Implementation of Industrial Engineering concepts in Apparel Industry to improving Productivity and it’s cost reduction

N Mekala¹, S D Sanju², V Thamaraiselvan¹ & M Kavya²
¹Assistant professor ,Department of Fashion Technology, Bannari Amman Institute of Technology, Sathyamangalam, Erode, Tamilnadu, India.
²Department of Fashion Technology, Bannari Amman Institute of Technology, Sathyamangalam, Erode, Tamilnadu, India.
mekalan@bitsathy.ac.in

Abstract: In current scenario the fashion industry (industry 4.0) needs to satisfy the various needs of customer in the aspect of quantity as well as quality of the products. In traditional methods the apparel industry used basic sewing machines for all operations with the help of man power so on that time to introduce different styles in the apparel is very difficult. In recent days the automation as well as improved techniques known as industrial engineering concepts is applicable in the field to improve productivity as well as quality to overcome the competitive market. Manufacturing of garment involves number of operations in different departments. In apparel sector to improve productivity as well as quality one must concentrate on machine, method, material and man. So the industrial engineering concepts will cover and manage the all above said factors and help to improve the productivity as well as quality of the products that will satisfies the consumer needs. This paper is going to discuss about the existing (manufacturing) methods in apparel units and help them to improve productivity by applying the one of recent techniques such as Capacity Study, Work study, Time study, Operator Performance, Follow-ups, Work-in-Progress and line balancing and they are already proven techniques to improve the productivity in different industries.

Key Words: Productivity, Cost reduction, Material & Machine management.

1. Introduction

Industrial engineering is basically related to the efficient use of machines, manpower, material and energy. The IE team is engaged in cutting, sewing and finishing work to reduce manpower and to increase the machine capacity to complete the work in progress [1]. Time research of the manufacturing process is measured to out the scope of improvement. The time it takes to complete each step in garment manufacturing is measured by averaging 20 cycles per process [2]. Setting the production in circular layout can improve work efficiency, productivity. It is done by demand forecasting, develop new designs, develop layouts by using different quality tools and blend product and seasoning development. An industrial engineer’s work is to manage the efficiency, wages and income calculation, CNC machine operation, scheduling, capacity analysis, production line balance, production planning [3]. Calculation of NPT deals with the social, mathematical and physical aspects of integrated production systems. Two important attributes must be considered, one is the possible standard method and the other one is the considerable method. Time research takes time to record the individual capabilities of each employee and production line using stop watch. Work metrics will record the time (start and end of the operation) and work rate in the process [4]. Then they analyze and record the results of the job measurements to implement the job performance level.

Through time study research, each worker’s actual personal ability in process line is calculated. There are two processes in manufacturing a garment, one is completion of whole garment by an individual operator (tailor) but there will be not proper or standard measurements will follow. The other one is a group of people joined together to complete a whole garment (industry people) they follow standard size charts for preparation [5]. The concepts outlined here are the most an important
factors in improving industrial engineering methods, such as method engineering, work research, capacity research, production line planning and other operation management systems, which will ultimately high profits and develop the industry. Working environment modular design of garment manufacturing is based on expanded elasticity and flexibility modular product are used to increase the economies of scale of end user value. Combines flexibility, modularity, design adaptability to provide greater freedom to adjust and adapt to change for improvement productivity, this research will improve various productivity according to the government’s initiative, the garment industry will become part of manufacturing.

2 Materials and methods

2.1 Material

Men’s formal shirt has been used as material. This is the very common costume mostly used by men in various scenarios in south India locations. So, the most of the manufactures focused on Shirt manufacturing process. So it will help the industry to implement the IE concepts in Shirt manufacturing process. [6].

2.2 Problem Identification:

In particular Apparel industry the productivity of the concern product getting delay. So that the problem has been identified through the method study and time study concepts belongs to the IE concepts. The following problems have been identified for lag or excess time required completing different operations of the product. 1. Machine Breakages, 2. Improper training to the tailors (labour), 3. Improper Layout plan, 4. The poor knowledge on Machine handling and maintenance etc…

2.2.1 Solution to the problem

This project, have been analyzed that the major lag and defect occurs mainly in the production area. After cutting and numbering the fabrics are passed to sewing department, the major operations of sewing have been carried out manually. Production of the manufacturing unit always depends the skilled and trained labour, proper machine alignment with respect to the operations breakdown of the garment. Good working conditions of sewing machines; The above all factors are very important to save the time and also increase the productivity of the company. In traditional method the companies only relied on man power and machineries, they used to hard work to complete the order given by buyer not by smart work.

The Industrial engineering concepts will help the technicians to improve their work as well as productivity by doing smart work with the help of industrial engineering concepts. The Automation is the Key factor of Industry 4.0 and that can increase the productivity and can reduce the labour cost but the developing companies can’t invest huge money on machineries so the IE concepts will help them to improve their production with no cost.

This work analyzed the problem behind the sewing department then finds the solution for them without affecting the production of the particular product. The following obstacles were found in the production area. The Sewing machines are not aligned in proper manner with respect to the style specifications of the particular mentioned garment due to this unwanted movement has taken place in the sewing line the production gets delay. [1]

To rectify this step by step operations has been listed out then identified the required good working conditioned machineries replaced to complete that particular operation. In these keeping machines in good condition through systematic maintenance the idle time can be consumed without any disturbance the productivity as well as quality of the garments can be achieved. [7]

To avoid machine breakages in sewing line the bottom level labours are equipped with proper maintenance like proper oiling, Needle change, proper threading & proper winding of bobbin case [2]. In this case also the time study has been carried out before and after the training to the labour

The Unwanted materials from the line have been removed in the sewing area to avoid the unwanted movement. Handling of materials has been studied and improved in easy manner. New concepts like lean manufacturing, 5S management process are advised to implement inside the factory to avoid the
wastages of time which affects the production. [3]. So that the sewing operator cannot mesh up with other unwanted materials. They can stitch the operation easily and without delay time in searching the next material.

2.2.2 Time & Method Study In Industry

It is the technique used to record the time & method of performing certain activity to identify the time taken by the operator to complete the particular task in certain method. Time Study and Method study is the main techniques of Industrial engineering concepts which are needed to conduct to improve the productivity in the garment industry. So in this project we have been studied the methods as well as time to improve the production by reducing the time by implanting the necessary changes in sewing line.

To study the time study first the design needs to be analyzed with their specifications properly. Once the design analyzed properly then operation breakdown is needed for that particular style. After that the calculation of required machineries and operator efficiency need to be calculated. Then suitable layout needs to be planned according to the style of the garment. The time should be recorded for each and every change happened in the line to improve the productivity to identify the improvement that happened in the industry.

3 Result and discussion

After observation of method and time to complete the garment the following line balance concept has been introduced to reduce the idle time as well as improve the quality in production process. The construction process has been broken into so many steps and aligned the machinery with respect to the operation.

Flow process 1: Circular Line balancing System
By using circular line balancing system, the operation of the garment is able to complete soon with inspection table (or) machine located at the middle of the circle [11]. For difficult operations it is supposed to add an extra operator to that process so we can finish the garment quickly. Thus, the productivity will also increase. The Machineries has been arranged in circular manner to reduce the unwanted movement to carry the pieces one after another operation and the operators can handle the machine without delay.

The SAM value of each operation differ, So we can add one more machine in the operation which has less SAM value easily so the productivity will improve automatically. In addition to that we can introduce some work aids in the sewing machine to reduce the SAM value and it also helps to reduce the fatigue of labour so this will leads to improve work efficiency of the worker.

3.3 SAM calculation before and after implementation of time study method

SAM- Standard Allowance Minute. It is a measuring unit to calculate the efficiency. SAM= Basic time + Bundle allowance+ machine allowance

Table 1. SAM Calculation before and after Time Study

| S.no | Operation list                        | Standard SAM Value (sec) | Industries SAM Value (sec) | After implementation of SAM value (sec) |
|------|---------------------------------------|--------------------------|---------------------------|----------------------------------------|
| 1    | Pinning to profile                    | 0.234                    | 0.459                     | 0.345                                  |
| 2    | Run stitch collar                     | 0.219                    | 0.382                     | 0.285                                  |
| 3    | Trim collar                           | 0.285                    | 0.340                     | 0.312                                  |
| 4    | Clip and turn collar                  | 0.223                    | 0.372                     | 0.245                                  |
| 5    | Crease collar                         | 0.381                    | 0.428                     | 0.392                                  |
| 6    | Top stitch collar                     | 0.42                     | 0.84                      | 0.53                                   |
| 7    | Run stitch collar band                | 0.291                    | 0.465                     | 0.301                                  |
| 8    | Crease collar band                    | 0.317                    | 0.419                     | 0.324                                  |
| 9    | Insert collar in neck band            | 0.799                    | 0.986                     | 0.810                                  |
| 10   | Turn and crease collar                | 0.452                    | 0.580                     | 0.462                                  |
| 11   | Attach bias piece to cuff             | 0.874                    | 0.910                     | 0.882                                  |
| 12   | Crease cuff                           | 0.458                    | 0.657                     | 0.461                                  |
| 13   | Hem cuff                              | 0.501                    | 0.744                     | 0.522                                  |
| 14   | R/S cuff                              | 0.565                    | 0.726                     | 0.572                                  |
| 15   | Trim cuff                             | 0.36                     | 0.52                      | 0.42                                   |
| 16   | Turn cuff                             | 0.527                    | 0.655                     | 0.530                                  |
| 17   | Crease cuff bottom                    | 0.566                    | 0.759                     | 0.574                                  |
| 18   | Attach placket to sleeve              | 0.795                    | 0.993                     | 0.813                                  |
| 19   | Lock and make diamond                 | 1.026                    | 1.346                     | 1.032                                  |
| 20   | Sew pleats(4.no)                      | 0.389                    | 0.575                     | 0.392                                  |
| 21   | Hem right front                       | 0.494                    | 0.736                     | 0.501                                  |
| 22   | Attach front placket                  | 0.603                    | 0.880                     | 0.612                                  |
| 23   | Create pocket                         | 0.542                    | 0.799                     | 0.553                                  |
| 24   | Hem pocket mouth                      | 0.28                     | 0.53                      | 0.35                                   |
| 25   | Attach pocket to front                | 0.861                    | 1.102                     | 0.865                                  |
| 26   | Attach brand label and tack loop      | 0.589                    | 0.794                     | 0.591                                  |
|   | Operation Details          | Time 1 | Time 2 | Time 3 |
|---|---------------------------|--------|--------|--------|
| 27 | Crease patch pieces       | 0.236  | 0.657  | 0.243  |
| 28 | Attach patch piece        | 0.333  | 0.696  | 0.356  |
| 29 | Sew pleats                | 0.278  | 0.771  | 0.286  |
| 30 | Attach yoke to back       | 0.475  | 0.825  | 0.479  |
| 31 | Top stitch back yoke      | 0.365  | 0.725  | 0.368  |
| 32 | Join shoulder             | 0.64   | 0.91   | 0.72   |
| 33 | Top stitch shoulder       | 0.656  | 0.840  | 0.676  |
| 34 | Attach collar             | 0.535  | 0.819  | 0.542  |
| 35 | Close collar with size label | 1.01  | 1.42   | 1.06   |
| 36 | Sleeve attach             | 0.862  | 1.109  | 0.867  |
| 37 | Top stitch armhole        | 0.678  | 0.987  | 0.682  |
| 38 | Top stitch side seam      | 1.036  | 1.435  | 1.039  |
| 39 | Attach &close cuff        | 0.696  | 0.922  | 0.698  |
| 40 | Top stitch cuff           | 0.524  | 0.792  | 0.527  |
| 41 | Hem bottom                | 0.947  | 1.109  | 0.954  |
| 42 | Total SAM                 | 22.322 | 32.011 | 23.184 |

Excess time consumed per garment with respect to industrial time:

32.011-23.184 = 8.827 seconds

3.4 Outcome:

Operation Time (Before implementation of IE concepts (Time study) =32.011 – Operation time (After Implementing IE concepts) 23.184 = Reduction time: 8.827 seconds.

To manufacture one men’s formal shirt the time has been reduced from 32.011 to 23.184 seconds, Obviously it states that production & productivity of that particular product will improve.

There are nearly 25 machines being used in the industry, for constructing a men’s formal shirt it requires 18 machines.

Equation used to calculate the production:

Total machine productivity = (total no of output per day per line)/ no. of machines used ………… … [1]

By using equation [1], we get after implementation of time study concept

Daily machine productivity = working time per day* no. of sewing machines/total time per garment

= 480*18/32.011 =270

By using equation [1], we get after implementation of time study concept

Daily machine productivity = working time per day* no. of sewing machines/total time per garment

=480*20/23.184 = 414

Here we get 270 garments per day as a total productivity before time study implementation, 414-270=144 garments were increased after using this method. Thus the productivity of constructing a garment is being increased.

The above chart shows the individual time required for each and every operation we can also able to calculate the target or lead time from this study concept 8.827 seconds has been reduced from the industrial SAM value [12].
4. Conclusion

The above research clearly states that the IE concepts are very effective tools to improve the productivity in the competitive fashion market. Current industry mostly looking forward of new machines which will reduce the man power as well improve the quality as well as production. The cost is very high to invest on machineries instead of that it is very easy to implement the IE concepts and improve the productivity. Anyhow if we invest on advanced machineries also we need to utilize very effectively to reduce the manufacturing cost of the product and productivity of the particular order. In this research it clearly states that by implementing the Industrial concepts, which can reduce the idle time of the particular sewing line as well as can improve the production of the product without cost reduction.

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