

AN ERGONOMICS CHECKLIST ON THE ANALYSIS OF OCCUPATIONAL ACCIDENT RISK FACTORS

Mehmet Eker; Habip Erođlu; Hulusi Acar

Faculty of Forestry
Karadeniz Technical University
61080, Trabzon – Turkey
mekeker@ktu.edu.tr

Keywords: ergonomics checklists, occupational accidents, forest workmanship, safety-health

Abstract: *In the forest workmanship, the various ergonomics checklist have been commonly prepared to inspect the working conditions, to analyze the current working system, to optimize work and worker productivity, to control whether or not safety and health rules are being applied, to fix appropriate work method, and to work under the humanely working conditions according to different method. Ergonomics deals with the performing of their harmony. The checklists are one of the ergonomics indicator and these can be implemented by means of direct observation, questionnaire or another way.*

The wood harvesting workmanship is considered carefully or inspected by means of ergonomic indicators to promote work safety and worker health. The application of ergonomic indicators to well-structured harvesting system such as full mechanised is more evident. The questionnaire and direct observation aid to the inspection. But, in the semi/ill-structured harvesting system, it is an issue which indicators are used or how it can be done. In this respect, a discussion paper that is about preparation, implementation, and interpretation of a questionnaire focusing on ergonomics indicators was put in order to expose safety and health conditions and also work accident risk factors in Turkish forestry. The ergonomic checklist was arranged as literature-orientated. It was intended to form a questionnaire that can be able to analyze and define accident risk factors, expose state-of-the-art of existing working conditions, and control the application of safety and health rules. This was local objective of the study. The global objective was also to compare with the results of similar researches conducted in developed countries and our researches in that method, implementation and results.

1. Introduction

Forestry works are characterized as a difficult – dirty – dangerous working environment, heavy physical effort and high accident risks. In developing countries, this result in low productivity, poor wages and an unstable workforce. Therefore, these make forestry employment unattractive. However, forestry workforce is less stable and tends to leave for other jobs if there are alternative employment opportunities. In order to build up and retain in forestry sector a core of qualified workers it is imperative to provide acceptable working conditions. That is, to secure the future of forestry, human resources as well as forest resources must be used in a sustainable manner. The application of ergonomics in forestry is an important tool in creating such conditions (ILO, 1992 and 2000). While the necessity of ergonomics is well understood in the industrialized countries, forestry operations in most developing countries such as Turkey continue suffer from the lack of attention given to ergonomic requirements. Research and studies into these aspects are important means of overcoming the prevailing ignorance. Under the prevailing circumstances, starting ergonomics checklist that is data collecting system like labour inspection in Turkish Forestry is not an easy task.

Ergonomics aims at finding the best possible relation between man and work in order to make jobs easier, healthier, safer and more efficient. The forestry workmanship, realized under dynamical conditions such that natural conditions (climate, terrain, vegetation), technological patterns (tools, machines, methods, etc.), and organizational factors (planning, control, supervision, etc.) can be managed and monitored/controlled respect to ergonomic principles to provide both safety and health working conditions, as well to improve work productivity. To adapt ergonomics the forestry workmanship especially in Turkey, it should be firstly collected detailed data or information about workers and work conditions to analyze the real working situation. Although we have general information in bits on the state of the art of Turkish forestry workmanship, the standardized ergonomic checklist can be available to collect required data about it.

In the forest workmanship, the various ergonomics checklist have been commonly prepared to inspect the working conditions, to analyze the current working system, to optimize work and worker productivity, to control whether or not safety and health rules are being applied, to fix appropriate work method, and to work under the humanely working conditions according to different methods. Ergonomics deals with the performing of their harmony. The checklist is one of the ergonomics indicator and these can be implemented by means of direct observation, questionnaire or another way.

The wood harvesting workmanship is considered carefully or inspected by means of ergonomic indicators to promote work safety and worker health. The application of ergonomic indicators to well-structured harvesting system such as full mechanized is more evident. The questionnaire and direct observation aid to the inspection. But, in the semi/ill-structured harvesting system, it is an issue which indicators are used or how it can be done.

In this respect, a discussion paper that is about preparation, implementation, and interpretation of a questionnaire focusing on ergonomics indicators was put in order to expose safety and health conditions and also work accident risk factors in Turkish forestry. The ergonomic checklist was arranged as literature-orientated. It was intended to form a questionnaire that can be able to analyze and define accident risk factors, expose state-of-the-art of existing working conditions, and control the application of safety and health rules. This was local objective of the study. The global objective was also to compare with the results of similar researches conducted in developed countries and our researches in that method, implementation and results. Furthermore, we aimed to set up a comprehensive database system on Turkish forestry workmanship can be available for everybody.

2. Forest workmanship in Turkey

Turkey's 20.7 million ha of forest cover about 27 percent of the country. More than 7 million people live in over 19 000 forest villages in or to close to these areas. While almost all forest is state owned, the constitution requires not only that the area be expanded, but that it is developed and that benefits accrue to the population. Employment is one of the more important benefits. Number of forest workers are recorded about 300 000. These workers are forest villagers and they employ by contract as piece-work. All of them are unionized and no benefit from social security coverage. They are worked by forest cooperatives or contractors and their salary are paid State Forest Administration (Acar and Eker, 2002). There is about 15 millions man/day per year during working in forestry sector.

In general labour is abundant and therefore cheap in rural areas. Moreover, average age of forest worker is over 40 years. They have a low level of income and poor living standards. As well, skill levels are low. They learn the job by try and error method. Remuneration is based on production rate. Both shun investments in equipment, machines and training and try to earn a maximum by working harder and faster, often resorting to risky methods. As a result, productivity is low and safety and health situation is alarming. Unfortunately, there are no statistics about the accidents. Surveys of worker health show that 60 percent and more of the workers suffer from occupational health problems. Furthermore, depending upon various reasons, the technology in forestry activities is dominantly low level or rarely mid level. On the other side, applied ergonomics could clearly improve the situation (Acar and Eker, 2002).

Under these circumstances, first of all it should be a field survey to gather data for analyzing the fundamental causes of issues. An ergonomic checklist can be an illustrator for beginning step to collect data or information about forest workmanship in Turkey. Especially, we look forward to learn information about occupational accident, incidence, frequency, severity, etc. of which. Now, detailed records and reports are not available except for regional studies conducted by researchers on a few workers regarding to workmanship.

3. Discussion on methodology of ergonomic checklist

A variety of different ergonomic checklists have been successfully applied in forestry work for a long time for hand tools, fixed working position and machines in many countries. Based on ergonomic checklist, it can be collected information on working conditions, worker, and work environment. Some improvements and preventions strategy for worker health and work safety and a congruous solution synthesis for sophisticated issues can be developed by analyzing of the checklist.

This checklist covers a wide range of conditions, which may be found in work situations in forestry. Apud et al. (1989) stated that ergonomic checklist would be useful when;

- Designing new tools, machines and equipment,
- Purchasing new tools, machines and equipment,
- Changing working techniques, organization and methods,
- Assessing entire workplace, working techniques, methods, and organization,
- Conducting safety inspections.

When the checklist used for specific problem surveys, it ensures that (1) a logical and systematic approach is used, (2) all relevant and important data and background information are collected, (3) important aspects are not overlooked, and (4) improvements are suggested whenever possible. When a survey in forestry working conditions is carried out, a well-designed checklist will provide sufficient information for evaluation and improvement of basic work aspects. The checklist is used for collecting qualitative rather than quantitative data to obtain an overview of working conditions, enabling the user to detect critical deficiencies (Apud et al., 1989).

Some general information on forestry workmanship to use in variously objective should be collected while preparing a forestry workmanship database to improve and inspect it. It should compile information on: (a) size and structure of forestry sector (forest resources, forestlands, management, inventory, growing stock, etc.); (b) employment in forestry (numbers of workers, terms of employment, principal activities, equipment and machines, productivity, training, occupational safety and health, working and living conditions, remuneration, social security, and industrial relations); (c) labour standards applicable in forestry (labour legislation, collective agreements, regulations on occupational safety and health, social criteria of codes of forest practice) (ILO, 2000). A bit proportion of them can be obtained from statistical records (Statistical Institutes of State, Turkish Republic), Ministry of Forestry (MoF), trade union, and etc. Not all of the information is easily available, for example if forestry sector is grouped together with other economic sectors in statistical records.

Therefore, it is necessary to supplement the overall information on employment in forestry by a field survey of a representative sample of forest employers and employees. These are (ILO, 2000);

- *For forest employers* (enterprises, contractors or cooperatives)
Operations carried out; Size and nature of workforce; Equipment and machine used; Planning, organization and supervision of work; Daily time schedule; Productivity and remuneration; Social security; Accidents, first aid, personal protective equipment (PPE); Camps, supply of food and water; Labour relations, contracts, agreements; Problem encountered; Improvements suggested.

- *For forest workers*
Age and family status, children; Origin, residence; Education, vocational training, skill certificates; Since when and on what type of jobs employed; Remuneration and other benefits; Accident and sickness experienced; PPE and first aid provided; Camps, supply of food and water; Quality of equipment, machines, and work organization; Relations with supervisory staff; Problems encountered; Improvements suggested.

We prepared a checklist to satisfy our objectives aforementioned above. The checklist is very large but once it applied to forestry workmanship then comprehensive information will be collected. Its general concept and abbreviated content can be seen in Table 1.

This checklist was prepared according to ILO criterion and publication that is ILO (2000); Apud and Valdes (1995), Apud et al. (1989). It was modified to our specific case. Moreover, this checklist includes 21 main sections and wide range subsection. There are question and observation about work, worker, workplace, and machine/tools. The checklist has inquiry format, it can be therefore applied to forest workmanship. Each question incorporates an explanation row if it is required. In addition, we are preparing an anthropometrical measures table to apply workers who are working in suit where. Although the list is very long, it is to be used as a checklist, recording list, inquiry, control list, and guideline in semi or ill-structured forestry workmanship in Turkey.

This checklist is very important to gather information or data on forest workmanship. In this concept, the accident statistics and recording can also be provided and it will be the first time to collect occupational accident information. Some general information about other components of the workmanship may be reachable, but, we don't know drastically about accident rate, often, severity, risk factors, lost time, injury, cost, etc. in Turkish forestry, yet.

For that reason, we take into consideration accident section of the checklist. We discuss how we record the old accident and how the regular accident report system should be under these circumstances. We give accident reporting form (inquiry) abstracted from ergonomic checklist, in Table 2.

Table 1: Ergonomic Checklist Abbreviated

No	SECTION	SUBSECTION - CONTENT
1	INTRODUCTION	Related to workplace, workers, working machines /tool/ equipment, work elements and type, etc.
2	WORKING POSITION	worker posture during work, standing or sitting, static or dynamic work, job rotation, rest, etc
3	TOOLS,/EQUIPMENT/MACHINES	used in work (number, type, appropriateness, ergonomic, maintenance, etc....)
4	CONTROLLING AND GUIDELINE INSPECTIONS	Whether or not applied them?, often, degree, knowledgeable....
5	MANUAL WORKS	loading, lifting, carrying, load introduction, weight and dimension of load, etc
6	PHYSICAL WORKLOAD	Is it heavy workload?, heavy work elements, improvements,.
7	VISIBILITY AND LIGHTING	Work place lighting, visibility
8	NOISE	Effects and origin of noise, repetition, density, precaution, ...
9	VIBRATION	Effects, type, and source of noise, density, precaution, ...
10	DUST/SMOKE/GAS/CHEMICALS	Effects and source of dust, smoke, gas and chemicals
11	CLIMATIC FACTORS	Heat, effects of hot, cold and moisture, precaution,
12	WORK AND WORKER RELATION	Work process, inspection, break time, work methods,rotation
13	WORKING TIME	Working time, shift, daily working time, feed break
14	GENERAL SAFETY AND HEALTH ASPECTS – ACCIDENT RECORDING	Education about work accident, work accident occurred time, type of accident, accident place, cause of accident, first aid
15	TRANSPORTATION AND SAFETY	Transportation, enter and exit to work place, platform
16	PERSONAL PROTECTIVE EQUIPMENT	Protection clothes, using rate, goggles, gloves, protection shoes, trousers, waistcoat,
17	AID TOOLS FOR SAFE FELLING/DEBRANCHING/CUTTIN G	Felling lever, dagger, lift tools, rotate hook, rate of using the felling, debranching and cutting aid tolls
18	SAFETY DEVICES ON CHAIN SAWS	Front and back hand protecting, automatic break, anti-vibration system, maintenance
19	WORKER’S NUTRITION/SOCIAL SECURITY/WELFARE	Compensation of accident, illness, disability, social engraving, arriving time to work place, possibilities of accommodation, nourishing time and place, type of food.
20	WORKER’ S BACKGROUND	Working time, work statue, level of education,
21	GENERAL INFORMATIONS	Annual income, marital statue, number of child, wages, labor union, occupational training, improvement,

The determination of occupational accidents rate is very important in Turkish forestry. Up to now, except for some local scientific research, there is no national accident statistical conducted in forestry. We know that forest workers are exposed to a high accident risk. Accident may lead to injury or death of workers and to damage of equipment. Minor injuries may be followed by a few days of absence from work; serious injuries lead to prolonged absence from work, to permanent disability or to death. Accident rates in the forestry sector are much higher than for most other industries. One out of two forest workers per year may be injured through an accident as against one out of 10 workers in other industries. A frequent source of forest accidents is slips and falls in the terrain, leading to contusions, bruises, sprains or fractures. Open wounds caused by cutting tools are also quite frequent. Most of the serious accidents occur in wood harvesting when the worker is hurt by trees, brunches or logs (ILO, 1992). However, we don't know what the source of accident is and what the severity of it is or etc., for Turkish forestry.

Table 2: Occupational Accident Record Form Abbreviated

No	Question & Query	Accessory Questions
1	<i>Identification</i>	<i>It is abstracted from ergonomic checklist form</i>
2	Working status of FW*	Permanent, seasonal, occupation, working time...
3	Attended training course	Year, where, length, nature....
4	The accident place	Where, in route, to work, from work, etc.
5	When did happen accident	Year, month, week, day, hour,
6	Work activity during accident	Logging, transport, marking, loading, etc.
7	Distance to health centre	Time (min), distance (km), transition time, etc.
8	Type of accident	Falls, struck, caught, overload, poison, etc.
9	Agency involved	Machines, hand tools, equipment, animal, FW, etc.
10	Nature of injury	Fractures, dislocations, sprains, wound, crushing, cut...
11	Bodily location of injury	Head, neck, trunk, upper limb, multiple, others...
12	Hazardous conditions	Lack of PPE**, excessive noise, improper tools, etc.
13	Unsafe factors	Failure to use PPE, wrong postures, operating speed...
14	Unsafe personal factors	Lack of skill, improper attitude, disobedience, defects..
15	Severity of accident	Permanent/temporary/partial disablement, fatal
16	Number of days lost	Day, week, month, year
17	Open risk factors	Observation
18	Number of near-miss accident	At last year, type of, frequency
19	First aid tool kit	In FW bag, in working place

* Forest Workers

** Personal Protective Equipment

All accidents, which result in loss of working time, should be reported. The reports should be used to establish accident statistics. These are an important source of information on what types of accidents are serious and of determining where and how preventive measures should be taken. Unfortunately, an accident reporting systems not exist in the forestry sector of Turkey. There is not any office that can provide valuable information on which to base accident prevention. On the contrary, this kind of information has proved quite effective to stress the need for specific preventive measures and to motivate workers to adopt safe working habits.

In addition to accident record form in inquiry format, simplified accident report card can be prepared including the following question (ILO, 1992);

- Who was injured?
- Who saw the accident or was nearby?
- When and where did it happen?
- What kind of activity was being carried out?
- What did the worker intend to do and what went wrong?
- What kind of agent was involved (e.g. axe, branch)?
- What was the injury (part of body, nature, and expected period of absence)?
- What kind of PPE was being used?
- How was first aid and transport of the victim carried out?
- What material damage was caused (e.g. broken machines)?

Thanks to inquiry and records the accident risk factors such as unsafe conditions (technical, organizational, geographical, and climatic) and unsafe behavior (violation of safety rules, and etc.). Finally, tractable measures should be proposed on how to avoid a repetition of similar accidents.

4. Result and recommendations

Ergonomic checklist is a useful tool to analyze the essential working conditions and to gather information on forest workmanship. The checklist can be widely applied for multiple objectives to forest employee or employers. But, these cannot be applied everywhere. The forest workers should be ready to interview or to give information by self.

When the local researches are realized, it was shown that the forest worker including the interview bored because of inquiry had long query list. On the other hand, we desire to collect detailed information to set up forestry workmanship database system to forward statistics, i.e. occupational accident and disease. Thus, there is a conflict, which is between long ergonomic checklist and workers' willingness.

Nevertheless, we have to apply the ergonomic checklist or its subsections like accident reporting form to forest workmanship in Turkey wide. Partially, some information on working conditions can be obtained few worker, employer or administer, but occupational accidents, disease, near-miss accident rate, etc. cannot be learned from a bit observations. For that reason, we are dominantly considering accident section of the ergonomic checklist because now we have minimum information about forestry accidents.

In Turkey, there is about 1,5 millions man/day per year during working in forestry sector. Detailed records and reports are not available except for regional studies conducted on a few workers regarding to work accident. In many countries where are carried out intensive forest operations, such as Slovenia, Austria, USA, Canada, Chile, and other countries the work accident risks have been determined and orderly reported, and the risks were escaped. Thus, many improvements were provided relevant to workers health, work safety and productivity by preventing from accident risks.

We have no data warehouse where are accumulated the work accident reports or records. The forest workers exposed to work accidents have not been declared any work accidents occurrence. Consequently, this research project was prepared to fill the blanks about occupational accidents in forestry, to constitute the background of work accident reports and statistics, to make a work accident risk map, to put forward the working conditions of forest workers according to body posture, energy intake and expenditure, and other variables related to workers and working conditions.

Research methods include questionnaire, observation and measurement. Firstly, a premise investigation is to be carried out to determine the reasons of work accident and a number of work accidents occurred in the past in sensitive regions. Prepared questionnaire will be applied forest workers. In addition, the research results will be obtained by making of the sufficient questionnaire respect to sample size that describes the various working condition. The observations and work-study about work environment will be realized to give information on work accident is occurred in which condition. To put forward the relation between work and worker, tension rate, body posture, pulse, blood pressure, noise etc. will be measured as secondly level. Besides, tools and machines used by workers will be scrutinized respect to ergonomic control lists, and physiological properties of workers and relations between work and work environment will be determined. Therefore precautions will be determined about the work accident and occupational diseases.

Many developments and changes in Turkish Forestry Sector are necessary so that it can be adapted to European Union. Thus, the improvements of both forest resources and worker (workforce) resources should be standardized. When this project is completed, it can be available and helpful on how to be made the standardization of working condition and workers, that is, this project's results can illustrate to all relevant persons or association. In addition that, the willingness of humanist working conditions and the new trends on work laws entails the ergonomics improvements in forestry sector as well.

5. References

Acar, H. H. and Eker, M. (2002) Ergonomics in Forestry –A Challenge for Turkey and a Call for Partners, Forworknet update – December 2002, ILO Sectoral Activities Department.

Apud, E.; Bostrand, L.; Mobbs, I. D.; Strehlke, B. (1989) Guide-Lines on Ergonomic Study in Forestry. ILO Publications, 241 pg., Geneva.

Apud, E. and Valdes, S. (1995) Ergonomics in Forestry – The Chilean Case. ILO, Geneva.

ILO (1992) Fitting the Job to the Forest Worker – An Illustrated Training Manual on Ergonomics. ILO, Geneva.

ILO (2000) Approaches to Labour Inspection in Forestry – Problems and Solutions. Sectoral Activities Department, ILO, Geneva.