INTRODUCTION

Leather is one of the first manufactured materials, and the workers who are directly involved in this industry can claim to be a member of an ancient profession.

In India, a large number of unorganized sectors are directly engaged in the manufacturing of leather materials.

The un-organized sector accounts more than 90 per cent of total work force in the country. Unfortunately, in the post independence era more emphasis was given for the improvement of the conditions of labour in the organized sector than the unorganized sector of India.

1.1 Leather Industry in India

1.1.1. Indian Leather Sector: A Profile

Leather and allied industries in India play an important role in terms of providing employment to the large number of artisans and also earning foreign exchange through exports. The major factors responsible for the growths of Indian leather industry are availability of raw materials (hides and skins), cheaper labour, technology and government policy support. Leather sector exports account for Rs.1069 crores and provides direct employment to more that 2.5 million people and among, them many belong to socially and economically backward communities (Department of Industrial Policy & Promotion, 2002). The basic raw material for the leather industry is hides and skins. These raw materials are recovered as by product from meat industry. In the case of bovine hides, fallen category, i.e., animals died due to natural causes like old age, diseases also account for sizeable share. The major specific of livestock that supply hides and skins are cattle, buffalo, goat and sheep. These animals are reared for different purposes such as cattle mainly for draught purposes, buffalo for milk and goat and sheep for meat purposes.

There are nearly 4000 units engaged in manufacturing footwear in India. The industry is dominated by small scale units with the total production of 55%. The total turnover of the footwear industry including leather and non-leather footwear is estimated
at Rs.8500-9500 crore including Rs.1200-1400 crore in the household segment. India's share in global leather footwear imports is around 1.4%. Major Competitors in the export market for leather footwear are China (14%), Spain (6%) and Italy (21%) (SINET).

The footwear industry exist both in the traditional and modern sector. While the traditional sector is spread throughout the country with pockets of concentration catering largely to the domestic market, the modern sector is largely confined to select centres like Chennai, Ambur, Ranipet, Agra, Kanpur and Delhi with most of their production for export. Assembly line production is organized, and about 90% of the workforces in the mechanized sector in South India consist of women. In fact, this sector has opened up plenty of employment opportunities for women who have no previous experience. They are trained to perform a particular function in the factory itself.

1.1.2. Availability of low cost skilled labour

India's advantage as a source of low cost, skilled labour is quite relevant to industries such as manufacturing of leather goods and footwear that are manufacturing of leather goods and footwear which are relatively labour intensive.

India has among the lowest cost of labour among key footwear producing countries (SINET). Leather/Footwear Industry sector is mostly consisting of unorganized labour forces, when compared with the modern facilities enjoyed by peoples of the developed countries in this modern age of science.

There is no doubt that, in the western world, Leather/Footwear workers as well as industrial workers are markedly better off than the Indian or any workers of the third world countries. Higher standards of living, shorter working hours, greater social security and better medical care contribute to improving the life of the modern worker. The development of safety devices, industrial hygiene, toxicology and industrial medicine has also done a great deal to improve the working conditions and health of the worker of the western countries. Too often a task is required of a man without knowledge of his physical qualifications for performing it. One reason for this is that the study of the
physiological expenditure involved in work is in its early stage. Another is that industry is not using the knowledge of human physiology already acquired.

One must admit that this is a paradoxical situation. An engineer would not use a machine without knowing its characteristics: power, optimum speed, and efficiency of production. Strangely enough, when the problem is the use of human machine as a source of mechanical energy, the attitude changes. In modern industry occupations usually are classified by studies of time or time or motion. The task is defined, but the question of the physiological expenditure required of the workers is not considered. The efficiency and the power of his muscles, heart, lungs, his optimum rhythm of motion, his physiological working level, his fatigability and unknown factors. The physiological energy expenditure must be measured because it is the only accurate means of evaluating the effort of worker and of estimating the degree of his fatigue. These measurements are the key to the solution of the problem of what a man can do safely, but they are still ignored in industrial/occupational practice.

In our country (India), only a few laboratories are devoted to the study of human physiology and very few of them study the problems of man involved in LEATHER INDUSTRY. Besides, there is little contact between the laboratories for human physiology and industry, so that real problem are often poorly understood or inaccurately stated. Management is also unaware of the importance of human physiology, and is interested only in the fact that a worker is good, mediocre or poor as far as productivity is concern and does not realize that it would be a major step in job organization and in the solution of workers to know their physiological capabilities.

Although we must acknowledge that the work to be done is vast and that the progress will be slow, but the first steps should be taken without further delay in our country as well as in the third world countries, and especially on Leather/footwear workers who are mostly neglected here.
1.1.3. Economic condition of the footwear industry

The footwear industry is a significant segment of the leather industry in India. India ranks second among the footwear producing countries next to China (Tiwari, 2005). The industry is labour intensive and is concentrated in the small and cottage industry sectors. While leather shoes and uppers are concentrated in large scale units, the sandals and chappals are produced in the household and cottage sector. India produces more of gents’ footwear while the world’s major production is in ladies footwear. In the case of chappals and sandals, use of non-leather material is prevalent. The major production centres in India are Chennai, Ranipat, Ambur in Tamil Nadu, Mumbai in Maharashtra, Kanpur in U.P., Jalandhar in Punjab, Agra, Calcutta and Delhi.

The estimated annual footwear production capacity in 1999 is nearly 1736 million pairs (776 million pairs leather footwear and 960 million pairs of non-leather footwear) (Department of Industrial Policy & Promotion, 2002).

Shoes manufacturers in India wear brand names like Florsheim, Gabar, Clarks, Salamander and St. Michael’s. As part of its effort to play a lead role in the global trade, the Indian leather industry is focussing on key deliverables of innovative design, consistently superior quality and unfailing delivery schedules. India in itself has a huge domestic market, which is largely untapped.

The availability of abundant raw material base, large domestic market and the opportunity to cater to world markets makes India an attractive destination for technology and investment.

In 1999, the global import of footwear (leather and non-leather) in terms of value was around US$43278 million, accounting a share of 63.42% in the total global import of leather and leather products. Out of this, import of leather footwear alone accounted for US$26379 million and non-leather footwear US$16899 million.

India’s export of leather footwear touched US$331 million in 1999-2000, recording and increase of 3.29% over the preceding year. India thus holds a share of 1.25% in the global import of leather footwear. The major markets for Indian leather
footwear are in UK, the USA, Germany, Italy, France and Russia (Department of Industrial Policy & Promotion, 2002).

The Indian Leather/footwear workers are engaged in the work almost throughout the year irrespective of adverse climatic conditions. They are mostly economically weaker and are not in a position to have square meals a day. Their living conditions and other facilities are not at all comparable to their counterparts in European countries. Even in this modern scientific age, a lot of development has taken place, in India as well, to improve the quality modern equipments but very little attention has been paid on the well being of the vast unorganized Leather/Footwear work forces.

1.2. Leather Industry in West Bengal

1.2.1. Profile

West Bengal is one of the country’s leading states for export of finished leather goods and accounts for almost 25% of the country’s leather exports. There are 538 manufacturing industries in the state producing leather goods. West Bengal has exported US$ 348.66 million worth of leather products in the year 2004-05.

The Government of West Bengal has set up state-of-the-art integrated leather complex on the eastern fringe of Kolkata spreading over 1100 acres, where a large number of tanneries located earlier within the city precincts have shifted and new investment interest has been generated. The leading players in the sector include:

Bata India Ltd (BIL), one of the leading and the most popular shoe brands in the country. It sells around 60 million shoes and exports around 3 million footwear each year.

Khadim Group is another prominent player in the footwear industry in West Bengal and has 183 franchisee outlets across the country (Leather & Leather Products-Profile & Performance, 2010).
The footwear industry in West Bengal comprises mainly cottage or tiny to small scale sector. The sector directly and indirectly employs about 10 lakh workers (Kolkata Newsline, 2006). The footwear industry of Kolkata is worth of Rs.3,000 crore.

1.2.2. India's largest leather goods producer

Calcutta offers the leather industry several advantages: easy availability of a wide variety of leather (cow, calf, buffalo, sheep, goat, kid); low production costs; a large pool of unskilled, semi-skilled and skilled workers at competitive rates; and abundant water and power. An airport and two ports facilitate exports. West Bengal is India's largest manufacturer of leather goods. In addition to BIL (annual capacity over 20 million pairs of shoes/upper) there are approximately 20,000 small units making footwear/upper (12 million pairs per year); industrial gloves (50 million pairs per year); garments (800,000 pieces per year); and accessories and luggage 35 million pieces per year).

1.2.3. India's largest exporter of leather products

West Bengal accounts for 65 percent of India's leather goods exports (1999-2000 exports were valued at USD 226 million). But its share of total Indian leather and leather goods exports is 15 percent. The European Union and North America are the leading importers of West Bengal's leather and leather goods (79 percent and 12 percent respectively). Unfortunately, West Bengal is generally considered a source of low-priced, poor quality leather goods. Improving the quality of both leather and leather goods is a problem as most tanneries and manufacturers are small and cannot afford the investments required to Up-grade production facilities. Only a few manufacturers have modern equipment. But most of them are handicapped by low overall production capacity, which prevents them executing large export orders.

1.2.4. Labour issues

As far as working conditions are concerned, BIL, Taj Leather Works (TLW) and a few other units are the exception. In addition to salubrious working conditions, BIL's workers enjoy subsidized housing, medical facilities and numerous other benefits. TLW
has modern machines with devices to prevent accidents and injuries to workers. In contrast, working conditions in the tanneries and the leather products (in particular the footwear industry) manufacturing units are generally appalling and there is scant regard for workers' safety or health (Kanjilal, 2010).

There is lack of awareness among workers and the owners about the occupational safety and health which includes less attention to industrial hygiene, poor housekeeping, less safe storage of chemicals and poor employee protection, this is due to lack of occupational safety and health exposure. Most of the industrial laws in the country are only confining to the paper and never seen a reality in implementing their standards. There is always poor investment or industrial safety, labour is cheap and easily replaceable, so employers never seen a need for improving occupational safety and health. Labour unions are mostly weak, politician driven and lack knowledge about the occupational risks.

So the footwear industry of Kolkata is of great concern. It needs attention from the Government and other agencies and also from the employees since they are the ones that make the products and generate the turnover for the company.

1.3. Characteristics of the Footwear Industry

The footwear industry is in general a low wage and low earning sector where family labour is engaged in some home-based sectors. This sector has a prevalent rate of child labour. Migrant labour from different parts of the country is involved in this sector. Piece-rate payment and contractual works are increasing trends in this sector. Most jobs are, for the greater part, on a casual basis. Health hazards exist in majority of the processes involved in footwear making.

1.4. The Process of Footwear Manufacturing

The process in the footwear making include Measuring, Last making, Pattern cutting, Sewing, Assembling and Finishing. Each of these processes is associated with certain type of hazards. In the process of Measuring, large leather sheets are measured according to the size of the footwear and the workers have to adopt awkward positions
while performing the task, they have to bend over and reach up to perform the task. In last making, the last are made either of wood or plastic according to the shape and comfort of the footwear required. During the process workers are exposed to wood/rubber dust and suffer cut from loose-knives cutters used for cutting stock, soles and heels. Once the desired last is ready, the desired pattern is selected and then the leather is cut with special scissors and this process of cutting is called "Clicking". Here exposure to leather dust and cut from scissors is prevalent. Then the upper and bottom stock are assembled and then stitched, glued, nailed or screwed together. These operations are followed by shaping and levelling between rollers. Finally the finishing touch is given by waxing, colouring, spraying, polishing and packing and the footwear is ready for marketing. Among the raw material used in the manufacturing process, the health hazards are toxic solvents. Finishing machines produce dust containing adhesive residues. Some of the polishes, stains, colours and glues may carry a dermatitis risk.

Flow diagram of processes in footwear manufacturing:
There may be over a hundred operations in the making of a shoe, and only a brief summary is possible here. Mechanization has been applied at all stages, but the pattern of the hand process has been closely followed. Introduction of new materials has modified the process without changing its broad outline.

These workers are exposed to physical factors like poor illumination, noise and poor ventilation, and chemicals like leather dust, benzene (used as a solvent in glues) and \( p \)-tert butyl phenols (used in neoprene adhesives) and several other ergonomic hazards. Thus, most of the workers suffer from respiratory problems, lung diseases and skin infections through constant exposure to glue and fume.

Ergonomics is the science of fitting jobs to people. The discipline encompasses a body of knowledge about physical abilities and limitations as well as other human characteristics that are relevant to job design. Ergonomics can help prevent injuries and limit secondary injuries as well as accommodate individuals with various disabilities, including those with musculoskeletal disorders (MSDs).

1.5. Musculoskeletal Disorders and Footwear Industry

According to OSHA, “work-related MSDs currently account for one third of all occupational injuries and illness reported to the Bureau of Labour Statistics (BLS) by employers every year (ILO, 1981).

Musculoskeletal disorder is commonly caused by overexertion, muscle strain and repetitive strain. The risk of disorder also directly related to the number and speed of movements and the amount of force exerted with each movement. A task with high repetition and poor postures may result in a significant number of complaints or injuries (NIOSH – 1997) (Norman et al, 2004).

Cumulative trauma disorder is a term used to describe a class of soft tissue injuries and disorders that are caused, precipitated or aggravated by a number of occupational activities. These disorders are frequently observed among workers who perform hand intensive jobs (Armstrong, 1990).

Millions of dollars are being spent on medical costs, lost work day cases, retraining costs, rework costs, and other hidden costs associated with employees developing CTD’s in occupational environments (BLS, 1994).
The study of Bernard et al (1994) suggested a high prevalence of musculoskeletal disorders of the upper extremities among newspaper employees, and they provide additional evidence that increased work load, time pressure, and greater hours of computer use are related to the occurrence of work-related musculoskeletal disorders among these workers, particularly for disorders in the hand or wrist area.

There are several studies that have investigated the specific relationships between tasks involving repetition and force and cumulative Trauma Disorder. Chiang et al (1993) studied 207 workers from 8 fish processing factories in Taiwan. There was a statistically significant association between CTD and highly repetitive jobs compared to low repetitive jobs, irrespective of force.

1.6. Injury
In the footwear industry, the main causes of injury are:

- slips and trips
- manual handling/musculoskeletal injuries
- being struck by moving or falling objects

These three causes account for nearly 90% of all reported injuries. (Footwear and Leather Industries, 2010).

The Occupational Injury and Illness Classification Manual provide a classification system for use in coding the case characteristics of injuries, illnesses, and fatalities in the Survey of Occupational Injuries and Illnesses (SOII) and the Census of Fatal Occupational Injuries (CFOI) programs. The original system was released in December 1992. It was approved for use as the American National Standard for Information Management for Occupational Safety and Health in 1995 (ANSI Z16.2—1995) and was updated to incorporate various interpretations and corrections in September 2007. The Occupational Injury and Illness Classification System contain the following code structures:

- Nature of Injury or Illness
- Part of Body Affected
- Source of Injury or Illness/Secondary Source of Injury or Illness
- Event or Exposure
1.7. Nature of Injury or Illness—Definition, Rules of Selection
The nature of injury or illness identifies the principal physical characteristic(s) of the injury or illness.

1.8. Part of Body Affected—Definition, Rules of Selection
The part of body affected identifies the part of the body directly affected by the previously identified nature of injury or illness.

Source of Injury or Illness—Definition, Rules of Selection
The source of injury or illness identifies the object, substance, bodily motion, or exposure which directly produced or inflicted the previously identified injury or illness.

Event or Exposure—Definition, Rules of Selection
The event or exposure describes the manner in which the injury or illness was produced or inflicted by the source of injury or illness (BLS, 2007).

The work of Nakata et al (2005) on small and medium-scale enterprises in Japan was carried out to find out the contribution of daily sleep habits to occupational injuries. Their findings suggested that poor nocturnal sleep habits are associated with self-reported occupational injury.

1.9. Biochemical and Physiological Hazards in Footwear Industry

Olga et al (2001) did biological monitoring of n-Hexane exposure in Portuguese shoe manufacturing working. They found that the excretion of 2,5-Hexanedione was significantly increased in a group of shoe manufacturing workers exposed to n-hexane and other organic solvents compared with a control group on the same unit who had not been exposed to organic solvents. As described above, 2, 5-HD is a principal metabolite of n-hexane and is considered the cause of n-hexane polyneuropathy. Thus, measuring urinary 2, 5-HD in industries using n-hexane and other solvents such as shoe manufacturing, provides more information about health hazards.

Langauer-Lewowicka et al (1983) showed the correlation of psychological and neurological changes with indicators of exposure of worker in a shoe factory to glue solvents. The authors supposed that sub clinical signs, detectable by means of psychologic and neurophysiologic method, many be considered as early symptoms of individual reaction to organic solvents.
The study of health risk among workers employed in rubber footwear plant by Szubert et al (2001) defined the cause and length of temporary work disability, as well as mortality causes and level. The analysis was carried out in the groups of workers performing the following jobs: mixing, mill-operation, pressing and vulcanizing. The result of the study indicated the enhanced risk of cardiovascular diseases among workers employed in the basic phases of the production process. The increased risk of the digestive system was observed in men and women employed in: finishing, sorting and packing of product and also in men involved in mixing, pressing and vulcanizing. The analysis showed that the temporary work disability may be regarded as a parameter useful in early assessment of health effects of the work environmental hazards.

World-wide epidemiological studies provide evidence that the employment in the shoe production and repair plants is associated with an enhanced risk for cancer (primarily nose and nasal sinuses). According to the majority of authors, it is induced by exposure to leather dust. Szadkowska-Stańczyk-I (2003) provided a review of the results of epidemiological studies on health effects of exposure to harmful factors present mainly at the footwear production and repair. These results reveal an enhanced risk for cancer of nose or nasal sinuses induced by leather dust, as well as neoplasms of hematopoietic and lymphatic systems, resulting from exposure to solvents (mostly benzene). Among non-neoplasms, diseases of the musculoskeletal system associated with ergonomic factors, contact dermatics, chronic pulmonary diseases and damage of peripheral nerves in solvent-exposed workers are diagnosed.

1.10. Respiratory Health Status

Pulmonary function test provides a clearer understanding of pulmonary function in subjects of different races, age, sex, occupation and profession. If there are functional abnormalities in the respiratory system, the deviation from normal can form a basis for diagnosis and assessment of progress in the management of chronic ventilatory diseases (Ali, 1983).
1.11. Variables of Productivity

In a recent Indian work organizational study in sand core making process, work environment was carried out by lowering the cases of MSDs and productivity was improved up to 30% by means of low-cost and simple modification in the existing work process and workstation design (Gangopadhyay, 2006).

Raimo Niemelä et al (2002) investigated the effect of air temperature on labour productivity. The study design consisted of an observational approach and an intervention approach. Productivity was monitored both before and after the intervention. The indoor climate of both call centres was determined by measuring thermal climate and concentrations of relevant air pollutants as well as the acoustical environment and lighting levels. The study shows that productivity may fall by 5–7% at the elevated indoor temperatures.

The quality of the product heavily depends on worker’s comfort in the working condition. Humidity and illuminance level can give significant effect on the worker performance. So Ismail et al (2010) carried out a study to determine the optimum values of environmental factors such as relative humidity (%) and illuminance (lux), on the operators’ productivity at Malaysian automotive industry.

Emin Kahya (2007) studied the effects of job characteristics and working conditions on job performance. The results showed that there were substantial relationships between employee performance both job grade and environmental conditions. Poor workplace conditions (physical efforts, environmental conditions, and hazards) result in decreasing employee performance consisted of following organization rules, quality, cooperating with coworkers to solve task problems, concentrating the tasks, creativity, and absenteeism.

Effective applications of ergonomics in working conditions enhance employee job performance; provide worker safety, physical well-being, and job satisfaction. Many studies in ergonomic area [Das and Shikdar, 1999, Resnik and Zanotti, 1997, Shikdar and Sawaqed, 2003, Yeow and Sen, 2006] have focused on the positive effects on quality, productivity, hazards, occupational health, and their cost effectiveness of ergonomic improvements in a workstation or workshop at a manufacturing company.
In an international study of Konarska et al. (2005) showed the before and after conditions of a work organization. They ergonomically assessed the improper working conditions such as inadequate lighting, uncomfortable chairs, and lack of forearm and wrist support, which revealed that the subjects complained about neck and shoulder pain, visual problems, and psychosocial conditions. The results after the intervention design showed mainly improvement in chair comfort, lighting conditions, visual strain, and sitting posture.

Pin-Chieh Wang (2007) carried out a study to assess the contribution of work-organisational and personal factors to the prevalence of work-related musculoskeletal disorders (WMSDs) among garment workers. They concluded that work-organisational and personal factors were associated with increased prevalence of moderate or severe upper body musculoskeletal pain among garment workers. They suggested that the owners of sewing companies may be able to reduce or prevent WMSDs among employees by adopting rotations between different types of workstations thus increasing task variety; by either shortening work periods or increasing rest periods to reduce the work–rest ratio; and by improving the work-organisation to control psychosocial stressors.

So one of the major concerns of manufacturing enterprises/factories should focus on improving worker productivity, which is one of the job performance measures. Some of the common features of these enterprises/factories are heavy work load, adverse environment, poor human–machine system design, unpleasant working conditions, etc. Workplace conditions such as inclement weather, extreme heat/cold, chemical smell, noise, poor lighting, vibration, and dust have direct or indirect effects on employee job performance. These conditions decrease employee concentration towards tasks which lead to low employee performance such as low productivity, poor quality, physical and emotional stress, which cause high cost. Effective applications of ergonomics in working conditions enhance employee job performance; provide worker safety, physical well-being, and job satisfaction.

The problem of this large unorganized sector has not given much importance in India. Therefore, an attempt has been made in the present investigation to focus on their body profile and work postures, physiological condition, the difficulties
usually they encounter in performing different Leather/Footwear tasks and to measure
how work environment of workshop alters throughout the year. The design of the work
station and its impact on workers also be evaluated and necessary modification, if
essential, be worked out. The objective of this study is to provide necessary ergonomic
measures for betterment of working condition, improvement of safety measures and
minimising health related problems of the workers of this industry.
Figure: I - Checking the footwear size

Figure: II - Tools used in footwear making.