

**SUBJECT**

**1**

**APPRODEV WORKBOOKS**

**FINNIDA**



# ***LOGGING MANAGEMENT***

**FTP INTERNATIONAL TRAINING MATERIALS**

**FOREST HARVESTING SERIES**

## APPRODEV & FTP INFORMATION

### APPRODEV PROJECT

*"DEVELOPMENT AND PROMOTION OF  
APPROPRIATE TECHNOLOGY FOR  
ENVIRONMENTALLY AND ECONOMICALLY  
SOUND FOREST HARVESTING"*

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- *Workbook design and task writing by Mark Seymour*

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NATIONAL BOARD OF EDUCATION GROUP

## ■ ABOUT THE APPRODEV WORKBOOKS

- APPRODEV workbooks contain revision and analysis tasks to accompany the information in the APPRODEV Reference Manual. Most answers can be found by studying the reference manual and discussing with your supervisor.
- The information and tasks contained in this APPRODEV training material is relevant for the following region: **East and Southern Africa.**
- The main types of activity found in the workbook are as follows. The type of activities used in each section depends on the subject.

**OPEN ANSWER ACTIVITY** - *In this type of activity there is not necessarily a fixed, right or wrong answer. You should be able to write down your ideas and opinions on the subject and be able to discuss them.*

**QUESTION SET** - *The question set works by helping you to follow a logical process to examine the subject. The answers are supposed to be short and there is normally a right or wrong answer, but not always. The answers should also be discussed.*

**WORK TASK ACTIVITY** - *These activities are related to situations that might be faced in the workplace. They may be in the form of **calculations**, making **priority lists**, doing **short research tasks**, etc.*

**GROUP WORK ACTIVITY** - *longer tasks for a group of students, involving research, analysis and reporting as a group.*

## TYPE OF ACTIVITY

**Instructions:** Read the information on this page to familiarize yourself with how to use the workbook and how it relates to the APPRODEV Reference Manual.

**Time scale:** Tells you roughly how much time you should spend on the activity.

**Assessment:** Tells you how to assess your answer, normally by reference to the APPRODEV Reference Manual and discussion with your supervisor.

**Assessment notes:** Space for writing comments on your answer.

## SECTION HEADING

○ On the right hand side of the page you will find a fuller description of the activity or question and the data necessary to complete it.

It is recommended that you write your answers in the space provided in the workbook.

*This tells the subject of the activity and relates to a section with the same title in the APPRODEV Reference Manual.*

*There are several different types of activity used in the workbooks, as described on the previous page.*

*This is the reference number for the page*

**OPEN ANSWER  
ACTIVITY**

**Instructions:** Respond to the question on the right and on the next page by giving your own ideas and opinions. There are not necessarily right or wrong answers.

**Time input:** These two activities should take about 30 minutes to do, plus time for discussion.

**Assessment:** Read the relevant section in the APPRODEV reference manual and compare. Discuss with fellow students and your supervisor.

**Assessment notes:**

**■ PLANNING THE TECHNOLOGY**

○ *Activity 1:* How would you define *appropriate technology*, is it simply an intermediate level between high-tech and low-tech?

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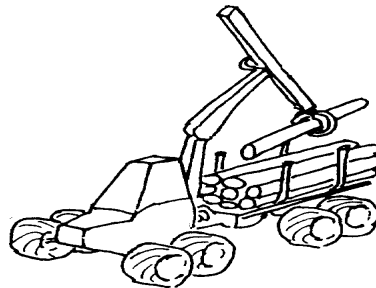
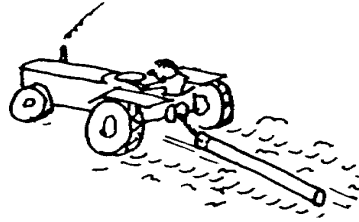
p.t.o.

## OPEN ANSWER ACTIVITY

*Instructions: Study the pictures on the right and write down your ideas on their advantages and disadvantages for a typical logging operation in your region or workplace.*

**Assessment notes:**

Activity 2:



## QUESTION SET

**Instructions:** Answer the structured set of questions given on the right. Write in the space provided. Continued overleaf.

**Time input:** This activity should take 30 minutes to do, plus time for discussion.

**Assessment:** Read the relevant section in the APPRODEV Reference Manual and compare the information with your answers. Discuss with your supervisor.

**Assessment notes:**

## ■ PLANNING THE TECHNOLOGY

○ Name four different methods for extracting logs from the stump to the roadside in a small sawmill's logging operation:

○ In the following questions you should be thinking about the important factors to consider when choosing appropriate harvesting technologies?

1. How would a poor machine spare part supply affect your choice?

p.t.o.

**QUESTION  
SET**

*(Continued from previous page)*

***Assessment notes:***

2. How would the physical conditions in the logging site area affect your choice? Give some examples:

3. How would the interest rate for borrowing money influence your choice?

*p.t.o.*

**QUESTION  
SET**

*(Continued from previous page)*

***Assessment notes:***

4. How would the cost of labour influence your choice?





## QUESTION SET

**Instructions:** Answer the set of questions given on the right. Write in the space provided. Continued overleaf.

**Time input:** This activity should take 20-30 minutes to do, plus time for discussion.

**Assessment:** Read the relevant section in the APPRODEV Reference Manual and compare the information with your answers. Discuss with your supervisor.

**Assessment notes:**

## ■ LOGGING SITE PLANNING

○ The logging site is normally planned by the logging foreman or junior logging manager by making a reconnoitering visit to the logging area. He will be looking at various factors and visualizing the logging situation.

1. Why would the foreman want to know that his workers are capable of directional felling when he is considering the logging site?

2. What physical factors will the foreman be looking at in the logging area?

*p.t.o.*

**QUESTION  
SET**

*(Continued from overleaf)*

*Assessment notes:*

3. What decisions will he make based on this information?

4. How would you record the plan if you were a logging foreman?

## GROUP WORK ACTIVITY

**Instructions:** Form a group of at least two people and carry out the activity described on the right. You should be able to produce a brief written report. Ask your supervisor for guidance if the task is unclear.

**Time input:** This activity should take about 1 full day to complete.

**Assessment:** Discuss your work with your supervisor.

## ■ LOGGING SITE PLANNING

○ Go to your local forestry office, college library, etc. and obtain a map (e.g. 1:10,000) for a plantation forest area you know of.

You will need to read the relevant section of the APPRODEV Reference Manual before going on, and preferably one of the further references listed in the manual.

Study the map and define a logging area of, for example, 1-2 hectares by looking at the position of existing roads, natural boundaries, etc.

Discuss as a group the type of logging you will use, e.g. felling method, type of logs to be cut, skidding method, road transport method, etc.

Work as a group to write down the following information, in the form of a logging site plan. Make a sketch map of the logging area (e.g. 1:5,000) so that you can mark some of the information onto it. Write down:

- the logging area you have defined;
- the position and spacing of the strip roads you will open up in the forest;
- the probable location of landings;
- the number, type and **distribution** of workers, animals or machines you will require;
- the cutting pattern, according to any lean of the timber, steep terrain areas, etc.;
- any other information you consider relevant.







## WORK TASK ACTIVITY

**Instructions:** Complete the analysis tasks given for the situation described on the right.

**Time input:** This activity should take about 45 minutes to do.

**Assessment:** Read the relevant section in the APPRODEV Reference Manual and consider your answers. In some cases the answer may not be necessarily right or wrong but open to discussion. Discuss with fellow students and your supervisor.

**Assessment notes:**

## ■ LOG QUALITY AND WOOD WASTE

○ You are a logging contractor selling logs to pulp and sawmills. In order to make your business successful you need to maximize the amount and value of the wood in your forest concession. This means reducing waste and producing good quality logs through good felling, cross-cutting and extraction techniques.

*Analysis 1:* You have decided to introduce the following size rules for cross-cutting and to offer 3 types of logs for sale, as shown in the table.

Log classification	Length (metres)			Minimum top diameter (cm)
	minimum	maximum	intervals	
Sawlogs	3.5	5	0.5	17
Small sawlogs	3	5	0.1	13
Pulp logs	2.5	5	0.1	6

How do these rules help you maximize the wood in your forest concession compared to having rules with one length and one minimum top diameter?

p.t.o.







## WORK TASK ACTIVITY

**Instructions:** Respond to the work tasks according to the work situation described.

**Time input:** This activity should take about 30 minutes to do.

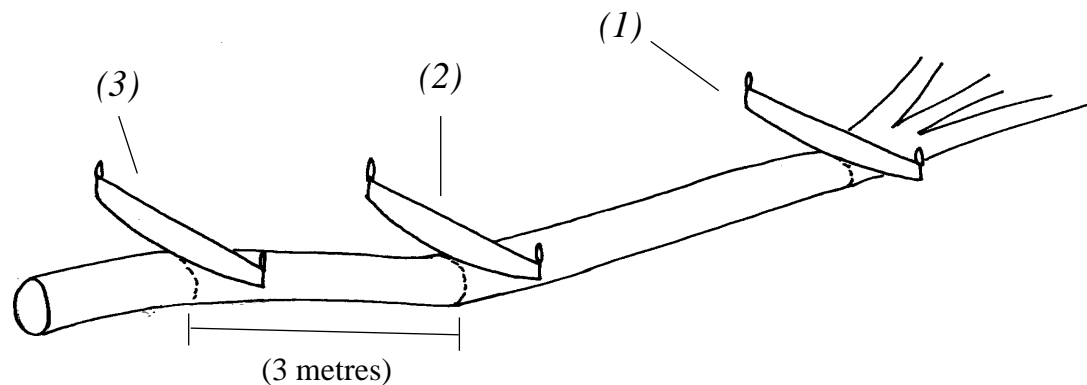
**Assessment:** Read the relevant section in the APPRODEV Reference Manual and compare your response to the reasons given in the manual.

**Assessment notes:**

## ■ LOG QUALITY AND WOOD WASTE

○ You are a logging foreman supervising tree felling and cross-cutting logs. Your objective is to minimize the amount of waste at the logging site and maximize potential log quality.

*Task 1:* Explain why you would advise your workers to cut this log also at point (3), not simply at points (1) and (2).



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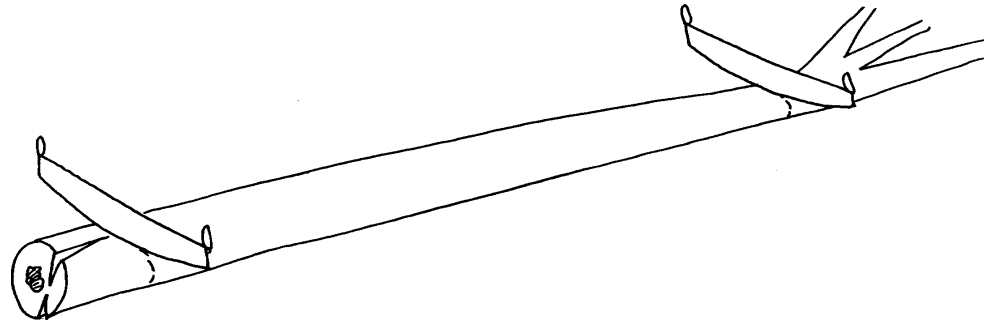
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**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

*Assessment notes:*

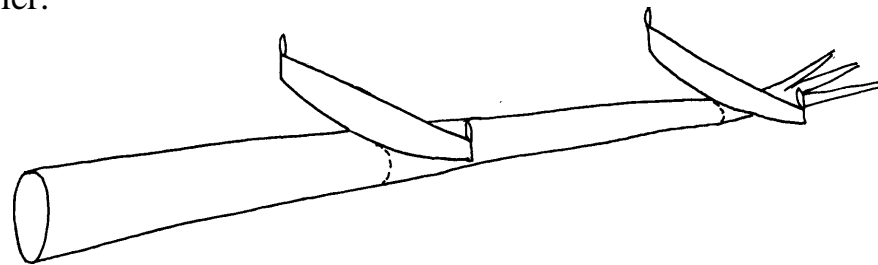
*Task 2: Give the reasons for cutting the end off this log.*



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*Task 3: Explain the defect in this log and why cross-cutting in the middle improves the log for the sawmiller.*



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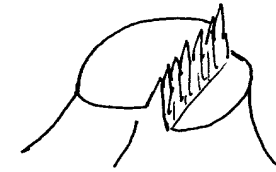
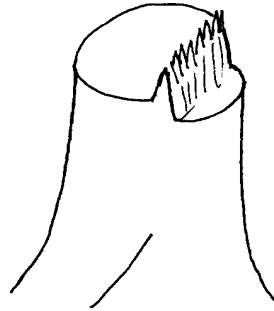
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**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

**Assessment notes:**

*Task 4:* Explain this picture. What is wrong with one of the stumps and why should it be avoided by your workers?



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## QUESTION SET

**Instructions:** Answer the structured set of questions given on the right. Write in the space provided.

**Time input:** This activity should take about 30 minutes to do, plus time for discussion.

**Assessment:** Read the relevant section in the APPRODEV Reference Manual and compare the information with your answers. Discuss with your supervisor.

**Assessment notes:**

## ■ WOOD MEASUREMENT

○ Look at the log sheet in the APPRODEV Reference Manual Part 1. This is an example of a log recording sheet from Finland, used to record the number of logs coming into a small sawmill's log yard, for example. This sheet is based on a log sizing system where logs are cut at the logging site into many different diameters and lengths so that as much of the felled tree stem is utilized as possible.

Answer the following questions to examine how such a system could work in your country.

1. Why is a sawmill interested in knowing the number and size of logs entering its log yard?

p.t.o.

**QUESTION  
SET**

2. Could you use this log sheet in your country? If not, how would you need to revise it or the measuring system, e.g. by making fewer size divisions?

*(Continued from overleaf)*

*Assessment notes:*

*p.t.o.*



**QUESTION  
SET**

*(Continued from overleaf)*

*Assessment notes:*

3. Why would logs be measured at each stage of a log transport operation, e.g. at the logging landing and at the sawmill's log yard?

4. What are some of the possible methods for measuring the volume of a load of logs?

## WORK TASK ACTIVITY

**Instructions:** Complete the work task described on the right by filling in the blank spaces in the log sheet. You will need a calculator.

**Time input:** This activity should take about 1 hour to do.

**Assessment:** Compare your completed log sheet figures with the correct figures in the similar log sheet in the APPRODEV Reference Manual. If you have made a mistake, you can double check the figures for number and length by balancing the rows and columns, as described on the log sheet.

## ■ WOOD MEASUREMENT

○ You are on a training exchange at a small Finnish sawmill and have the task of calculating the volume of logs taken from a logging site into the sawmill. Use the following procedure to **fill in the blank spaces in the log sheet** and find the day's total volume.

- 1) **Add up the columns** for each log length. Write in the *total number of logs* and their *total length*. The correct values for the first column have been given as an example.
- 2) **Add up the rows** for each log diameter class. Write in the *total number of logs* and *total length*. The correct values for the first row have been given as an example.

Calculating the total length is much easier with a calculator with a *memory plus function*. Learn how to do this as follows (example from the first row given here):

3	(X)	3.1	(M+)	[9.3]
1	(X)	3.4	(M+)	[3.4]
1	(X)	3.7	(M+)	[3.7]
4	(X)	4	(M+)	[16]
2	(X)	4.3	(M+)	[8.6]
1	(X)	4.6	(M+)	[4.6]
1	(X)	5.5	(M+)	[5.5]
(MC) or (MRC) or (MR)				[51.1]

*(Don't forget to clear  
the memory before  
starting a new  
calculation)*

- 3) Calculate the volume for each row by multiplying the row's *length total* by the *factor*. The final calculation is to find the ***total volume for the day***.

TECHNO SAWMILL LTD <b>DAILY LOG SHEET</b> Species: <i>Pinus radiata</i> Volume: m <sup>3</sup> , measured overbark from top diameter														
Diam/Length	m 3,1	3,4	3,7	4	4,3	4,6	4,9	5,2	5,5	5,8	Number	Length	Factor	Volume m <sup>3</sup>
cm 15	///	/	/	////	//	/			/		13	51.1	0,0258	1,32
17	//	//	////	/	//	///	/	/		/			0,0302	
19	//	///	//	///	////	//	//			/			0,037	
21	//	//	///	//	///	////							0,0446	
23	////	/	//// /	//// //	//	///		//					0,0527	
25	//	//	///	///	//	//	//						0,0617	
27		///	//// //	//	////	///	/			/			0,0715	
29	/	//	//	/	/	//		//		/			0,0821	
31	//	///	////	///	//	/	/						0,0934	
33	//	//	//	//	/		/						0,1054	
35		/	//	//		//							0,1183	
37	/	//	//	///			/	/					0,1319	
39				/	//		/						0,1463	
41	/		/	/									0,1615	
43													0,1775	
45	/		/										0,1942	
Number	23													TOTAL M <sup>3</sup>
Length (m)	71.3													

Notes: Make sure that the sum of the row and column balance in these boxes

Measured by: \_\_\_\_\_ Date: \_\_\_\_\_ Checked by: \_\_\_\_\_

TECHNO SAWMILL LTD DAILY LOG SHEET Species: <i>Pinus radiata</i> Volume: m <sup>3</sup> , measured overbark from top diameter														
Diam/Length	m 3.1	3.4	3.7	4	4.3	4.6	4.9	5.2	5.5	5.8	Number	Length	Factor	Volume m <sup>3</sup>
cm 15	///	/	/	////	//	/			/		13	51.1	0.0258	1.32
17	//	//	////	/	//	///	/	/		/	17	70.1	0.0302	2.12
19	//	///	//	///	////	//	//		/		20	81.8	0.037	3.03
21	//	//	///	//	///	////					16	63.4	0.0446	2.83
23	////	/	//// /	//// //	//	///		//			25	98.8	0.0527	5.21
25	//	//	///	///	//	//	//				16	63.7	0.0617	3.93
27		///	//// /	//	////	///	/		/		24	98.1	0.0715	7.01
29	/	//	//	/	/	//		//		/	12	54.1	0.0821	4.44
31	//	///	////	///	//	/	/				16	61.3	0.0934	5.73
33	//	//	//	//	/		/				9	32.7	0.1054	3.45
35		/	//	//		//					7	28	0.1183	3.31
37	/	//	//	///			/	/			10	39.4	0.1319	5.20
39				/	//		/				4	17.5	0.1463	2.56
41			/	/							3	7.7	0.1615	1.24
43											0	0	0.1775	0
45	/		/								2	6.8	0.1942	1.32
Number	23	24	41	35	27	24	9	6	3	2	194			TOTAL M <sup>3</sup>
Length (m)	71.3	81.6	151.7	140	116.1	110.4	44.1	31.2	16.5	11.6		774.50		52.69

Notes: *Today's productivity down due to tractor breakdown for 1 hour*

Measured by: *Joe Caliper* Date: *4th December 1994* Checked by: *Joe Foreman*

Log top diameter class  
e.g. 16-18 cm = 17 cm

Number of logs  
of that size, e.g. 2

Log length

Sum of number of logs

Sum of the logs' lengths

Factor used to convert length to volume for that diameter class. Obtained from species volume tables (representing normally the mid diam. area of a 4.6 m log)

Length multiplied by factor

Sum of numbers cross-checked in row and column

Total volume for the day

Sum of lengths, cross-checked in row and column

**Example of completed daily log sheet for small sawmill recording *Pinus radiata***



**QUESTION  
SET**

*(Continued from overleaf)*

*Assessment notes:*

○ What basic training should machine operators receive?

○ List some common ways by which you could improve a logging worker's job motivation.

*p.t.o.*

**QUESTION  
SET**

*(Continued from overleaf)*

*Assessment notes:*

○ What kind of training would you give to an inexperienced tree felling worker coming to work in your operation? Consider if he has had any training at a college before coming to work, what kind of initial training you would give him and what regular re-training you would consider.

*p.t.o.*

**QUESTION  
SET**

4. *(continued)*

*(Continued from overleaf)*

*Assessment notes:*



## WORK TASK ACTIVITY

**Instructions:** Complete the two work tasks given for the work situation on the right.

**Time input:** This activity should take about 10 minutes.

**Assessment:** Read the relevant section in the APPRODEV Reference Manual and compare the calculation given for a felling crew piece rate with the process used in your own calculation for the sulky. Check your answer with your supervisor.

**Assessment notes:**

## ■ TRAINING AND MOTIVATION

○ You have just introduced a sulky to your logging operation for extracting logs from the stump to the roadside landing. There are three workers to use the sulky and in order to make efficient use of it you have decided to introduce a piece rate payment system for the crew.

- The average skidding distance is 80 metres over flat terrain
- The average size of the pine sawlogs is 0.28 m<sup>3</sup> (e.g. top diameter 28cm, length 4m)

**Task 1:** Based on your judgement, set a **realistic** daily target for the sulky (i.e. how many logs the crew of three workers can skid at that site in an average day). Assume that there are 6 working hours in the day. **Daily target = \_\_\_\_\_ logs**

**Task 2:** Calculate a **piece rate for the sulky crew** using the following calculation (i.e. how much you will pay to the sulky crew for skidding each log).

$$\frac{(1 \text{ worker's normal daily wage}) \times (\text{no. of workers in sulky crew})}{\text{daily target for logs skidded per sulky}} = \text{piece rate per crew per day}$$

x

\_\_\_\_\_ =





## WORK TASK ACTIVITY

**Instructions:** Complete the work task given on the next page by using the data provided in the five step calculation found in the relevant section of the APPRODEV Reference Manual. You will probably need a calculator.

**Time scale:** This activity should take 1-2 hours to do.

**Assessment:** Check the correct answer with your supervisor. If it is not correct, study the calculation given in the APPRODEV Reference Manual and double check your answer with your supervisor.

**Note:** the answer to this exercise is not the same as the example given in the reference manual.

## ■ LOGGING COSTS

○ You have two methods of skidding logs in your logging operation: a second-hand forestry equipped farm tractor and a pair of logging oxen. You want to make a comparison of the cost of skidding logs between the two methods. The following information will be necessary in your calculation.

### Tractor:

Purchase price	=	\$ 15,000
Expected life	=	8 yrs
Residual value	=	\$ 3,000
Working hours	=	1,200/year
Maintenance cost	=	\$ 3,000/year
Fuel consumption	=	\$ 30/day
Daily production	=	3.5m <sup>3</sup> /hour
Labour required	=	1 driver, 1 choker, 12 fellers

### Oxen:

Purchase price	=	\$ 500/pair
Working life	=	8 years
Residual value	=	\$ 400/pair
Working hours	=	1,200/year
Maintenance cost	=	\$ 100/year
Feeding cost	=	\$ 1.5/day
Daily production	=	1 m <sup>3</sup> /hour
Labour required	=	1 handler, 1 choker, 4 fellers

### General data:

Interest rate on borrowing capital	=	25% per annum
Labour cost (general workers)	=	\$ 27.5/month
Labour cost (drivers & oxen handlers)	=	\$ 38.5/month
Worksite hours per day (average)	=	5 hours
Days worked per month	=	22 days

## WORK TASK ACTIVITY

*(Continued from overleaf)*

**Assessment notes:**

**Task:** Use steps 1-4 of the five step calculation shown below to calculate the cost of felling and skidding logs to the roadside (1) by **tractor** and (2) by **oxen**.

### 1 Equipment costs per hour (machines, animals or tools)

- Depreciation:**

$$\frac{\text{Purchase cost} - \text{Residual value}}{\text{Life (in years)} \times \text{Hours used per year}} = \text{cost/hour}$$

- Interest:**

$$\frac{\text{Interest rate per annum}}{100} \times \frac{\text{Purchase} + \text{Residual}}{2 \times \text{Hours per year}} = \text{cost/hour}$$

- Fuel & Lubricants (or food costs for oxen):**

$$\frac{\text{Cost of fuel or food consumed per day}}{\text{Worksite hours per day}} \times 1.15 = \text{cost/hour}$$

- Repair & Maintenance (or veterinary costs for oxen):**

$$\frac{\text{Total costs per year (e.g. service, repairs, tyres, chains)}}{\text{Working hours per year}} = \text{cost/hour}$$

**sub-total =**

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

**Assessment notes:**

**② Labour costs per hour (per operation, see note\*)**

- **Machine or oxen driver wage category:**

$$\frac{\text{No. of workers of this type} \times \text{Monthly wage rate}}{\text{Hours worked per day} \times \text{Days worked per month}} = \text{cost/hour}$$

- **Cutting crew/choker wage category (supplying tractor or oxen, see note\*):**

$$\frac{\text{No. of workers of this type} \times \text{Monthly wage rate}}{\text{Hours worked per day} \times \text{Days worked per month}} = \text{cost/hour}$$

**sub-total =**

*\* Note: Labour cost per hour can be calculated for all those workers you wish to include in your value for logging cost. In this case the logging cost refers to a tractor or oxen pair (equipment) and the appropriate number of workers (tree cutters + chokerman) that supply the day's logs for that equipment.*

**③ Administration costs per hour:**

$$20\% \text{ of the total of steps } \textcircled{1} \text{ and } \textcircled{2} = \text{cost/hour}$$

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

**Assessment notes:**

**④ Logging cost per cubic metre (m<sup>3</sup>)**

$$\frac{\text{Sum of hourly costs ① to ③}}{\text{Hourly production rate (e.g. for the tractor or oxen, see note*)}} = \text{cost/m}^3$$

*\* Note: use the rate for the team of oxen or tractor plus felling crews. Their hourly production rate will be the amount of wood piled at the roadside each month, divided by the number of hours worked in the month.*

**TRACTOR LOGGING COST (YOUR ANSWER):**

**① Equipment costs per hour (tractor)**

- **Depreciation:**

$$\frac{\text{---}}{\text{---}} \times \text{---} = \text{--- /hour}$$

- **Interest:**

$$\frac{\text{---}}{100} \times \left( \frac{\text{---}}{2} + \text{---} \right) = \text{--- /hour}$$

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

**Assessment notes:**

- **Fuel & Lubricants:**

$$\text{_____} \times 1.15 = \text{_____} / \text{hour}$$

- **Repair & Maintenance:**

$$\text{_____} = \text{_____} / \text{hour}$$

$$\text{sub-total} = \text{_____} / \text{hour}$$

**2 Labour costs per hour**

- **Tractor driver:**

$$\begin{array}{r} x \\ \text{_____} = \text{_____} / \text{hour} \\ x \end{array}$$

- **Tree cutting crew which supplies this tractor + chokerman:**

$$\begin{array}{r} x \\ \text{_____} = \text{_____} / \text{hour} \\ x \end{array}$$

$$\text{sub-total} = \text{_____} / \text{hour}$$



**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

*Assessment notes:*

③ **Administration costs per hour:**

$$\text{_____} \times 0.2 = \text{_____} / \text{hour}$$

④ **Logging cost per cubic metre (m<sup>3</sup>)**

$$\text{_____} + \text{_____} = \boxed{\text{_____} / \text{m}^3}$$

**OXEN LOGGING COST (YOUR ANSWER):**

① **Equipment costs per hour (oxen pair)**

• **Depreciation:**

$$\frac{\text{_____}}{\text{_____}} \times \text{_____} = \text{_____} / \text{hour}$$

• **Interest:**

$$\frac{\text{_____}}{100} \times \frac{\text{_____}}{2} + \text{_____} = \text{_____} / \text{hour}$$

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

**Assessment notes:**

- *Food costs (including herdsman):*

$$\underline{\hspace{10em}} \times 1.15 = \hspace{10em} /hour$$

- *Veterinary costs, bedding costs, etc.:*

$$\underline{\hspace{10em}} = \hspace{10em} /hour$$

$$\textit{sub-total} = \hspace{10em} /hour$$

**2 Labour costs per hour**

- *Oxen handler:*

$$\underline{\hspace{10em} \begin{matrix} x \\ \end{matrix}} = \hspace{10em} /hour$$

*x*

- *Tree cutting crew which supplies this oxen pair + chokerman:*

$$\underline{\hspace{10em} \begin{matrix} x \\ \end{matrix}} = \hspace{10em} /hour$$

*x*

$$\textit{sub-total} = \hspace{10em} /hour$$

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

*Assessment notes:*

③ **Administration costs per hour:**

$$\quad \times 0.2 = \quad /hour$$

④ **Logging cost per cubic metre ( m<sup>3</sup> )**

$$\quad + \quad + \quad = \quad /m^3$$

The result of the calculation is:

**LOGGING COST FOR CUTTING & TRACTOR SKIDDING =** **/m<sup>3</sup>**

**LOGGING COST FOR CUTTING & OXEN SKIDDING =** **/m<sup>3</sup>**

## WORK TASK ACTIVITY

*Assessment notes:*



## ■ LOGGING COSTS

The correct answer for the task, using the data given in the workbook, is as follows:

### TRACTOR LOGGING COST (ANSWER):

#### ① Equipment costs per hour (tractor)

- *Depreciation:*

$$\frac{15,000}{8} - \frac{3,000}{1,200} = \$ 1.25 \text{ /hour}$$

- *Interest:*

$$\frac{25}{100} \times \frac{15,000 + 3,000}{2 \times 1,200} = \$ 1.88 \text{ /hour}$$

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

*Assessment notes:*

A

- *Fuel & Lubricants:*

$$\frac{30}{5} \times 1.15 = \$ 6.9 \text{ /hour}$$

- *Repair & Maintenance:*

$$\frac{3,000}{1,200} = \$ 2.5 \text{ /hour}$$

*sub-total = \$12.53 /hour*

**2** Labour costs per hour

- *Tractor driver:*

$$\frac{1 \times 38.5}{5 \times 22} = \$ 0.35 \text{ /hour}$$

- *Tree cutting crew which supplies this tractor + chokerman:*

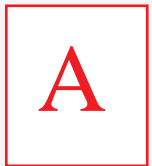
$$\frac{13 \times 27.5}{5 \times 22} = \$ 3.25 \text{ /hour}$$

*sub-total = \$ 3.6 /hour*

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

*Assessment notes:*



③ **Administration costs per hour:**

$$16.13 \times 0.2 = \$ 3.23 \text{ /hour}$$

④ **Logging cost per cubic metre (m<sup>3</sup>)**

$$\frac{12.53 + 3.6 + 3.23}{3.5} = \boxed{\$ 5.53 \text{ /m}^3}$$

**OXEN LOGGING COST (ANSWER):**

① **Equipment costs per hour (oxen pair)**

• **Depreciation:**

$$\frac{500 - 400}{8 \times 1,200} = \$ 0.01 \text{ /hour}$$

• **Interest:**

$$\frac{25}{100} \times \frac{500 + 400}{2 \times 1,200} = \$ 0.09 \text{ /hour}$$

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

*Assessment notes:*



- *Food costs (including herdsman):*

$$\frac{1.5}{5} \times 1.15 = \$ 0.35 \text{ /hour}$$

- *Veterinary costs, bedding costs, etc.:*

$$\frac{100}{1,200} = \$ 0.08 \text{ /hour}$$

*sub-total* = \$ 0.53 /hour

**2 Labour costs per hour**

- *Oxen handler:*

$$\frac{1}{5} \times 38.5 = \$ 0.35 \text{ /hour}$$

- *Tree cutting crew which supplies this oxen pair + chokerman:*

$$\frac{5}{5} \times 27.5 = \$ 1.25 \text{ /hour}$$

*sub-total* = \$ 1.6 /hour

**WORK TASK  
ACTIVITY**

*(Continued from overleaf)*

*Assessment notes:*

**A**

③ **Administration costs per hour:**

$$2.13 \quad \times \quad 0.2 \quad = \quad \$ 0.43 \quad /hour$$

④ **Logging cost per cubic metre ( m<sup>3</sup> )**

$$\frac{0.53 + 1.6 + 0.43}{1} = \boxed{\$ 2.56 /m^3}$$

**LOGGING COST FOR CUTTING & TRACTOR SKIDDING = \$ 5.53 /m<sup>3</sup>**

**LOGGING COST FOR CUTTING & OXEN SKIDDING = \$ 2.56 /m<sup>3</sup>**