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A Study on Enhancing Productivity & Efficiency of Loomshed in Kanoria-Africa Textile

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Abstract—Kanoria-Africa textile is a foreign owned company in Ethiopia engaged in the production of denim products. In this paper, it is aimed to study the causes why the company is not achieving its target production & efficiency. Accordingly, basic quantitative parameters are taken and compared with the standards. For the analysis, two months of production data have been analyzed and deviations from the standards are also observed. Currently, the company is producing a daily production of 391m/loom while the target is 500m/loom. The standard efficiency for Toyota air-jet loom is 88% but the company's actual efficiency is about 61%. For the higher efficiency loss, contributions of warp & weft yarn breakages are more than 30% followed by beam-gaiting & knotting contributing a loss of 3.4%. From the study, 3 to 4 times higher than the standard warp & weft yarn cmpx is observed. To solve these efficiency and productivity problems, quality requirements for both warp & weft yarn is suggested to be checked, monitored & implemented. Weavers' efficiency in attending breaks is six times lower than the standard required. This brings an efficiency loss of about 0.5%/break. To enhance their efficiency, periodic refreshing training & implementation of motivational incentive scheme has to be there.

Keywords—Kanoria-Africa, efficiency, productivity, training, incentive scheme

I. INTRODUCTION

Kanoria Africa Textiles PLC has been established by Kanoria Group's flagship company Kanoria Chemicals and Industries Limited, based in New Delhi, India.

The main aim of the company is to produce denim products with a weight ranging from 4 oz to 15 oz. it uses cotton, elastane yarn, and polyester-lycra yarns.

The dyeing unit uses indigo &sulphur dyes with colors of brown, black, blue, grey, olive, etc.

Spinning section has Truetzschler Blow Room line with yarn product range from Ne 6 to Ne 30 weaving/knitting open end yarns, with an installed capacity of 370 tons/month.

Two Morrison Ball Warping (MDS350) machines are there with creel capacity of 432 ends in each. Five Morrison Long Chain Beamer (MDS550 RB) and one Ukil Sizing Machine Expert-100, for sizing of dyed yarn and making weaving beams are also installed.

USA made Morrison Rope Dyeing machine with a capacity of 24 ropes (expandable to 48 ropes) is also there for producing a versatile combination of indigo and sulphur shades.

Loom shed is equipped with sixty versatile high speed Toyota-810 Air Jet looms.

Stenter machine is there for heat-setting of stretch denims, a Mercerizer for high quality flat finish/over dyed denims and a Morrison Wet Sanforizer for consistent dimensional stability of products.

Currently, the company is not achieving the daily target production plan of 30,000m. This study tries to focus on the causes for lower productivity and efficiency of weaving section.

Efficiency can be reduced due to weavers' skill gaps, raw material quality problems, machinery status issues, process related problems, etc [1].

So, the paper focuses on the stated issues for finding the specific problems and suggests solutions for enhancing productivity and achieving the targeted production plan.

II. RELATED WORK

As the study is specific to Kanoria-Africa Textile Company, for assessing its productivity problem, the company tries to implement some common systems and soft-skill trainings with the use of potentials of senior staffs. But in relation with this no published work has been found.

III. METHODOLOGY

For conducting the study, data has been collected from loomshed section of the company. Based on the collected data mean values have been analyzed. The analyzed values are then compared with the standard best practice values. For the study, main loomshed productivity parameters of wastage level, production, efficiency, machine utilization, fabric realization percentage, etc have been considered. Thus, main focus is on identifying the causes why the

target production plan of loomshed section is not achieved in Kanoria Africa textile. For that the main production parameters have been taken and comparison is made between the standard best practices and the actual performance. The best practice standard parameters are referred from [2]. For the study, November and December production data reports have been used and analyzed based on the percentage shares of raw material quality, man power efficiency, process related issues & machinery issues.

IV. RESULTS AND DISCUSSION

About 19 quantitative parameters are taken for knowing the status of the factory mainly in productivity, efficiency & fabric realization. For that the two months production report is referred and analyzed. In table 1, summary of results for the selected parameters are shown.

Currently looms are running at a maximum speed of 800 rpm which is 100 rpm lower than the target speed of 900 rpm for Toyota air jet looms with 2 weft color selectors. This brings an actual production of 391 meters/day. Thus, 6540 meters/day are lost (for 60 looms) as compared with the total production achieved with the target production of 500 meters/day. Looms are running with an average efficiency of 61 %. Efficiency loss due to warp and weft breakages contributes more than 30% of the total loss and beam gaiting & knotting contributes about 3.4%.

Among 60 looms, an average of 56 looms /day is utilized. This brings a machine utilization of around 94%. From the lost 6%, occurrence of bad beams and waiting for knotting contributes the highest of around 4% followed by want of beams, which contributes a 1.8% loss.

Coming to fabric realization, the factory realizes a 93.5% Fabric, which is 4% lower than the standard requirement. This is indicated by the higher hard waste generation in loom shed and loom preparatory sections (ball warping, rope dyeing, LCB & sizing). The hard waste generated in the stated sections is twice higher than the standard requirement. For this, process wastes like fringe length/pick, no. of false selvedge ends, remnants from warping & sizing creels and sized wastes has to be reduced and brought to the standard limits.

Coming to operators' efficiency, both warp & weft attending time are 6 times higher than the standard requirements of 1 min & 20 seconds respectively.

As it is shown in the table, in most of the compared quantitative parameters, the factory's performance is found to be lower. For improvement, areas like: raw material quality assessment, man power efficiency, machine efficiency, etc have been discussed in detail.

a) **Causes of low performance**

From the study, we can analyze why the target production and efficiency is not achieved in loom shed on the basis of: weavers' efficiency, weft and warp yarn quality, machine related issues and process related performances.

b) Quality of weft yarn

For a weft yarn to run on Toyota air jet loom of having a speed range from 800 to 900 RPM, the following yarn quality parameters have to be checked and compared with the required one. In the factory, most of the necessary parameters are not tested and brought for production [3].

c) Warp/sized yarn quality requirements

Sizing is the basic process which helps in achieving the targeted productivity & efficiency if all the parameters are kept to the desired result ranges. Otherwise, because of the cyclic loads & tensions incurred in weaving machine, higher warp yarn breakages will occur [4].

Table 1 Weaving Production Quantitative Parameter Standards vs. Actual Performance

No	Deliverable Parameters	Unit of measure	International Benchmark Values	Existing Factory Situation
1	**Loom shed**			
1.1	Knotter productivity	ends/person/shift	13000	29560 (for six knotters)
1.2	Knotter speed	Knots/min	88	32
2	**Loom status**			
2.1	Toyota loom (Air jet)	rpm	900	760-800
2.2	Man power in shuttle less loom weaving shed	Looms/person	8-16	6
3	Beam Knotting timing	Min/end	0.012	0.031
4	**Beam gaiting without sort change:**			
4.1	Single width loom	Hrs.	1-3	2.5
4.3	**Beam gaiting with sort change:**			
4.4	Single width loom	Hrs	8	8-14
5	**Loom Hard waste level**			
5.1	For leno and false selvedge on loom	mm	20-80 per pick	50-90 per pick
5.2	False selvedge	ends	4-20 in false selvedge	6-8 in false selvedge
5.3	Total hard waste in weaving	%	1.8	3.5
5.4	Machine productivity per loom	Meters /Day	500	391
6	**Production**			

No	Deliverable Parameters	Unit of measure	International Benchmark Values	Existing Factory Situation
6.1	Warp Stop - CMPX		3.5	10.43
6.2	Weft stops – CMPX		2.5	8.63
6.3	Weaving Hard waste	Total waste % weaving Preparatory and Loom shed	3 1.2 1.8	6.44 2.94 3.5
6.4	Efficiency	Loom	88	60.72
6.5	Cause wise snap Efficiency loss%		12.00%	39.28
6.5.1		Warp breaks	2.50%	23.4%
6.5.2		Weft breaks	0.40%	7.3%
6.5.3		Mechanical repairs	1.00%	0.02%
6.5.4		Beam gaiting and knotting	2.50%	3.38
6.5.5		Lubrication and cleaning	0.50%	NA
6.5.6		Power failures and others	5.1%	5.18
6.6	Machine Utilization %		92%	93.94
6.7	Cause wise Machine Utilization loss%		8%	6.06
6.7.1		Loss% due to Reed change	0.05	NA
6.7.2		Maintenance	1.25	0.14
6.7.3		Beam gaiting and change	2.5	0.11
6.7.4		Article change	0.2	0.07
6.7.5		Spares	0.5	NA
6.7.6		Man power shortage	1.5	0
6.7.7		Want of beams	0.5	1.84
6.7.8		Power failures and others	1.5	3.9 (due to bad beams and waiting for knotting)
7	**Fabric Realization%**		97.50%	93.5%
8	Weaver attending time for breaks			
8.1	Weaver attending time-	warp	60 seconds	377 seconds
8.2	Weaver attending time-	Weft	20 seconds	131 seconds

Table 2 Weft yarn quality requirements as compared with the actual

Parameters	Required vs. actual					
Nominal Cont	**7 OE required**	**7 OE actual**	**9 OE required**	**9 OE actual**	**10 OE required**	**10 OE actual**
Average Count (Ne)	7	6.9	9	NA	10	9.81
Count Range	6.73-7.27	6.8-7.14	8.65-9.35	8.66-9.4	9.57-10.43	9.2-10.3
Count Cv%	<1.2	NA	<1.2	NA	<1.2	NA
Avarage Strength	257	NA	194.4	NA	186.4	NA
Strength Range	219-296	NA	165-224	NA	158-214	NA
CSP	1800	NA	1750	NA	2050	NA
Strength Cv %	<4.5	NA	<4.5	NA	<4.5	NA
T.P.I.Test Results						
Average T.P.I.	11.7	NA	12.7	NA	12.6	NA
T.P.I Range	9.95-13.46	NA	11.22-15.18	NA	11.82-15.99	NA
T.P.I. Cv%	<4.0	NA	<4.0	NA	<4.0	NA
Proposed T.M	4.42	NA	4.23	NA	3.80	NA
Uster Test Results						
Avg. U%	9.0	NA	10.0	NA	11.5	NA
Thin/Km. (-50%)	0.0	NA	1.0	NA	5.0	NA
Thick/Km.(+50%)	10.0	NA	12.0	NA	30.0	NA
Neps/Km.(+200%)	4.0	NA	5.0	NA	15.0	NA
Total Imp/Km.	14.0	NA	18.0	NA	50.0	NA
Hairiness Index	<8.5	NA	<8.0	NA	<6.6	NA
SH	<1.85	NA	<1.75	NA	<1.74	NA
AvgR.Km (Nm* Kgf).	11.0	12.17	11.0	11.58	12.5	12.32
Elongation %	>5.6	7.44	>5.5	6.88	>5.7	5.9
Range Elongation	4.17-7.03	6.66-7.89	4.10-6.90	5.41-7.00	4.25-7.15	4.72-7.67

d) Process related performances

A knotter is expected to knot 13000, ends/shift, but in the factory an average knotting of only 5000 ends/shift/knotter is made. For this, weaver beam shortage contributes a lot besides having a lower knotter speed of 32 knots/min or 0.03 min/end while the standard is 88 knots/min or 0.01 min/end. This lowers machine utilization and efficiency.

Higher lappers and cross ends are recorded in sizing process, it is higher than the standard of 1%. It is the basic reason for higher warp cmpx of 10 when compared with the standard cmpx value of 3.5. Lappers /migrated ends can be rectified through proper leasing and avoidance of sticky ends both in the body of warp sheet and selvedge sides.

So periodic refreshing training has to be given to sizing, LCB & ball warping and knotting operators.

e) **Weavers' efficiency**

For attending warp and weft breaks, weavers consume 377 and 131 respectively. From the required standard requirements of 60 and 20 seconds, they take additional times of 317 & 111 seconds/break. This lowers weavers' efficiency by 0.5%/break. When the no. of breaks are higher, weavers' efficiency will be reduced by a significant amount and thus productivity and loom efficiency will also be reduced by a greater amount.

For improving weavers' efficiency on attending breaks, periodic refreshing training has to be planned to give to loomshed operators on how fast they have to attend breaks along with the standard requirements.

For those operators performing good and achieving higher production/shift or efficiency, a system of motivational incentive scheme can be developed and award to the deserved ones.

f) **Machine related issues**

Selvedge sides of Squeezing pressure rollers are coated with plaster tapes. This creates stickiness of sized warp sheet since the roller with tape side cannot squeeze excess starch to the required amount. For having a weaver beam with uniform size pick and free from sticky ends, besides having the correct size recipe and proper R.F (solid content), squeezing rollers have to buffed/changed. Shore hardness values of the rollers have to be kept from 60-70.

The stretch counter in sizing machine has to be brought to working condition since keeping stretch to an optimum value of <1% reduces warp breakage (cmpx) to the desired amount [5].

Most of the loom settings are good and set as per manual. Air pressure has to be checked and the required 100 psi should be kept and brought to loom shed for full machine utilization.

Table 3 Warp yarn quality requirements

S.no	Parameters	Unit of measure	Expected results	Company status
1	High speed cylindersizing machine speed	Meters/min	65	50
2	Mechanical yarn stretch	%	1	Most of the time showing negative results Yarn is shrunk, showing that higher tension in creeling position/unwinding area. Has to be corrected, functionality of the counter has to be checked.
3	Gain in strength and loss in elongation at break of sized yarn			
3.1	Up to 40s	%	>25 Gain in strength <15 Loss in elongation	NA Has to be measured and calculated since it contributes for higher end breakage in looms.
4	Dead loss	%	15	NA
5	Variation in size pick up	%	±1	
6	**Migration of ends/lappers (for cylinder sizing).**			
6.1	Up to 40s	No. of ends/1000 ends/1000mtrs	1	>1 More cross & sticky ends are there, rectified through proper leasing and adjusting squeezing pressure
7	Set change waste per set	meter	45-50 sized yarn + 25 grey yarn	>100 Length variation in LCB machine has to be kept minimum, while doffing, yarn dragged for next weaver beam has to be decreased in winding/head stock zone.
8	Bad beam/soft beams	%	0.02 of sizing production	NA
9	Doffing time	Min.	3.5	NA
10	Mending time per lapper	min	1.5	NA

V. CONCLUSION AND FUTURE SCOPE

In general, the loomshed section is having an average daily production of 22,000m, with an efficiency of around 61%. This is lower against the target production plan of 30,000m and the best practice standard efficiency of 88%. The looms are running 100 RPM lower than the expected speed. Suppose the yarn issued for warp and weft requirements are properly checked for their quality parameters, speed increment can be achieved and productivity will also enhance. Thus, both weft and warp yarn quality requirements has to be checked and followed for different counts. If the receipt of yarn from spinning and sizing sections is not as per required, a system of giving proper feedback to them and having the corrected one has to be ensured. Among 60 looms, an average of 56 looms /day is utilized. This brings a machine utilization of around 94%. From the lost 6%, occurrence of bad beams and waiting for knotting contributes the highest of around 4% followed by want of beams, which contributes a 1.8% loss. The factory realizes a 93.5% fabric, which is 4% lower than the standard requirement. This is indicated by the higher hard waste generation in loom shed and loom preparatory sections.The study shows that both warp & weft attending time are 6 times higher than the standard requirements of 1 min & 20 seconds respectively. So, to minimize the productivity problems and issues: the study recommends that;Knotters have to get proper training for the techniques of proper dressing and combing besides knotting with leasing method. This reduces occurrence of high lappers in weavers' beam and higher warp breakages. The same has to be followed for sizing operators, as many cross-ends occur in sizing process due to sticky ends. For improving weavers' efficiency, besides giving refreshing training, a system of motivational incentive schemes can be implemented & followed. It is observed that the damage in the selvedge side of squeezing roller in sizing machine is creating a high number of sticky ends and lappers in weavers' beam and higher bunch breaks in selvedge side. So, the rollers have to be either buffed or changed by new one. The stretch counter in sizing machine has to be checked and brought to its working condition. For utilizing the 60 looms and increasing plant efficiency, the incoming air pressure has to be kept with the requirements of air-jet looms.

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