A Research about the Comparison of Classical Lockstitch Sewing Machines and Sewing Automats

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Abstract
There is strong competition on the market for ready-made garment products, which are an important part of world trade. In this sector, the technology development and research facilities have an important place because the quality and technology are a priority. In our country, Turkey, many manufacturers tend to favour valued and profitable products instead of usual, low-priced and low-valued products. In this situation, new technologies must be used. But the usage of such technology may not be suitable for every company. The sewing automat is a kind of system group that can perform any kind of sewing operation by itself. These kinds of complex machines need fewer but more skilful workers to operate them. A decrease in order quantities, rapidly changing product and production types are necessary for the workers to adapt to these changes [4]. In this paper, the increase of production quantity without changing quality was researched. For this purpose, an ideal production method was proposed, with the comparison of classical sewing machines and sewing automats from the point of view of production methods.

Key words: lockstitch sewing machines, sewing automats, garment production, production quantity, product quality, per point method.

Variable Expenses
Variable expenses are applicable throughout the production period, and can change according to the production quantity. Labour expenses (LE). Direct labour expenses were investigated because the profit calculation of methods was calculated:

\[ LE = UT \times LC \times SE \]

were:
- \( UT \) - unit time, cmin \((100 \text{ cmin} = 1 \text{ min})\)
- \( LC \) - labour cost
- \( SE \) - social expenses.

Maintenance Expenses (ME). Maintenance expenses include expenses for repair and the maintenance of machines used for production:

\[ ME = n_M \times PRME \]

were:
- \( n_M \) - number of machines
- \( P_M \) - Price of Machine
- \( IR \) - Interest Rate

Consequently the total expense (TE) we have;

\[ TE = FE + ME + LE \times APQ \]

were:
- \( APQ \) - Annual Production Quantity

The Effect of Expenses on Choosing the Technology Used

For choosing the technology, a par point analysis was used. At this point, total expenses for both groups are equal. The level of technology effect is fixed, and that of expenses is variable [1].

Fixed Expenses
Fixed Expenses (FE) include expenses not related to production quantity.

Interest Expenses (IE). The interest expense of investing money for the machines must be calculated, because an economical calculation of methods will be made:

\[ IE = n_M \times P_M \times IR \]

were:
- \( n_M \) - number of machines
- \( P_M \) - Price of Machine
- \( IR \) - Interest Rate

Amortisation Expense (AE), i. e. the allowance of money for every year to allocate production equipments. At the end of the definite period, an amortisation allowance is stated. If the value and useful life of inventory stock are known, the amortisation rate can be calculated:

\[ AE = n_M \times PM/AP \]

were: \( AP \) - amortisation period

Conventional Sewing Machines: Lockstitch sewing machines were used [2,3].

Sewing Automats: Machines for attaching a belt, sewing a hangtag, sewing a pocket flap, attaching a hip pocket to the denim trousers and sewing a belt loop were used in this project [5].

Chronometer: A digital chronometer was used.

Method

In this research to decide the most economical method, lockstitch sewing machines and sewing automats were compared for economicity and quality.

1st method: Production was carried out on conventional lockstitch sewing machines.

2nd method: Production was carried out on sewing automats.

The MPM-REFA Work Study Method was used to obtain job flow steps, flow segments and time values of the flow segments.

The MPM-REFA Work Study Method is used to define work procedures. In order to do this, we need to categorise them according to their different sizes.

Material

Apparel Companies: This research was conducted in 2 groups of apparel compa-
This gives us several ways to adapt work procedures to different time modules to use them for several other purposes. This classification allows people to be a part of the work process and gives us indications that prove how much more productive they can be working together as one. The time duration for each work process was measured. Real time duration is the period needed for people and machines to complete certain tasks as one work process module. These real durations can be timed at the workplace by an inspector or by automatic odometers installed in the machines. For this research, an inspector timed real durations for each work process. In this study, ‘Human Activities’ and ‘Production Machinery Use’ are also included. ‘Main Activity’, ‘Side Activity’ as well ‘Main Usage’, and ‘Side Usage’ time durations are also included in the study. The averages of 15 study values were calculated.

Par point method.
The intersection point of the compared methods’ total expenses is named at the par point. At this point, the expenses of both methods are equal.

For deciding the capacity of the machines for more productivity, the critical point was calculated. After this point, the technology which had lower production expenses was preferred. The FOT values of machines was used for calculation. For the evaluations, the following standards were accepted:

1€ = 1,667,000 TL (Turkish lira, prior to revaluation of 1 January 2005) 1 JPY=12,500 TL (Turkish lira, prior to revaluation of 1 January 2005)

Daily work time = 8 hours
Social Expenses = Labour costs × 0.5 Interest rate: 25%
The amortisation time for each machine was accepted as standard and evaluated as 10 years.

Findings
The results obtained from choosing the machines are presented in Tables 1-3. The annual production number where the total expenses of both groups were equal was determined by using the Tables 1-3. After the production quantity passes the par point, the company could cover all expenses and make a profit. The production quantity at par point and the years when sewing automats could profit for the company are presented in Table 4.

As shown in the following figures, the expenses of the 1st and 2nd methods intersect at the par point. This point is the beginning of profit. After the production numbers at this point, the company can cover all expenses and can make a profit.

The numbers of production and par points can be shown in Figures 1-6 for the operations of sewing a hangtag, sewing a piped pocket, sewing a pocket flap, attaching a hip pocket to denim trousers and sewing a belt loop.

Results
The new technologies are obtained from scientific researches, and by using these kinds of new technologies the productivity and quality are increased and the costs are decreased. Consequently, labour training and the adaptation of developing technologies to the workers are important.

When the automats are investigated one by one, the following results are obtained:
Attaching belts
The data concerned with the belt attaching operation was taken from a company which produces approximately 1000 pairs of trousers per day. The value of the belt automats is much more expensive according to the lockstitch sewing machine, but the production number of the automat is nearly 8 times greater than previously.

Sewing hangtags
When the time study values are investigated, a sewing automat is enough to sew 2500 hangtags for a day. For the same production with a conventional sewing machine, the number of sewing machines must be increased 3 times. This means more work labours, larger production areas, and more costs.

Sewing piped pockets
According to the data obtained from the research, the piped sewing automat profited the company which produces 500 jackets per day by the end of the 3rd year. It is profitable for a company which produces 1500 jackets per day at the end of the 1st year. The quality is the same for all products. If the number of products increases, the time to profit decreases like the other operations. Companies which produce lower quantities but higher-quality products prefer to use automats.

Sewing pocket flaps
The pocket flap preparation sewing automat profited the company which has a capacity of 900 jackets per day after a great many years. The high price of the machine causes that the par point time period may rise even up to 13 years.
Attaching hip pockets to denim trousers
The pocket sewing automat profited the company which produces 1500 trousers per day at the beginning of the 2nd year because of its higher price.

Sewing belt loops
The belt loop sewing automat profited the company in the middle of the 2nd year, and provides the same quality for all loops.

Conclusions
According to the above-mentioned results, the following conclusions may be drawn:

- While many of the automats may profit a company as early as the 1st year, others may not profit before several years have elapsed. In some companies covered by this paper, profit was barely achieved even by the thirteenth year.
- It is known that automation has some advantages such as standardisation of quality, a decrease of dependency on workers' labour, a decrease in the costs by shortening the production time, a decrease in industrial accidents, and making easier applications to the areas where it is hard to sew [6]. For these reasons, when making a new investment, costs and quality must be taken into consideration over a long period, and not simply the costs of the first investment.
- This research proves that the usage of automats is necessary for producing good-quality products with lower production costs, lower prices, and higher quantities. For this reason, it is easy to understand that the usage of automats is necessary especially for big companies.

References
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