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MODERN SAFETY AND TRAINING METHOD IMPLEMENTATION IN DIFFERENT TYPE OF TEXTILE SECTORS

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Abstract: *Textile manufacturing is a major industry. It is based on the conversion of fiber into yarn, yarn into fabric. These are then dyed or printed, fabricated into clothes. Different types of fiber are used to produce yarn. Cotton remains the most important natural fibre, so is treated in depth. There are many variable processes available at the spinning. In spinning industries spinning is a process in which we convert fibers by passing through certain processes like Blow room, Carding, Drawing, Combing, Simplex, Ring Frame and finally winding into yarns. These yarns are then wound onto the cones. Textile industry meet the many hazards like noise, Electrical, fire, Ergonomics, Psychosocial Hazards., In existing research work implemented several safety and training programs to avoid these type of hazards, In other hand these type of training is not sufficient to reduce the accidents in textile sectors, For the reason is in most of the industries the employers are uneducated and also 20% of employees are North Indians. Due to this they struggle to understand the training session and one of the major issues is language. To overcome these problems, in this paper, an efficient chunk training method is presented in textile industry. The performance of training is evaluated and results demonstrate that the proposed training method has attained good performance for textile sectors with state-of-the-art methods.*

Keywords: *Textile industry, Spinning, Hazards, Safety, Training program, Chunk training method.*

1. INTRODUCTION

Coimbatore is called the Manchester of South India due to its extensive textile industry, fed by the surrounding cotton fields. It is a major commercial and business hub in the state of Tamil Nadu. First textile mill was established in 1897 by sir Robert Stanes an English man (Stanes Motors South India) with local businessmen in Coimbatore spinning and weaving mills. In 2010, Coimbatore ranked 15th in the list of most competitive (by business environment) Indian cities. Today, Coimbatore is hailed as the region with the highest concentration of textile activity in the world. It has numerous centres that specialize in spinning, weaving, power

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looms and knitwear. A large produce of the manufacture is exported to different countries. Exports include knitwear, woven apparel and home furnishings. The Southern India Mills' Association (SIMA) was established in 1933, is very active in the Coimbatore region and governs most of the textile industry in South India. SIMA has a membership spread across the southern states and protects the interests of the textile mills and its workers. The neighbouring town of Tirupur is home to some of Asia's largest garment manufacturing companies, exporting hosiery clothes worth more than 50,000 million.

Spinning Process

Spinning is the process by which fibres are converted into yarn. Until the 1740s all spinning was done by hand using a spinning wheel. The Spinning process contain several units, process of spinning is illustrate in Figure 1(a) and Figure 1(b).

Blow Room

Blow room is the starting of the spinning operation. Where the supplied compressed cotton bale turns into a uniform lap of particular length by opening, cleaning, blending or, mixing is called blow room section. It is the first step of spinning. The section consist a number of different machines used in succession to open and clean the fibres. Opening- Opening of compressed cotton bales and cotton bales are made into small tufts. Cleaning- To eliminate dust, dirt, broken leaf, seed particles, grass and other foreign impurities from the fibre. Dust removal- To remove the dusts which are completely enclosed in the flocks. Blending/mixing- To produce a comparatively good quality cotton fibre by mixing different types of cotton together. Lap forming-(a) to convert the opened and cleaned fibre into a sheet of particular width and uniform weight/unit length is called lap. (b) To give a cylindrical shape to the pre-determined lap by winding it in the lap pin and to make it suitable for the next process carding.

Carding

The card is the machine which is used for carding. In the card we put lap from blow room and after carding we get carded sliver. This is second stage machine operation in conventional spinning line. Carding is a mechanical process that breaks up locks and unorganised clumps of fibre and then aligns the individual fibres so that they are more or less parallel with each other. Carding can also be used to create blends of different fibres or different colours. Carding plays a crucial role in all spinning cycles; it contributes a lot to the yarn quality. Opening to individual fibres: The blow room only opens the raw material to flocks whereas the card opens it to the stage of individual fibres. This enables the eliminations of impurities and good performance of the other operation. Elimination of impurities: Impurities are mostly eliminated

in taker in and a small portion of it is eliminated by flat stripping. Modern card removes 80 – 90% impurities from lap and sliver contains only 0.05 – 0.3% foreign matter. Elimination of dust: Card is good dust removing machine. I t removes free dust as well micro particles by significant friction. Disentangling of neps: Blow room increase neps from machine to machine, but card reduce it to a small friction. The card does not remove neps but disentangles it by opening them. Closer spacing between the clothing, sharper clothing's optional speed of taker in, low doffer speed etc. Can improve the disentangling process of neps. Fibre blending: The card scarcely improve long term blending as the residence time of the material in the machine is too short. The card improves traverse blending and fibre with fibre mixing.

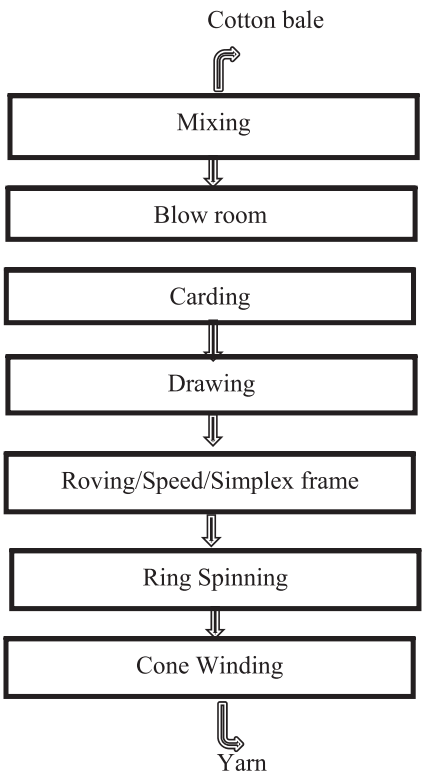

Figure 1: (a) Flow chart of spinning process of Carded Yarn in textile industry

Drawing

Drawing is the operation by which slivers are blended, doubled and leveled. In short staple spinning the term is only applied to the process at a draw frame. In drawing slivers are elongated when passing through a group of pair rollers, each pair is moving faster than previous one. This permits combing, drawing and elongating of several slivers to make them strong and uniform. Objects of drawing,To straighten

the crimped, curled and hooked fibers, To make the fiber parallel to their neighbors, To improve uniformity of fibers by drafting and doubling. To reduce weight per length unit of sliver. To remove dust from slivers. To blend raw material of same hank perfectly. Drawing, also called Drafting, in yarn manufacture, Drawing reduces a soft mass of fibre to a firm uniform strand of usable size. This is the machine on which drafting & doubling are carried out. Carded sliver is that they are not even (uniform) enough to produce to good quality yarns. Therefore, usually all the carded slivers are subjected to Doubling & Drafting on a machine called "Draw Frame".

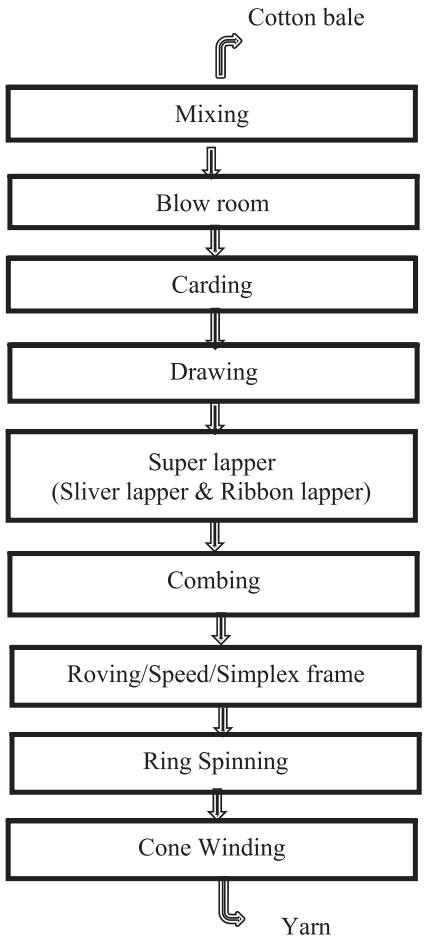

Figure 1: (b) Flow chart of spinning process of Cowbed Yarn

Combing

The process of straightening and parallelisings of fibers and the removal of short fibers and impurities by using a comb on combs assisted by brushes and rollers is called combing. The combing process is carried out in order to improve the quality

of the sliver coming out of the card. The process eliminates short fibres, it achieves better parallelisation of fibres, it straightens curls, and it removes neps and residue impurities.

Objectives of Combing

To remove naps in the carded sliver. To make the fiber more parallel and straight. To produce a uniform sliver of required per unit length. To remove the fiber shorter than a predetermined length. To remove remaining impurities in the comber lap. Necessity of Combing The following quality of fibers can only be obtained by combing ,Absence of nap,More parallel arrangement of fibers, Straight fibers, Clean finer fiber,Uniformity in length of fiber. Combingis a process which is introduced into the spinning of finer and high quality yarns from cotton. The carded materials (sliver) contain certain amount of short fibres, neps, fine kitty and leaf particles. Short fibres are a hindrance to spinning of finer counts where the number of fibre in the cross section of the yarn is less. The short fibres cause thick and uneven places in the yarn length and the yarn looks hairy. Apart from this, very short fibres do not contribute anything to yarn strength. Short fibres below a certain pre-determined length can be easily separated out by using comber.

Roving/Speed Frame

The product delivered by roving machines is called Roving. Roving is a Fibre strand of lesser count than that of a sliver. It is also has a small twist to keep Fibres together. It is wound on to a package which is suitable for feeding spinning machines. Objectives of speed frame, Attenuation of draw sliver to a suitable size for spinning. To insert a small amount of twist to strengthen the roving. To wind the twisted strand roving into a bobbin. Operation involved in speed frame: Drafting, Twisting, Winding, Drafting: To reduce the weight/unit length of sliver to make it suitable for ring spinning system.

Twisting

To insert small amount of twist to give required strength of roving. Winding: To wind the twisted roving on to bobbin. Speed Frame: Simplex is an intermediate process in which fibers are converted into low twist lea called roving. The sliver which is taken from draw frame is thicker so it is not suitable for manufacturing of yarn. Its purpose is to prepare input package for next process. This package is to prepare on a small compact package called bobbins.

Ring Spinning

The ring spinning is the most widely used form of spinning machines due to significant advantages in comparison with the new spinning process. Ring spinning

is a method of spinning fibres, such as cotton, flax or wool, to make a yarn. In ring spinning, the roving is the first attenuated by using drawing rollers, then spun and wound around a rotating spindle which in its turn is contained within an independently rotating ring flyer. Traditionally ring frames could only be used for the coarse counts, but they could be attended by semi-skilled labour.

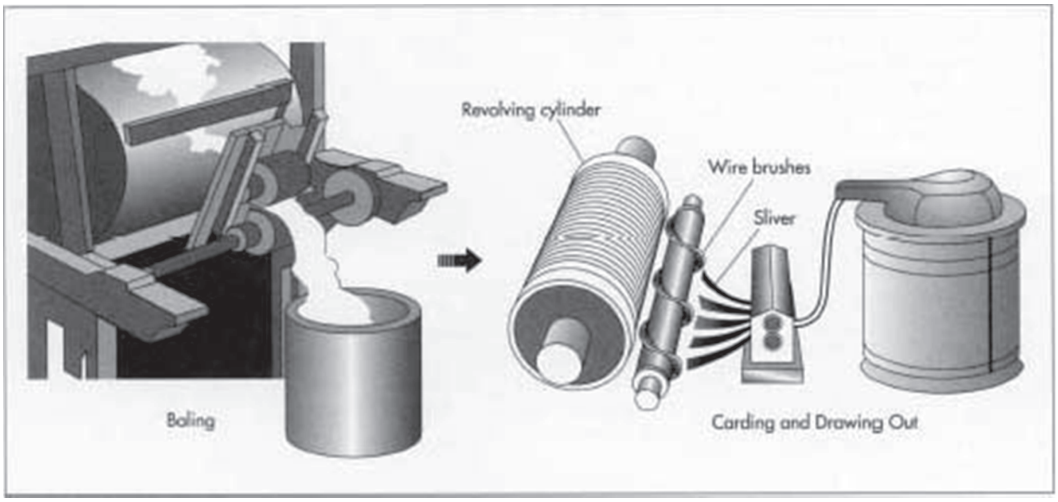

Figure 2: Graphical representation of spinning process

Figure 2 represents the spinning process, Fibers are shipped in bales, which are opened by hand or machine. The picker loosens and separates the lumps of fiber and also cleans the fiber if necessary. The carding machine separates the fibers and pulls them into somewhat parallel form. The thin web of fibers formed then passes through a funnel-shaped device that produces a rope like strand of parallel fibers. Rollers elongate the strand, called a sliver, into a single more uniform strand that is given a small amount of twist and fed into large cans. This paper consists of five sections. Section II explains about existing safety and training techniques in Textile Industry. Section III describes process sequence of spinning mills in Tamil Nadu and remedial measures for hazards in textile industries. Section IV the proposed technique is evaluated. Section V concludes the paper.

2. LITERATURE SURVEY

In this section,safety and training techniques in Textile Industry has been discussed. McQuiston et al. [1994] reported that substantial numbers and percentages of workers followed through on training by using resources provided in the training, conducting training at their workplaces, identifying safety And health problems, obtaining changes in training or equipment, and improvement of handling of spills. This Methodology reflected substantial improvement upon methodologiesused in

many earlier training evaluation studies that measure student satisfaction or student retention of information [Cohen and Colligan, 1998].

Since publication of the McQuiston study, other efforts have been made to evaluate the impacts of NIEHS funded Hazardous Waste Worker Training Programs. For example, an assessment of the impacts of training conducted by the New Jersey/ New York Hazardous Materials Worker Training Center employed mail and phone surveys 6 months following training [Weidner et al., 1998]. They reported that workers believed that technical topics and hands on training were important in their training, that they had a high level of recall of information communicated in training, and that the training had significantly improved their ability to respond to actual hazardous material incidents.

While the NIEHS training programs continue to move away from defining impact as numbers trained, improved knowledge, and course evaluation by students, there remains ,a diversity of impacts measured by the training programs. Evaluations from 17 grantees in 1996 utilized a wide variety of measures including student evaluations of program, student self-rating of proficiency, pre- and post-tests of knowledge, changes in work site policies and practices, and activities such as use of resources and training of co-workers [McQuiston, 1996]. Similarly the methods of measuring impact are diverse, including interviews, survey, focus groups, and gathering of anecdotal stories [Cole and Brown,1996]. While some of the training organizations asked participants if training had improved their effectiveness in reducing hazardous material hazards, none of the 17 evaluation studies compared information on impacts before and following training [Cole and Brown, 1996].

The National Institute for Occupational Safety and Health (NIOSH) TIER model of research on training effectiveness lists impact assessment as an important fourth research goal [Loos et al., 1999]. A NIOSH analysis of published evaluations of worker training efforts aimed at reducing chemical exposures indicates that 13 of 22 published studies measured self-reported application of knowledge. Measurement of impacts of safety and health training remains the most difficult outcome for the training community to measure [Gotsch and Weidner, 1994; Robson et al., 2001].

The study of occupational safety and health training impact fits into a broader category of intervention research. Intervention research (or prevention effectiveness) is the study of planned and applied activities designed to produce designated outcomes by applying apply scientific methods to measure the impact of health interventions [Goldenhar and Schulte, 1994; Robson et al., 2001]. Such evaluation should carefully incorporate a theoretical basis for the intervention, an intervention powerful enough to be measured, a rigorous study design, valid measurement instruments, and appropriate use of statistical analysis [Goldenhar and Schulte, 1994].

The move from evaluating occupational safety and health training by student course evaluations and testing, to Measuring of impacts has developed in tandem with important changes in workplace safety and health training Philosophies. Three important developments have influenced training in recent years in ways that by definition must also influence the evaluation of these training programs.

The first of these is the growth within the worker training community of participatory or empowerment training. Increasingly, training by unions or labour education organizations seeks to empower workers to take an active part in making workplaces safe [Wallerstein and Baker, 1994]. This approach to training has a theoretical basis in a philosophy of participatory education described by Shor and Freire [1987]. This type of training sees trainers as facilitators in the development of knowledge that students possess through life experience, rather than communicators of a static body of knowledge. It is worker centered, emphasizes participatory and hands-on exercises, and seeks to motivate participants to remain active in improving their working conditions [McQuiston et al., 1994; Deutsch, 1996].

A second and related development is the increasing use of workers as trainers. The ICWUC and several other NIEHS sponsored training programs rely on worker trainers to both deliver training and to become the full time educational staff. This use of peer training in occupational safety and health has been reported to be more successful for increasing self-efficacy among trained workers than the use of professional trainers [Kurtz et al., 1997].

Thirdly, this philosophy of training becomes particularly important in light of increasing attention to the limits that worker training may face in the context of a variety of work place circumstances or systems. These systems may not be supportive of making changes that prevent injuries and illnesses to workers. This perspective takes a systems approach to workplace organizations and suggests that while worker training may be a prerequisite to improved safety at work; it can be significantly limited or enhanced by the 64 Becker and Morawetz organization to which the training is applied [Ford and Fisher, 1994]. These limits to training appear to support the need for training workers beyond technical materials. Effective worker training should help workers become more effective in making work place changes. At the same time evaluation of training that is meant to create impacts on complex workplace systems must recognize the limited though critical role of training in overall work place safety and health programs [NIEHS National Clearinghouse, 1997].

Becker, P., & Morawetz, J. (2004). -This study of the ICWUC training program confirms suggestions by an earlier study [McQuiston et al., 1994] that the program increases the use of hazardous materials resources, and increases the quantity of training conducted by participants. More importantly the program appears to increase trainees' self-confidence or willingness to make safety and health

improvements and their effectiveness at making these improvements. In the aggregate more workers tried and succeeded at making changes following training, leading to a suggestion that the training has contributed to substantial improvements in workplace conditions. While the study lacks the rigor of an experimental model, its replication of earlier results and the addition of statistical comparisons of impact measures pre- and post-training, increase the strength of the hypothesis that the ICWUC training program impacts workplaces in important ways likely to be protective of workers' health and safety.

3. PROCESS SEQUENCE OF SPINNING MILLS IN TAMIL NADU

In this section,Process sequence for 4 types of spinning mills in Tamil Nadu &India, and remedial measures of Industrial hazards has been discussed. The process sequence of spinning mills and performance results of existing safety& training programmes are shown in Figure 4 and Figure 5.

Remedial Measures of Hazards in Textile Industry

Noise: Isolation of the machine and silencer must be kept, Inverted drive control noise in ring frame, proper maintenance lubricating control noise level can be lowered by the use of noise control enclosures, absorbers, silencers and baffles and by the use of Personal Productive Equipment(PPE), such as Earmuffs etc. Where technical methods are insufficient, noise exposure may be reduced by the use of hearing protection, By administrative controls such as limiting the time spent in noisy environment.

Dust: Causes respiratory problems and causes Byssinosis, a disease causede by cotton dust, To avoid these problem, some remedial measure taken towards the dust hazards, like Introducing Dust collector,proper housekeeping,Necessary PPE should wear by worker.

Light: Causes eye strain and glaring- overcome these problems Proper lightening conditions are maintained in work place. Lifting Heavy Weight-Causes Muscular Skeletal disorders- precautions taken against these issues,Theoretical and practical training are given to the workers such as, Keep your backbone straight while lifting load, pull the load as close to the body, lift and carry loads with stht arms.

Fire Hazards: Loss of life, damages to the equipment, Welding operation causes spark ignition is very dangerous due to avoiding weldinding problems, restrict unauthorized person to do welding and ACB (Air Circuit Breaker), MCB (Motor Circuit Breaker) are introduced at industries to avoid electrical hazards. Smoking causes major fire accidents in textile industry and also easily gets fire with cottons, So, the management given awareness about causes of smoking,Safety signs and workers must aware of not using any ignition product.

Electrical hazards: It includes Short circuits, Improper Earthing, Improper isolation, Moistrue etc., To solve this problem Care about the things like avoid improper earthing and loose connections, All circuits to be enclosed in a proper circuit, Moisture to kept in control.

Ergonomical hazards: It includes continuous work and improper workstations due to this repetitive star in injuries (Wrist,neck, shoulder, Knee, leg, hands and angle), to solve this problem given proper working procedure to workers and importance to ergonomics.

Physiological hazards: It includes personal problems, financial problems, the major source of physiological hazards is not interested to work, stress (production target).

Existing Safety and Training Programmes

Training of personnel in textile industry is one of the major services offered by SITRA. SITRA has been offering training services for the past 35 years, with more than 100000 personnel, comprising all levels, having benefitted out of it. While training programmes intended for the top and middle level management personnel are held both at SITRA and also offered as in-house programmes; for operatives, the hands-on training modules are conducted at the mill premises, To avoiding injuries, accidents at work place The training and safety programmes are necessary to the workers, SITRA is one of the institutions certified by the Govt. of Tamil Nadu to offer skill based training programmes for the backward and denotified communities in the areas of weaving and knitting. It gives the general training programs, etc., shown in Figure 4.

This Information are given by Director of Industrial Safety and Health,Chennai

Department	*Fatal accident details*				
Year	*2010*	*2011*	*2012*	*2013*	*2014*
Textile	7	4	5	5	13
Electrical	5	3	13	2	14
Fire	10	82	46	52	12
Serious accident	21	8	10	4	5
Others	–	–	–	–	13

Place	*No of miles*	*Worker*
Coimbatore	978	61255 25796(M) 35459(F)
Coimbatore, Thirupur Neelagiri	1339	1,15,352
Tamilnadu	2333	2,35,174

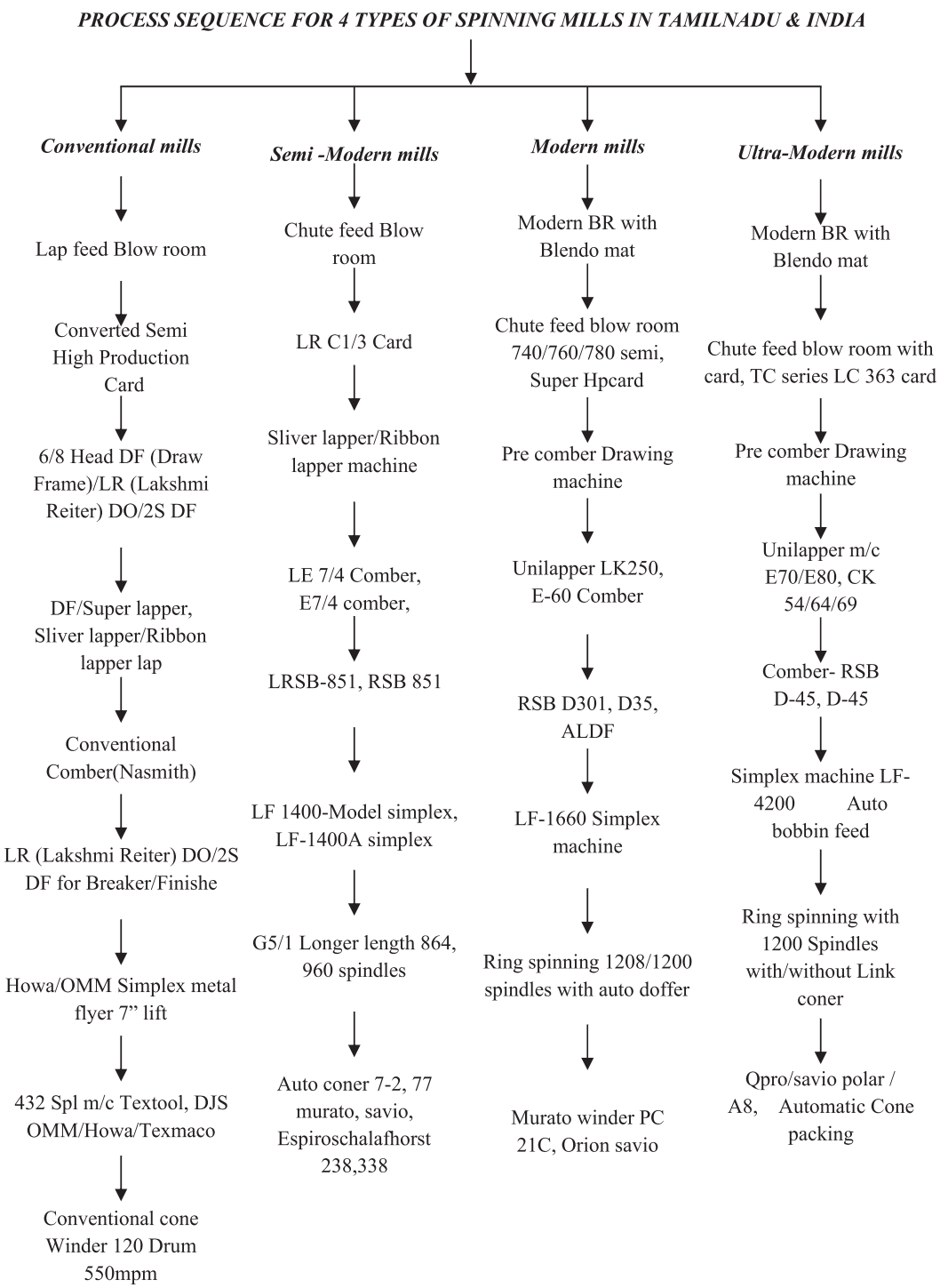

Figure 3: Process sequence for 4 types of spinning mills in Tamil Nadu & India

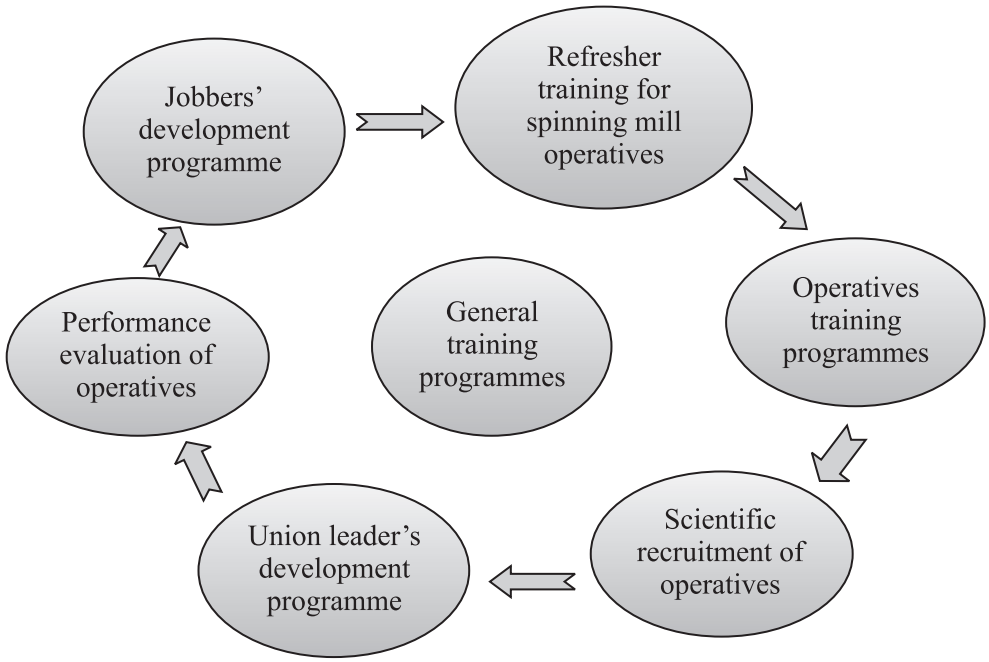

Figure 4: Graphical representation of existing training programmes

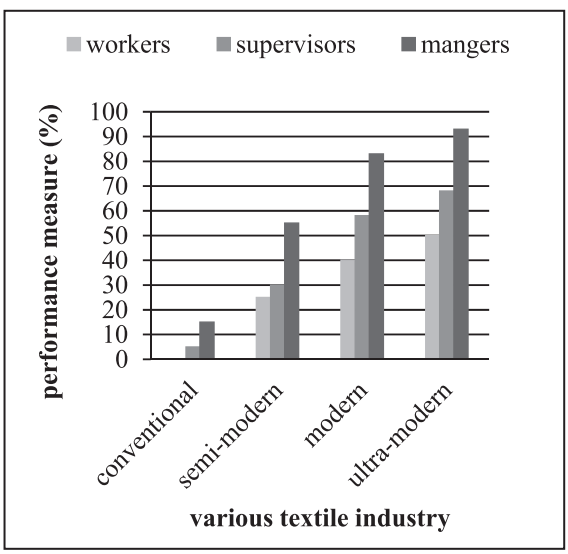

Figure 5: Performance measures comparison for existing safety and training

Figure 5 shows that the graphical representation of existing safety and training methods performance evaluation for various textile industries such as conventional, semi-modern, modern and ultra-modern. It shows the performance evaluation for workers, supervisors and managers.

4. PROPOSED MODERN SAFETY & TRAINING METHOD

In this section, a Modern safety & training method is implemented along with existing training method, For the reason, In textile industry the safety and training programmes are do not conduct weekly basis and regularly it is offers only yearly basis, due to this the workers are forget the things quickly, which is learned in safety &training sessions, Most of the employers in textile industry are uneducated, they can't remember every think about safety programmes, It creates major accidents and injuries to the workers at textile industries. To overcome this problem the chunking training method is introduced in this work. Chunking is one strategy that can be used to improve a person's short-term memory. Chunking is the process of breaking down instructional materials into smaller, "bite-sized" pieces and then arranging them in a sequence that makes it easier for your learners to learn the material. For example, at the time of training session the information cannot given like paragraphs, because the listeners(employers) cannot understand or quickly forget it, so make it simple split into keywords and trained up the workers, Thoughts chunking have three important parameters such as pause, keywords and pacing to speech. Using this modern safety & training method provide some slogans related to how to handle such type of machineries Do's and Don'ts in textile industries, etc., In this modern safety training programme conducted for weekly basis in textile industries located around Coimbatore. Organised by K.P. Karpannan (Author of this article). The images Figure 6(a) shows that Safety & training program conducted to workers at weekly basis, Figure 6(b) shows the Chunking training method (at the time of training- Highlight the keywords ,Because of easily understand to the workers and simple to keep in workers mind).

Figure 6: (a) Safety & Training program conducted by K.P. Karupannan

Figure 6: (b) Chunk Training Method

5. PERFORMANCE RESULTS

In this section, the performance results of Modern Safety & Training programs for workers, Supervisors, Managers has been showed. The result shows effective improvement of safety awareness for workers, supervisors, Managers when compared to existing methods of training.

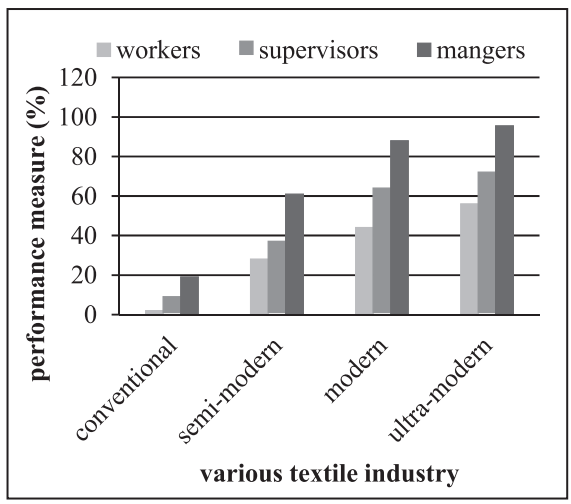

Figure 7: Performance results comparison of proposed Training method

Figure 7 shows that the graphical representation of proposed safety and training methods performance evaluation for various textile industries such as conventional,

semi-modern, modern and ultra-modern. It shows the performance evaluation for workers, supervisors and managers.

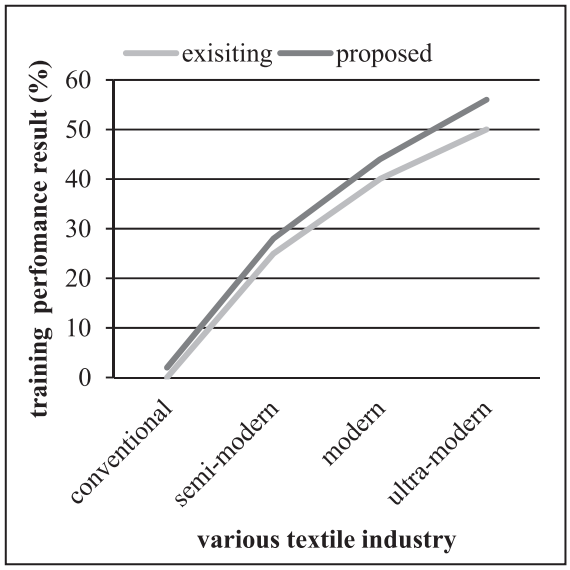

Figure 8: Performance results comparison of workers

Figure 8 shows the performance result of workers in various textile industries, the performance is compared with existing method. Its shows effective results among the workers awareness in spinning manufacture

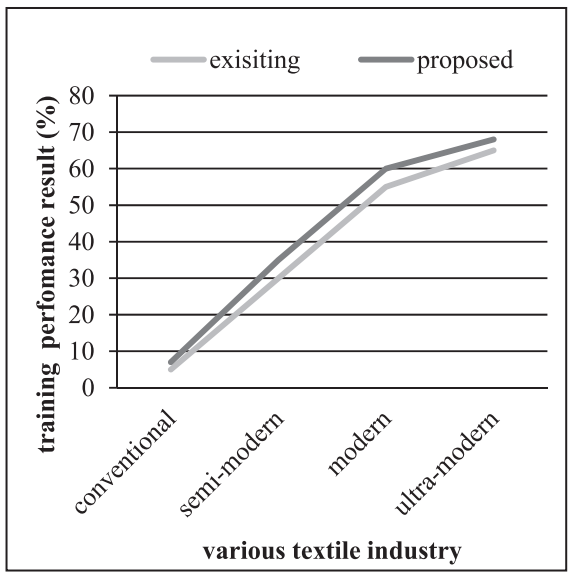

Figure 9: Performance results comparison of Supervisors

Figure 9 Shows the performance result of supervisors in various textile industry, To avoid the hazards in textile industry, safety & Training program given to the workers is not sufficient, It's gives to supervisors also, Because in textile industry Most of the workers are uneducated, they need proper guidance to handle some machineries or equipment, For that reason this training program is necessary to the supervisors in textile industries. The performance result is compared with existing method. Its shows effective results among the supervisors awareness in spinning manufacture.

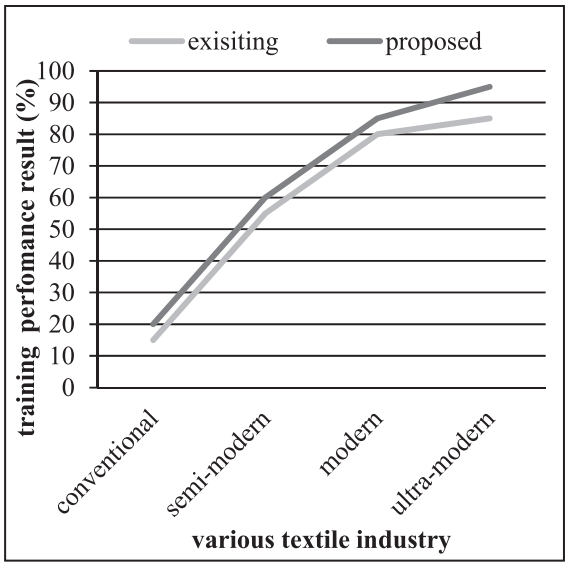

Figure 10: Performance results comparison of Mangers

Figure 10 shows the performance result of managers in various textile industries, only a good management given healthy work environment to the workers, to attain the health and safety working environment, this training program is necessary to the managers in textile industries. The performance is compared with existing method. Its shows effective results among the managers awareness in spinning manufacture.

6. CONCLUSION

This research paper presented Modern safety and training program for workers in textile industry, the major cause of accidents at workplace is lag of awareness about safety and training. The modern safety and training is more effective when compared to existing training program, because this training includes different way of teaching process, the result is it's very easy to memorize the training sessions for workers even if they are uneducated. The performance evaluation of Modern safety and training program for workers, supervisors and managers in several types of textile industries are studied and compared with existing results. The

benefits of the Safety and training programme Health Management System could be observed and studied. However, In future needs to enhance the safety and training programmes in textile industry. This development is used to protect the workers from the harmful hazards.

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