**Ziynet Ondogan,
M. Cetin Erdogan,
Zumrut Bahadir Unal,
Oktay Pamuk**

**Ege University
Engineering Faculty Textile Engineering Faculty**
Izmir, Turkey

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

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 quatily, product quality, per point method.*

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:

$$AE = nM \times PM/AP$$

were: *AP - amortisation period*

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 cmin = 1 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: $n_M = DPT \times UT/480$
DPT - Daily Production Time
PRME - Percentage of Repair and Maintenance Expense
C_M - *Cost of Machine*

$$PRME = C_M \times 0.05$$

Consequently the total expense (*TE*) we have;

$$TE = FE + ME + LE \times APQ$$

were:
APQ - Annual Production Quantity

Material

Apparel Companies: This research was conducted in 2 groups of apparel companies which have different specifications. Both clothing companies are manufacturers of denim trousers, conventional trousers and conventional jackets. In the first group, the companies have classical lockstitch sewing machines. The companies belonging to the second group have classical sewing machines and also sewing automats.

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 researchto 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.

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.

Table 1. *Characteristic data for method 1.*

Operations	Price of machine, EUR	Unit time, cmin.	Number of machine -	Repair and maintenance expenses, EUR	Daily production numbers -	Annual production numbers -
Attaching belts	2,126	398.25	8	106,30	1000	288000
Sewing hangtags	2,126	56.90	3	106,30	2500	720000
Sewing piped pockets	2,126	468.00	5	106,30	500	144000
Sewing pocket flaps	2,126	100.14	2	106,30	900	259200
Attaching hip pockets to trouser	2,126	262.00	8	106,30	1500	432000
Sewing belt loops	4,621	88.50	3	231,05	1500	432000

Table 2. *Characteristic data for method 2.*

Operations	Price of machine, EUR	Unit time, cmin.	Number of machine -	Repair and maintenance expenses, EUR	Daily production numbers -	Annual production numbers
Attaching belts	24,754	42.2	1	1237.00	1000	288,000
Sewing hangtags	22,141	19.4	1	1107.00	2500	720,000
Sewing piped pockets	32,285	103.3	1	1614.25	500	144,000
Sewing pocket flaps	70,567	68.0	1	3528.35	900	259,200
Attaching hip pockets to trousers	85,441	40.0	1	4272.00	1500	432,000
Sewing belt loops	33,461	35.0	1	1673.00	1500	432,000

Table 3. *The comparison of fixed and total expenses for method 1 and method 2.*

Operations	Method 1; expences, EUR		Method 2; expences, EUR	
	Fixed expenses (FE)	Total expenses (TE)	Fixed expenses (FE)	Total expenses (TE)
Attaching belts	2,253.56	34,474.74	3,279.91	7,919.92
Sewing hangtags	845.09	12,422.43	2,933.68	7,951.72
Sewing piped pockets	1,408.48	20,384.54	4,277.76	10,068.01
Sewing pocket flaps	563.39	7,937.45	9,350.13	17,813.65
Attaching hip pockets to trousers	2,253.56	34,051.38	11,320.93	20,431.33
Sewing belt loops	1,836.85	12,772.86	4,433.58	10,340.18

Table 4. *The years when automats profit the company.*

Operations	Annual production numbers (A)	The production number at par point (B)	The beginning of profit year with automats (A/B)
Attaching belts	288,000	21,637.0	0.075 ~ 1st year
Sewing hangtags	720,000	294,218.1	0.408 ~ 1st year
Sewing piped pockets	144,000	42,914.0	0.3 ~ 1st year
Sewing pocket flaps	259,200	1,356,653.0	5.2 ~ 5th year
Attaching hip pockets to trousers	432,000	212,887.0	0.5 ~ 1st year
Sewing belt loops	432,000	269,605.0	0.6 ~ 1st year

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:

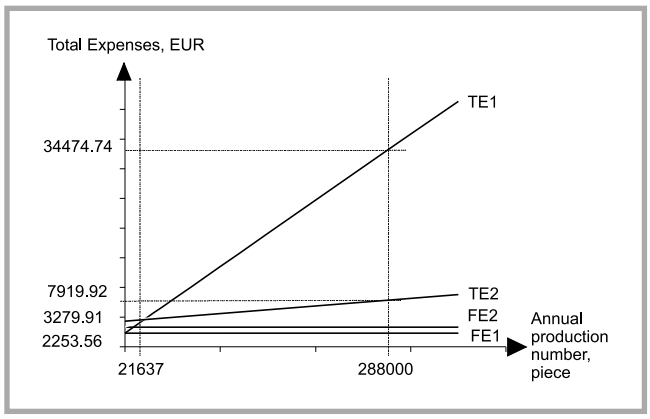

Figure 1. *The par point at belt attachment operation.*

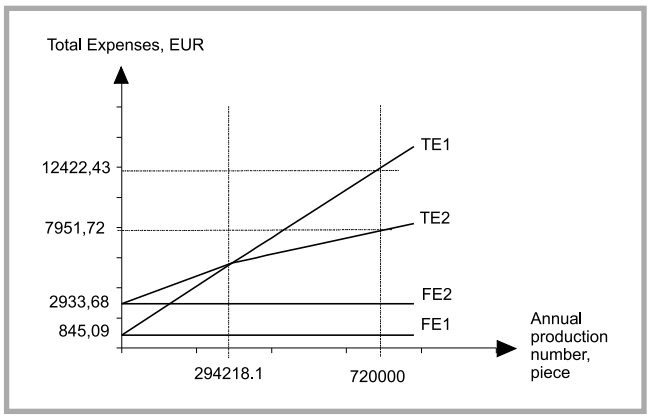

Figure 2. *The par point at hangtag sewing operation.*

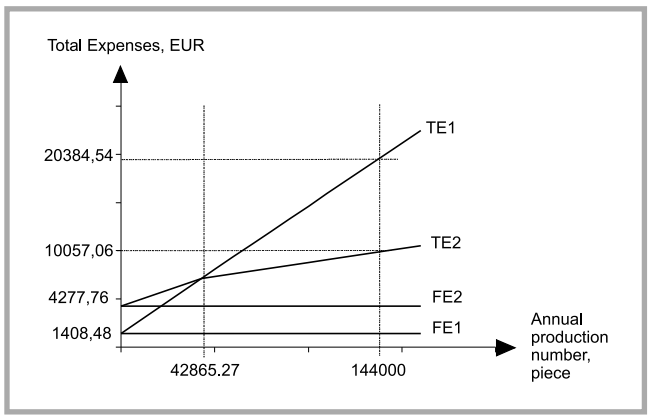

Figure 3. *The par point at piped pocket sewing operation.*

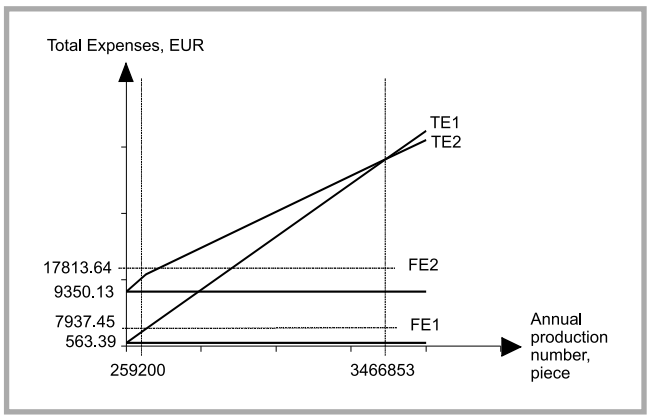

Figure 4. *The par point at pocket flap sewing operation.*

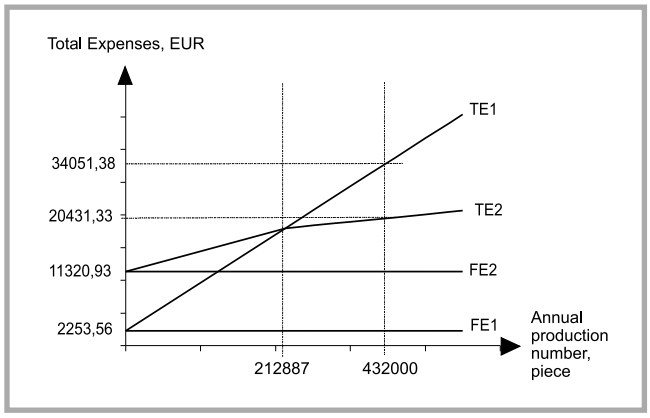

Figure 5. *The par point at hip pocket attachment to denim trouser operation.*

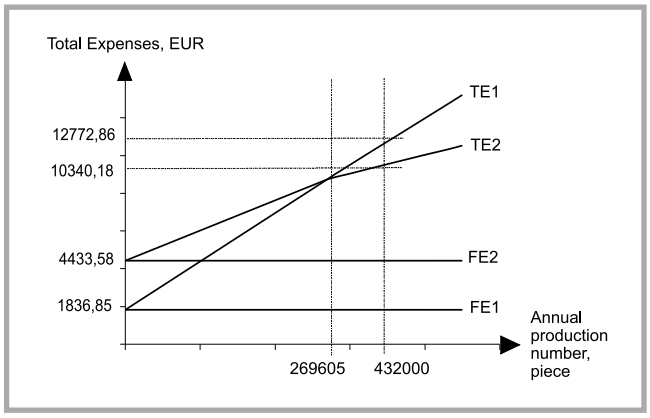

Figure 6. *The par point at belt loop sewing operation.*

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 automat 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 produce 500 jackets per day by the end of the 3rd year. It is profitable for a company which produce 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.

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Received 27.07.2004 Reviewed 20.01.2005

5th All-Polish Students' Seminar TEXTIL 2005

'Seriously and Frivolously - New Trends in Clothing'

18 April 2005, Łódź, Poland

Organiser: Faculty of Textile Engineering and Marketing, Technical University of Łódź (TUŁ)

This year, for the fifth time, the Faculty of Textile Engineering and Marketing organised the Students' Seminar, a very interesting and useful event, principally for high-schools age studends who are educated in textile science and practice and plan to study these subjects.

Pupils of textile high schools from all parts of Poland attended the Seminar. As in previous years, this year's seminar was devoted to presenting of their works in the form of models, posters, computer programs, pictures, and stained glass-windows. In addition, university researchers presented examples of scientific and technological investigations which have been recently carried out.

The Seminar was prepared by the Scientific-Organisation Committee under the leadership of its chairman Bogdan Ignasiak, Ph.D.,Eng. University students and high-school teachers also took part in this Committee.

The Seminar was opened by Professor Izabela Krucińska Ph.D., D.Sc. the Dean of the Faculty, and was followed by a fashion-show prepared by pupils from the High Schools for Clothing in Poznań ('**The play of imagination - the search for beauty**') and the Textile and Clothing High School No. 8 in Łódź ('**Women and frills**'). The young peoples' imagination about fashion was presented in the form of fashion collections for daily use and "Première Vision', prepared by 20 high schools. The presentations were judged by a special competition commission with regard to their originality and usefulness. The best works were given awards thanks to the generosity of sponsors from the industry.

Ryszard Korycki, Ph.D., D.Sc. the Vice-Dean of the Faculty presented information about the Faculty, its educational directions and specialisation. Next, the following lectures were held:

'**Textiles in Medicine**' by Marek Snycerski, Ph.D., D.Sc., professor of TUŁ; '**Seams in textile products**' by Renata Krasovska, M.Sc., Eng.; and '**The role of the functionality description of clothing in the design process**' by Marian Rybicki, Ph.D., Eng.

The main aim of the Seminar, i.e. the mutual exchange of achievements and information was fulfilled this year, as usual.

For more information please contact:

Technical University of Łódź
Faculty of Textile Engineering and Marketing
ul. Żeromskiego 116, 90-543 Łódź, Poland