THE ROLE OF QUALITY CONTROL IN THE PREDICITION AND REDUCTION OF PRODUCTION DEFECTS OF SOME TEXTILE PREPARATION STAGES (WARPING)

Ibrahim, G., E., & Dorgham, M.,E.,

Spinning, Weaving and Knitting Dept,
Faculty of Applied Arts , Helwan University

Abstract

All industrial institutes are seeking to improve productivity process and reduce the appearance of defects and errors that affect the quality of production. Quality control managements had a long role in the tracking of production stages and tracking defects to work on minimalist and reduction. The study have been tracked by one of the stage textiles preparations (warping) in one of the factories producing fabrics for a whole month and recording all the inputs and outputs of this process with the registration of all observations on production during the study period in order to get to the defects in this process and their causes. The study concluded that reasons affecting production quality in this stage were divided into two parts. The first part is resulting from defects in the inputs coming from the production processes prior to this stage.

The second part is resulting from defects in the production stage through defects and problems during the processing the stage itself. Both the first and second parts have been attributed to the defects of this stage, and according to the study the rates which effect the efficiency of production ,causes and their effect on the efficiency of production and ways of tracking it during operation were calculated, to reduce and prevent them.

1.Introduction

All factories in producing fabrics and textiles are seeking to the upgrading of industrial process and reducing the appearance of defects and errors that affect the quality of the product and disrupting the production. Quality control management and production tracking are playing an important role in the measurement and follow-up of the production rates and its quality to maintain the best performance of the production process and upgrading it.

The aim of this research is to follow up the production lines of warp threads preparations and to find the errors and defects always associated with this phase and identify the causes and quantify and try to minimize them and reduce their appearance and get rid of the obstacles affecting the quality of this stage and treat them which will enhance and not disrupt the following stages in the production process.

The importance of the research is to get to the original points of the defects and identify the causes of these errors and how to treat them to work on avoiding them and make the final product to reach the required quality and not delay the following stages in the production process.

The research hypothesis that some of the errors in yarn preparation and spinning stages have their impact in influencing the quality of the performance of warping stage, in addition to other errors that may occur as a result of non-compliance and negligence in the order of color repetitions required to produce some warp beamings while preserving the quality of dyeing and the cones that comes from factories.

There are many different methods of producing warps for the loom, each having some particular advantages for the type of warp made. The reasons for the different methods are largely due to type of yarn, spun or continuous –filament, grey or dyed, for monocolored or patterned fabric, large –scale or small –scale production …..etc. According to this, there are two principal methods of warping these are:

-Direct or Lancashire beaming.

-Sectional warping or the Continental silk system. [1]

The preparation of warp yarns is more demanding and complicated than that of the filling yarn, each spot in warp yarn must undergo several thousand cycles of various stresses applied by the weaving machine. Weaving stresses include dynamic extension, contraction, rotation (twist-untwist) and clinging of hairs, additionally there are metal –to-yarn and yarn –to-yarn abrasion stresses. Modern weaving machines have placed increased demands on warp preparation due to faster weaving speeds and the use of insertion devices other than the shuttle .warp yarn must have uniform properties with sufficient strength to withstand stress and frictional abrasion during the weaving ".

With today's computerized sectional warping system, once the basic style information is entered, the computer automatically calculates the following:

1-Number of sections on the beam and width of each section.

2- Carrier lateral movement speed and automatic positioning of each section start point.

3-Automatic stops for leasing.

4-calctulation of the correct feed speeds irrespective of the material and warp density.

The computer can also monitor the following:

1-Automatic stops for predetermined length

2-Operationg speed regulation of +/- 5 % between warping and beaming

3-beaming traverse motion

4- Memory of yarn breakage during warping for beaming

Other typical features of a modern sectional warper are:

1-Feeler roller to apply material specific pressure to obtain exact cylindrical warp buildup.

2- Lease and sizing band magazines.

3-Constant warp tension over the full warp width.

4-Automatic section positioning with photo-optical section width measurement.

5-Pneumatic stop breaks

6-Warp tension regulation for uniform buildup.

7-Automatic warp beam loading, doffing and chucking. [2]

Warp Breaks Detection

Warp breaks detection represents a bottleneck in the sequence of woven fabric processes. In this issue, weaving machine manufacturers and researchers undertaken two routes during last two decades. The first route targeted increase in speed through material selection and innovative design of machine parts and mechanisms. The second route targeted automation and several milestones have been achieved lately. These are automatic filling repair, automatic pattern change, adaptive control systems of filling, arrival time in air jet weaving, quick style change, and pre-programmable variable weaving speed and variable pick density ([3,4,5]).

The repair of warp breaks remained, however, un-automated and still requires the weaving machine operator's intervention.

Woven fabric producers and researchers undertaken parallel investigations related to warp breaks. The research has, however, been limited to monitoring break frequency, location, and the reason associated with breaks in order to improve warp yarn quality through warp preparation and spinning processes [6,7].

While this approach led to improvement in weaving efficiency, warp breaks still represent a major problem, especially for today's high-speed weaving machines. Researchers have been trying to develop commercial automated systems to repair warp breaks with no commercial success. [8]

The traditional drop wire is still the common mean of monitoring the warp breaks by merely stopping the process when a warp yarn breaks. [9, 10]

Application of ISO 9000 in textile factories

In a fast changing world, the importance of quality systems (QSs) in organizations' excellence has been felt more and more demanding, because it ensures consistent and desired product quality. [11, 12]

In recent years, ISO 9000 standards have gained considerable attention specially in the textile industry .ISO is important for international trade as well as domestic business [2]

The role of quality control and production is mainly in predicting errors and defects that affect the preparatory stages for the manufacture of textiles and so reducing the appearance of defects and errors that affect the quality of the product ISO 9000 has evolved and is being updated continuously to provide necessary conceptual and structural input to the development of such a system. As a consequence, customers demand ISO 9000 certification from their suppliers. Implementation of ISO 9000 standards requires the establishment and development of a documented system, and the involvement of all the employees in adhering to it. [11, 12]

2.The experimental work

During the practical work, certain deficiencies were identified. In order to remove these deficiencies, it was felt that executives had to study the problem in details and try to solve it.

A Following-up and monitoring of the full production in fabrics factory was done for month , 24 hours a day, with a truncated of weekend days, and a follow-up certificate has been designed to record all production, stops and problems encountered during the run-time for each warp beam. When the complete study of the warping stages and warp production were finished the results were analyzed. 51 warp beams, 9680 ends for each beam, 20400 m totale warp length production, 650 m/min average speed for warping machine and beaming speed 85 m/min .

Table (1) the specification of the warp machine used for this research [13]

No	Property	Specification
1	Company	benninger
2	Model	Ben-Ergotronic
3	Year of manufacturing	1996
4	The manufacturer country	Switzerland
5	Warping speed	800m/min
6	Beaming speed	100 m/min
7	creel capacity	640 cons

Table (2) the specifications of warp beaming process

No.	Property		Specifications
1	**Total number of warp beam**		51
2	**Total number of ends for every beam**		9680
3	**Total wrap length production (m)**		20400
4	**Warping machine average speed (m/min)**		650
5		**Number of cone**	600
	Average of running creel capacity	**Time of creel Package and tie cone (min)**	0.2
6		**Number of sections**	867
	Total number of sections	**Time of leasing section (min)**	2
7	**Beaming Speed (m/min)**		85

Table (3) the number and times stopping for the final warping during the month

No	Property	Number	Fixing or exchange time (min)
1	Breaks	548	1.5
2	Cone length off stops during warping	11	30
3	Mechanical stops	6	45
4	Creel rearrangement defaults	3	60
5	Cone hairness	63	0.2
6	Cone dying problems	48	0.2
7	Beaming	51	10

3.Results and Discussion

First: Time

1-Running and preparation time

Table (4) the total preparation time for the final warping during the month

Preparation time				
No	Process time	(number ×time / min)	Min	Hour
1	Creels	(51×600)×0.2	6120	102
2	Leasing sections	867×2	1734	28.9
3	Beaming change	15×10	510	8.5
4	Total of preparation time		8364	139.4

Table (5) the total running time for the final warping during the month

Running time				
No	Process time	(number ×time / min)	Min	Hour
1	Total warping running time	(20400/650) × 867	27210.46	453.5
2	Total beaming time	20400/85	240	4
3	Total running time		27450.46	457.5

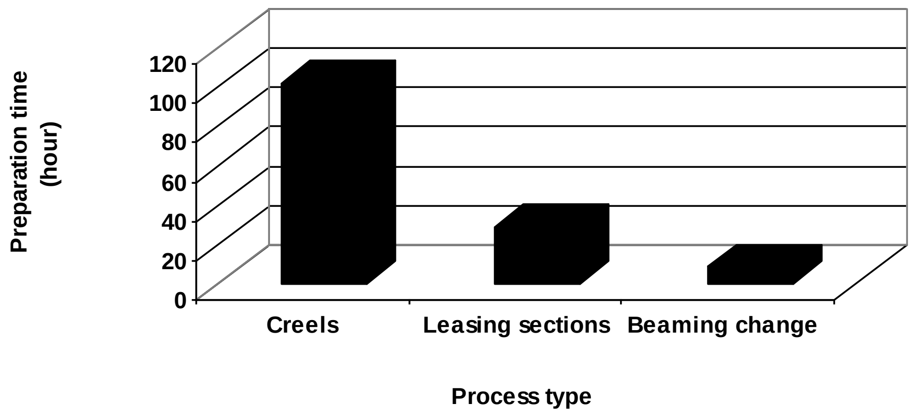

Fig.(1) the total preparation time for the final warping during the month

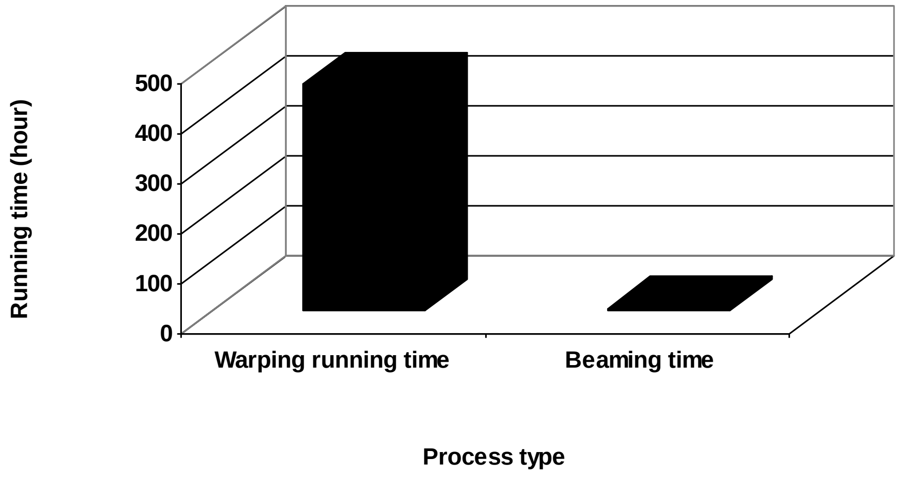

Fig.(2) the total running time for the final warping during the month

The actual running time was divided into two parts

1- The first concerns the warping and the warp threads preparation

2- Concerned with the transporting of all warp threads to the beam.

These stages are associated with the machine speeds which is linked to the quality of yarn used and the viability of running at different speeds.

Theses stages have consumed the largest part of the total working time

3- Installation of the threads on the warp creel, which is an important stage, but it was found that it is significantly affected by the number of the actual used cones in the warp creel specially when associated with a specific color repeat, as well as the time required for the installation of each thread.

4- The time of leasing warp sections, this stage is associated with the number of warp sections for each required beam, as well as the time of submission of each section independently, according to the efficiency of the machine operator and the extent of his experience and speed.

5- Replacement and installation of warp beams and the requirements necessary for the preparation of warp threads on the warp beams , the time of this process is connected to the number of operators and the number of warp threads .

2- Stopping time

Table (6) the total stopping time during the month for all process .

		Total Stopping time		
No	Process time	(number × fixing or exchange time (min)	Min.	Hour
1	Breaks	548×1.5	822	13.7
2	Cone length off	11×30	330	5.5
3	Mechanical stops	6×45	270	4.5
4	Creel rearrangement fixing	3×60	180	3
5	Exchange hairiness cone	63×0.2	12.6	0.21
6	Exchange cone dying defaults	48×0.2	9.6	0.16
7	Total stopping time		1624.2	27.07

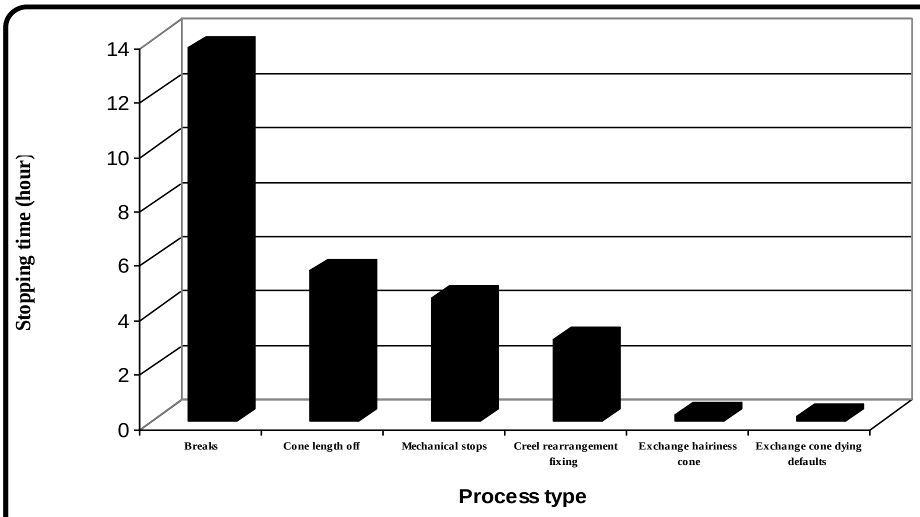

Fig.(3) the total stopping time during the month for all process

The actual warping machine disruption time were measured as time and causes of failures were monitored, and it was found that:

1- The time of submission of fixing each break yarn it is according to the quality and efficiency of the warp threads used which had a profound effect the speed of warp beaming. And clear the increase these number

2-The time taken for the restart and replacement of the cones as a result of unequal yarn lengths on the cones which caused the disruption of warping machine in waiting for dividing of the cones

3-The mechanical disruption and stops has caused the disruption of the production process of the warping stage because it is not connected to tables set for the regular maintenance of machine and there is not a determined times for regular maintenance of machinery which had a deep impact in stopping the machine during the production process, thereby hindering the production process completely and affect the timeliness of production and the connection to the external market.

4-The time required for re-installing and ordering of the cones on the creel and this is due to the inaccuracy of employment commitment to required warp repetition data, which illustrates the importance of the role of the departments of quality and production tracking to focus on such errors and work to prevent it.

5-Time of hairness cones changing which had an impact on the disrupt of the warping process as a result of errors in the cone winding process so the installation of these quality of cones must be avoided.

6- The time of changing the irregular dyed cones , this defect was emerged during the process as a result of the heterogeneity of the color in each cone which has a great influence in the disruption of warping process in order to maintain the quality of the produced beam and its uniformity.

Time Calculation

From table (4,5,6) ,we calculate the time for all processes ,and it is clear that in the following tables

It is clear from tables that total time per warping stage per month

=time of running + preparation time + stops time

= 457.5+139.4+27.07= 623.97 hour

We can also calculate the efficiency of every procedure to know about every procedure problems and know how can we introduce the best solutions.

Second: The efficiency

Table (7) the production efficiency

No	Process	Efficiency (%) (time of process/ total time)
1	Warping running	453.5/623.97 ×100 = 72.6 %
2	Beaming	4/623.97 ×100 =0.64 %
3	Total Production Efficiency (%)	73.24 %

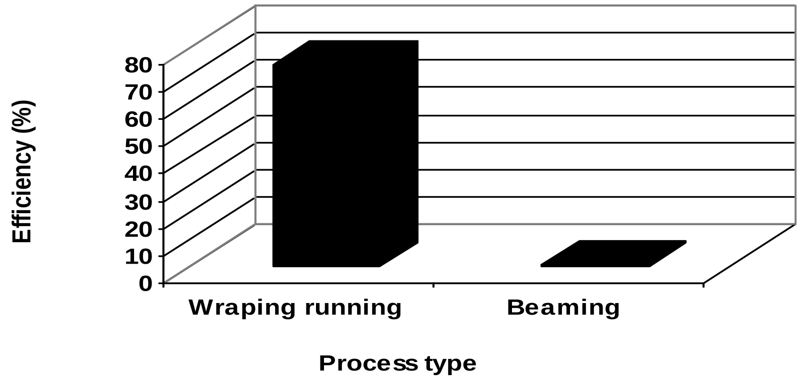

Fig.(4) The production efficiency

By calculating rates of production efficiency and figures ,it was found that:

1- The production efficiency

1- The warping process has reached 73.24% of the overall beaming process according to other external factors affecting the rates of performance in the limited time because it works on a combined image of warp threads on the whole beam.

2- For warps winding stage and transferring them to warp beams, it did not affect the performance rates due to the decrease in the consumed time because it works as a bulk on the whole beam .

2-The lost in efficiency

Table (8) the lost in efficiency

No	Property	Lost in efficiency (%)
1	Creeling	102/623.97×100=16.3 %
2	Leasing sections	28.9/623.97×100= 4.6%
3	Beaming change	8.5/623.97×100=1.4%
4	Breaks	13.7 /623/97 ×100=2.2 %
5	Cone length off	5.5 /623.97×100=0.9%
6	Mechanical stops	4.5 /623.97×100=0.7 %
7	Creel rearrangement fixing	3 /623.97×100=0.5%
8	Hairiness cone	0.21/623.97 ×100=0.03 %
9	Dying defaults	0.16/623.97 ×100=0.02%
10	Total lost in efficiency	26.65%

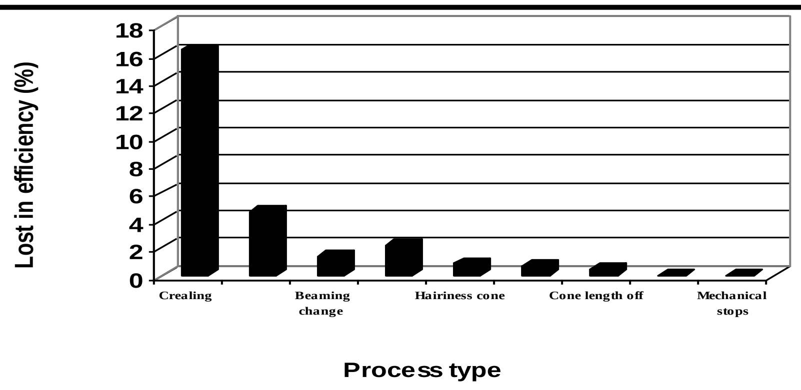

Fig.(5) totl lost in efficiency in warping process

Fig. (6) Comparison between production efficiency and lost in efficiency

1-The efficiency and time of warp creel installation of which affect significantly the machines disruption time and the efficiency of the production process because it highly occupies operating time.

2-The efficiency of withdrawn warp sections had negatively affected the time required for warping which came second after the installation of warp creel and its impact on production efficiency.

3- Changing and preparing of warp beams to transfer warp threads have an impact on the time during the process as a result of separation and stopping of the warping machine which is connected to the number of operators and the efficiency of the human factor and experience

4– The number of warp threads breaks has an impact on the time, which increases the time used to fix yarns and this affects process efficiency.

5- One of the common and important defects, which urges those involved in the departments of quality comprehensive to pay attention are the lengths of thread on the cone are not equal, which affected the warp stops during process and to increase the disruptions ,in addition to its bad influence on yarns winding and production tables delaying

6- Mechanical stops affected negatively on the functioning of the production process due to the lack of attention to the maintenance of the machine and attention to efficiency, which has affected the efficiency of the required production.

7- As the result of the lack of attention and precision during the installation and preparation of warp creel, especially when preparing warp beams of complicated color constructions, which leads to errors in the threads order inside the fabric which affect disruption rates as well as the corruption of the entire production process and leads to the production to be refused.

8- The disruption of threads hairness have affected efficiency of production, though there must be commitment to the continued monitoring of the quality of the cones that comes from the previous preparation stages not to negatively affect the quality and efficiency of warping process.

9- One of the important reasons that affected the process efficiency is the emergence of some thread packages defects that have more degrees of color and color evenness does not occur on the surface of the thread which is one of the external causes affecting the quality of production.

Conclusion

Through this research, it was reached to the following points which could develop the production process of warping stage as follow :-

1-Paying attention to the quality of yarn used by the examination and primary tests to avoid yarn disadvantages (decrease in tensile strength – yarns hairiness - the heterogeneity of colors) .All these defects affect the quality of production and it is not referred to warping mistakes .

2 - Compliance with the color repeats and reviewing it before processing.

3 - Commitment to periodic maintenance of the machines to avoid sudden stoppings during working

References

1- " **J.,E.,Booth,B.Sc.F.T.I, .A.M .C.S.T**." Textile Matematics,Vo. 3 .Textile Insitute .Manchester-1977

2- **Adunur, S.,,"**hand book of weaving ,sulzer -2001

3-**Jin H Lee,**, Seyam ,A., Mohamed, Hodge,G., Oxenham,W., Ph.D., Grant,E., "Warp Breaks Detection in Jacquard Weaving Using MEMS: Effect of Weave on Break Signals , Ph.D. ,North Carolina State University, Raleigh, North Carolina, USA Correspondence to:

4-**Seyam, A. M., "** Advances in Weaving and Weaving Preparation at ITMA" ’99, Textile Progress Journal, 30, 22-40, 2000.

5-**Seyam, A. M.,** “ITMA 2003: Weaving Technology,” Textile World, 34-39, February 2004.

6-**Dolescki, S. K.,**" The Causes of Warp Breaks in the Weaving of Spun Yarns, Journal of Textile Institute," 65, 68-74, 1974.

7-**Shankam, V. P, Lee, J. H., Seyam, A. M., Grant, E., Hodge, G., Oxenham, W.,** "Automation of Warp Break Repair: Warp Break Location and Frequency in Jacquard Weaving, "The Proceedings of the TI 83rd World Conference, Shanghai, China, 2004.

8-**Prat, R. E.,** " Apparatus and Method for Automatically Repairing Broken Warp Threads in Weaving Machines Performance, European Patent, EP 0364404, 1989.

9-**Lee, J. H.,** Warp Breaks Detection in Jacquard Weaving using MEMS, Doctoral Thesis, North Carolina State University, 2005.

10-**Gahide, S.,** " Exploration of Micro-machines to Textiles: Monitoring Warp Tension and Breaks during the formation of woven fabrics," Ph. D. Thesis, North Carolina Sate University, 2001.

11- **ISO** " Quality Management and Quality Assurance Standards (Geneva, ISO)"

12- **SARKAR, A.,** "Implementation of ISO 9000 in a textile mill" SQC & OR Unit, Indian Statistical Institute, Old CGO Building, 101 Maharshi Karve Road,
Bombay 400 020, India, Total Quality Management, Vol. 9, NO. 1, IGQS, 123-131
CARFAX

13-Benninger,Benninger Ben-Ergotronic, "Warping Machine Setting Instruction"1996.