

Role of Skilled Manpower and their Allocation in a Production Line: A Case Study

Binuraj V K, Asok Kumar N

¹MTech Student, College of Engineering Trivandrum

²Assistant Professor, College of Engineering Trivandrum

Abstract – In the current business world, companies face an increasingly competitive environment and thus tremendous pressure to perform in such an environment. Every company is challenged to offer improved capacity by utilising the available resources. This can be achieved only by increasing the efficiency and productivity of the existing production line. Companies need to identify a profitable product mix that can be efficiently manufactured. This demands a higher level of sophistication and effectiveness in their product management. This is very much applicable in manufacturing industry.

In this paper, the impact of skilled worker allocation in a manufacturing firm which produces multiple variants and runs on shift mode is analysed. Initial steps of study involved identification of the Production Line to be improved, collect the required data from production logs, and identify the bottleneck process in the entire production line. Simulation techniques were used for this purpose. Further the bottleneck process was analysed in detail to identify the constraints. At this stage, the skilled manpower allocation was identified as one of the key constraint. Further data collection and analysis were performed to analyze the existing resource scheduling process, shift-wise productivity. A detailed competency mapping exercise was carried out.

With the availability of sufficient inputs like variant wise production plan as well as the variant wise skilled worker competency matrix, scheduling team can ensure that for the variant being produced, skilled workers with required competency are available in the shift. This will maximize the process output, and in turn will reduce the cost per piece.

Key Words: Skilled worker, Productivity, Competency Mapping, Profit, Forecast, Bottleneck, manufacturing industry

1. INTRODUCTION

The competition on the market is intense and companies try to satisfy the various marketing goals and capture different market segments by offering multiple variants of the existing product. Having multi variants in the production line is challenging to the overall

manufacturing performance, as the skillset requirement may vary for each variants and more sophisticated production management is required to ensure the required productivity and product quality. In this paper, skilled manpower allocation in a manufacturing firm with multi variant product line which operates 24X7X365 in shift mode is studied. The production line produces multiple variants of which Variant-1 and Variant-2 are the most voluminous ones. Few points to be noted regarding the variants w.r.t the manpower and materials are

- Skilled worker is essential for Variant-1 & Variant-2
- Skill required for Variant-1 & Variant-2 are different
- Raw material and Semi-finished goods required for both variants are different.

1.1 Study of Existing Process

Skilled worker is an essential and one of the most critical input for the variant wise production. Required skill set and skilled worker availability data was taken from the HR department. Of the various skills required, the most essential eight ones can be listed as follows.

A. Process Knowledge	E. QMS Knowledge
B. Product Knowledge	F. Machine Maintenance Knowledge
C. Quality in Output	G. Output Quantity
D. Application Knowledge	H. Discipline & Attendance

Table 1 Skill Set

These are essential for both the variants in the Production Line.

1.2 Data Collection

A separate study was carried out to find out how the above competencies are distributed among the available manpower allocated for the each process. A detailed competency matrix was created to find out the distribution, and is shown in the following figure.

Required Competency	Number of Workers in each competency (Rank-wise)							
	Variant-1				Variant-2			
	1	2	3	4	1	2	3	4
A. Process Knowledge	9	7	7	4	7	5	8	4
B. Product Knowledge	7	8	6	4	8	5	7	4
C. Quality in Output	8	7	5	4	8	6	5	4
D. Application Knowledge	8	8	4	4	8	3	4	4
E. QMS Knowledge	8	8	7	4	9	8	5	4
F. Machine Maintenance Knowledge	8	8	4	4	7	6	4	4
G. Output Quantity	8	8	4	4	8	7	4	4
H. Discipline & Attendance	8	7	6	4	8	9	8	4

Figure 1 Competency Matrix

Following points to be noted from the above competency matrix.

- Rank is taken as a measure to assign the competency of a worker in a particular skill, with Rank-1 being the highest and Rank-4 being the lowest.
- It is preferred to run the process with workers having Rank-1 or 2 since lower ranks, especially in the competency A to E can severely affect the quality of the product and hence the company reputation.
- Each cell in the above matrix denotes the number of workers with the competency rank for a particular skill set.
- For planning the shift, though Rank-1 or Rank-2 is always preferred, few workers in a particular shift can have Rank-3 also.
- People with Rank-4 in the skill set cannot be used for any shifts
- Workers having Rank-4 in a particular skill may have Rank-1 in another skill.
- Same is the case w.r.t variant wise skill distribution also. Workers having Rank-1 or 2 for Variant-1 may be having lower ranks for the same skill set required for Variant-2.

2 Data Pattern Analysis and Results

From the competency matrix, variant wise availability of minimum numbers of workers having the first three ranks in all skill set are tabulated below.

Variant	Deduction	Nos	Total No \ (Rank-1 & 2)
1	Minimum Number of Workers having Rank-1 in all Skill set	6	13
	Minimum Number of Workers having Rank-2 in all Skill set	7	
	Minimum Number of Workers having Rank-3 in all Skill set	4	
2	Minimum Number of Workers having Rank-1 in all Skill set	6	11
	Minimum Number of Workers having Rank-2 in all Skill set	5	
	Minimum Number of Workers having Rank-3 in all Skill set	4	

Table 2 variant wise availability of minimum numbers of workers

We can see that a minimum of 13 workers are only available with Rank-1 or Rank-2 for Variant-1 skill set and a minimum of 11 workers are available with Rank-1 and Rank-2 for Variant-2 Skill set. From the production logs, it can be seen that the manpower requirement per shift for Variant-1 and Variant-2 at the bottleneck process is as follows.

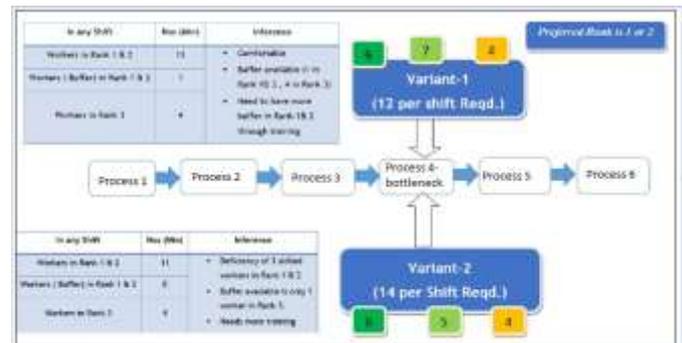


Figure 2 Skilled Manpower - Requirement Vs. Availability

The above figure also brings out how the skilled worker requirement (for each shift) compares with the minimum number of variant wise worker pool available with Rank-1 and Rank-2. It is clear that Variant-2 is having a shortage of 3 skilled persons in the Rank-1 and Rank-2 competency area. With workers from Rank-3 category, Variant-2 production is being run.

In the production line under study, proper allocation of skilled worker w.r.t the Variant being produced was absent. This aspect was seriously affecting the output of specific process. It is to be ensured that when Variant-1 is under production, 12 skilled worker with Rank-1 or Rank-2 should be available in that shift. Similar is the case with Variant-2 also.

The above data was generated by preparing a Variant wise competency score card for each of the assigned workers in the one process area, and a sample compiled data of three such workers is shown below. Similar one is made for all the workers. The competency score card gives a quick understanding of how each of the workers perform in the eight most important competencies required for identified bottleneck process in the production line. This becomes a

useful tool to planning team for shift scheduling of these workers.

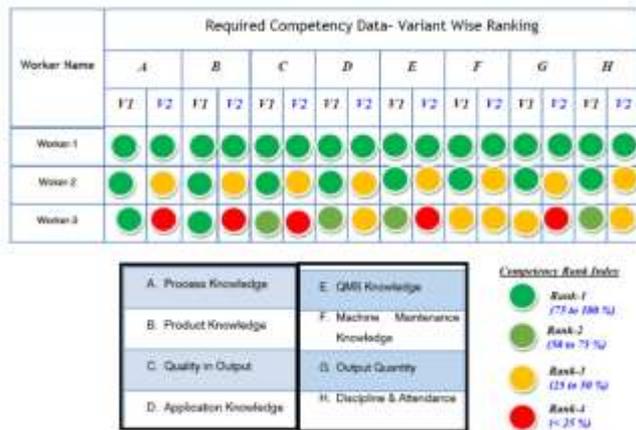


Figure 3 Variant Wise Ranking

2.1 Skilled Worker Scheduling in Existing System

Examining the present skilled worker scheduling for the concerned process identified as bottleneck has brought out the following aspects.

- Variant wise competency matrix was not available to scheduling team. Process wise competency [whether the worker is suited for a specific process in the production line] was only available. [Please note that Comprehensive competency matrix discussed in this paper was made as part of this study only]
- Hence, competency score in variant wise process skill set was not taken as the base reference for scheduling. Overall process wise competency was taken as the reference for workers shift scheduling.
- This means workers are allocated to a specific process shifts if he is having an overall idea about that process without seeing whether he is competent enough to the variant being produced in that particular shift. This created scenarios where a worker having Rank-4 (poor skill set) in all skill set in Variant-2 is allotted to shifts running assembly of Variant-2.
- Up on examination of earlier worker allotment schedules, it was understood that such scenarios were regularly happening in the scheduling.

So the requirement of skilled worker with required competency score (Rank-1 or Rank-2) w.r.t the variant being produced IS NOT MET in the existing system.

2.2 Improving the Skilled Worker Allocation

From the points elaborated so far, we can clearly bring out the fact that skilled worker with required competency score (Rank-1 or Rank-2) is essential w.r.t the variant being produced. This will increase the throughput of the identified bottleneck process and reduces cost / piece

The above described scenario is the ideal one to be followed in the identified bottleneck process. The improvement achieved by having variant wise schedule, skilled resource mapping and carefully chartered skilled resource scheduling can be summarized as below.

Particulars	Before Improvement	After Improvement	Effect of Improvement
Skilled Workforce Availability in shift	Not as per the variant requirement under production. Workers sometimes may have minimal knowledge of the variant being produced. Slows down the output or increases rejection rate.	Deployed as per the variant requirement with Rank-1 or 2 skill score	Smooth production flow as the workers are well versed in the production of variant in the particular shift. Improved out put Reduced cost per piece

Table 3 Results

3. CONCLUSION

Managing high levels of product variety in a manufacturing firm is challenging in terms of productivity and quality assurance. With the availability of sufficient inputs like variant wise production plan as well as the variant wise skilled worker competency matrix, scheduling team can ensure that for the variant being assembled, skilled workers with required competency score are available in the shift. This will maximize the process output, and in turn will reduce the cost per piece. This study has shown how the selected product's production efficiency, is improved by detailed analysis on the allocation of skilled resources. Skilled labour is one among different variables affecting the output in a production line, and other inputs like material flow can be further studied.

4. REFERENCES

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