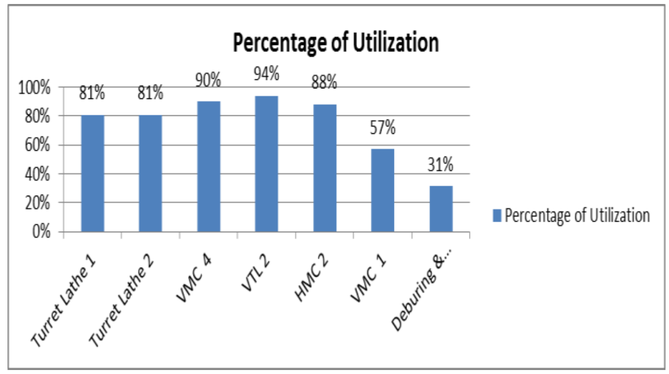


**Fig 2:** Percentage Utilization of the Resources (Existing Simulation Model)

### 3.3 Total Number Seized

The table 2 shows total number of unit seized (Existing Simulation Model).

**Table 2:** Total Number Seized (Existing Simulation Model)

| Resources | Turret Lathe 1 | Turret Lathe 2 | VMC 4 | VTL 2 | HMC 2 | VMC 1 | Deb & Chf |
|---|---|---|---|---|---|---|---|
| Value | 40 | 40 | 40 | 35 | 33 | 32 | 31 |

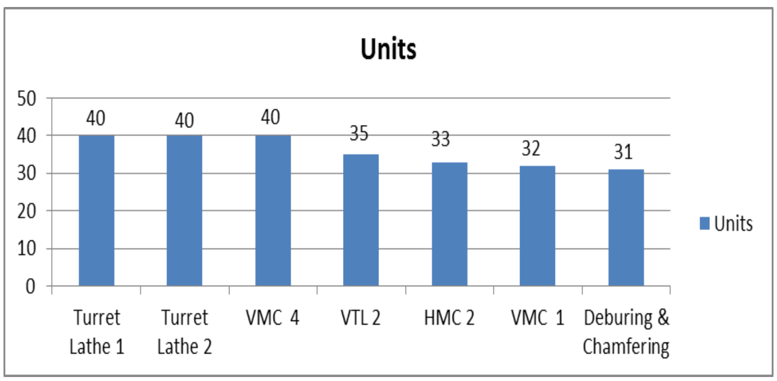


**Fig 3:** Number of Units Seized by the Resources (Existing Simulation Model)

Number of units seized graphically represented in fig.3.

## 4. The Proposed Simulation Model

The proposed arena simulation model is shown in the fig 4

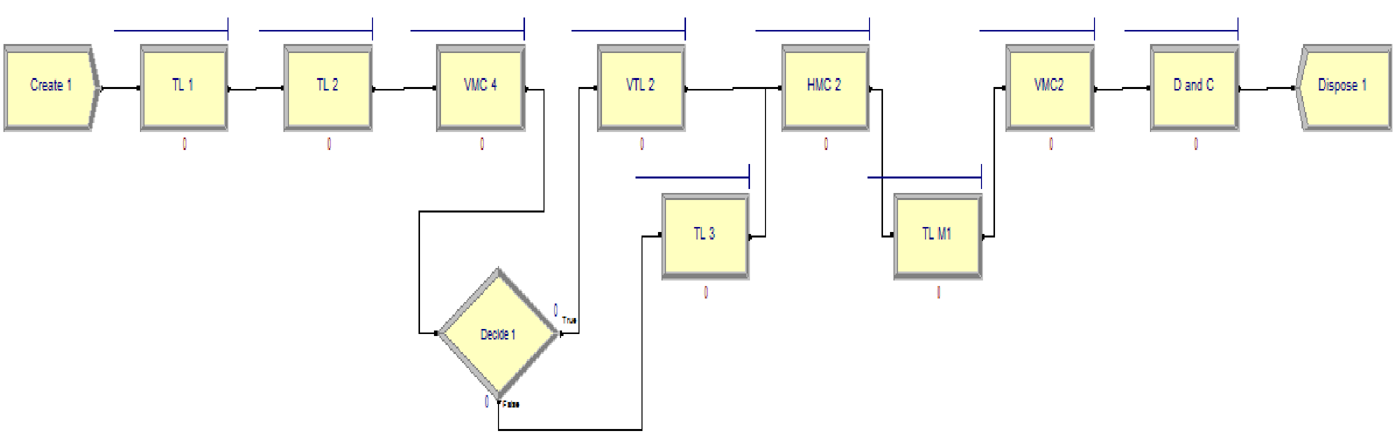


**Fig 4:** Proposed ARENA Model

| Number of housings in | Value |
|---|---|
| Entity | 1 40.0000 |
| **Number of housings out** | **Value** |
| Entity | 1 38.0000 |

### 4.1 Resources Utilization Proposed Simulation Model

**Instantaneous Utilization**

The table 3 shows instantaneous utilization the resources (Proposed Simulation Model)

**Table 3:** Instantaneous Utilization (Proposed Simulation Model)

| Resources | Schedule | Average | Half Width | Minimum Value | MaximumValue |
|---|---|---|---|---|---|
| Turret Lathe 1 | 1.0000 | 0.8090 | (Insufficient) | 0.00 | 1.0000 |
| Turret Lathe 2 | 1.0000 | 0.8090 | (Insufficient) | 0.00 | 1.0000 |
| VMC 4 | 1.0000 | 0.8989 | (Insufficient) | 0.00 | 1.0000 |
| VTL 2 | 1.0000 | 0.9371 | (Insufficient) | 0.00 | 1.0000 |
| HMC 2 | 1.0000 | 0.8706 | (Insufficient) | 0.00 | 1.0000 |
| VMC 1 | 1.0000 | 0.6721 | (Insufficient) | 0.00 | 1.0000 |
| Deburing & Chamfering | 1.0000 | 0.3750 | (Insufficient) | 0.00 | 1.0000 |
| Turret Lathe 3 | 1.0000 | 0.1754 | (Insufficient) | 0.00 | 1.0000 |
| Tap Fast 1 | 1.0000 | 0.3849 | (Insufficient) | 0.00 | 1.0000 |

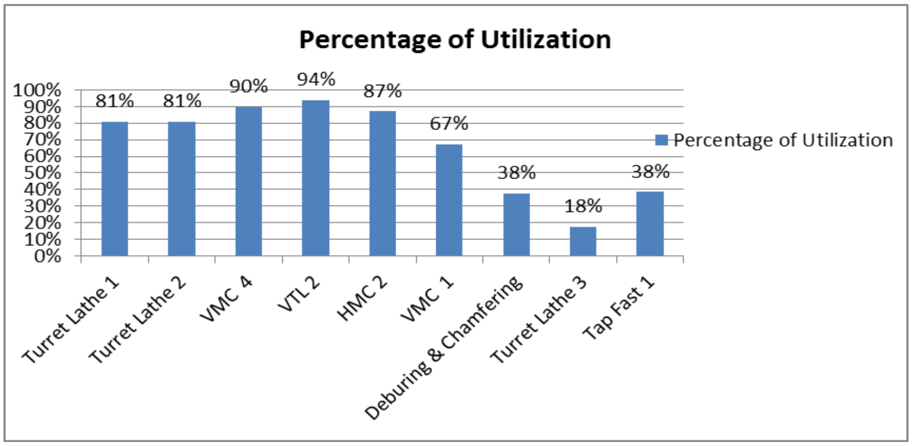


**Fig 5:** Percentage of Utilization of the Resources (Proposed Simulation Model)

Percentage utilization of the resources graphically represented in fig. 5

### 4.2 Total Number Seized

The table 4. Shows total number of units seized (Existing Simulation Model).

**Table 4:** Total Number Seized (Proposed Simulation Model)

| **Resources** | Turret Lathe 1 | Turret Lathe 2 | VMC 4 | VTL 2 | HMC 2 | VMC 1 | De & Ch | Turret L 3 | Tap Fast 1 |
|---|---|---|---|---|---|---|---|---|---|
| **Value** | 40 | 40 | 40 | 35 | 33 | 32 | 31 | 5 | 39 |

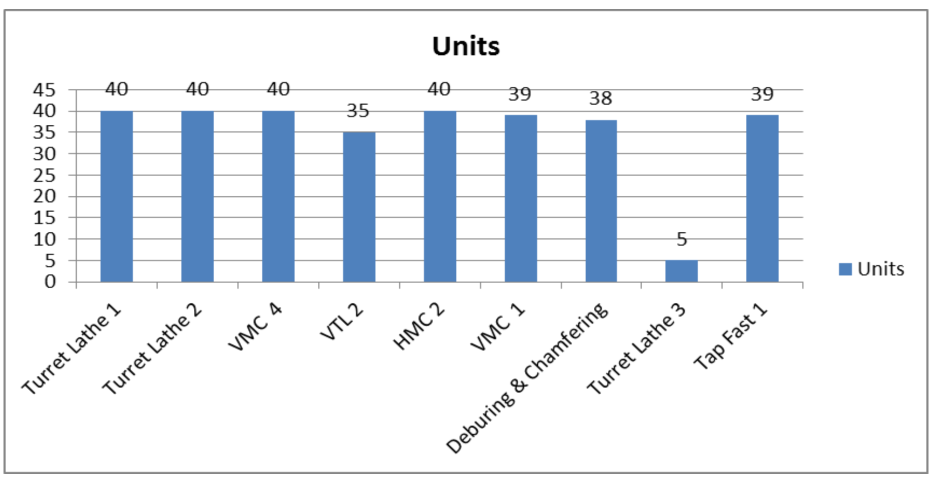


**Fig 6:** Units sized by the Resources (Proposed Simulation Model)

The fig. 6 shows number of units seized (Proposed Simulation Model)

## 5. Conclusion

The above results obtained from ARENA simulation model. Initially existing ARENA simulation model created according to available resources present in the production line. Existing ARENA simulation model created for the demand of 40 parts per shift. The trial on the existing simulation model has carried out and observed that it produced output about 31 parts and WIP inventory observed in front of the constraint resources.

Finally proposed ARENA simulation model created by introducing Tap Fast 1 and Turret Lathe 3 resources. Proposed ARENA simulation model created for the demand of 40 parts per shift. The trial on the proposed simulation model has carried out and observed that it produced output about 38 parts and considerable reduction in WIP inventory in front of the constraint resources.

After performance improvement of production line, the analysis gives following results.

| Performance Parameter | Before TOC | After TOC | Percentage of Improvement |
|---|---|---|---|
| On Time Deliveries | 82% | 97% | 15% |
| Production Volume | 992% | 1162% | 17% |
| Profit | Rs.3,53,010/- | Rs.4,14,313/- | 17% |
| Labour Productivity | 17.71 | 18.17 | 2.59% |
| Machine Productivity | 2.4195 | 2.8356 | 17.19% |
| Material Productivity | 0.3787 | 0.4388 | 15.87% |
| Work in process inventory | 207 | 35 | 83% |
| Raw material inventory | 239 | 62 | 74% |

## 6. References

1. Tsai-Chi Kuo, Sheng-Huung Chang, Shang-Nan Huang. Due-date performance improvement using TOC's aggregated time buffer method at a wafer fabrication factory. Expert Systems with Applications. 2009; 36:1783-1792.
2. Frazier GV, Reyes PM. Applying Synchronous Manufacturing concept to improve the production performance in High-Tech Manufacturing. Production and Inventory Management journal. 2000; 3:60-65.
3. Satya S Chakravorty, Atwater JB. The impact of free goods on the performance of drum-buffer-rope scheduling systems. International Journal of Production Economics. 2005; 95:347-357.
4. Chandrasekharan Rajendran, Knut Alicke. Dispatching in flow shops with bottleneck machines. Computers and Industrial Engineering. 2007; 52:89-106.
5. Tsai-Chi Kuo, Sheng-Huung Chang, Shang-Nan Huang. Due-date performance improvement using TOC's aggregated time buffer method at a wafer fabrication factory. Expert Systems with Applications. 2009; 36:1783-1792.
6. Horng-Huei Wu, Ching-Piao Chen, Chih-Hung Tsai, Chun-Jheng Yang. Simulation and scheduling implementation study of TFT-LCD Cell plants using Drum–Buffer–Rope system. Expert Systems with Applications. 2010; 37:8127-8133.