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Research Article

Application of Industrial Engineering in Garments Industry for Increasing Productivity of Sewing Line

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Abstract

This paper represents the application of Industrial Engineering in garments sector for reducing the cost of SMV and improving productivity by implementation of proper line balancing. Line balancing process is one of the most important stages in ready-made Clothing sector. Line balancing is an important parameter. In apparel manufacturing, skills and expertise of a sewing operator is being presented in Efficiency term. An operator with higher efficiency produces more garments than an operator with lower efficiency in the same time frame. The Line Balancing is to design a smooth production flow by allotting processes to workers so as to allow each worker to complete the allotted workload within an even time. It is a system where we meet the production expectations and we can find the same amount of work in process in every operation at any point in the day. We know that in our garments sector main problem is that the garments are conducted by the poor, inefficient and entraining people. So that a big concern is essential in this sector like low production, longer production lead time, high rework, rejection, poor line blanching, low flexibility of style change.

Keywords: *Industrial Engineering, Line Balancing, Productivity, Efficiency, skill.*

1. Introduction

Line and work cell balancing is an effective tool to improve the throughput of assembly lines and work cells while reducing manpower requirements and costs. Assembly Line Balancing or simply Line Balancing (LB) is the problem of assigning operations to workstations along an assembly line, in such a way that the assignment be optimal in some sense. LB has been an optimization problem of significant industrial importance: the efficiency difference between an optimal and a sub-optimal assignment can yield economies (or waste) reaching millions of dollars per year. LB is a classic Operations Research (OR) optimization problem, having been tackled by OR over several decades. Many algorithms have been proposed for the problem. Yet despite the practical importance of the problem, and the OR efforts that have been made to tackle it, little commercially available software is available to help industry in optimizing their lines.

The expectation of the customer are on the rise and manufactures have to design and produce well in as many Varity as possible to cater to the demand of the costumer in productive efficiency of the organization so the SMV & line balancing is going to play pivotal role in increasing productivity. Varies SMV and line balancing techniques are used to analyze improve the time method to eliminate waste and proper allocation and utilization of recourse.SMV & line balancing is the knowledge of mathematically and natural science gain by study. Experience and particle is apply with judgment develop way to utilize economically the material and natural recourse and focus nature for the benefit of mankind

SMV or Standard Allowed Minute is used to measure task or work content of a garment. This term is widely used by industrial engineers and production people in the garment manufacturing industry. For the estimation of cost of making a garment SMV value plays a very important role. In past scientists and apparel technicians did research on how much time to be allowed to do a job when one follows standard method during doing the job. According to the research study minute value has been defined for each movement needed to accomplish a job.

2. Literature Review

In (Sudarshan and Nageswara, 2014) have studied that the readymade garment (RMG) industries produce momentous quantities in shorter cycle times. Garment product is highly correlated with high level of productivity as sewing line is balanced in shorter possible time and effective way for each style of garment and required quantity. The focal constraint against the higher productivity is the difference in

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individual capacity leading to improper line balancing and thus abottle neck. This paper is based on an effective layout model to clear the bottleneck process through benchmark capacity leading for a balancing process using two separate concepts of manufacturing processes- modular line and Traditional system both together.

In (Gokcen, 2004) has studied on shortest route formulation of simple U-type assembly line balancing problem. A shortest route formulation of simple U-type assembly line balancing (SULB) problem was presented. This model was based on the shortest route model developed in for the traditional single model assembly line balancing problem. A new approach on traditional assembly line balancing problem was presented. The proposed approach was to establish balance of the assembly line with minimum number of station and resources and for this purpose, 0–1 integer-programming models were developed.

In (Dolgui *et al,* 2006) have studied on special case of transfer lines balancing by graph approach. In their work for paced production they considered a balancing problem lines with workstations in series and blocks of parallel operations at the workstations. Operations of each workstation were partitioned into blocks. All operations of the same block were performed simultaneously by one spindle head. All blocks of the same workstation were also executed simultaneously. The operation time of the workstation was the maximal value among operation times of its blocks. The line cycle time was the maximal workstation time. A method for solving the problem was based on its transformation to a constrained shortest path problem.

In (Becker and Scholl, 2006) have studied that assembly lines are traditional and still attractive means of mass and large scale series production. Since the early times of Henry Ford several developments took place which changed assembly lines from strictly paced and straight single-model lines to more flexible systems including, among others, lines with parallel work stations or tasks, customer oriented mixed model and multi-model lines, U-shaped lines as well as un paced lines with intermediate buffers.

3. Materials and Methods

As the study is based on knit garments so the experiment was done on knit garments also. The first experiment was studied on a knitted T-shirt. After taking the sample Analysis was done through a several steps. The experiment and analysis is presented bellow correspondingly.

At first I noted some important information regarding types of fabric used to produce the specimen, fabric composition, Item types, Buyer name, Order NO, Style NO, Order quantity etc.

Fabric Types: Single Jersey (S/J)
Item Types: Long sleeve T-shirt
Fabric Composition: 80% cotton + 20% polyester
Buyer Name: ADLER
Oder NO: 38
Style NO: 0053
Oder Quantity: 7000

This is the most important task needed to do before starting production. Because this gives a clear view of the total jobs needed to complete the garments. Normally the responsible person or (IE) gives the breakdown of a garments. This is also called operation bulletin.

1. Front & back part match by helper
2. 1st shoulder join over lock machine
3. Rib join
4. Neck piping
5. Neck top stitch
6. 2nd shoulder join
7. Shoulder out tuck
8. Sleeve hem
9. Thread cut
10. Body & sleeve match
11. Sleeve join
12. Side seam close & main label join
13. Thread cut
14. Body hem
15. Sleeve in tuck
16. Care label join
17. Thread cut

There are some important calculations closely related to the production. The calculation is too much essential for costing, time estimating, target setting, shipment, worker grading etc.

Different operation takes different time. So, the SMV is also different for each operation. Calculate SMV of each operation and then compared with the SMV calculation of the floor. Saw that it was same in both cases. The SMV of the garments can be obtained by adding all the individual SMV of each operation. The individual operation SMV gives worker ratting, capacity, individual process target, worker grading and finally line target which ultimately influences the production or efficiency. The final SMV of the garments gives the time required to complete the garments, line target, Output, Efficiency and Costing etc.

Front & back part match calculation

Actual time	= 0.22min
Observe time	= 0.20min
Ratting	= (observe time/actual time) ×100
	= (0.22/0.20)×100
	=90%
Basic time	= observe time ×ratting
	= 0.20×90%
	= 0.18
SMV	= basic time + allowance
	= 0.18+20%
	= 0.22min
Target	= 60÷SMV
	=60÷0.22
	=272

Now the calculation bellow obtained from the data presented above.

Pitch time = smv/total operation
=5.33÷17
=.31

Efficiency

= (Output × SMV) ÷ (Manpower × Working hour×60) × 100
= (1530×5.33) ÷ (19×8×60) ×100
= 85%

Production

= (total manpower× total working hour ÷smv) × 85% = (20×8×60) × 85% =1530

SAH = (Output × SMV) ÷ 60
= (1530×5.33) ÷60
=136

Line target per hour =1530/8
=195pieces

Per operators output =1530/20
=76 pieces

Line machine productivity = 1530/13
=113

Table 1 SMN for different process

S.No:	Process Name	SMV
1	Front & back part match	.22
2	1st shoulder join	.23
3	Label join	.24
4	Neck piping	.31
5	Neck top stitch	30
6	2nd shoulder join	.25
7	Shoulder out tuck	.23
8	Sleeve hem	.19
9	Threat cut	.16
10	Body sleeve match	.25
11	Sleeve join	.29
12	Side seam close	.43
13	Thread cut	.25
14	Body hem	.24
15	Sleeve in tuck	.73
16	Care label make	.22
17	Thread cut	.79
		Total=5.33

Please note that the properties of the equations must not be locked

4. Result and Discussion

From the experimental details on discussion I come to know that several personnel and machineries are involved in industrial engineering production which developed merchandising department, production department, finishing department, quality assurance production etc. The industrial department accepts various steps to increase production.

A standard working procedure is involved maintaining IE department. The procedure is done step by step. These steps are made day by day with experiences met by the Industrial Engineering department. I also come to know a standard operating procedure of production by the IE department.

To complete the total garment it needs 17 operations. All the operations don't take equal time to complete. The minimum time (SMV = 0.16) taken by the operation named thread cut and maximum time (SMV = 0.79) taken by the operation named thread cut. The difference is too high and numerical value is 0.63. This time is enough to complete another 2 processes as the average SMV called pitch time is 0.31. So, it is a clear indication that the bottleneck occurs in those operations having more SMV. Now the main task is to minimize the bottleneck as possible. To do this some steps should be taken.

If the operation having SMV 0.79 can be divided in to 3 operators then it takes time near about 0.26 that is available in other operations. But it is a matter of more cost.

Another step can be taken that the operation can be divided within the existing operators. Some operations take low SMV than the pitch time such as thread cut 0.16, sleeve hem 0.19 and so on. They can be employed to do the part of the divided operation having more SMV. Because their output is so high and after a time they sit idle as the lengthy operations can't complete their output and bottle neck occurs. In this case the operators have to be trained to do versatile work. These measures don't take more cost usually.

The first one is practiced in the factories but the last one is not yet practiced yet widely. If this can be done as a regular then the more production can be obtained same using same time and same manpower. Layout will be changed to do these steps.

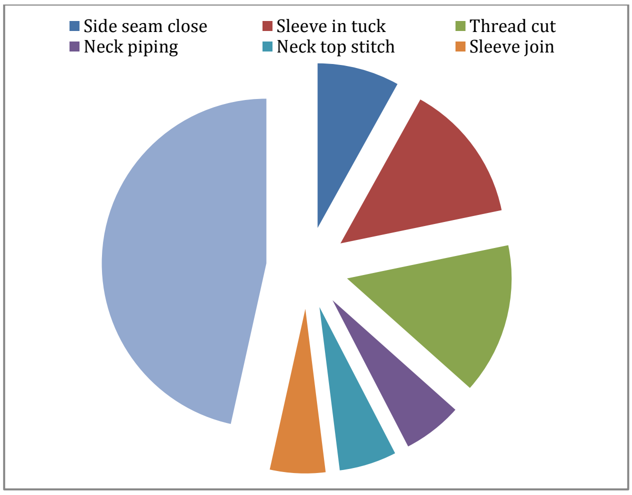

Fig. 2 Comparison of operations having higher SMV of different operations

Conclusions

Result would have been more effective if would have taken some large quantity order and balancing the process is highly related to the type of machines as machine utilized in bottleneck and balancing process should be similar.

Further improvements in the productivity can be achieved by considering large amount of order. The new bench mark target which can be the further chance of improvements to balance the line. Skilled workers are eligible for the production processes and proper training and supervision is essential to achieve the optimum improvements on productivity and efficiency. Researchers can do work regarding this issue.

Besides that, further research can be done regarding machine layout for effective line balancing. It can play a great role to minimize CM cost which will be helpful to get order.

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