

ENVIRONMENTAL CHARACTERISTICS AND RISK OF OCCUPATIONAL ACCIDENTS IN LA XUYEN WOOD CARVING CRAFT VILLAGE

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ABSTRACT

Wood carving is one of the oldest traditional professions with a history of hundreds of years and has developed to this day. The environment of craft villages has its own characteristics because the production area and the living area are located in the same household. Wood carving is a meticulous, labor-intensive job, characterized by the use of high-damage equipment such as saws, planers, chisels, hammers, nails, etc., and heavy materials. This exposes workers to many risks due to the nature of the job or the working environment. Woodworking activities are mostly done by people in the village and some surrounding areas. The construction of a database on the environment and occupational accidents and diseases related to wood carving is still limited. In this study, we analyzed the characteristics of the working environment and the risks of occupational accidents that workers have to bear in wood processing in La Xuyen craft village, Vietnam. Within the scope of the study, a total of 377 employees were surveyed using the survey method.

KEY WORDS: Pollution environmental, Wood carving, Occupational accidents, Occupational safety and health, La Xuyen craft village, Vietnam.

INTRODUCTION

Traditional occupations contribute to timely response to diverse needs of social life, capable of attracting many workers, creating jobs and increasing incomes for millions of rural people, contributing to development economic in local. Vietnam has more than 300 woodworking craft villages with hundreds of thousands of workers, including workers in craft villages and laborers from outside to work.

Wood processing plays a very important role in the livelihoods of households in La Xuyen craft villages. In addition to its economic importance, at present, the environment of woodworking craft villages also has many concerns such as noise, dust, etc. Investment in improving working conditions have received little attention. The quality of people's living environment is declining, the rate of work accidents is increasing.

According to the report of the Ministry of Labor, Invalids and Social Affairs in 2021, the investigation of occupational accidents in areas without labor contracts (including woodworking craft villages) has not been fully implemented according to regulations. The fact that the Commune People's Committees make occupational accident records for employees without labor contracts is still very limited. When an occupational accident occurs, the most disadvantaged employee is the employee, especially the employee who does not have health

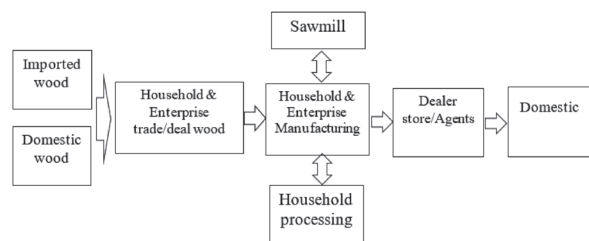


Fig. 1. General supply chain of craft villages

insurance, occupational accident insurance must take care of all costs.

The research objective is to determine the environmental characteristics and the risk of occupational accidents of the La Xuyen wood carving craft village.

MATERIALS AND METHODS

The study was carried out in the traditional wood carving village of La Xuyen, Y Yen, Nam Dinh, Vietnam.

The geographical location of the craft village is at coordinates 20.319556701934903, 106.04996203622775 (determined by google map).

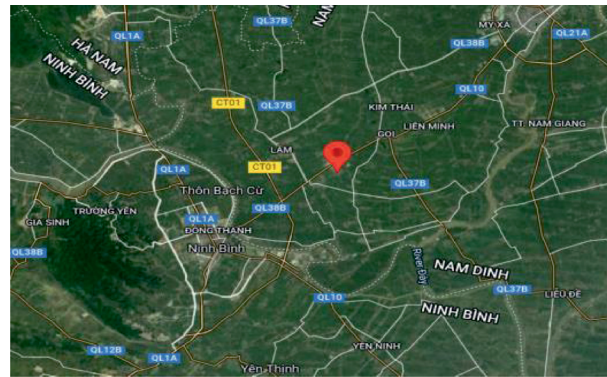


Fig. 3. Location of the study area

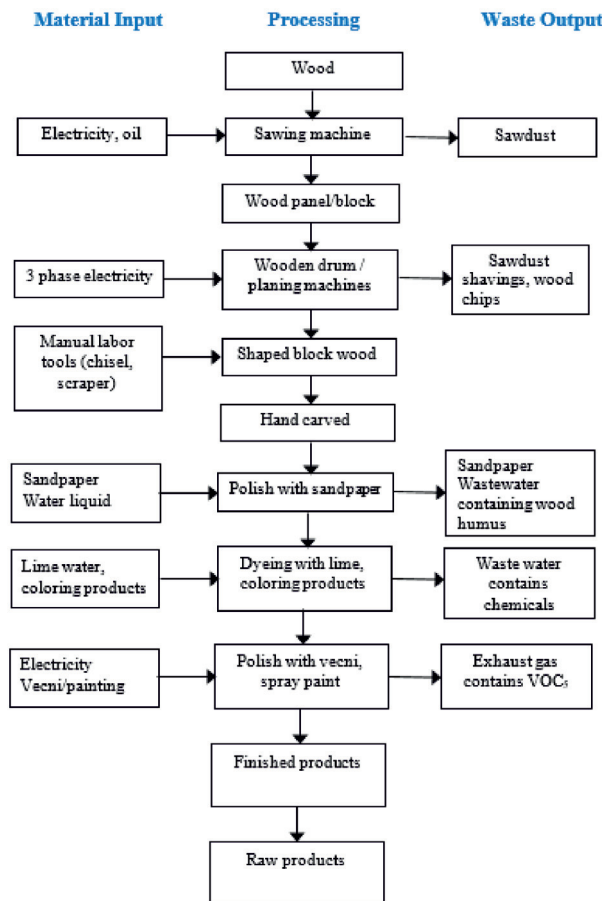


Fig. 2. Production process in wood carving craft village

La Xuyen wood carving village has a tradition of more than 1000 years with the main products being tables, chairs, beds, cabinets... in traditional designs and 100% of households do carpentry. The main form of production organization in La Xuyen is the household organization. Each household has its own workshop with 2-3 main employees and hired labor

from neighboring areas, in addition, there are also a few small and medium-sized furniture factories.

At the time of the survey, due to the impact of the Covid-19 epidemic, the craft village had about 6,500 workers, of which 6,000 were in the craft village, and 500 in other places.

To consider the level of environmental pollution of the craft village, in this study, wastewater, noise and total suspended dust (TSP) (sampled in 1 hour) were measured at 7 locations typical for production stages in the craft village and stretching from the beginning of the village to the end of the village.

Table 1. Survey sites

Location	Symbol
Household specializing in the business of wood materials: Duong Van Thuong	LĐ 1
Households that both trade in wood products and process and produce: Pham Van Giang	LĐ 2
Household processing sawn timber: Pham Van Tung	LĐ 3
Household processing chisels by hand: Truong Thi Huong	LĐ 4
Household processing chisels by machine: Truong Ngoc Linh	LĐ 5
Household finishing processing and assembling wood products: Truong Van Viet	LĐ 6
Household trading in wood products: Truong Thi Phong	LĐ 7

To survey about occupational accidents, the study chose a simple random sampling method with the total number of employees at the time of the survey was 6,500 employees, with 95% confidence, 5% standard error. The sample size was calculated according to the simple formula:

$$n = \frac{N}{1+N*(\alpha)^2}$$

The study included 377 workers selected by random sampling method. In this study, a questionnaire consists of 10 questions about occupational accidents and 8 questions related to risks and costs that employees have to pay when having occupational accidents. Surveys were conducted by handing out questionnaires to employees to fill in their own information, which were then collected and processed. The answers of the survey questions were processed using the program SPSS 22.0. This study is a cross-sectional study.

RESULTS AND DISCUSSION

Characteristics of the working environment of the craft village

La Xuyen village has about 2000 households with the characteristic that all households are engaged in wood processing. The workplace is not isolated but located in the household. Most of the households use their house directly as a place of production. The number of households with separate factories is 35 out of 2000 households, accounting for 1.75% of the total number of households. There are 1965 households using their house as a place of production (98.25%). This shows the current shortage of production space in craft villages. This is a problem that leads to an unsafe living and working environment, with many potential risks to health and safety.

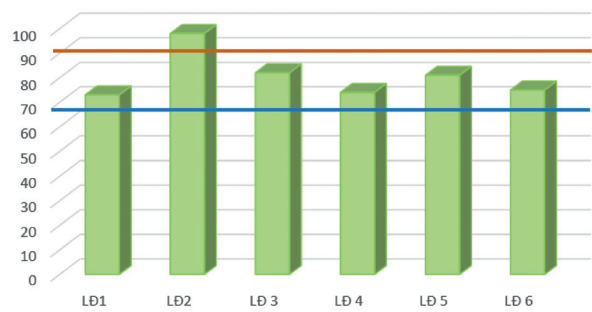
Table 2. Place of work status

Place of work status	Number of house holds	Percentage (%)
Place of work separate	35	1,75
Place of work in household	1965	98,25
Total	2000	100

Because the workplace is located in the household, the working area of employees is very limited. The pressure on production space is especially great when there is a need for space to store raw materials and finished products. The production area and the living area are not separate, so the craft village is facing serious environmental pollution problems. Issues include noise pollution, dust, sewage, solid waste, etc.

The air environment of the craft village is affected by two typical factors: noise and dust. Noise pollution is a problem that villagers are facing due to

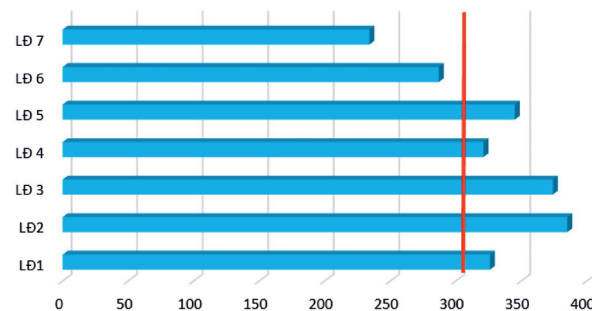
sawmills, chisels, planers, etc., which operate almost all day from 7 a.m. until about 7-8 p.m. Noise is also caused by some activities such as loading and unloading materials and products, the operation of cars and motorbikes in and out of the craft village. The noise is almost throughout the day except for the period from 11am to 1pm because people take a lunch break. Noise in the workplace has times and places that are very high. Although basically, the production noise does not exceed the specified limit, but the residential noise exceeds the permissible standard by about 1.04 to 1.4 times. The cause of noise in residential areas is higher than the allowable standards because the place of work is also the place to live. This is a disadvantage of the living environment of the people in the craft village.



— : Limiting noise in residential areas (QCVN 26: 2010/ BTNMT)
 — : Limiting noise in work (QCVN 24: 2016/ BYT)

Fig. 4. Noise analysis results

The air environment of craft villages is also affected by dust. According to the analysis results, there are 2 locations with dust concentration lower than the allowable standards: product sales area and product finishing and assembly area. These are also the locations that emit the least dust in the craft village. At most of the remaining locations at the time of sampling, the dust content was higher than



| : Limit dust concentration in the surrounding air (QCVN 05: 2013/ BTNMT)

Fig. 4. Dust analysis results (TSP)

the allowable standards. The dust is mainly wood dust, the dust content is 1.07-1.28 times higher than the allowable standards. This is a consequence of the fact that the production households do not have the conditions to install the dust collection system. The workplace is also a place to live. The collection has not yet ensured environmental sanitation, and there is no separate place to store waste, so dust from the production and processing process is not collected and treated.

The craft village does not have a wastewater treatment system. Wastewater from work place in households is discharged together with domestic wastewater then discharged into Sat river, which is also a source of domestic water supply for households in this area. Wastewater generated mainly in the product finishing stage includes wastewater from sanding and lime dyeing. Wastewater includes production wastewater and domestic wastewater. From the results of the table below, it can be seen that the analytical parameters of pH, BOD5, COD, suspended solids, nitrogen, iron, coliform all exceeded the allowed standards (compared to QCVN 40: 2011/ BTNMT/B). The analysis results show that the wastewater from the wood carving craft village has high organic matter content. This is explained by two reasons: Because the village's drainage system has not been able to separate between production wastewater and people's daily-life wastewater; These two sources of wastewater are discharged to the common drainage system, and at the same time, the craft village does not have a wastewater treatment system, leading to heavily polluted wastewater.

Lighting is also an issue, as wood carving requires meticulousness and precision, and most employees work under natural light. Therefore, employees have to adjust their eyes more than

mixed light.

The waste is quite diverse in the craft village, including domestic solid waste and production of solid waste. According to the survey results, the amount of solid waste is relatively large compared to the corresponding household size. On an average, every day craft villages discharge more than 5 tons of solid waste into the environment, mainly production solid waste including wood chips and sawdust. These wastes are collected and sold to plywood factories. However, due to the lack of planning, the solid waste collection area is often not fixed. Waste is spreading everywhere. The cleaning is not done regularly, so place of work and place of living allway have waste and dust. The living environment of the villagers is polluted.

Hazardous wastes such as rags, oil-absorbing paper, and chemical packaging; etc are not collected and treated according to regulations. These hazardous wastes are disposed of together with the domestic waste collection system, and then dumped in the village's common landfill. This is an open ground that has not been planned, built and managed by the government.

The results show that the majority of employees in the survey group (82%) do not understand the environmental regulations related to production and processing in the craft village. Only 16% of respondents knew that there were environmental regulations, but they also shared that due to limited capital, they could not meet those requirements. According to the households, the local government has not made any environmental requirements for the households. The State's regulations on environment are currently only applied to processing enterprises, but not to processing households in craft villages.

Table 3. Wastewater analysis results

Analytical parameters	Unit	Result							QCVN 40: 2011/ BTNMT/B
		LĐ1	LĐ2	LĐ3	LĐ4	LĐ5	LĐ6	LĐ7	
pH	-	6,8	7,1	7,2	6,8	7,3	7,1	6,9	5,5 - 9
Color	PTU	243	320	245	214	232	254	218	150
COD	mg/l	324	400	314	328	302	341	326	150
BOD5	mg/l	98	105	86	87	95	103	89	50
TSP	mg/l	220	310	216	234	256	205	187	100
Total P	mg/l	0,019	0,115	0,213	0,032	0,167	0,025	0,069	6
Total N	mg/l	46,1	51,7	42,8	41,3	42,1	43,1	41,6	40
Total mineral oil	mg/l	0,07	0,08	0,08	0,09	0,07	0,08	0,07	10
Coliform	MNP/ 100ml	6100	7200	6800	6500	6700	6500	6200	5000

Risk of occupational accidents

Due to the characteristics of the environment and working conditions in the craft village, there are many potential risks of occupational accidents. The survey results on working conditions show that the production area has many machines and equipment with high risk as as sawing machines, chisels, bending machines, rim machines, etc..., hand tools such as chisels, planers, hammers have potential hazards. The ventilation and dust extraction system is not available. Employees are not equipped or inadequately equipped with personal protective equipment. The noise is not loud but all day.

Table 4. List of hazards

Hazards	Threats
excessive machine noise	hearing impairment of a worker disturbance of worker's concentration fatigue of a worker
Sharpness of saw blade	sectioning of the upper limb cutting off a portion of the upper limb
Rotating high-speed saw blade	grabbing, pulling, wringing of the working clothes of the operator coughing of the upper limbs
damage of the saw blade	hit by saw blade fragments or thrown material the formation of sparks and flame, fire
flying particles from materials (sawdust, chips, dust, cuttings workpiece kickback	operator hit by the particles the penetration of the particle into the eye punching, stabbing, and picking up the material into the operator by machine
present dangerous flammable wood dust and sawdust	respiratory tract irritation, allergy poisoning, suffocation explosion
lack of daylight	eye damage worse employees concentration visual fatigue of the employees
obstacles and dirt on the floor around the workplace	fall, clogging a employees on waste material on the floor near the machine slipping the employees on the floor
sawing large size materials	fall, prevalence, overthrowing pressing, pressing of the operator
electric current	electrical tripping and electric shock

Woodworking operations are very dangerous and can lead to serious occupational injury.

In this study, base on of assessing the working environment and based on the survey results of employees, we have determined the possible risks that cause occupational accidents and threaten the health of employees as follows:

Employees do not perform regular machine checks before each work on the machine.

Employees are not equipped with personal protective equipment and therefore do not use personal protective equipment during work.

As a rule, after the job is completed, workers are not allowed to leave the workplace until the saw blade has come to a complete stop, but in fact they have left before the saw blade has completely stopped.

Workers do not clean the machine and working space regularly

Workers do not use devices to reduce noise levels.

Large workpieces are not always sufficiently secured against tipping, tilting or falling during machine cutting.

No machine manuals within reach of the operator.

There is no protective cover on the main saw blade.

Daily (spot) lighting in the workplace is not always enough

There is no fixed waste collection site

Power lines on the floor are dangerous.

The worker's working posture is not suitable

No fire fighting equipment

With the above risk of accidents, the survey results of 377 workers in craft villages show that factors of working environment greatly affect the rate of occupational accidents in craft villages. Of the total surveyed workers, 371 people suffered occupational accidents, accounting for 98.4% of the total number of people surveyed. Only 1.6% of the people surveyed have not had a work accident. Among people suffering from occupational accidents, 16.7% suffered from 1 to 3 accidents and 79.2% of employees said that they had accidents from 3 to 10 times and 4.1% had accidents more than 10 times. Out of 371 people who had an accident, 121 people had their fingers and toes cut or a foreign object shot into their eyes, causing eye damage, accounting for 32.6%. The rest are minor occupational accidents such as soft tissue injuries, slips and falls... There are many causes leading to occupational accidents. In which, the reason is

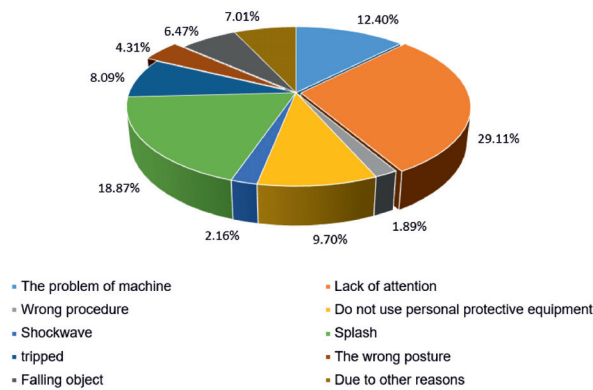


Fig. 5. Direct causes of occupational accidents

mainly employees lack of attention (29.1%). This type of accident usually happens at the end of the working day. This can also be explained because at the end of the day, employees are often tired, have the mentality of finishing work to rest, so they are subjective, do not pay attention in work and let accidents happen. The occupational accidents is happened also caused by objects or dust splashed on body or eyes, accounting for a high rate accident (18.87%). Followed by broken machinery and equipment (12.4%). The survey results showed that the cause of incorrect procedures accounted for the lowest rate (1.89%). This is acceptable because woodcarving is quite simple. Because the production area is in the family, from a young age, employees have grasped the working process.

There are 263/37 surveyed people who buy health insurance voluntarily, accounting for 69.8% and are covered part of medical care costs when having an accident. Because they are self-employed, workers in craft villages do not buy occupational accident insurance. They think that it is very expensive and the accident may not happen to them. At the same time, Vietnamese law does not clearly stipulate the cost of accident insurance for



Fig. 6. The longest time off work when employees having an occupational accident

employees who do not have an employment relationship.

The longest time off work for an employee who has ever suffered an occupational accident is shown in pic 6. The employee takes the longest leave when suffering an occupational accident from 1 to 7 days have the highest rate 55%. This shows that the main accidents for workers in craft villages are minor occupational accidents. However, there are about 3% of employees, when having a work accident, have to stop working for more than 3 months.

Because they are self-employed workers, workers in craft villages are not entitled to the same benefits as workers in enterprises.

About 30.2% of employees have to pay the entire cost of medical examination and treatment when suffering from occupational accidents. The prolonged healing time will affect their lives and income. Among those who suffered a work accident, about 49 people (accounting for 13% of the total number of people surveyed) thought that their health had deteriorated after being involved in a work accident, and about 46 people (12.2% of the total number of people who suffered an occupational accident) reported a decrease in income after being injured at work. In addition, there are 16 people (accounting for 4.3% of the total number of people with occupational accidents) who have to buy periodic drugs or go for regular medical examination as a result of the accident.

CONCLUSION

Environmentl characteristics have an influence on occupational accidents. With the characteristic that the place of residence is also a place of production, the living environment of the people is not guaranteed. Air environment is polluted by dust and noise due to outdated machinery and equipment, no dust collection and treatment system, no measures to reduce noise. Wastewater is not collected or treated. Domestic wastewater and production wastewater are discharged from the same pipe leading to water pollution. Ordinary solid waste is collected together with hazardous solid waste, without a standard treatment system. Industrial hygiene is not concerned by workers. Outdated machinery and equipment and high risk of unsafety. Employees do not have knowledge about occupational safety, being subjective at work leading to a high rate of accidents, especially those with amputated fingers, toes, and eye injuries.

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