

WORK STUDY (MOTION AND TIME STUDY) IN THE GENERAL ESTABLISHMENT FOR LEATHER INDUSTRIES (AS AN APPLIED MODEL)

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Abstract

The study of work has a direct relationship to productivity and is usually used to increase the amount of production with a limited amount of resources without resorting to additional investments except in some cases and on a small scale. Studying work as one of the methods that lead to raising productivity, as the principles of work study were applied to one of the industrial facilities, specifically in (the leather shoes factory in the eastern Karadat) - Factory No. (1) of the General Establishment for Leather Industries, and a study of movement and time was conducted on a linear basis Separation and sewing of shoe model (701) women's textile shoes, and there were several savings and differences between the current method of work and the proposed method. Removing bottlenecks and not removing the basic processes for manufacturing the product with the most important recommendations.

Keywords: *Performance method, Work measurement, Motion study, Time study.*

INTRODUCTION

The first attempts were made to study the methods of work in 1760 by the French Bernot and then Robert Owen between 1858-1871, who conducted a study of his method of performance through experiments he carried out on textile factories and concluded that rearranging work sites, developing his methods and improving his conditions may raise productivity. In 1945, Charles Kwik and Che Koehler established a system for measuring labor called the labor factor, while in 1948 Meyer and Schwab created a system in methods of measuring time (MTM), and both systems are still applied in projects in industrialized countries.

The study of work involves, in the general case, two related issues, one of which complements the other. The first is concerned with analyzing the existing work method and thinking about excluding non-economic movements for the purpose of simplifying and facilitating the performance of the work and then proposing the most effective method of performance. The second deals with the issue of measuring the time required to implement the simplified work for all skill levels.

Search Methodology

First: the research problem

The problem can be summarized as follows:

1. Poor planning of the work site and difficulty in handling and flowing materials.
2. Some flaws in design and specifications.
3. The absence of a time program for the implementation of production.

Second: the importance of research

The importance of research comes from realizing the extreme importance of studying work through the following:

1. It is a means to raise the production efficiency of a factory or unit by reorganizing its work in a way that does not include capital expenditure.
2. They are systematic both in analyzing the original performance and in developing the new method.
3. It is the most accurate method that has been extracted so far to set performance priorities, on which production planning and control depends.
4. Benefiting from the resulting savings as a result of the proper application of the study of work is achieved immediately upon its occurrence, and this benefit continues as long as the ongoing operations continue within the improved framework.
5. It is a tool that can be applied anywhere and can be used successfully wherever there is manual labor or an industrial unit, and this is not only in production workshops, but also in offices, laboratories and service businesses such as retail and wholesale trade, restaurants and farms.
6. It is one of the survey tools most used by management, as it strips the company's activities and functions, whether good or bad, for everyone to see.

Third: Research objectives

It can be summarized as follows:

1. Studying the process movements (method study) in detail with the aim of improving them.
2. Measuring the work to determine the period that will be taken for completion, discovering lost time, and determining the necessary procedures to avoid its causes in order to ensure reaching the ideal time as much as possible, and then give the new method (proposed) to work and apply it in the factory.
3. Linking wages to productivity.
4. Facilitate the task of programming and monitoring performance.

Fourth: the research community

The research community is represented by the general facility for leather industries (Eastern Karrada site), which includes nine factories. The study took place in Factory No. (1), as the factory produces two types of shoes (leather and textile), and the production of textile shoes is (1000) pairs per day. As for the total production For leather shoes, it amounts to (7000) pairs per day.

No. (1) was chosen out of interest in the consumer's essential and indispensable needs and because it is one of the products that complain of low production in exchange for the wide demand for it.

Fifth: Data collection methods and research procedures:

1. Personal observation through the field visits that the researcher made over a period of six months.
2. Written documents and records, if they have been viewed.
3. Personal interviews.
4. Using the method of measuring by timing capacity to calculate the time taken by successive production processes.

Sixth: research hypothesis

The hypothesis of the research is analytical based on the method of temporal overlap to perform the various operations.

The theoretical side

First: the concept of work study and its objectives

The study of work is one of the scientific methods to raise the productive efficiency in industrial projects and one of the most important means that are used to develop business performance methods and reach the best economic methods as a result of the optimal use of available material and human resources according to a specific time limit for the completion of productive activities (Everett&Ronald,1992).

The aim of the work study is to improve the process by which the work is performed, and the following indicators give a clear picture of the objectives of the work study:

1. Optimal use of production elements.
2. Improving production processes and methods.
3. Setting the time program for the implementation of production.
4. Linking wages to productivity and developing proper incentive formulas and methods.
5. Establishing a sound system for production costs.
6. Facilitate the task of programming and monitoring performance. (Jeffery,2005)

Second: Work study methods:

A. Method of performance:

It can be defined as a systematic record and a critical test of the current and proposed methods of performing work as a means of developing and implementing easier and more effective methods in addition to reducing costs.

The study of the method of performance is the means that is used in analyzing each of the work movements to be studied in order to get rid of unnecessary movements and to find the best ways in terms of ease and speed in performance. The means in terms of shape, size, and place of work in terms of arrangement and internal conditions, such as lighting, for example, and the raw materials that he deals with.

The study of the method of performance generally aims to: (Curry,2000)

1. Eliminate wasted time at work.
2. Reducing stress and boredom by avoiding unnecessary movements.
3. Finding the best methods of performing the work.
4. Optimal utilization of human and material resources (machinery and materials).
5. Improving and arranging the workplace appropriately.
6. Profiling the method of performing the work after conducting the study on it.
7. Training of working individuals to perform the best work.

Stages of studying the method of performance:

1. Selection a job:

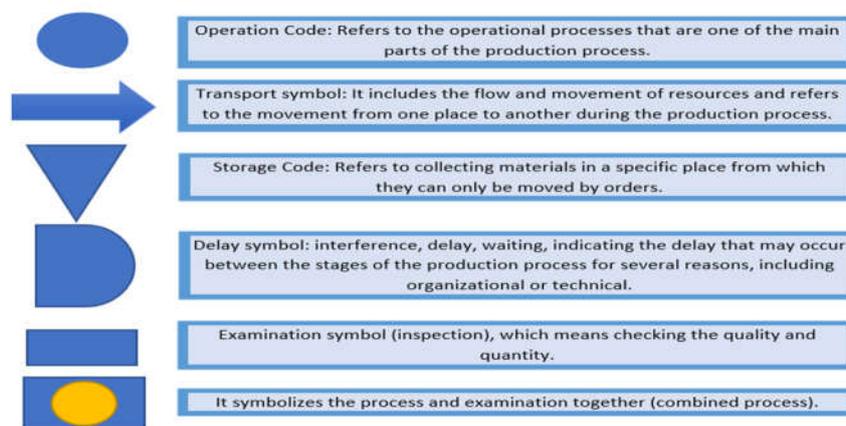
The choice of work means defining the work to be studied and the method of its performance, and there must be a justification in choosing the work method to be studied, which makes it at the forefront of the problems that must be addressed, including mainly the economic return as a result of the improvement and development of the work method, and the economic return can be determined by relying on the rate The expected economic return of the proposed method, using the following equation:

$$\text{Rate of return} = \frac{\text{return from the proposed method}}{\text{costs of the proposed method}}$$

There are a number of factors affecting the choice of work, including economic factors, technical factors, and the human reactions of the working individuals. Agreed upon by all (Gray,2004) (Chase&Aquilan,1995).

2.Recording

Recording data is the most important step in studying the method of performance, and here it is necessary to focus on the element of accuracy in recording in order to reflect the true picture of the reality of performance. A type of special symbol is usually used in the registration process, which divides the work to be studied into five functions. Among the common symbols are the following:



Prepared by the researcher based on the source (Goldratt,2009)

-Recording supplies

There are a group of types of plates that are usually used to record information and data related to the study of the method, and these plates are:

1. Overall operations dashboard.
2. The sequential operations panel is divided into:
 - a. The sequential operations panel of the material and records what happens to the material.
 - B. Equipment sequencing dashboard, in which you record how to use the equipment.
- 3 Time measurement boards: It is divided into:
 - a. Joint Activity Dashboard: It is a board on which the activities of more than one subject (personnel, machine, equipment) are recorded on a common time scale to show the relationship between them.
 - b. Man-Machine Dashboard: To show pictures of operations performed sequentially by a man or a machine to record the sequence of time spent, whether for the man or the machine, in connection with one of them with the other, and this information is obtained by direct observation of the work sequence for the worker or the machine.
 - c. Therblig: It shows the movements of the human body in the workplace and the mental activities associated with it. Gilbreth divided these movements into (17) basic movements of the hand or the hand and the eye.
 - d. Simo board: It is a questionnaire for the study of fine movement in brief, and it is of the sequential operations board model, and it is often performed at high speed and recorded using the wink counter (your color = 1/200) of a minute. Agreed upon by all (Uday,2006) (Lockyer,2006).

Among the types of schemes commonly used in registration are the following:

- a. **Thread diagram:** It is a scale plan of a specific drawing or a model in which the thread is used to measure the sequence of the places of passage of workers, materials, or equipment during a specific sequence of events.
- b. **Flowchart:** It is used to re-plan the sequence of operations for the better. It also helps to use less time using the most optimal methods.
- c. **The three-dimensional flow chart:** This diagram is used in factories that require material to move up or down in the factory during the operation process (i.e. in factories that consist of several floors).

3. Analysis

It means analyzing the results by examining and checking the data and information related to the work to be studied in order to infer the best methods of performance. The analysis process includes identifying the details of all the old methods, as well as the methods of transferring materials and using the method of critical testing through questions, for example, what is the purpose of the work to be studied What is the right place to do the work? As well as the timing or the best time to perform in an appropriate and economical manner. (Evans,1993)

4. Developing

It is the stage in which the best method is reached and replaced with the old method. This stage requires taking into account the economic aspect and a statement of the expected advantages by comparing the alternative method with the applicable method, in terms of time, effort and cost. In addition to taking into account the technical aspect in terms of designing the equipment that is used in performing the task in a way that leads to the integration of more than one movement, especially with regard to the movement of the hands of the individual, in addition to taking into account the human aspect. (Matz,2009)

5. Definition

This stage aims to introduce the individual to the alternative method and how to apply it with the required accuracy by training the worker to perform according to the new method and providing the supplies that help him to fully understand whether by using explanatory means such as drawings, tables or semi-films. (Stevenson,2018)

6. Installation

In order to apply the new method, a work plan must be prepared that includes all the details about the nature, place and time of the performance, in addition to preparing all the necessary requirements for the work, and then applying the method and conducting preliminary experiments to find out the extent of its conformity with what is required and planned. (Waters,2003)

7. Maintain

What is meant here is to follow up on the application of the new method and to detect differences and the extent of accuracy of implementation by comparing the performance of the workers and the instructions of the new method. (Gray,2004)

B. Work Measurement:

Sometimes called work content, it is the application of technical methods that aim to determine the level of work for a specific task, by determining the time required to implement it at a certain level of performance by a qualified worker.

Also, the study of the method is concerned with reducing the work content of a process, while the work measurement is concerned with the survey to reduce the unproductive time and determine time patterns or levels for the process on the

basis of the work content that could be reached by studying the performance method. Based on the foregoing, it can be noted that the study of the performance method Measurement of work are but two complementary subjects (Ray,1995). The work study is presented on the basis that the time of any work or activity consists of two parts, one of which is necessary and the other represents wasted time that can be disposed of or reduced by the study and the work can be done in less time and effort. The lost time may be due to one or more of the following elements:

1. Some defects in design and specifications.
2. Unclear engineering drawings or operating orders.
3. Poor efficiency of maintenance and maintenance activities.
4. Administrative defects, such as poor material and moral work conditions.
5. Not adopting modern technology.
6. non-acceptance of standardization and privatization systems.
7. Negligence by the worker himself due to his poor choice, preparation or negligence at work.
8. Poor planning of the work site and the difficulty of handling and flowing materials (Peter&Keong,1994).

Measurement of work is the method that completes the study of the method of performance and is defined as the application of technical methods designed to create the time for a qualified worker to perform a specific work at a specific level of performance.

Work measurement aims to:

1. Evaluate the performance of the individual worker by comparing the actual production with what is planned.
2. Determine the organization's manpower needs.
3. Determine production costs.
4. Determine the capacity available to the organization.
5. Make a comparison between the methods used in the work.
6. Helps in the process of finding material incentives for workers.
7. Reduce wasted time.
8. Helps in the process of good production planning.
9. Knowing the number of production machines that the worker can manage on his own.

There are several ways to measure work:

1. Study time.
2. Study work samples.
3. Analytical estimate.
4. Compilation of item times from standard statistics.
5. Set the preset movement time.
6. Study productivity.

It is worth noting that most of these methods rely entirely on guesswork, estimation, and research, while some of them are somewhat close to the process. (Otis,2009)

-Work measurement steps

The steps of a work measurement are similar to a method study except for time measurement.

- 1.Selection: Choosing the work to be measured.
- 2.Recording: Recording all the facts related to the selected work.
- 3.Testing: Conducting a critical test of the facts recorded about the events that make up the work to ensure that the most effective means and movements are used.
- 4.Measurement: Measuring the amount of work exploited in each element of the work using an appropriate technical method.
- 5.Calculation: A procedure dealing with the collection of standard time data for the process.
- 6.Determination: Determining the typical time for specific activities and means. (Matz,2008)

-Time Study:

The study of time is one of the latest methods of measuring work, which is an observation and recording of the time required to perform or accomplish a task at a certain level of performance. Or specifying the standard time required for a specific industrial operation to be performed by an industrial worker who is sufficiently trained and has the necessary competence to carry out such operations according to the specified method of performance under normal working conditions.

The time study method is used to benefit from it in the following areas: (Geffery,2005)

- 1.Determining the standard time for various operations, which helps the management of industrial organizations by determining wage rates and incentives.
- 2.It is used as a method to determine the cost of production with the required accuracy.
- 3.Studying time helps in controlling production processes and activities.
- 4.It helps to determine the time for completing the work, according to which the management of industrial organizations can set a date for the smooth delivery of the produced commodities.
- 5.Using the method of time study makes it easier for management to know the number of machines that one individual can manage and supervise. (Lockyer,2006)

-Steps to conduct a time study

1. Recording the information related to the process to be measured and the working individual whose performance time is to be determined.
2. Divide the operational process into its elements, with a full description of the method of performing each element.
3. Recording the time spent by the individual worker in performing each element of the operational process.
4. Determine the number of courses to be documented (number of observations).
5. Determine the rate of performance of the working individual.
6. Ensure that the number of observations is sufficient and documented to carry out the work study.
7. Determine the percentage of allowances required at a time.
8. Determine the standard time for the operation. (David,2009)

-Methods of conducting a time study

1. Study the time using a stopwatch.
2. Studying time using time recording devices.
3. Study time using a motion picture camera.

Ways to use the stopwatch

1. The continuous timing method.
2. Iterative timing method.
3. The cumulative timing method.

In order to determine the number of timing times, researchers and specialists in the study of time resorted to using some statistical and mathematical methods, as there are many statistical methods to determine the number of timing times needed, and one of the most important methods dedicated to this purpose is the sampling theory (observations) and represents the statistical basis on which to choose the necessary sample size. It has been customary to use a level of confidence (95%) with a level of significance (+-5%), as mathematical equations were used to find the value of N, which represents the number of observations required from them.

$$N=(2*S/0.05*A)$$

N=Sample size

A=The arithmetic means of the community

S=Standard deviation

In this regard, a number of readings are taken using a stopwatch, then the arithmetic mean of these readings is obtained and the standard deviation is found, and from here it is possible to reach the appropriate sample size. The same results can also be obtained if the following equation is used:

$$M=(40SQRT(N\sum X^2 - (\sum X)^2/\sum X^2))$$

SQRT=Square root function

M=The number of required readings

N=The actual number of reads of the element

X=Each stopwatch reading or individual note (Goldratt,2009)

Applied side:

First: the field of research

Factory No. (1) was chosen, as this factory specializes in producing five models of women's shoes, as shown in Table (1).

	Model no.	Planned production per day	type
1	701	1000	texture
2	736	300	leathern
3	749	100	leathern
4	737	50	leathern
5	731	50	leathern
6	738	150	leathern

Prepared by the researcher

Factory No. (1) includes three production lines: the seaming line, the sewing line, and the pulling line. It has been noted that there is a possibility for improvement and development in this factory, especially the seaming and sewing lines, as there are large delays in these two lines. The textile shoe model (701) was chosen. (women) is an area of study because it is the most existing and desired model by the consumer and the most produced by the factory, as the required production is about (1000) pairs per day, at a rate of $(1000/1650) = 60\%$ of the total production.

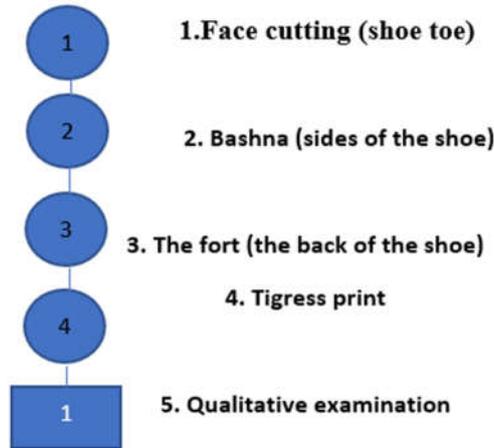
The study was organized so that the trend is to study reducing the time period or the delay in the production process of this model through the reorganization of the production line in relation to the processes of making this model, which is therefore reflected in the level of factory productivity for this model in general.

Second: Factory production lines:

The following is an explanation of all the main operations of the factory production lines and all models.

5. Separation line operations, which can be represented by a diagram (1).

Scheme (1) the overall operations of the separation line

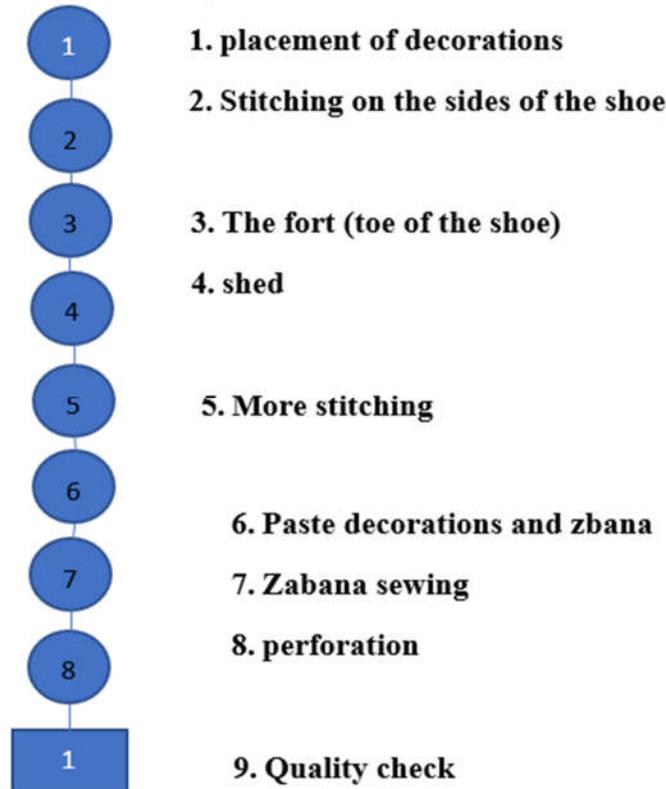


Prepared by the researcher.

Noting that the process of the sides of the shoe for some models is not included in the separation line. With regard to the process of printing the number, there is a weekly system that is fixed on the lining of the shoe, or what is called lines, printed in the following sequence (model name - number - outline - week) for example (701 - 36 - 1000 - 6).

With regard to the qualitative examination (quality control): if the semi-factory product is defective, it is repaired, and if it conforms to the required specifications, it is transferred to the second line, which is the sewing line.

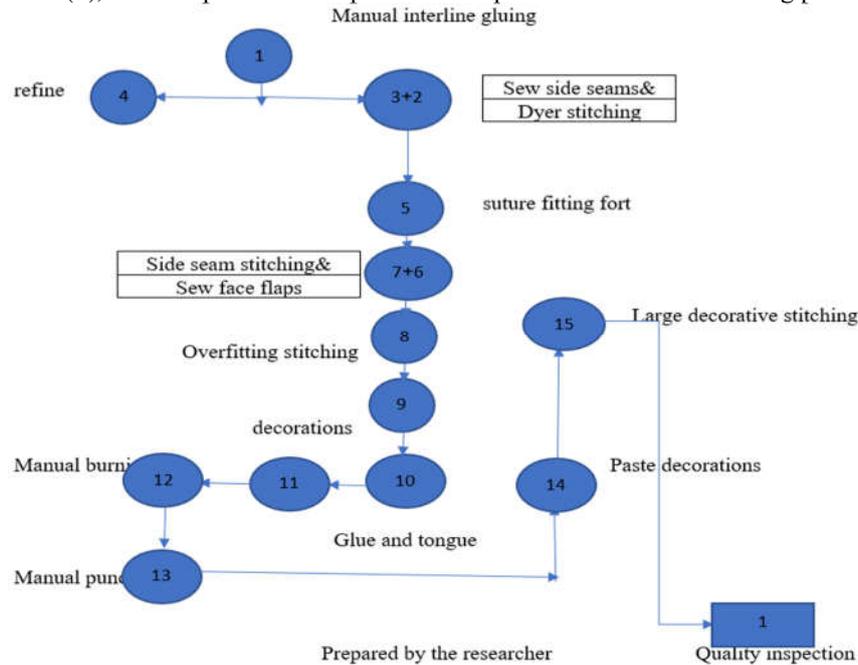
Diagram (2) the overall operations of the sewing line



Prepared by the researcher

Noting that the perforation process is not repeated for all models in the sewing line. As we have explained, the work study will be applied to the separation and sewing operations of model (701), which represent the important part in the factory. As for the drawing line operations, they will be excluded, because the operations times in this line It is fixed and that the laboratory does not take it into consideration, and from this standpoint, and in order to reflect the true picture of the work, the field of study will be on Model (701) related to the operations of the separation and sewing lines together.

The following is Scheme (3), which represents the operational sequence of the manufacturing processes of Model (701).



Third: Calculations of the time required for production:

The calculated time for the planned production, which represents the daily requirement of textile women's shoes, model (701), according to the current method, as shown in the table(2) below.

	Current method
1	Planned production = 1000 pair per day
2	The number of scheduled work meal hours = 10 hours
3	Total working time per worker = 600 minutes
4	In addition to the rest and maintenance allowances, which constitute (25%), the actual time will be: $600 * 100/25 = 450$ minutes actual time per worker.
5	Total number of tailors and designers = (planned daily production * total minutes for model making operations) / (available time * 20 pairs)
6	Total model making time = 162 minutes for (20) pairs
7	The total number of workers including tailors and designers = $(1000 \text{ pairs} * 162 \text{ minutes}) / (450 \text{ minutes} * 20 \text{ pairs}) = 16200 / 9000 = 18$ workers
8	The time needed to produce one pair = $162 \text{ minutes} / 20 \text{ pairs} = 8.1$ to produce one pair
9	The time required to produce 1000 pairs = $(1.8) * (1000) = 8100$ minutes
10	Number of work meal hours = $(450 \text{ minutes}) / (60 \text{ minutes} / \text{hour}) = 5.7$ working hours

Table (3) shows the times of manufacturing operations of the model (701) for one working meal, which is done on a minute basis and was calculated by the stop watch, noting that the readings were recorded for (20) pairs.

Table (3) the number of readings calculated for the manufacture of Model (701) and for (20) pairs.

Activities	1	2	3	4	5	6	7	8	$\sum x$	$\sum x/n$
1 Manual interline gluing	10	10	9	10	11	10	11	9	80	10
2 Sew side seams	8	6	5	5	6	6	6	6	48	6
3 Dyer stitching	10	10	10	10	10	10	10	10	80	10
4 refine	6	4	4	4	3	4	3	4	32	4
5 suture fitting fort	12	12	12	12	11	12	12	13	96	12
6 Side seam stitching	10	6	6	5	5	5	6	5	48	6
7 Sew face flaps	6	8	8	8	9	8	9	8	64	8
8 Overfitting stitching	27	19	19	19	19	19	19	19	160	20
9 Glue and tongue	15	10	9	10	9	9	9	9	80	10
10 Ornamental sewing	15	9	9	9	9	10	9	10	80	10
11 Manual burning	10	4	3	3	3	3	3	3	32	4
12 Manual punching	10	4	3	3	3	3	3	3	32	4
13 Paste decorations	4	5	5	6	5	5	5	5	40	5
14 Large decorative stitching	15	10	9	10	9	9	9	9	80	10

Prepared by the researcher

The number of readings was chosen in relation to the process of (suturing the installation of the fort) at the limits of a degree of confidence (95%). It is (8) readings, which were determined according to the following calculations:

$$R = 13 - 11 = 2$$

$$Y = \sum x / n = 96 / 8 = 12, R / Y = 2 / 12 = 0.16$$

And through the use of the appendix of the number of readings needed to measure the time (N) with confidence limits of 95%.

The number of readings required = 8 readings

The following is Scheme No. (4) showing the design of Model (701).

Diagram (4) showing the design of Model (701)



Fourth: Proposals for improvement and development

After studying and analyzing the components and content of the work for the separation or design and sewing lines of Model (701) for women and textiles and following up and examining each of the operations in terms of location, purpose, arrangement and time, it was found that there is a possibility of improvement and development in methods and work time to achieve savings, as it is possible to raise the level of work performance through the following improvements:

1. It is possible to improve, develop and reduce the content of the work by removing the processes of gluing and sewing adornments and the tongue with regard to small adornments only due to their insignificance. Therefore, it is possible to suffice with gluing and sewing large adornments only, as shown in Scheme (5). The savings achieved as a result of this will be as follows:

$$Y9 = \sum x / n = 80 / 8 = 10 \text{ min}$$

$$Y10 = \sum x / n = 80 / 8 = 10 \text{ min}$$

Since the production of one pair takes (80) minutes

So the saving in time for (20) pairs = 162 - 20 = 142 minutes

Accordingly, the total number of tailors and designers, after removing the glueing and sewing processes, will be as follows:

$$(1000) \text{ pairs} * (142) \text{ minutes} / 450 \text{ minutes} * (20) \text{ pairs} = 9000 / 142000 = 16 \text{ workers}$$

This means that the time needed to produce one pair per minute is 142/20 = 7.1 minutes

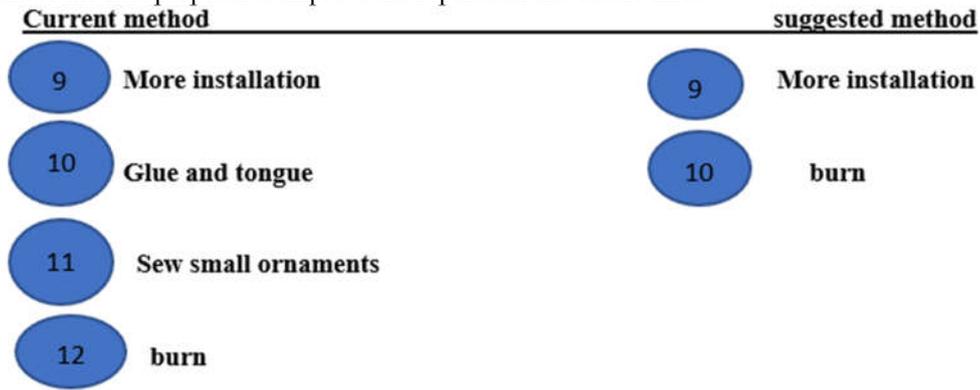
As for the time needed to produce (1000) pairs = (701) * (1000) = 7100 minutes

Total time saving = 8100 - 7100 = 1000 minutes

Accordingly, the number of pairs that can be produced during the period of time availability reaches (140) pairs as follows:
7.1 / 1000 = 140 pairs

And since the price of the shoes = 2550, the value of (140) pairs is 357,000 Iraqi dinars.

Diagram (5) shows the first proposal to improve the separation and suture lines



Prepared by the researcher

2. It was observed through the study that the process of sewing the sides of the shoe includes a partial process, which is cutting the threads, as the process of cutting the threads is carried out by a second worker other than the sewing worker, and this worker takes (10) minutes, while if he did this process the same as the sewing worker, and it is possible and it will take a process Sewing and cutting together only (6) minutes, as by calculating the times of the elements it was found that the process of cutting the threads takes one minute while the process of sewing the sides of the shoe takes (5) minutes, i.e. the total minutes of the two operations together = (6) minutes.

The savings resulting from this will be as follows:

Time saved for total operations = 142 minutes - 10 minutes = 132 minutes.

Savings in the total number of workers = (1000) pairs * 132 minutes / (450) minutes * (20) pairs = 9000 / 132000 = 15 workers.

Savings in the time needed to produce one pair per minute = 132 / 20 = 6.6 minutes

The time required to produce (1000) pairs = (6.6) minutes * (1000) = 6600 minutes

Saving in total time = (7100) - (6600) = 500 minutes

So the number of pairs that can be produced during the period of abundance = 500 / 6.6 = 75 pairs

Accordingly, the sales value of (75) pairs amount to (191250) Iraqi dinars

Table (4) shows the savings achieved when implementing the proposal.

Table (4) Savings achieved when implementing the proposal

	Details	Current method	suggested method	Savings achieved	Percentage of increase
1	output (pair)	1000	1215	215	21.5%
2	Number of employees	18	15	3	-16%
3	Wages* (Iraqi Dinar)	11700000	9750000	1950000	-17%
4	Time(min)	8100	6804	1296	-16%
5	Sales Value (Iraqi Dinar)	2550000	309825	548250	21.5%
6	Earnings (**IQD)	70900	400950	33000	21.5%

Prepared by the researcher

* The average worker's wage is (650,000) Iraqi dinars

** The cost of producing the shoes is (2220) dinars and the selling price of the shoes is (2550) Iraqi dinars.

Note that the improvement and development on the line will not require additional investments in machinery and equipment, but only needs to rearrange and organize the work according to the proposal. A copy of the research was given to the research and development department of the researched company and the laboratory concerned with that.

Conclusions and Recommendations

Conclusions

1. It is possible to apply the proposal reached, which includes economic savings, which will be reflected in the result on productivity, whether it is related to shortening the time or reducing the cost. In the future, the factory management can make proposals and introduce new amendments according to the current proposal without costing the company any additional investments.
2. The analytical research hypothesis, which is based on the time overlap to complete the various activities, has been proven correct. This is done by reducing the total work time by removing bottlenecks and not removing the basic processes for manufacturing the product.
3. The workers, supervisors and engineers of the production lines showed clear and serious cooperation with the researcher throughout the period of her visits to the production lines, which indicates their keenness on any new initiative aimed at improving and developing the work entrusted to them and thus achieving the general interest of the company and everyone. Entrances to achieving total quality in the company.

Recommendations

- 1.The need to search for new designs and models of leather and textile shoes.
- 2.Reconsidering the method of transportation and material handling and re-operating the conveyor belt instead of using a worker for transportation and making the transportation process a mechanical process in the future.
- 3.Paying attention to quality control by finding control points within the work stages instead of focusing on the last stage in production in order to reduce spoilage and reduce the rejected percentages of production during all manufacturing stages, which will reflect positively on the profitability and cost of production and sales.
- 4.Reconsidering the system of incentives used, whether material or moral, to encourage workers to increase production and shorten time, and the need to emphasize training programs for workers to improve their level of performance and encourage creativity and development.

References:**A. Books**

- [1]. Chase, Richard B., & Aquilino Nicholas J., 1995, "Production and operations management: manufacturing and services, 7th Ed, Irwin.
- [2]. Curry, A., 2000, "Development of production systems, London: Francis LTD.
- [3]. Evans, James R. 1993 "Applied production and operations management" 4th Ed U.S.A: West publishing company.
- [4]. Everett E. Adam GR., and Ronald J. Ebert, 1992, "production and operation management: Concepts, Models, and Behavior", 5th Ed.
- [5]. Lockyer, K., 2006, "Production control in practice", Britain: pitmen, Publishing.
- [6]. Matz, N., 2007, "Production planning and control", Britain: Wheaton co.
- [7]. Peter stonebraker and G. Keong Leong, 1994, "Operations strategy: Focusing competitive Excellence" Allyn and Bacon.
- [8]. Ray, Wild., 1995, "Essential of production operations management" London: Cassell.
- [9]. Stevenson, Williams J., 2018, "Production operations management", 7th Ed.
- [10]. Waters Donald, 2003, "Operation management: Production Good and Services", Addison-Wesley.

B. Journals & Periodicals

- [1]. David M. Upton, 2009, "Making Flexible", Work Study, Desember 5, copy HBR.
- [2]. Goldratt, E.M., 2009, "Computerized shop floor scheduling", International Journal of production Research, vol.46, no.3.
- [3]. Gray Hamel, C.K. Prahalad, 2004, "Competing for the future", Harvard Business Review, July-August.
- [4]. Jeffery Dyer, 2005, "Dedicated Assets: Japan Manufacturing Edge", Harvard Business Review, November-December.
- [5]. Otis Port, 2008, "The Agile Factory: Custom-Made, direct from the Plant: Business Week, December 19.
- [6]. Uday Karmarkar, 2006, "Getting control of JIT", Harvard Business Review, September-October.