

EVALUATION OF THE ATTENDANCE OF REFRESHER COURSES FOR FORESTRY MACHINE OPERATORS

*Aigars Strubergs¹, Andis Lazdins², Linards Sisenis¹

¹Latvia University of Life Sciences and Technologies, Latvia

²Latvian State Forest Research Institute 'Silava', Latvia

*Corresponding author's email: aigars.strubergs@llu.lv

Abstract

The study finds out the forest machine operators' opinion about the need for refresher courses, the quality of the courses, the knowledge and skills gained as a result of attending the courses. As part of the research, a questionnaire was compiled and sent to forest machine operators who have attended courses at the Forest Machine Operator Training Center in the last 4 years to improve their professional skills. The questionnaire was prepared and sent electronically at the end of 2021. Within two months, the questionnaire was completed by 147 operators. The aim of the survey is to find out the operators' opinion about attending refresher courses, and whether operators acquire the necessary knowledge and skills in refresher courses, which would increase their productivity. Among the surveyed operators, operators in the age group up to 30 years with work experience on the respective machine under 5 years were more interested in refresher courses, while operators in the age group over 41 years of age having work experience over 5 years were less interested in the refresher courses. It was found that 30% of forwarders and 33% of CTL (Cut-To-Length) harvester operators attend refresher courses on their initiative, while all forwarders operators and 65% of harvester operators attend refresher courses on the initiative of the employer. 75% of forwarder operators and 66% of harvester operators stated that they had acquired additional new knowledge and skills as a result of their training, as a result of which their professional qualification level as well as productivity increased.

Key words: education, harvester, operator.

Introduction

In today's mechanized logging, harvester productivity is affected by several factors. Some of the influencing factors cannot be changed, such as tree species, diameter at breast height (DBH), type of felling, terrain, etc. There are several studies in this direction, where the influence of environmental factors is clarified (Olivera *et al.*, 2016; Nurminen *et al.*, 2006). However, some factors are subject to change and are largely related to the behavior of the operators, including psycho-emotional state, speed of reaction, speed of decision-making, and other factors (Purfürst, 2010; Purfürst & Erler, 2011). One such variable is the readiness of the operator of the logging machine (Alam *et al.*, 2014). Periodic operator training plays a very important role in increasing productivity. Training can improve the skills of operators to perform certain activities. Training can take place in nature, in a logging machine, as well as the practical skills of operators can be developed with the help of a simulator (Eriksson & Lindroos, 2014). However, simulators differ in environmental factors, which sometimes cause problems for the operator in making decisions. Training operators in nature is an expensive process, because, firstly, the hourly cost of the logging machine itself is high and, secondly, a large part of the cost is fuel costs. Despite these costs, 8-16 hours of training is provided in Latvia, where the instructor follows the work of the operator in person and provides recommendations for more efficient work. This type of training produces results, but the result was largely determined by the professionalism

of the instructor, from his ability to assess the situation and make recommendations. The aim of the research is to find out how forest machine operators working in Latvia use opportunities to increase their professional skills in professional development courses to increase productivity.

Materials and Methods

In this study, to find out the opinion of forest machine operators about the need for training and benefits from training, a survey of forest machine operators was created in electronic form (Geske & Grīnfelds, 2020). The survey consists of 3 blocks. The first block provides general information about the operator, the second block focuses on issues related to the in-service training process, and the third block provides questions related to the benefits of the training and recommendations. To be able to perform the mathematical processing of the survey, the variants of the answers to the questions of the second and third blocks of the survey are compiled according to the Likert scale in a six-point system from 'strongly disagree' to 'strongly agree'. Before the survey, the questionnaire was experimentally tested to ensure the clarity of the questions. The questionnaire was prepared electronically, emailed to the operators, and the questionnaire was filled online. The link to the survey was sent to the largest logging companies in Latvia, which have at least five logging machines and their forest machine operators participate in training organized by the Forest Machine Operator Training

Center. The master of logging companies distributed the questionnaire to forest machine operators. The results of the survey were collected and grouped with MS Excel. Harvester and forwarder operators were separated for analysis. Next, operators were grouped according to the level of education obtained: basic, secondary, secondary-professional and higher. In addition, operators were divided by age: up to 30 years, 31 to 40 years and over 41 years. To get a more complete picture of the impact of training on work productivity, operators were grouped by length of service on the relevant machine: up to 5 years and more than 5 years. The statistical processing of the survey data was performed using the R program by performing the chi-square test.

Results and Discussion

From 2018 to 2022, in-service training was conducted for 315 forest machine operators at the Forest Machinery Operators Center. 147 forest machine operators participated in the survey and filled in the questionnaires.

According to the survey data, the average age of operators is 33 years. During the survey, it was found that 18% of the surveyed operators had primary education, 20% had secondary education, 55% had secondary vocational education and 6% had higher education. 57% of the surveyed operators had obtained a diploma in forestry as a forest machine operator. The average total length of service of operators on logging machines is 7,6 years. Because two types of logging machine operators work in logging, the operators of

harvesters and forwarders are separated. Initially, operators are sorted into separate groups. There are three groups according to the age of the operators: up to 30 years, 30-40 years, and more than 41 years, based on work experience in the last logging machine for up to 5 years and more than 5 years and education obtained accordingly.

Forwarder operators.

The average length of service on this machine of the surveyed forwarder operators was 6,4 years. To get a fuller picture, Table 1 shows the length of service and education of operators as a percentage of the total.

Of the surveyed forwarder operators, six operators in the age group up to 30 years have obtained a forest machine operator qualification diploma. The others have obtained a driver's license for the relevant category of tractors and further improved their professional qualification by working in a logging company and attending refresher courses.

Harvester operators.

The average length of service on this machine of the surveyed harvester operators was 4,7 years. To get a more complete picture, Table 2 shows the length of service and education of operators as a percentage of the total.

In the age group up to 30 years, 24 operators have obtained the qualification of a professional forest machine operator. In the age group 30-40, 4 operators have a professional qualification as a forest machine operator. Other operators have improved their professional skills by working in a logging company and attending refresher courses.

Table 1

Distribution of forwarders operators by age groups, the length of service in the respective machine, and level of education (as a percentage of the total number)

Age group (years)	Work experience (years)		Education			
	To 5	More than 5	basic	secondary	secondary – professional	higher
To 30	20	20	5	15	15	5
30-40	25	10	5	5	25	-
More than 41	10	15	10	10	-	5

Table 2

Distribution of harvester operators by age groups, the length of service in the respective machine, and level of education (as a percentage of the total number)

Age group (years)	Work experience (years)		Education			
	To 5	More than 5	basic	secondary	secondary – professional	higher
To 30	31	17	-	4	41	4
30-40	28	14	17	10	14	-
More than 41	3	7	-	-	10	-

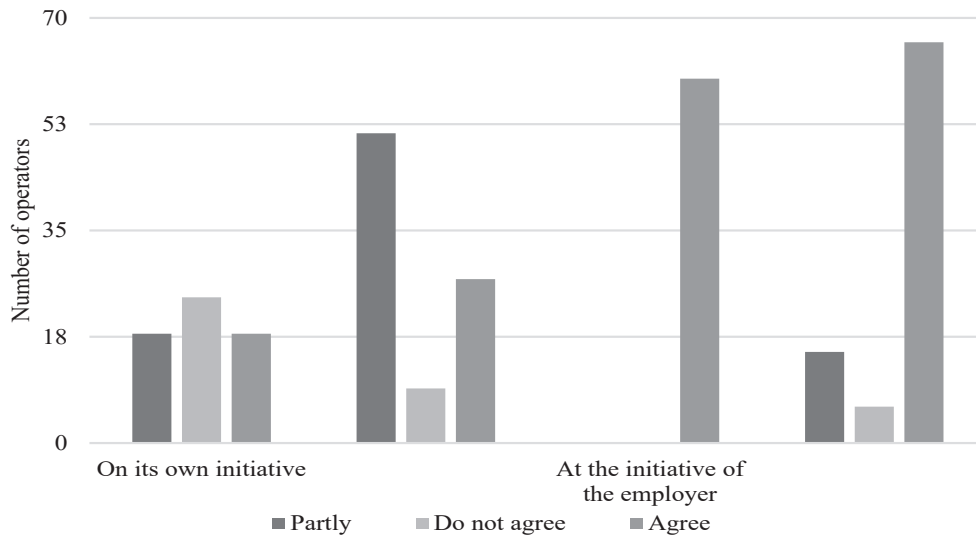


Figure 1. Attending refresher courses on your initiative or the employer's initiative.

The survey aimed to understand how attendance at qualification courses was assessed by the operators themselves. How useful were the knowledge and skills acquired under the guidance of professional instructors and how they affected productivity.

According to the information available at the Training Center for forest machine operators, it is understood that the operators of some logging companies have attended refresher courses several times. Consequently, operators were asked how often they attend refresher training.

According to the survey data, 42% of forwarder operators and 41% of harvester operators attend refresher courses one or more times a year. Of the forwarder operators who attended the refresher course once or more a year, 40% had less than 5 years of experience on the machine in question, and 60% had more than 5 years of experience, 67% and 33% for harvester operators, respectively.

According to the results of the survey, harvester operators, especially new operators with less than five years of experience with the machine, pay more attention to their professional development and productivity by improving their working methods.

Given that the response of the operators to the survey was relatively low, only 47% of the operators trained at the Forest Machinery Operators Training Center in the last 4 years answered the questionnaire, the answer groups of the following questions are merged. The Likert scale answers 'strongly agree' and 'partially agree' are combined as 'agree'. 'Partly agree' and 'partly disagree' are combined as 'partly'. The answers 'disagree' and 'strongly disagree' are combined as 'strongly disagree' (Geske & Grünfelds, 2020).

The purpose of the next two questions is to find out whether the operators attended the refresher courses on their own or on the employer's initiative (Figure 1).

The diagram in Figure 1 shows that the initiative of harvester and forwarder operators to attend in-service training courses differs significantly $\chi^2 = 20.12$, $p = 4.275e^{-0.5} < 0.05$. 30% of forwarder operators answered that they attended the refresher courses on their initiative, 30% partially agreed with this statement, and the remaining 40% did not agree with the statement that they attended the refresher courses on their initiative. In turn, all surveyed forwarder operators indicated that they attended refresher courses at the initiative of the employer. On the other hand, 33% of harvesters agreed with the statement that they attended the training on their initiative, 57% partially agreed but 10% did not. 65% of the surveyed harvester operators fully agreed with the statement that the training was attended at the initiative of the employer, 28% partially agreed, but 7% did not agree with this statement. Comparing the answers of the harvesters by separating the operators according to the length of service, it was noticed that the answers of the operators differed significantly in this section $\chi^2 = 12.147$, $p = 0.002303 < 0.05$. Harvester operators with up to 5 years of experience attended more training on their initiative or in part, while harvester operators with more than 5 years of experience mostly attended refresher courses at the initiative of the employer.

One of the preconditions for the success of individual training is whether knowledge and skills are assessed before the training. According to the survey data, the evaluation of harvester and forwarder operators on the test of knowledge and skills before training did not differ significantly $\chi^2 = 0.47815$, $p = 0.7874 > 0.05$. 6 forwarder and 12 harvester operators denied that their knowledge and skills had been tested before the training; however (Figure 2), 90% of harvester operators and 86% of forwarder

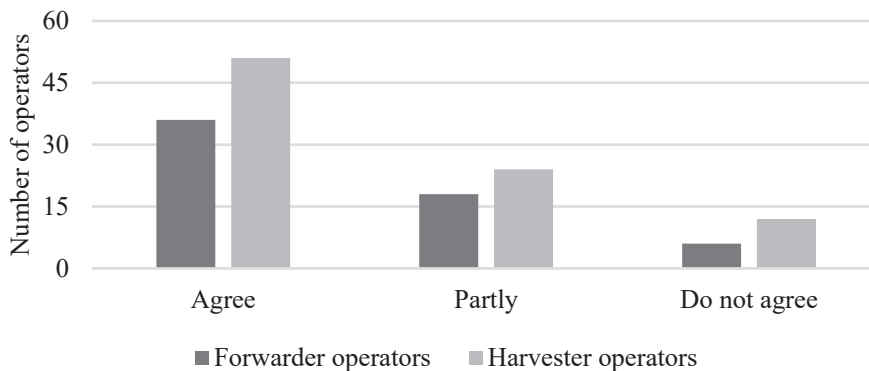


Figure 2. Test of operators' knowledge and skills before training.

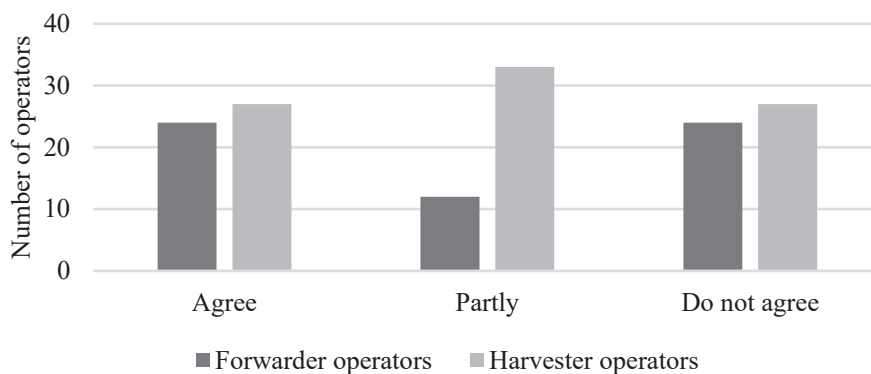


Figure 3. Analysis of the training process after completion.

operators confirmed or partially confirmed that their knowledge and skills were assessed by instructors. As a result, the instructor had an idea of the operator's skills and working methods. In the training process, the instructor paid increased attention to the skills that needed to be developed.

The survey of operators revealed that the instructor instructed the operator on more productive working methods. It was found that 80% of forwarder operators and 80% of harvester operators received training in the training process for mistakes made in the work process and for the benefits of using rational working methods, although 7% of harvester operators replied in the negative, the responses of forwarder and harvester operators did not differ significantly $\chi^2 = 1.8565$, $p = 0.3952 > 0.05$. As a result, operators were able to verify the effectiveness of these methods while continuing to work under the supervision of an instructor.

There was no significant difference between the responses of harvester and forwarder operators to the statement that after the training the instructor performed an analysis of the training process, $\chi^2 = 4.8366$, $p = 0.088907 > 0.05$ (Figure 3). 40% of forwarder operators and 31% of harvester operators agree with the statement that after the training, the analysis of the training process was carried

out, as a result of which the operators realized the mistakes made. 20% of forwarder operators and 38% of harvester operators partially agreed with this statement, while 40% of forwarder operators and 31% of harvester operators disagreed with the statement. Therefore, it can be concluded that the operators who did not agree with the statement that the analysis of the results was done after receiving the training, the operators did not take the training process seriously or that the instructor has formally addressed the training process.

The training process was generally positively assessed by 75% of forwarder operators and 66% of harvester operators, partially by 25% of forwarder operators and 31% of harvester operators. One harvester operator considered that training was irrelevant. Analyzing the survey data, it was found that a partially negative and negative evaluation of training can be found in the responses of operators over the age of 41 and length of service over 5 years. The most positive attitude towards periodic training is found among operators under the age of 30 and the length of service up to 5 years.

Conclusions

1. The qualification course is most actively attended by harvester operators younger than 30 years

and with up to 5 years of work experience on the relevant machine and forwarder operators in the age group of 30 to 40 years with up to 5 years of work experience, respectively 31% and 25%. Less active training courses are attended by harvester operators older than 41 years and with less than 5 years of work experience on the relevant machine and forwarder operators in the age group from 30 to 40 years, with more than 5 years of work experience and in the age group over 41 years, with work experience up to 5 years, respectively 3% and 10%.

2. The research found that the majority of operators have attended the training courses several times. Among those who attended training courses: 30% of harvester operators and 33% of forwarder operators attended the courses on their own initiative, while all forwarder operators and 65% of harvester operators mentioned that they attended training courses on the initiative of the employer.
3. The majority (75%) of forwarder operators and 66% of harvester operators positively evaluated the training process and confirmed that they had acquired new knowledge and skills during the training.

References

- Alam, M., Walsh, D., Strandgard, M., & Brown, M. (2014). A log-by-log productivity analysis of two Valmet 475EX harvesters. *International Journal of Forest Engineering*, 25(1), 14–22. DOI: 10.1080/14942119.2014.891668.
- Eriksson, M., & Lindroos, O. (2014). Productivity of harvesters and forwarders in CTL operations in northern Sweden based on large follow-up datasets. *International Journal of Forest Engineering*, 25(3), 179–200. DOI: 10.1080/14942119.2014.974309.
- Geske, A., & Grīnfelds, A. (2020). *Izglītības pētījumu aptaujas – no izveidošanas līdz datu apstrādei (Educational research surveys – from creation to data processing)*. Rīga: LU Akadēmiskais apgāds. (in Latvian).
- Nurminen, T., Korpunen, H., & Uusitalo, J. (2006). Time Consumption Analysis of the Mechanized Cut-to-length Harvesting System. *Silva Fennica* 40(2), 335–363. DOI: 10.14214/sf.346.
- Olivera, A., Visser, R., Acuna, M., & Morgenroth, J. (2016). Automatic GNSS-enabled harvester data collection as a tool to evaluate factors affecting harvester productivity in a Eucalyptus spp. harvesting operation in Uruguay. *International Journal of Forest Engineering*, 27(1), 15–28. DOI: 10.1080/14942119.2015.1099775.
- Purfürst, F.T. (2010). Learning curves of harvester operators. *Croatian Journal of Forest Engineering*, 32(2), 89–97. ID: 63720
- Purfürst, F.T., & Erler, J. (2011). The Human Influence on Productivity in Harvester Operations. *International Journal of Forest Engineering*, 22(2), 15–22. DOI: 10.1080/14942119.2011.10702606.