(REFEREED RESEARCH)

ANALYZING THE DISTURBANCES IN GARMENT MAKING LINES

GİYSİ ÜRETİM BANTLARINDAKİ DÜZENSİZLİKLERİN ANALİZİ

Önder YÜCEL
Ege University
Bayindir Vocational Training School
e-mail: onder.yucel@ege.edu.tr

ABSTRACT

Effective use of production resources is of big importance for both production and serving sectors. Disturbances of manufacturing systems have a negative impact on the performance of production and result in productivity losses. Aim of this study is to analyze the causes of disturbances and to investigate the effects of production disturbances to efficiency of manufacturing times. For this purpose, three case studies from apparel plants which are founded in city of Izmir were examined. Data of the study were obtained using the distribution time method which is divided according to random time plan. The method used in this study is offered by The REFA-Association for Work Design/Work Structure, Industrial Organization and Corporate Development. Eighteen different machines operating in garment making lines of the plants were used in time measurement. Selected sewing machines should represent all the operations in production was targeted. These sewing machines also represent workstations to collect data for the study. In this study, production period which is 10800 minute was used for each plant

According to the results obtained, waiting times, correcting the seam faults and breakdown of machines are the major causes of disturbance. These disturbances reduce the efficiency of manufacturing time and may upset production schedules during execution.

Key Words: Disturbance, Waiting Time, Disturbance Management, Effective Manufacturing.

ÖZET

Gerek hizmet gerekse üretim sektörlerinde kaynakların etkin kullanımı büyük önem taşımaktadır. Üreti,m sistemlerinde karşılaşılan birtakım karışıklıklar üretim performanslarında negatif etki yaratarak çeşitli kayıplara neden olabilmektedir. Bu çalışmada konfeksiyon üretiminde ortaya çıkan üretim düzensizlikleri ve bunların üretim verimliliğine olan etkileri incelenmiştir. Bu amaçla İzmirde faaliyet gösteren üç ayrı konfeksiyon işletmesinin giysi üretim hattında durum analizi gerçekleştirilmiştir. Çalışmada REFA tarafından önerilen rastsal dağılım zamanı metodu kullanılmıştır. Ölçümler tüm operasyonları temsil edecek şekilde seçilmiş olan sekiz ayrı dikiş makinesinden alınmıştır. Çalışmada her bir işletmeden 10800 dakikalık üretim zamanın verileri toplanmıştır. Giysi üretim hatlarından elde edilen verilere göre en çok görülen düzensizlikler, bekleme zamanları, dikim hatalarının düzeltilmesi ve makine arızaları olarak belirlenmiştir. Bu düzensizliklerin üretim verimliliğini önemli ölçüde azalttığı görülmüştür.

Anahtar Kelimeler: Düzensizlik, Bekleme zamanı, Düzensizlik yönetimi, Etkili yönetim.

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1. INTRODUCTION

Production disturbances in manufacturing systems can result in substantial production losses, deteriorated quality and lowered safety. Efficient and reliable disturbance handling is therefore of increasing importance for technical as well as economical and human resources. (1). An increased productivity and better overall efficiency of the manufacturing lines are important goals for many companies. Handling of disturbances is of great importance for more reliable and robust manufacturing systems. Disturbance can occur in all system levels in manufacturing and it is important to achieve a more systematic approach to increase overall productivity for a system (2). Disturbances in production systems are defined by the several authors. Some of these definitions are given below;

“All the activities that are carried out or should be carried out in correction, prevention, and elimination of production disturbances and potential production disturbances in both existing and future systems during their life cycles” (3).

“Disturbance is an unplanned or undesirable state or function of the system”[4].

“A disturbance is a deviation from the assumptions upon which the schedule is based and is an event which upsets the contents of schedule” (5).

"A disturbance is a change occurring internally or externally to a production system, which can affect its operational performance, and is ether outside its control or has not been planned by the system" (6).

Causes of disturbance in manufacturing systems may be related to technical, organizational, planning and operational factors (7). Types of disturbance in production systems are evaluated in three basic groups;

Upstream disturbance: Material quality problems, supplier production problems, materials delivery delays, material property variations, incorrect deliveries.

Internal disturbance: Control and communication system failures, operator errors and omissions, material ordering errors, material stock control problems, machine breakdown, variability in machine performance, unavailability of labour and material handling equipment failure.

Downstream disturbance: Rush orders, changes to orders, customer production problems, demand variations, forecasting errors, finished goods delivery delays, lost stock and poor stock monitoring (8).

Manufacturing systems, because of their complexity, are quite difficult to schedule and control, so production disturbance are unfortunately quite common in the manufacturing industry today (8, 9). Various researches conducted on production disturbances show that only 50-50 per cent of total production time is used for manufacturing and the rest of the time is

wasted in different disturbances (2). To stay competitive in the global market, it is thus vital for manufacturing companies not only to cope with frequent product changes and fluctuating demand, but also to reduce disturbances or at least the impact of disturbances on the overall manufacturing performance (10). Hence, plants need the effective disturbance management for decreasing the negative effect of the production disturbance.

Disturbance management is an approach designed to reduce the negative consequences of disturbances on the performance of a batch process from the perspective of the scheduler (5).

In this study, three case studies in different apparel plants were carried out to investigate the causes of disturbance in garment making lines. And the effects of disturbances to efficiency of manufacturing time were examined.

2. METHODOLOGY

The case study methodology was considered appropriate for the research purpose.

The explicit purpose of the case study methodology is to gain knowledge in order to understand how and why events occur. Evidence for case studies may come from six major sources: documents, archival records, interviews, direct observations, participant observations, and physical artifacts (11).

Data of the study were obtained using the distribution time method which is divided according to random time plan. The method used in this study is offered by The REFA- Association for Work Design/Work Structure, Industrial Organization and Corporate Development. This research was conducted in three apparel plants which are founded in city of Izmir. Apparel plants in this study were labeled as plant A, plant B and plant C. Production data of the plants are presented in Table 1.

Eighteen different machines operating in garment production lines of the plants were used in time measurement. Selected sewing machines should represent all the operations in production was targeted. These sewing machines also represent workstations to collect data for the study. Sewing machines types selected in time measurement are shown in Table 2.

In this study, production period which is 10800 minute was used for each plant. Time types determined in the study are given in Table 4. In determining the measuring time, random-hour-minute table which is

Table 1. Production data of the plants

Plants	Number of Machines in Production Lines	Basic Product Groups	Daily Capacity for Basic Models
A	81	Men Suits	225
B	68	Underwear	2188
C	74	Jean Trouser	1162

Table 2. Sewing machines types selected in time measurement

Plants	Selected Machine Types for Measurements
A	Lockstitch Sewing Machine Overlock Sewing Machine Automatic Sewing Machine for Sleeve Parts and Back Parts Sewing Machine for Stitching Sleeve Vent Corners Automatic Lockstitch Pocket Welt Sewer Machine for Setting of Sleeves Button Hole Sewing Machine Button Sewing Machine
B	Lockstitch Sewing Machine Overlock Sewing Machine Covering Stitch Machine Semi- automatic Hemmer for Sleeves Machines for Waist Elastic Machine for Attaching Elastic Lace Machine for Attaching Circular Collar Flat Seaming Machine
C	Lockstitch Sewing Machine Overlock Sewing Machine Belt Sewing machine Automatic Lock Stitch Bartacker Automatic Pocket Setter Machine Feed-of-the Arm Chain Stitch Sewing Machine Button Hole Sewing Machine Button Sewing Machine

offered by REFA was used. Total measuring time (AZ) used in study consists of seven different time types. These time types are presented below;

AZ = G + Er +Vsk + Vsv + Vp+ N + F

AZ = Total Measuring Time

G = Basic Time

Er = Resting Time

Vsk = Objective Constant Distribution Time

Vsv = Objective Variable Distribution Time

Vp = Personal Distribution Time

N and F= Unused Times

N means the times of special talks and personal faults. F is the sort of time which consists of the technical and organizational faults, long-timed breakdown and cut of electricity in plants.

Effects of disturbances to efficiency of manufacturing time were determined using the formula below.

$$EMT = \frac{AZ - TDT}{AZ} X\ 100 \qquad (1)$$

EMT = Efficiency of manufacturing time

TDT= Total Disturbance Times

AZ = Total Measuring Time

3. CASE STUDY RESULTS and DISCUSSION

Improved efficiency of manufacturing systems to achieve increased output and consequently reduced disturbance is a vital area. The first step for handling and reducing the disturbances is to determine the disturbance in manufacturing systems. This study is focused on to reveal the cause of disturbance in garment production lines. For this purpose, three case studies were accomplished to study the causes of disturbance in the clothing plants. In addition to this, the effect of disturbance to efficiency of manufacturing time was determined. Obtained results from Plant A, B and C are presented in Table 3, 4 and 5. Percentage values of disturbances determined in the plants are given in Table 6. The effect of disturbance to efficiency of manufacturing time in plants is shown in Table 7.

Table 3. Measured Times in Plant A

Activities in Work Places	Time Type	Time (minute)
Taking Bundle	G	170
Sewing	G	7699
Taking the part to be sewn	G	412
Putting the part to be sewn	G	614
Controlling the Bundle	Vsv	42
Changing the apparatus	Vsv	73
Talking about work	Vsv	129
Work Control	Vsv	119
Changing the needle	Vsv	71
Correcting the seam faults	Vsv	259
Changing the bobbin	Vsv	147
Correcting the other person's fault	Vsv	78
Waiting times	Vsv	449
Cut of electricity	Vsv	20
Breakdown of machine	Vsv	114
Adjusting the sewing machine	Vsv	77
Preparing and cleaning the workplace	Vsk	141
Going for toilet	Vp	88
Drinking water	Vp	45
Starting work late	N	10
Finishing work early	N	6
Special talks	N	31
Leaving the workplace	N	6
Long-timed breakdown	F	-

Table 4. Measured Times in Plant B

Activities in Work Places	Time Type	Time (minute)
Taking Bundle	G	134
Sewing	G	6163
Taking the part to be sewn	G	459
Putting the part to be sewn	G	670
Controlling the Bundle	Vsv	27
Changing the apparatus	Vsv	144
Talking about work	Vsv	36
Work Control	Vsv	191
Changing the needle	Vsv	78
Correcting the seam faults	Vsv	698
Changing the bobbin	Vsv	195
Correcting the other person's fault	Vsv	161
Waiting times	Vsv	961
Cut of electricity	Vsv	19
Breakdown of machine	Vsv	414
Adjusting the sewing machine	Vsv	46
Preparing and cleaning the workplace	Vsk	174
Going for toilet	Vp	68
Drinking water	Vp	77
Starting work late	N	11
Finishing work early	N	10
Special talks	N	44
Leaving the workplace	N	20
Long-timed breakdown	F	-

This study is focused on determining the main causes of disturbances in garment making lines. According to the case studies conducted in three apparel plants, waiting times, correcting the seam faults, breakdown of machines are the major causes of disturbance. Forming seam faults were intensively in Plant B and Plant C because of the lack of qualified workers and seam robots. Existing of qualified workers and intensive use of seam robots in Plant A result in the lowest seam fault proportion.

Waiting times in plant B and C is in the highest values. The major cause of this is insufficient balancing of garment production lines.

Establishment of balanced production line in Pant A results in effective use of total manufacturing time (%90.97) and improved production efficiency. Additionally, balanced production line is the major necessity for improving process flow and eliminating the bottlenecks. Existing of unbalanced production lines in Plant B and C reduce the efficiency of manufacturing time (%79.28 in Plant B and %77.06 in Plant C).

In both Plant B and Plant C production pressure is very high, resulting in a lack of preventative maintenance of sewing machines. Therefore, proportions of breakdown of machines are very high in Plant B (%3.83) and in Plant C (%5.86). In Plant A, systematic maintenance function for the machines is well organized and proportion of downtime of machine is at minimum level (% 1.06).

Effect of the other disturbance types determined is less compared to disturbances explained above. These disturbances can be kept at minimum level using the educated and trained workers in production lines. A the same time, educated and trained work forces help to improve a better working environment and smoother manufacturing.

4. CONCLUSION

Preventing and handling of the disturbances is of great importance for apparel plants. Apparel sector has a lot of dynamics like, international competition, short product life cycle, rapid delivery, fashion, product flexibility, high market pressure; hence, clothing plants need effective disturbance management to stay competitive. In this scope, effective disturbance management may be evaluated as one of the competition instruments. Additionally, decreased disturbances makes possible to increased productivity and better overall efficiency of production system.

To conclude, disturbances in production lines reduce the effective use of manufacturing times. For this reason, minimizing of disturbances is the major necessity for improved productivity in manufacturing systems. Based on three case studies decrease of 9.03 %, 20.72 % and 22.94 % respectively was determined due to the disturbances in efficiencies of manufacturing time of plants studied. This means, there is a constant need for the plants studied to minimize the disturbance to achieve the increased overall efficiency and to improve profitability in a competitive international environment.

Table 5. Measured Times in Plant C

Activities in Work Places	Time Type	Time (minute)
Taking Bundle	G	79
Sewing	G	6892
Taking the part to be sewn	G	296
Putting the part to be sewn	G	389
Controlling the Bundle	Vsv	42
Changing the apparatus	Vsv	43
Talking about work	Vsv	45
Work Control	Vsv	78
Changing the needle	Vsv	149
Correcting the seam faults	Vsv	472
Changing the bobbin	Vsv	162
Correcting the other person's fault	Vsv	119
Waiting times	Vsv	820
Cut of electricity	Vsv	81
Breakdown of machine	Vsv	633
Adjusting the sewing machine	Vsv	74
Preparing and cleaning the workplace	Vsk	139
Going for toilet	Vp	96
Drinking water	Vp	64
Starting work late	N	34
Finishing work early	N	20
Special talks	N	43
Leaving the workplace	N	30
Long-timed breakdown	F	-

Table 6. Disturbances in Plants

Cause of Disturbance	Proportion (%)		
	Plant		
	A	B	C
Correcting the seam faults	2.40	5.53	6.46
Correcting the other person's fault	0.73	1.49	1.10
Waiting times	4.16	8.90	7.59
Cut of electricity	0.19	0.18	0.75
Breakdown of machine	1.06	3.83	5.86
Starting work late	0.09	0.10	0.32
Finishing work early	0.05	0.09	0.19
Special talks	0.29	0.40	0.39
Leaving the workplace	0.06	0.19	0.28
Long-timed breakdown	0	0	0
Total	9.03	20.72	22.94

Table 7. Efficiency of manufacturing times

Plant	Efficiency of manufacturing time (%)
A	90.97
B	79.28
C	77.06

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DOĞA VE NANOTEKNOLOJİ

Yaşamdaki kolaylıkların araştırmacılara ilham vermektedir. Örneğin Lotus bitkisinin yaprağına düşen yağmur damlaları, yaprağın üzerinden kayarak yere damlarlar. Su damlası yaprak yüzeyi ile bir bağlantı oluşturamaz. Bunun etkisiyle su esaslı olan yapışkan maddeler, bal, yağ ve diğer akışkansı sıvılar bu tip yüzeylerde tutunamazlar.

Bu olay şimdilerde bilim adamları tarafından ele alınmakta ve bundan Nano kaplamaları vasıtasıyla faydalanılmaya çalışılmaktadır.

Temizlik işleri bu sayede kolaylaşmış, bu iş için gerekli zamanda azalmalar olmuş ve temizlik maddelerinin kullanılması yalnızca istisnai hallerde zaruri olmuştur