Production Process Smoothening and Elimination of Bottleneck

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Abstract. Efficiency of production line plays an important role in growth of manufacturing industry. We have to utilize our available resources. Manpower utilization and machine efficiency are the main contributing factor in line efficiency. Manpower utilization and machine efficacy measurement method should be accurate. There should be transparency with the higher management for looking for the production data so that they can easily find out fault and take immediate action on that fault for improvement of efficiency. A feedback method also used for checking the accurate solution implementation and ensuring that problem resolved.

Keywords: Machine efficiency; man power utilization; industrial production line; data management system; Process department utilization

1. Introduction

A production line is a sequence of established process sequence for getting raw material or component into final finished product. The stages in production process includes procurement of components or tools for product manufacturing, incoming inspection process, storage of material, kitting of material, shop floor loading of material, assembly, testing, quality check, packing and final dispatch of finished product. It can be automated, semi-automotive and manual production line. The line complexity depends on the manufacturing parts, cost, and sensitivity and production volume of product. The line setup and its layout depend on the production requirements. Industries started using Jigs, fixture and some automatic machines to assist workers. For automated line designing and installation required expert’s manpower.

Fig. 1 Process flow in manufacturing production line.

Figure 1 shows Process flow in manufacturing production line in which we start our process from procurement of material to finished Goods dispatch stage. Our first process is to procurement of raw material from vendors on time and exact quantity. Second stage is the Incoming Goods Inspection stage (IGI) stage where all the material is checked as per drawing and quantity verified and enter the records.
in the database. Third stage is to store the material at their appropriate stage assigned for that particular material in the store. In fourth process, we perform kitting of material for proper running of production line. In next process we load the material on line for assembly and then start assembly of the material. In next process, we perform testing of assembled goods if found good then send assembled product to quality check and then pack the finished good. Finally dispatch the finished material to customer end.

Factors affecting the efficiency of production line:

a) Machine Efficiency: For smooth functioning of line and for getting more efficiency higher management always analysis the data related to production line problems and solutions [1]. Machine efficiency plays a vital role in calculating the line efficiency. For maintaining the machine efficiency, we have to do timely maintenance of the machine [2]. So in manufacturing plants a responsible person is assigned for proper maintaining of machine for getting optimum utilization of machine and overcome the line stoppage due to machine stoppage or low efficiency. Machine maintenance is necessary for getting high efficiency. Machine maintenance is not able to resume its operation as a new machine but able to maintain up to some extends. The cyclic maintenance is required to reduce the major breakdown due to machine stoppage. Currently we are using sensors-based maintenance system so that we can find out the fault on time and maintenance before major breakdown and line stoppage.

b) Manpower Utilization: Humans play a major role on the industrial shop floor especially when it comes to meeting targets [3]. There are two categorizations of manpower for shop floor. First one is the operators working at the floor and other one is the supporting department. The Supporting department includes Total Quality Management (TQM), Production Planning and Control (PPC) and Maintenance. Sometime engineering support Group (ESG) or New Product Introduction (NPI) group also comes under this category. TQM is responsible for maintaining the quality of the product and other quality related issues. PPC is for planning and provide work target on the daily/monthly bases. The maintenance is responsible for all technical query related to machine maintenance. ESG is for new product related development and line setup for new product.

1.1 Production Breakdown:

The Production Breakdown can come due to some of following issues:

a) Material unavailability: The PPC has given the plan for assembly of any model of product for particular time period. The line can be stopped when material is not loaded on the production line on that particular time. The line can be stopped due to wrong material loading also.

b) Machine Breakdown: Machine breakdown can be come at any time so we should be ready for maintaining at that stage. We should arrange critical part of machine in advance for this type of breakdown. For example, in electronics assembly process, we should arrange nozzles of pick and placer machines in advance because this one is the more frequent broken part.

c) Wrong material loading: If we have loaded wrong material on the line then line can be stopped.

d) Untrained Manpower: If any one of the untrained people handling machine then there may be more chance of line stoppage.

e) Low output plan: This case can come if PPC has planned low output for particular model. So PPC should have knowledge of per hour output of particular model in production line.

f) Lack of discipline: If something un-disciplinary happening at line then there may be the chance of line stoppage problem. So there should be less interference of unrelated persons online.

g) Bottleneck in the material handling: Assembled goods handling should also be proper because excess quantity of material at production line area make because space problem and next process may stop because of unavailability of semi-finished goods.

h) Changeover time: It is the time required from unloading of one model material and loading of other model materials. It cannot be reduced to zero. It can be optimized only.
1.2 Solution to overcome Production breakdown: The Production Breakdown can be optimized by using some of improvement suggestions:

a) Material unavailability problem solution using advance kitting: The material unavailability problem can be resolved using advance kitting so that material can be loaded on time.

b) Machine Breakdown problem solution using data analysis: Machine breakdown problem can be resolved using maintaining old maintenance data and advance planning for critical part of machine.

c) Wrong material loading using pre-verification of kitting: Prior to plan for particular model, we have to pre-validate the material so that any discrepancy in the material can be resolved before actual loading.

d) Untrained Manpower using proper timely training to operators: We have to plan proper training for the operator and take feedback from their work.

e) Low output plan using proper analysis of old data: PPC have to plan after proper analysis of old data received from production on daily bases.

f) Proper discipline: The un-disciplinary can be maintained by using proper discipline for unrelated parsons on line.

g) Bottleneck in the material handling: Proper flow of material is necessary for smooth functioning of line so next processes also proper and symmetric with line.

h) Changeover time using offline loading: We can complete off line loading to resolve change overtime issue up to some extends.

2. Machine Efficiency Measurement

Overall Equipment Efficiency of machine can be measured with multiplication of Availability, performance and quality as shown in equation (1) [6] – [10]. The ratio of actual operation time to planned operation time is called availability. Performance of machine is measured in terms of Machine ideal cycle time, total piece produced, and planned operation time as shown in equation (3). Quality is the ratio of good piece produced to total piece produced [2], [4], [7], [11] - [13].

3. Work Stoppage issues

Some of common issues which also affect our line working which also cannot be ignored:

(i) Shop Floor Layout: We will work on the critical points related to the production assembly such as reduce cycle time but ignore some of minor points which cause lot of losses in production. Shop floor layout is one of them. We have to give some time for proper layout designing of our shop floor area because it runs in all working hour of the company.

(ii) Bill of material management: It is an important issue. We can define material as per our customize part and some of commonly used material with same part name for our material management. We have to isolate NPI with regular work production. There should be responsible person for taking ownership of material.

(iii) Unclear Work Instruction: Work instruction plays an important role for understanding of the production operator. Sometime work instructions are making in such a way that it is not understandable to operator. We should discuss the issue with production person and then make work instruction accordingly.

(iv) Poor Work cell layout: It’s ultimately about providing the employee with a functional, easily navigable work space.

(v) Resources Sharing: When we share resources between two stages, we have to calculate that...
how much time is wasted in this process. We can compare this time with calculated in terms of money and then with the sharing resources. If it is very less than we can arrange separate one for separate line or separate area.

Conclusions

In this paper, we have explained the line breakdown in production assembly and its efficiency calculation methods. We have provided the solution to resolve the problem that comes due to minor or major line stoppage issues. We have explained some details related to the fault and line stoppage. We have explained the maintenance requirement for more economic loss due to these breakdowns. General structure of production planning is explained with some examples for better understanding.

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