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ASSESSMENT OF CAUSES OF WARP YARN BREAKAGE ON LOOMS-A CASE STUDY AT BAHIR DAR TEXTILE SHARE COMPANY

ASSESSMENT OF CAUSES OF WARP YARN BREAKAGE ON LOOMS-A CASE STUDY AT

BAHIR DAR TEXTILE SHARE COMPANY

BY

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ETHIOPIAN INSTITUTE OF TEXTILE AND FASHION TECHNOLOGY

BAHIR DAR UNIVERSITY

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APPROVAL PAGE

I certify that I have supervised /read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in quality and scope, as a thesis for the fulfillment of the requirements for the degree of Masters of Textile Technology.

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I hereby do declare that this thesis which is being submitted in the fulfillment of the Master's degree is my own work and that all contributions from any other persons or sources are properly and dully cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I do understand and acknowledge any breaches in this declaration constitute academic misconducts, which may result in my expulsion from the programmed and/or exclusion from the award of degree.

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This is to certify that the thesis entitled **"Assessment of causes of warp yarn breakage on looms-a case study at Bahir Dar textile Share Company".**

Submitted in partial fulfillment of the requirement for the degree of master with specialization Textile Technology the post graduate student program of the Ethiopian Institute of Textile and Fashion Technology and has been carried out by WOLDEAREGAYE WOLDEMIKAEL ID.NO. MTT/R/004/09under my supervision therefore I recommended that the student fulfilled the requirements and hence hereby can submit the thesis to the institute.

______________________________ ________________ ________

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Abstract

This study was designed to investigate assessment of warp yarn breakage on loom in case of Bahir Dar Textile Share Company by looking the current efficiency and production of loom. The study was carried out in 100% cotton warp yarn and six looms out of the sixty six air jet looms. Data was gathered through observation and interview. The frequency count, cumulative frequency count, cumulative percentages, and the pareto chart are the statistical methods used in analyzing the data. The study showed that Crossed end, Thin and Thick end, Contamination, Oil warp, Knots, Taped ends, Wrong drawing-in, Tension, Abrasion, Leno bobbin change, Chopped ends, and Fluff dirt or impurities are the major causes which influence warp yarn breakage on loom. From the findings it was concluded that the 88.10% of warp breakages from the total are produced by 50% of the causes that is knot (28.44%), thin and thick end (17.43%), and tension (14.67%), cross end (11.1%), abrasion (9.2%), and Fluff dirt or impurities (8.25%). Therefore it can be inferred that if Bahir Dar Textile Share Company able to solve the most frequently occurring causes, 88.10% of the warp yarn breakage problems will be eliminated.

CHAPTER ONE

INTRODUCTION

1.1. Back ground of the study

Weaving is one of the most important fabric manufacturing processes. It is the most basic process in which two different sets of yarns or threads are interlaced with each other to form a fabric or cloth. One of these sets is called warp which is the lengthwise yarn running from the back to the front of the loom. The other set of crosswise yarns are the filling which are called the weft or the woof.

The performance of a loom depends on the incidence of stoppages due warp, weft breakages and other ancillary stoppages due mechanical reasons, during weaving. Out of all these stoppages, the time element involved in mending a warp break is comparatively higher and therefore, all attempts are made to reduce the warp breakages [4]. A high warp breakage rate not only reduce the productivity of a loom and increases work load of weaver, but also impairs substantially the quality of fabric [4].

In weaving, a warp sheet of parallel sized treads is subjected to various complicated stress such as constant tension, cyclic tension, Transient tension, bending, compression and abrasion. The weave ability of a yarn, therefore depends on the resistance of yarn to these stress, which, in turn, is influenced by the grey yarn characteristics and the treatment the yarn receives in the processes subsequent to spinning, particularly sizing. Many attempts have been made earlier to characterize the yarns for their weave ability either data on yarn quality or by simulation of weaving stress in laboratory [9].

In the weaving industry it is always emphasized to increase production and maintain quality of woven fabric so the mill can meet the demands of both national and international quality familiar consumers and markets [1]. Also Competitiveness is the main feature of the textile industry in future. The main issue is able to compete at international levels. In order to lower the production costs per meter of woven fabric the yarn breakages needs to be reduced at every stage of manufacturing the woven fabric. In weaving industry one of the most frequent facing problems is breakages of warp yarns which is not only reduce the production rate and also deteriorate the quality of the produced fabric. These breakages on the preparatory processes and also on loom produce lots of problems and become labor intensive. Lesser the number of warp yarn breakages lesser will be the defects. Therefore by reducing these breakages of warp not only increase the productivity of the processes involved to the production of fabrics including warping, sizing etc. maintain quality of the woven fabric can be increased but also reduces wastages of yarn, and energy ultimately the cost per meter/yard of the prepared fabric reduces [6].

1.2. Problem statement

During observation and interview in the Bahir Dar textile Share Company there are high warp yarn breakageson loom, due to improper tension, thin and thick places, contamination, knots and others factors . This leads to drop loom efficiency that is below 59.72%, therefore BDTSC losses 738.5 meter of fabric per hour per loomand 4430.8 meter of fabric per hour per 6 looms as well as 106339 meter of fabric per day per 6 looms, production cost per meter of fabric increases because when there are stoppages at the loom because of warp yarn breakages problem some cost will be need for repair, Constant warp yarn breakages on loom due to different problems also cause the wastage of yarn, constant breakage of warp yarn and definite knotting will damage the quality of fabric, when there is problem of warp yarn breakage constantly at the loom will be require additional man power to handle this situation, When there is warp yarn breakage due to this loom gets off again and again it will leave a "Starting Mark" at the surface of fabric and it effect the fabric quality, challenging as a defect for post-weaving operations

1.3. Research purpose and objectives

Purpose:

The purpose of this thesis is to assess the factors which causes and influence the yarn breakages on the loom. So, working on them to tell how BDTSC can improve or decrease the warp yarn breakage and to improve loom efficiency

Objectives:

- To Identify efficiency and production of loom
- To find the factors which causes and influence the yarn breakage on the loom,
- To identify which factors are the most frequently occurred on the loom,
- To give recommendation the possible solutions that might help to minimize the existing problem.

1.4. Significance of the study

The significance or importance of this study is to forward applicable solution and recommendation to the factors which causes warp yarn breakage on the loom for concerned body of Bahir Dar textile Share Company

Besides this it is believe that the finding of the study will:

- Help the company to increase loom efficiency
- Help the company to decrease production cost per meter of fabric
- Help the company to decrease man power requirement per loom
- Help the company to increase productivity
- Help the company to reduce Start Mark of fabric
- May help the fabric Convenience for post-weaving operations
- Serve as a basis for detail and future study for those who have the intention to make research on warp yarn breakage.

1.5. Justifications

This research is to distinguish the factors which causes the warp yarn breakage, differentiate which causes are the most frequently occurred and to recommend BDTSC to solve those causes, therefore loom efficiencies are increase, productivity of loom better, produce defect free fabric, to reduce production cost per meter as well as the fabric Convenience for post-weaving operations. Generally benefit the society by addressing a defect free product (bed sheet) with the optimum cost, and also to increase the effectiveness of BDTSC.

1.6. Implications and limitations

Implications:

After this study is completed the warp breakages on the loom in BDTSC will be minimizes, because of the company apply different adjustment parameters on the loom and yarn quality by receiving the researcher recommendation.

Limitation:

Although weft yarn breakage is equally a series problem, but this thesis only focus on warp yarn breakage due to time limitation.

1.7. Operational definition of terms

- **Warp sheet**: A sheet comprising up to several thousand ends that are combined to make up the warp during preparation for weaving or warp knitting.
- **Constant tension:**which includes the tension due to the relative movement of let-off and take-up motions. This tension comprises tension due to stretch and crimp and also do not causes warp breakage.
- **Cyclic tension:** which includes tension variation due to large shed opening and heavy beat up. Both causes warp breakage.
- **Transient tension:** is those tensions which may rise for a very short period of time and leads to breakage of warp yarns. This tension occurs when large knots unable to pass through the reed and when fibers or broken filaments or yarns are entangled.
- **Bending:** Maximum stress per unit area that a specimen can withstand without breaking when bent.
- **Abrasion:** yarnsurface wear and rubbing.
- **Stress:** The resistance to deformation developed within a specimen subjected to tension by external force.
- **Start Mark:** defects at the surface of fabric and it effect the fabric very badly

CHAPTER TWO
REVIEW OF LITERATURE

2.1. Warp breaks

Each element of yarn is subjected destructive actions a number of times during the weaving process [2]. As a result of this, the warp yarn is progressively fatigued and abrasion whilst abrading action accelerates yarn failure due to tensile deformation. The intensity of the destructive effect depends upon the magnitude of deformation, the extent to which the tension of the warp sheet varies and the frequency of the actions.

The sized yarn represents a system consisting of two distinct elements viz. the yarn and the size film, which react differently to a given action. Whereas rubbing affects the outside protective size file first, repeated extension affects both elements simultaneously. Both factors, however, represent complex action and they affect one another. Repeated extension weakens the size film at the faulty points in the yarn. The effect of rubbing being aggravated by the increased stress in the size film and fibers[2].

2.2. Analysis of warp breaks

The process of correctly analyzing all types of warp breakages is a tedious and lengthy task. So, it is necessary to classify the warp break under different headings.

Brown [3] classified the warp breaks under the eight headings which as follows.

1. **Knot:**literature indicates in cottonweaving, knots arethe causes of20-50% of the total warp breaks and inwoolen weaving upto 40% of the total breaks are due to the presence of knots. This is because, firstly the knot may slip or it may be break if it fails to pass through the healds, reed etc. secondly due to the scissoring action of knots, the adjacent warp threads are damaged [3, 4]and breaks are caused by the obstructions resulting from the action of knots on the yarn that creates abnormal tension in the obstructed threads [5]. The rigidity of protuberance on the yarn increased with the increase in size contact and this may increase the possibility of breaks. Breakage commonly occurs in the part of a thread that is at the greatest tension, which means, between the obstruction and healds. This type of breakages can be reduced by using spliced type joints in place of knots.

2. **Breaks due to impurities:** Fly which issized and flattened produces warp breaks by reason of its inability to pass through the reed dent, heald eyes and drop wires or flat-tened slubbecoming in the traps in the shedding zone.This type breaks occurs in the shedding zone as well as in the back zone.
3. **Chopped ends:** chopped ends which results in warp breaks are generally considered as such when they occur and reoccur adjacent to beam flanges. Severe treatment of bad handling of the weavers beam is the main cause of this type of breakages.
4. **Abrasion:** these breaks are usually confined to the shedding region with the majority occurring either in the healds or in the front shed. This is because, as mentioned earlier, the abrasive action of the loom is more in the heald –to-fell region, owing to the action the healds and the reed.
5. **Soft yarn:** thin or soft places are the region of weakness and some breaks occur at the weak places at the normal peak tension without any contribution from abnormal tension (resulting from obstruction) or disturbance of the yarn by abrasion.
6. **Twisted ends:** in this case two ends are twisted together tightly and compactly and considerable effort is required to effect separation. The frequency of occurrence of such fault is very low.
7. **Taped ends:** two or more number of ends sticking together also cause warp breaks. This is mainly due to faulty working at sizing.
8. **Unknown:** breaks for which there is no satisfactory proof as to their cause are recorded as known. According to Brown, 33% of warp breaks are due this cause.
9. **Tension:**The maximum warp tension during weaving should not exceed 5 to 6cN/tex, depending on yarn quality When applying typical warp tension will get many benefits like reduce the warp yarn breaks caused by low or high tension leading to decrease loom stops, Warp breaks cause longer stoppages as compared to weft breaks since they require more time for repair particularly when using 100% cotton yarn[21].

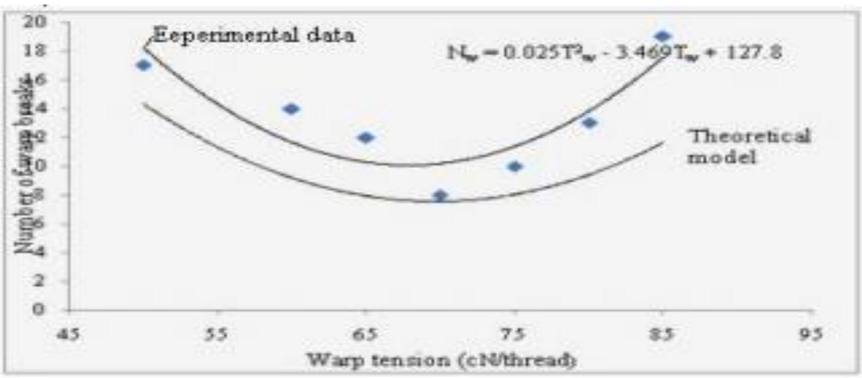


Fig .2.2.Warp breaks against warp tension curves, for experimental data and a theoretical model

The results obtained on varying warp tension at constant loom speed show that the number ofwarpbreaks whichoccurred during weaving were proportional to the tension ofthe warp (Figure 2.2). This was in agreement with Weinsdorferin Severine[22], who proved that the number of end breaks wasdirectly related to warp tension. Figure 2.2 shows that thenumber of warp breaks recorded at a tension of 50 cN is 17which is higher than the acceptable of warp breaks of notmore than 3.02[22]. This was because at low tension, the warp yarn was slack, and a clinging effect that subsequently led to more breaks was created.

2.3. Factors affecting the warp breaks

There are many factors which can affect the performance of yarn in weaving. The factors can broadly classified into the following classes.

I. Yarn quality
II. Quality of yarn preparation
III. Condition of loom and setting
IV. Atmospheric condition of weave room

2.3.1. Yarn quality

The warp breakages rate is relatively intensive in strength [5], but with a reduction in strength below a critical level, the warp breakage rate increases rapidly. Quality of the yarn is primary source influencing end breaks. A weak, fuzzy and non-uniform yarn will break very often. The requirement is strong, smooth, uniform yarn with high elongation at break to withstand the weaving stresses better, consequently improving the weave ability of yarn.

According to Vinzanekar and Ajgaonkar[7], during selection of warp yarn the following properties are needed to consider in order reducing breakages of yarns. These are as follows Twist in yarn, Tensile strength (Single yarn strength and Lea strength), Elongation, Hairiness, and Yarn imperfection (thin, thick places and neps).

2.3.1.1. Twist in yarn

There are two types of twist i.e. Z-twist or clockwise twist and other one is S-twist these directions of yarns have noeffect on the strength of yarn, elongation, luster, compressibility and compactness but affect the appearance the fabric.
Twist per inch can be calculated by T.P.I=T.F √cotton (Ne)

The strength of the yarn increases with the increase in TWIST FACTOR (T.F) so it reduces the yarn breakages but after certain limit this increment in the twist will reduce the strength of the yarn. Ultimately the yarn breakages rate will be high. So in order to reduce the yarn breakage there should be appropriate twist in the yarn. Staple yarn cannot be spun below a certain value of T.F. At low T.F yarns breaks mainly as result of fiber slippages. However, the T.F increases the angle of the fiber to the yarn axis increase as the strength of the yarn will decrease and yarn breakages rate will be high.

Twisting of fibers contraction in length when yarns twisted some of these tends to recover when the yarn faces tension so the elongation tends to increase with this twist factor. The strength of the yarn in increased and elongation is reduced by an increase in spinning tension, presumably because this produces a more compact and cohesive yarn. This reduction in elongation is not good when such yarns are subjected to the weaving. The rate of ends thus will increase and productivity and quality will be affected. So to reduce the breakages rate the appropriate T.F is used which does not affect the elongation.

The twist of the yarn also affects the size absorption by the yarn. The number of twist in yarn is inversely proportional to the absorption of yarn i.e. high the twist less will be the absorption. This factor is most important before the selection of the yarn otherwise the yarn will not get the sizing paste into its core and yarn strength also other purposes of the sizing will not obtain. Ultimately the yarn breakages rate will be high.

2.3.1.2. Strength of yarn

This is one of the most important factor which influence yarn breakages. It is the force in grams weight or pound required to break the yarn. It is calculated either by one of the following method.

- ✓ Single yarn tensile strength
- ✓ Lea strength

In weaving each yarn is important because every yarn has to withstand high stress strain during different processes. The yarn should have good strength otherwise it will affect the efficiency of machine and quality of the fabrics. CV% of single yarn strength influences warp stoppages more than any other factor. Higher the single yarn strength lesser will be the yarn breakages. Single yarn strength variability should not exceed 8 % and variability of single yarn twist should not exceed 6% if optimum performance is required.

Lea strength is strength of 120 yards of yarn made on warp reel his lea is tested on the strength tester. Lea strength is also considered during selection of the yarn for the manufacturing of fabric. Higher the lea strength lesser will be the yarn breakages. It can be calculated by the following formula

Lea strength (C.L.S.P) = count × weight in lbs

2.3.1.3. Elongation

The factor of elongation plays a very critical role in reduction of the yarn breakages. The elongation depends upon the length of the fiber and also on T.P.I. different yarns have individual values of elongation. For instance cotton has elongation of 6-7% which gives good power to the yarn against breakages. The elongation of yarn play part in each of the preparatory process e.g. cone winding, warping, sizing and weaving on loom. The sized warp sheet of cotton yarn always should have 4-5% elongation to avoid breakages on loom.

2.3.1.4. Hairiness

The yarns which are spun from the higher percentage of short or medium staple length have high ratio of hairiness. The yarn used for the weaving should also have very low hairiness and uniform distribution of hairs throughout the length of yarn. The remaining hairiness of the yarn is sticked onto the yarn with the help of sizing paste. The yarns with minimum hairiness have low yarn breakage and quality of the fabric is also good. So during selection of yarn this factor should be considered and hairiness of the yarn should be tested on the hairiness determining apparatus, so breakages may control and quality of the end product may consistent. Yarn unevenness affects fabric appearance and should preferably be around 12% - 15 %, U% depending on whether we are using combed yarn or carded yarn. Doubled yarns should have significantly lesser U% and lesser number of yarn defects.

2.3.1.5. Yarn imperfections (thick places, thin places &neps)

The yarn imperfection includes thin places, thick places and neps which have great influence on the yarn breakage and quality of the fabric. It is generally observed that all thick and thin places in the yarns are weak places, because at think place there is no T.P.I and at thin place more T.P.I than normal while neps in the yarn are either due to presence of immature fibers or due to poor carding operation. Neps tend to create FUZZ during shedding due to their breakage of protruding fibers by interfiber friction. Another quality affecting fabric appearance is yarn imperfections - particularly “neps”. These should not exceed 1000 - 1200 per km for carded yarns and 300 per km for combed yarns. The neps/unit length are measured on the apparatus known as “YARN IMPERFECTION TESTER”

2.3.2. Quality of yarn preparation

Given a quality of yarn, the end breaks during weaving are increased by preparatory deficiencies such as uncleared yarn fault, undersized beams, excessively stretched yarn etc.
One of the important objectives of winding is to remove objectionable yarn faults, which if not removed will show up as fabric defects or will cause an end break in successive processes, particularly in weaving. The quality of knot is very important for keeping the end breaks low

during warping and weaving [6]. Besides slipping, a knot can cause end break in weaving because of its big size when it will cause series obstructions as it pass through a heald eye or reed dent, its tail end causing entanglements With neighboring warp ends.

In warping we should aim at minimizing end breakage rate and the production of satisfactory beams that will unwind well during sizing. The stoppage of the machine due to an end break is likely to deteriorate the quality of the beam. The sizing of yarn is absolutely essential to render it weavable, without sizing the end breakage rate of warp, particularly in the case of single yarns, is so high that weaving becomes impossible.

2.3.3. Condition of loom and setting

The mechanical condition of loom parts which directly come in contact with the warp and settings of loom motions and mechanisms have a great influence on the warp breakage rate in weaving. Some important factors as recommended by BTRA [8]are as follows.

1. **Depth of shed and shed timing:** adjustment of shed lines and extent of opening of the shed influence end breaks during weaving significantly. More depth of shed than necessary and to early shed timing lead to a high number of end breaks.
2. **Reed alignment:** reed alignment influences shuttle flight and erratic shuttle flight damage the reed and shuttle. Both the damages reed and shuttle, increases end breaks.
3. **Jerky shedding:** the movement of warp during shedding should be smooth. Jerky movement is one of the main causes of a high end breaks during weaving.it introduces stresses of very high amplitude in the yarns and may lead to more end breaks.it is caused by tightness/slackness in shed connections.
4. **Excessive crowding of ends in reed dents:** in high density fabrics large proportion of warp breaks take place because of abrasion of yarn with yarn and loom parts and yarn entanglement. In such cases variable staggering of healds can effectively use to reduce warp breaks.
5. **Mechanical condition of loom parts:** loomparts such as healds, reed, and race board are in direct contact with the warp and may wear out with time due to constant abrasion with the moving yarns.
6. **Improper functioning of warp stop motion:** Improper functioning of warp stop motion is a source of multiple end breaks.

7. **Use improper temples:** excessive widthwise contraction of the cloth on a loom due to improper temples causes excessive abrasion of the selvedges ends with the reed dents and excessive stretching of selvedge yarns. It therefore leads to many selvedge end breaks.
8. **Improper loom cleaning:** fly and dustcollected ondrop wires, healds, reed and fly on warp sheet at rear side of the loom should be removed from time to time.

2.3.4. Atmospheric condition of weave room

The amount of moisture that the atmosphere can hold increases with its temperature so that warmer air can hold more water than cold air. The converse of this is that when air containing moisture is cooled, a temperature is reached at which the air becomes saturated. At this point moisture will condense out from the atmosphere as a liquid: this temperature is known as the dew point. When considering the effects of atmospheric moisture on textile materials the important quantity is not how much moisture the air already holds, but how much more it is capable of holding. This factor governs whether fibers will lose moisture to or gain moisture from the atmosphere [10].

The capacity of the atmosphere to hold further moisture is calculated by taking the maximum possible atmospheric moisture content at a particular temperature and working out what percentage of it has already been taken up. This quantity is known as the relative humidity (RH) of the atmosphere and it can be defined in two ways. In terms of the mass of water vapor in the atmosphere:

$$\mathrm{R.H}\ \% = \frac{Mass\ of\ water\ in\ given\ volume\ of\ air\ x\ 100}{\text{Mass of water vapor required to saturated this volume at same temperature}}$$

Alternative it can also be defined as the ratio of the actual vapor pressure to the saturated vapor pressure at the same temperature expressed as a percentage.

$$RH\ \% = \frac{\text{Actual vapor pressure x 100}}{\text{Saturated vapor pressure}}$$

The absolute humidity is defined as the weight of water present in unit volume of moist air measured in grams per cubic meter. It is important to note that the relative humidity of the atmosphere changes with temperature even when the total quantity of water vapor contained in the air remains the same the dotted line below figure shown the increase in the atmosphere with increasing temperature for a constant relative for a constant relative humidity of 65%.[10]. Correct ambient conditions are essential to prevent degradation of textiles materials during a series of operations right from beating in blow room to weaving fabric at loom shed or knitting the fabric or producing non-woven sheets. Fibers should have requisite properties so that the final product retains its basic shape, size and strength. In case of weaving, as the warp yarns are coated with size films, the environment should be suitable for the size film on the yarn. Too low humidity makes size film brittle resulting in cracking of the film, where as too high humidity makes the beam soft. During rubbing of yarn with several parts of loom such as heald, reeds etc.[11]

The size film is getting scrubbed off making the yarn bare. The bare yarn does not withstand wear during weaving and breaks. Thus both high and low RH % will detrimental to weaving operation. Correct RH % is therefore essential from several such technical requirements. Adequate yarn humidity (moisture in yarn) is needed to enhance the strength and the elasticity and to have smooth yarn surface. Both tensile strength and elasticity depend on fiber and spinning characteristics, on warp pre-treatment (sizing) and increase with moisture content of the yarn being fed into weaving process. Moisture content smoothens the hairs and lubricates the yarn surface.

Abrasion between yarns, mainly in the shed area, removes short fibers (lint) and size dust from the warp yarn. Adequate yarn moisture reduces the fall out. While weaving, the yarn absorbs water from the air. Lint and dust falling out from the yarn are incorporated into the room air. Power consumed by the loom and other devices in the room is converted into heat and incorporated into the room air. This heat evaporates the moisture from yarn.

Previous results show that yarns perform best in weaving machines when their moisture content is 7 – 9 % (parts of water in 100 parts of dry yarn). Less moisture reduces strength, elasticity and smoothness. Higher moisture may make the size glue the warp yarns together. Therefore, there is a need to humidify the area with suitable controls. [13]

According to B.Purushotham[13], the general reasons for controlling RH % and temperature in a textile mill

- Dry air causes lower regain and this contributes to poor quality and lower productivity.
- Yarns with low moisture content are weaker, thinner, more brittle, and less elastic, create more friction and are more prone to static electrification.

- Materials at optimum regain are less prone to breakage, heating and friction effects the handle better, have fewer imperfections are more uniform and feel better.
- Higher humidity reduces static problems. Reduced static makes materials more manageable and increases machine speed.
- Textile weights are standardized at 60% RH and 20°C. Low humidity causes lower material weights and lowered profits.
- Low humidity causes fabric shrinkage. Maintained humidity permits greater reliability in cutting and fitting during garment creation and contributes to the maintenance of specifications where dimensions are important, such as in the carpet industry.
- Humidification reduces fly and micro dust, giving a healthier and more comfortable working environment.

The proper levels of relative humidity and temperature should be maintained in weaving shed for satisfactory loom performance. These levels are relative humidity 75-80% and temperature 25 to 27° C for 100% cotton yarn and 65-75% RH and temperature 25-27° C for polyester blended yarn. [12]

2.4. Secondary date of loom efficiency and causes of warp breaks in BDTSC

According to quality control office of Bahir Dar Textile Share Company it can obtained the following secondary data.

Table 2.4.1.Loom efficiency and production of BDTSC per hour per 60 loom

Loom number	107	207	108	208	109	209	1604	1704	1605	1705	1801	1901
Efficiency	40%	61%	51%	38%	86%	62%	73%	72%	64%	82%	85%	62%
Production in meter	733	1131	935	705	1576	1136	1338	1320	1173	1503	1558	1136
Loom number	1802	1902	1803	1903	2104	2204	2105	2205	1806	1906	1805	1905
Efficiency	74%	87%	89%	86%	83%	19%	33%	57%	72%	74%	76%	71%
Production in meter	1356	1595	1631	1576	1521	348	605	1045	1320	1361	1393	1301

Loom number	1904	1601	1602	1702	1603	1401	1501	1502	2501	2601	2602	2603
Efficiency	75%	70%	58%	37%	33%	48%	35%	34%	82%	39%	54%	42%
Production in meter	1375	1283	1063	678	605	880	641	623	1503	715	990	770
Loom number	1706	1606	2301	2401	2302	2402	2303	2403	2001	2002	1201	1301
Efficiency	94%	87%	80%	70%	88%	49%	38%	58%	37%	61%	25%	36%
Production in meter	1723	1595	1479	1294	1613	898	696	1078	678	1225	463	660
Loom number	1202	1302	1203	1304	2106	2101	2201	2102	2202	2003	2004	2005
Efficiency	38%	42%	26%	36%	50%	31%	38%	42%	44%	64%	50%	64%
Production in meter	696	770	476	660	920	583	707	781	806	1175	916	1173

Table 2.4.2. Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number										
		107	207	108	208	109	209	1604	1704	1605	1705	
		F	F	F	F	F	F	F	F	F	F	Total
1	Crossed end	9	7	10	6	7	11	5	8	13	7	83
2	Thin and Thick end	32	56	38	42	58	23	40	47	27	34	387
3	Contamination	7	6	10	5	9	7	6	8	11	7	76
4	Oil warp	1		1			1		1		1	5
5	Knots	96	72	87	88	76	65	66	78	86	69	783
6	Taped ends	1	1		1		1	1		2	1	8
7	Wrong drawing- in	3	5	4	2	3	5	2	3	4	2	33
8	Tension	17	14	18	13	12	15	14	16	14	17	150

9	Abrasion	6	8	7	5	9	10	7	11	8	6	77
10	Leno bobbin change	4	6	5	7	6	5	8	4	5	4	54
11	Chopped ends	1	3	1	2	1	1	2	1	2	1	15
12	Fluff dirt or dust	4	3	5	2	3	5	2	4	3	5	36

Where F= frequency

Table 2.4.3. Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number										
		1801	1901	1802	1902	1803	1903	2104	2204	2105	2205	
		F	F	F	F	F	F	F	F	F	F	Total
1	Crossed end	6	9	10	5	4	8	6	9	11	8	76
2	Thin and Thick end	40	32	19	45	38	29	22	28	41	31	325
3	Contamination	9	9	8	5	8	10	8	8	9	11	85
4	Oil warp		1			2		1		1		5
5	Knots	54	99	101	62	92	36	98	92	69	62	765
6	Taped ends	1		1		1		1	1	1	1	7
7	Wrong draw-ing- in	2	3	2	4	3	2	1	2	3	3	25
8	Tension	12	15	11	14	10	19	13	17	16	14	141
9	Abrasion	8	5	9	6	7	10	7	6	8	9	75
10	Leno bobbin change	3	6	8	5	7	4	3	6	5	7	54
11	Chopped ends	1	2	1	3	1	1	2	1	1	2	15
12	Fluff dirt or dust	3	2	5	4	2	6	2	3	4	3	34

Table 2.4.4. Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number									
		1806	1906	1805	1905	1904	1601	1602	1702	1603	
		F	F	F	F	F	F	F	F	F	Total
1	Crossed end	9	9	13	7	6	12	11	8	7	82
2	Thin and Thick end	51	53	17	34	26	54	25	31	27	318
3	Contamination	6	9	7	11	8	9	6	9	8	73
4	Oil warp	1		1			1			1	4
5	Knots	85	77	63	65	73	94	82	86	72	697
6	Taped ends		1	1	1		1	1	1	1	7
7	Wrong drawing-in	4	3	4	3	5	3	2	4	3	31
8	Tension	13	16	15	12	11	18	19	12	14	130
9	Abrasion	8	7	6	7	6	7	9	5	7	62
10	Leno bobbin change	4	6	5	3	8	5	6	5	6	48
11	Chopped ends	2	1	1	1	3	1	2	2	1	14
12	Fluff dirt or dust	4	3	4	4	3	4	3	5	3	33

Table 2.4.5. Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number									
		1401	1501	1502	2501	2601	2602	2603	1706	1606	
		F	F	F	F	F	F	F	F	F	To-tal
1	Crossed end	5	4	6	11	5	3	7	9	4	54
2	Thin and Thick end	29	34	41	54	25	30	24	32	22	291
3	Contamination	4	6	7	6	9	10	10	8	7	67

4	Oil warp		2		1			1		1	5
5	Knots	73	61	82	68	78	82	83	76	85	688
6	Taped ends	1		1	1	1	1	1	1		7
7	Wrong draw-ing- in	3	4	5	2	3	3	4	3	5	32
8	Tension	16	15	17	14	13	17	13	18	14	137
9	Abrasion	9	6	7	8	9	7	6	8	7	67
10	Leno bobbin change	7	6	5	4	5	7	5	8	6	53
11	Chopped ends	1	1	2	1	2	1	3	1	1	13
12	Fluff dirt or dust	4	3	4	3	4	4	5	3	4	34

Table 2.4.6. Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number								
		2301	2401	2302	2402	2303	2403	2001	2002	
		F	F	F	F	F	F	F	F	Total
1	Crossed end	6	9	7	11	7	11	8	13	72
2	Thin and Thick end	44	35	38	94	57	46	72	61	447
3	Contamination	8	9	7	5	6	11	9	8	63
4	Oil warp	1	1		2		1		1	6
5	Knots	72	82	65	68	88	86	82	69	612
6	Taped ends	1	1		1	1	1	1	1	7
7	Wrong draw-ing- in	3	3	4	3	4	4	3	4	28
8	Tension	15	18	17	13	19	14	12	16	123
9	Abrasion	7	6	7	9	9	6	7	8	59
10	Leno bobbin change	5	4	7	6	5	8	6	5	46
11	Chopped ends	3	1	1	2	1	1	2	1	12
12	Fluff dirt or dust	5	4	3	4	3	4	5	4	32

Table 2.4.7. Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number							
		1201	1301	1202	1302	1203	1304	2106	
		F	F	F	F	F	F	F	To-tal
1	Knot	8	6	8	9	6	7	10	54
2	Thin and Thick end	26	33	42	65	46	37	25	274
3	Contamination	7	8	6	6	5	8	9	49
4	Oil warp		1		2	1	1	1	6
5	Crossed end	90	88	77	72	92	65	94	578
6	Taped ends		1	1	1	1	1	1	6
7	Wrong drawing- in	3	4	2	3	3	4	2	21
8	Tension	18	15	17	16	15	16	19	116
9	Abrasion	8	6	7	9	8	7	8	53
10	Leno bobbin change	7	6	4	9	7	8	6	47
11	Chopped ends	1	2	1	2	1	2	2	11
12	Fluff dirt or dust	5	4	5	4	5	4	4	31

Table 2.4.8. Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number							
		2101	2201	2102	2202	2003	2004	2005	
		F	F	F	F	F	F	F	Total
1	Crossed end	7	5	4	8	6	9	4	43
2	Thin and Thick end	34	44	38	32	72	52	44	316
3	Contamination	8	7	6	5	8	9	7	50
4	Oil warp	1		1			1		3
5	Knots	86	78	82	92	79	88	84	589
6	Taped ends	1	1	1	1	1	1	1	7
7	Wrong drawing- in	4	2	3	4	3	4	3	23
8	Tension	17	14	16	15	15	16	16	109
9	Abrasion	8	9	11	7	8	6	9	58
10	Leno bobbin change	6	4	5	7	6	7	6	41
11	Chopped ends	2	1	2	1	2	1	3	12
12	Fluff dirt or dust	4	5	4	3	4	5	4	29

CHAPTER THREE
RESEARCH METHOD AND MATERIALS

3.1. The Research Method

Descriptive survey design were employee, as it is the appropriate method to assess.

3.2. Types of data it was collected

The data it was collected from the company are causes of warp breakages, breakage rate, loom stoppages, and yarn parameters.

3.3. Sources of Data

- Primary data were obtained from direct observation that is the researcher recorded the breakage rate one hour per day for five consecutive days about 6 looms.
- Interview with weaving department head, shift leader and operators.
- Secondary data were obtained from document.

3.4. Sample and Sampling Techniques

According to Bahir Dar Textile Share Company there are 66 air jet looms working within the department. Totally 6 looms were selected, out of 66 weaving machine, using simple random sampling technique.

3.5. Data Collection Instruments

Observation

Direct observation is a method by which, recorded the information to the condition by watching what factors are influence the warp breakage on the loom.

Interview

Interview were conducted to collect more supplementary information about what factors which influence on the warp yarn breakage from weaving department head, shift leader and operator, so as to crosscheck the information obtained by direct observation.

3.6. Procedures of Data Collection

The direct observation and interview guides were prepared based on the literature reviewed. Before the data collection, permission was requested from the Bahir Dar Textile Share Company. After permission obtained, the researcher conducted observation about which causes are influence warp breaks attentively. And also the researcher was crosschecked the information by conducting the interview.

3.7. Method of Data Analysis

After it was collected enough data, analyzed the fresh data by using frequency, cumulative frequency, cumulative percent and Pareto chart.

3.8. Machine parameters

Air Jet Looms in Bahir Dar Textile Share Company at average loom speed of 550 revolutions per minute (550rpm), using a reed width of 1.6m, and producing a fabric with 24 ends per centimeter (24 ends/cm).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Identification of Loom efficiency and production

$$efficiency = \frac{\text{total picks} * 100}{\text{rpm} * 60}$$

Total picks = stop counter – start counter

$$\text{Pm} = \frac{\text{rpm} * \text{eff} * 60}{\text{ppc} * 100}$$

Where P_m = production in meter

Rpm = machine revolution per minute

Ppc = picks per centimeter

Eff = efficiency

To calculate the efficiency and production of 6 looms for one hour have obtained the following results.

Table 4.1 loom efficiency and production per hour

Loom number	1	2	3	4	5	6
Efficiency	60.04%	58.56%	44.8%	53.38%	72.4%	69.14%
Production in meter	1199.8	1123.79	830.6	1119.3	1388.7	1491.5

Fig 4.1.1 loom efficiency per hour

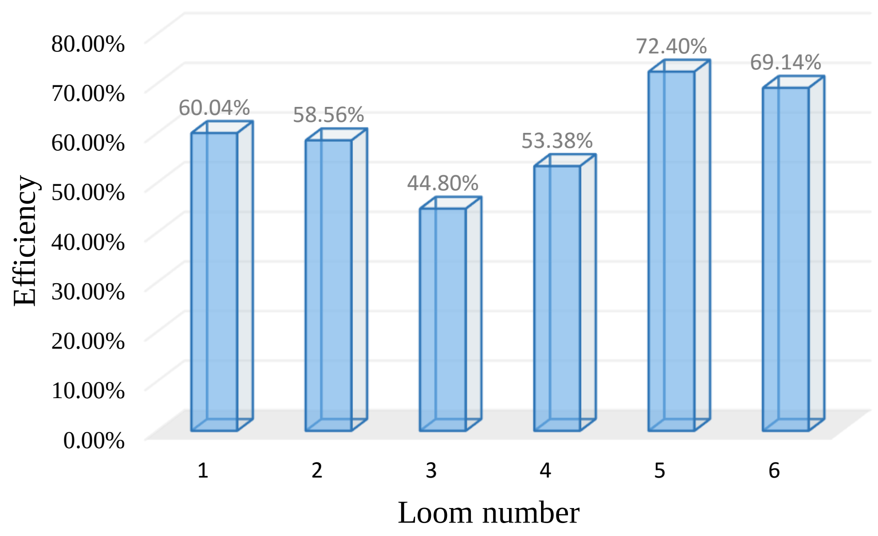
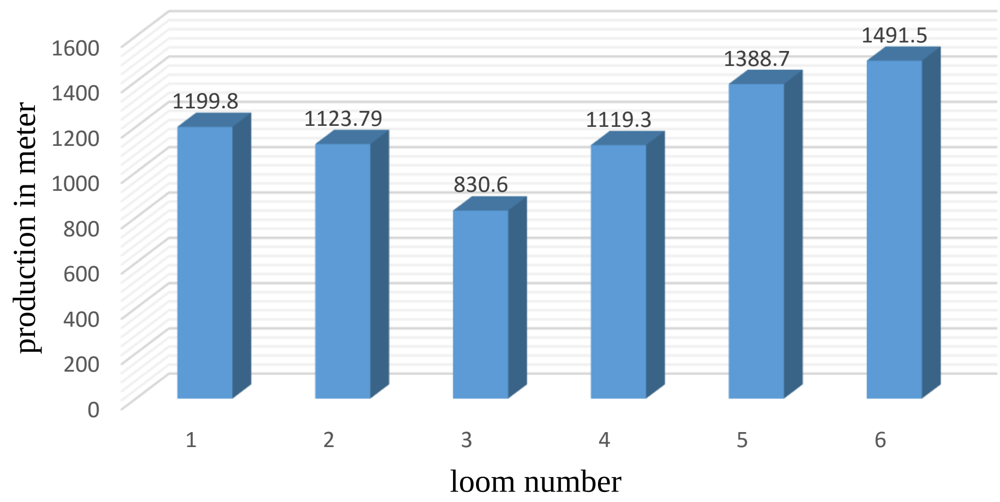


Fig 4.1.2 production in meter per hour



$$average\ \ efficiency = \frac{\text{eff of loom1} + \text{eff of loom2} + \ldots\ldots\ldots + \text{eff of loom6}}{6}$$

$$= \frac{358.32}{6} = 59.72\%$$

The above data shows that the average loom efficiency were low that is 59.72%, therefore BDTSC loss 738.5 meter of fabric per hour per loom, 4430.8 meter of fabric per hour per 6 looms as well as 106339 meter of fabric per day per 6 looms, loom stoppages during the weaving process occur as a result of warp breaks, weft breaks, mechanical breakdown, electrical faults, beam gaiting, shortage of spare parts, power cuts, beam changing, cleaning, oiling and lubricating. Amongst these warp breaks occur more frequently than the rest. in relation to this problem, quality of fabric were declined, different defects of fabric created, additional man power needed, as well as cost of production were increased.

4.2. Factors which causes and influence the warp breakage on the loom in case of BDTSC

During direct observation the researcher have recorded the breakage rate of the causes that influence the warp breakage on the loom in case of BDTSC about 6 looms, and recorded one hour per day for five consecutive days at a similar parameters, and obtained the following results.

Table 4.2.Factors which causes and influence the warp breakage in case of BDTSC

NO	Causes	Loom number						
		1	2	3	4	5	6	Total
		F	F	F	F	F	F	
1	Crossed end	2	0	2	1	0	6	11
2	Thin and Thick end	5	4	4	4	0	2	19
3	Contamination	0	1	1	0	1	1	4
4	Oil warp	0	0	0	0	0	1	1
5	Knots	5	7	3	5	5	6	31
6	Taped ends	0	0	0	0	1	0	1
7	Wrong drawing- in	0	0	0	0	1	2	3
8	Tension	4	4	3	0	1	4	16
	Abrasion	1	4	0	1	2	1	9
10	Leno bobbin change	1	0	1	0	0	0	2
11	Chopped ends	0	0	2	0	0	0	2
12	Fluff dirt or dust	5	1	0	3	1	0	10

4.3. Identify which factors are the most frequently occurred on the loom

Table 4.3. Cumulative frequency of causes and influence the warp breakage in case of BDTSC

No	Causes	Frequency	Cumulative frequency	Cumulative %
1	Knot	31	31	28.44%
2	Thin and Thick end	19	50	45.87%
3	In appropriate tension	16	66	60.55%
4	Crossed end	11	77	70.64%
5	Abrasion	10	87	79.82%
6	Fluff dirt or impurities	9	96	88.10%
7	Contamination	4	100	91.74%
8	Wrong drawing- in	3	103	94.50%
9	Leno bobbin change	2	105	96.33%
10	Chopped ends	2	107	98.20%
11	Taped ends	1	108	99.10%
12	Oil warp	1	109	100.00%

From the data It was observed that29.06 warp breaks per loom occurred within a period of 8hours, against an acceptable number of breaks which should be less than 0.4 per 1000 warp threads and 100 000 picks, as recommended by the International Standard Organization (ISO 1150 and 441), Which gives 4.06 acceptable warp breaks for 8 hours. When weaving for a period of 8hours at a loom speed of 550 revolutions per minute (550 rpm),using a reed width of 1.6 m, and producing a fabric with 24 ends per centimeter (24 ends/cm), the acceptable number of warp breaks for 100% cotton yarn was calculated as follows:

Total number of ends in a 1.6 m fabric width

= 24 ends/cm × 160 cm

= 3840 ends.

An acceptable number of warp breaks in 3840 ends and 100 000 picks inserted

= (3840 ends÷1000 ends) × 0.4

= 1.536 breaks

The time taken by a loom running at 550 rpm to insert 100000 picks is given by;

(100 000 picks÷550 picks/ min)

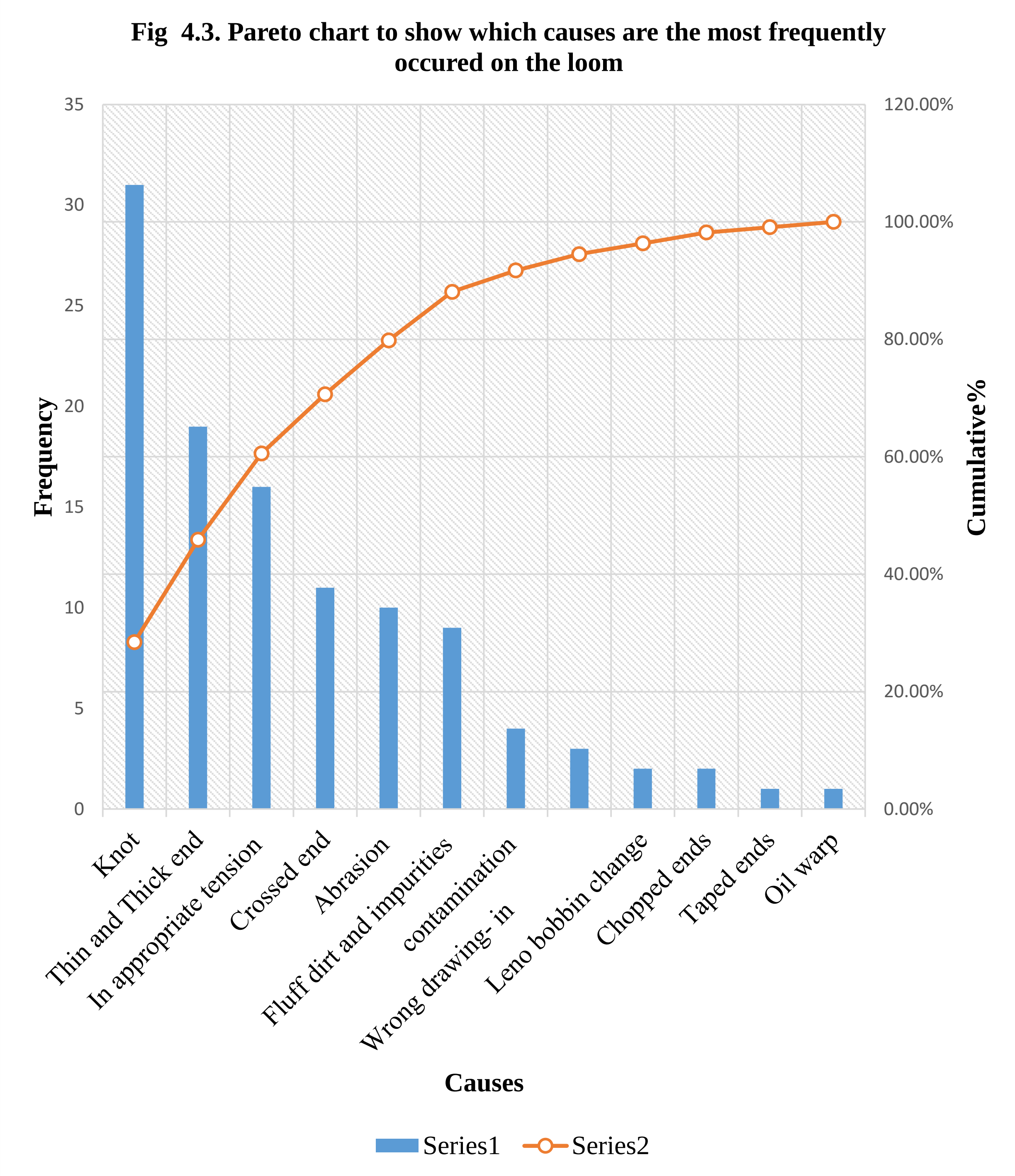
= 181.8mins

= 3.03hours

That is, for looms used for the study, the acceptable warp breaks in 3.03hours is 1.536, which means that in 8hours , warp breaks should not be more than;

(8 hours ÷3.03 hours) × 1.536 breaks

= 4.06 breaks



The chart shows that 88.10% of warp breakages from the total are produced by 50% of the causes that is knot (28.44%), thin and thick end (17.43%), and tension (14.67%), cross end (11.1%), abrasion (9.2%), and Fluff dirt or impurities (8.25%). Therefore it can be inferred that if Bahir Dar Textile Share Company able to solve the most frequently occurring causes, 88.10% of the warp yarn breakage problems will be eliminated.

The first factor which causes warp breaks is knot, majority of breaks (28.44%) from the total during weaving are directly or indirectly due to the presence of knot. firstly the knot may slip and it may be break it fails to pass through the heald, reed etc. secondly due to the scissoring action of knots, the adjacent warp threads are damaged and breaks are caused by the obstructions resulting from the action of knots on the yarn that creates abnormal tension in the obstructed threads. The rigidity of protuberance on the yarn increased with the increase in size contact and this may increase the possibility of breaks. Breakage commonly occurs in the part of a thread that is at the greatest tension, which means, between the obstruction and healds.

The second factor which causes warp breaks is thick and thin end (17.43%) from the total, thick end is a warp end having diameter larger than normal can cause warp breaks when passing through the drop wires, heald wires or reed and thin end is a warp end having diameter laser than normal containing less number of fibers forms a potential weak point affecting the strength of the yarn. Both long thick and thin end increase with wider back zone setting in ring frame [15]. The probable reason for the increase in long thin and thick end at wider back zone setting could be the relatively high level of short fiber content in cottons is supposed to result in some uncontrolled fiber movement in the back zone. This uncontrolled fiber movement creates mass variations at the back zone which are extended in length by the amount of draft in the main zone of ring frame. Hence, these mass variations are counted as infrequent long thick and thin faults.

The third causes which influence warp breaks is improper tension,low yarn tension creates a clinging effect, resulting in yarn breaks. As a result, the number of picks inserted was very low due to more loom stoppages which lead to the reduction in loom efficiency. Further increase in tension above 70 cN resulted in more warp breaks as the warp yarn was being subjected to more tensional force and stress[16]. Breakage of warp yarns occurs if the warp tension is too high. In contrast, if the warp tension is too low, warp yarns attend to jam and then break. Furthermore, a too low warp tension leads to an unclean shed formation. A clear shed is needed in order to have less problem of weft insertion.

The forth causes which influence warp yarn breakage is crossed end, which is produced due to the reason of loose warp, during tying of broken ends and defective knotting after breakage of yarn.

The fifth causes which influence warp breaks is abrasion, at low-twist, fibers can easily be removed from the Yarn so that it is gradually reduced in diameter. At high twist levels the fibers are held more tightly but the yarn is stiffer so it is unable to distort under pressure when being abraded. An increase in yarn hairiness, due to the higher level of protruding fibers from yarn surface, reduces fabric abrasion resistance.

The **s**ixth causes which effect Warp breaks is fluff dirt and impurities either spun along with the yarn or loosely embedded on the yarn due to the reason of more breaks in winding and warping, accumulation of fluff over machine parts, Fanning by workers and failure of overhead cleaners. Fly which is sized and flattened produces warp breaks by reason of its inability to pass through the reed dent, heald eyes and drop wires or flattened slub becoming in the traps in the shedding zone.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATION

5.1. Conclusions

- Based on the findings of the study, the following conclusions were drawn
- Crossed end, Thin and Thick end, Contamination, Oil warp, Knots, Taped ends, Wrong drawing-in, Tension, Abrasion, Leno bobbin change, Chopped ends, and Fluff dirt or impurities are the major causes which influence warp yarn breakage on loom.
- It was concluded that the 88.10% of warp breakages from the total are produced by 50% of the causes that is knot (28.44%), thin and thick end (17.43%), and tension (14.67%), cross end (11.1%), abrasion (9.2%), and Fluff dirt or impurities (8.25%).
- Therefore it can be inferred that if Bahir Dar Textile Share Company able to solve the most frequently occurring causes, 88.10% of the warp yarn breakage problems will be eliminated.

5.2. Recommendation

According to Sushil S. Badgujar, P.P.Raichurkar, Sachin Kulkarni, L.C.Patil&TusharPatil [14], a knot must be strong enough to withstand the cyclic tension and abrasion during weaving and at the same time it must be small enough to pass through the dent of the reed without jamming and it must be unaffected by its interaction with the reciprocating reed wires.

1. Strength of the knot should be enough sufficient that it should withstand the stresses and strain during weaving and it should not be slipped.
2. The size of the knot should be as minimum as possible since that it should pass through the heald eyes, reed dents.
3. The tail length of knot should be less about 1-2mm hence that it should not cause entanglement with another end.
4. Avoid more re-winding as it leads to more knots and adds to Yarn Hairiness also.
5. Package quality should be checked at rewinding.
6. Smaller package at rewinding should be avoided.

Better quality of knotting ensures the better performance of loom with respect to minimum end breakages which leads to cause improvement in efficiency.

It is necessary to keep the number of thin and thick places at minimum level for cost reduction and improved post spinning efficiency.
Some mechanism / method is devised to control the movement of short fiber in back zone and thereby to control the tendency of thick and thin end to increase with wider back zone setting, between 51mm and 60mm of back zone settings the increase is rather statistically significant[15].

The optimum range of warp tension ranges between 65 cN and 70 cN, with 70 cN registering the lowest number of warp breaks [16]. At 70 cN, the tension in the warp was high enough to prevent yarn entanglement and at the same time not excessive to impose more stress on the yarn and cause lots of breaks [16]. When applying typical warp tension will get many benefits like reduce the warp yarn breaks caused by low or high tension leading to decrease loom stops, thereby increase productivity, on other hand to improve cloth specifications through increase cloth resistant to friction and tensile stresses and thus improve product quality.

In order to improve crossed end during weaving, the company should be use fault free knotting and tension should be controlled.
There is an optimum amount of twist in a Yarn to give the best abrasion resistance.Compact yarn have higher abrasion resistance values compared to the ring yarn [19]. Since the fibersof compact yarns are held more tightly within the yarn structure and higher participation of the fibers into the yarn structure exists, compact yarns have a denser and closerstructure compared to the ring yarns. The compact yarn has lower hairiness, high tensile resistance as a result of that fiber movements causing limited abrasion [19, 20].

Malfunctioning of humidification plant, Machinery surfaces to be kept clean by using roller pickers, Fanning by workers to be avoided, Performance of overhead cleaners and humidification plants to be closely monitored.

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Appendix-I

Data gathered through Observation about Warp breakage study in case of Bahir Dar Textile Share Company

Date 29/08/2010 Temperature (c^{o}) 21.9 Relative humidity 66%

Start hour 2:00 Stop hour 3:00 Duration of test 1 hour

	Loom number	1	2	3	4	5	6	Total
Warp breaks causes	Rpm	675	625	530	666	575	700	
	Stop counter	154355	155886	99026	89786	147881	186920	
	Start counter	124673	128846	78663	56861	117875	147410	
	Number of picks	29682	27040	20363	32925	30006	39510	
	Efficiency	73.28%	72.1%	64%	82.4%	86.97%	94.1%	
	Production in meter	1648.8	1502	1130.67	1829.28	1666.9	2195.67	9973.3
	Knot		2		3	1		6
	Thin and thick end	1	1	3	1			6
	Abrasion	1						1
	Inappropriate tension			1				1
	Taped end							
	Fluff and dirt		1			1		2
	Chopped end							
	Cross end							
	Leno bobbin change	1						1
	Contamination					1	1	2
	Oil warp							
	Wrong drawing – in						1	1
Total	Warp breaks/loom	3	4	4	4	3	2	20

Date 30/08/2010 Temperature (c°) 24.2 Relative humidity 60.5%

Start hour 3:00 Stop hour 4:00 Duration of test 1 hour

Warp breaks causes	Loom number	1	2	3	4	5	6	Total
	Rpm	600	650	600	700	600	700	
	Stop counter	178443	153763	109015	70415	161014	258771	
	Start counter	148587	146277	97210	46493	136306	219496	
	Number of picks	29856	7486	11805	23922	24708	39275	
	Efficiency	83%	19%	33%	57%	69%	93.5%	
	Production in meter	1660	411.67	660	1330	1380	2181.67	7623.34
	Knot	1	1		2	2	1	7
	Thin and thick end	1	3	1	1			6
	Abrasion	1			1			2
	Inappropriate tension						1	1
	Taped end					1		1
	Fluff and dirt						1	1
	Chopped end							
	Cross end			1				1
	Leno bobbin change							
	Contamination							
	Oil warp							
	Wrong drawing – in					1		1
Total	Warp breaks/loom	3	4	2	4	4	3	20

Date 01/09/2010 Temperature (c°) 20.6 Relative humidity 67.6%

Start hour 9:40 Stop hour 10:40 Duration of test 1 hour

Warp breaks causes	Loom number	1	2	3	4	5	6	Total
	Rpm	580	400	480	500	550	550	
	Stop counter	85202	72809	48958	82615	89453	66262	
	Start counter	60781	58971	38273	71998	73583	54633	
	Number of picks	24421	13838	10685	10617	15870	11629	
	Efficiency	70%	58%	37%	35%	48%	35%	
	Production in meter	1353.34	773.34	592	583.4	880	641.67	4823.75
	Knot	1	1	1		1		4
	Thin and thick end							
	Abrasion	1	1		1	1		4

	Inappropriate tension			1				1
	Taped end							
	Fluff and dirt	1	1		1			3
	Chopped end			1				1
	Cross end	1					4	5
	Leno bobbin change							
	Contamination		1					1
	Oil warp							
	Wrong drawing -in						1	1
Total	Warp breaks/loom	4	4	3	2	2	5	20

Date 02/09/2010 Temperature (c°) 21.5 Relative humidity 70.4%

Start hour 7:00 Stop hour 8:00 Duration of test 1 hour

Warp breaks causes	Loom number	1	2	3	4	5	6	Total
	Rpm	550	640	610	620	600	535	
	Stop counter	41070	85877	52806	69194	89871	122428	
	Start counter	30568	54209	38645	49220	64106	99732	
	Number of picks	10502	31668	14161	19974	25765	22696	
	Efficiency	34%	82%	39%	54%	72%	71%	
	Production in meter	623.34	1749.34	793	1116	1440	1266.2	6987.85
	Knot	1	1			1	1	4
	Thin and thick end	2			1		2	5
	Abrasion	2						2
	Inappropriate tension	2					2	4
	Taped end							
	Fluff and dirt		2			1		3
	Chopped end			1				1
	Cross end	1		1	1			3
	Leno bobbin change							
	Contamination			1				1
	Oil warp						1	1
	Wrong drawing -in							
Total	Warp breaks/loom	8	3	3	2	2	6	24

Date 03/09/2010 Temperature (c°) 21.5 Relative humidity 67.3%

Start hour 3:00 Stop hour 4:00 Duration of test 1 hour

	Loom number	1	2	3	4	5	6	Total
Warp breaks causes	Rpm	535	575	575	575	550	675	
	Stop counter	39773	62054	56673	43253	74601	53617	
	Start counter	26964	40754	39045	29972	46257	32515	
	Number of picks	12809	21300	17628	13281	28344	21102	
	Efficiency	40%	61.7%	51%	38.5%	86%	52.1%	
	Production in meter	713.34	1182.6	977.5	737.9	1576.67	1172.25	6360.26
	Knot	2	2	2			4	10
	Thin and thick end	1			1			2
	Abrasion				1			1
	Inappropriate tension	2	4	1		1	1	9
	Taped end							
	Fluff and dirt							
	Chopped end							
	Cross end						2	2
	Leno bobbin change			1				1
	Contamination							
	Oil warp							
	Wrong drawing – in							
Total	Warp breaks/loom	5	6	4	2	1	7	25

Appendix-II

Data gathered through interview about Warp breakage study in case of Bahir Dar Textile Share Company

1. Do you believe that the efficiency and production of loom is good?
2. If not good, what are the major problems for the reduction of loom efficiency and production?
3. What are the major causes which influence warp yarn breakage?
4. What are the most frequently occurred causes which influence warp yarn breakage?