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5. Assessing the Financial Viability of Farm Forestry: A Tutorial Exercise

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This module is designed to aid in the understanding of the concepts and techniques used to assess the financial viability of a farm forestry planting, and to develop basis computer skills in assessing the financial viability of farm forestry plantings. The means to achieve these aims is to construct a simple financial model of farm forestry, from which the net present value and internal rate of return can be derived. The data entry and financial analysis procedures are set out to be followed step by step to derive these financial performance criteria, using the spreadsheet package Excel. This module provides background to operation of the Excel-based Australian Cabinet Timbers Financial Model (ACTFM).

1. FINANCIAL MODELLING OF SMALLHOLDER FORESTRY

The Australian Cabinet Timbers Financial Model (ACTFM) was developed by a team of researchers from the Rainforest Cooperative Research Centre, at the University of Queensland and James Cook University (see references). It is designed to allow landholders and extension officers to assess the potential viability of single and mixed species cabinet timber plantations in far north Queensland. The model was developed using the Microsoft Excel spreadsheet package, and requires this software to run. A Visual Basic version of the model (the Australian Farm Forestry Financial Model, AFFFM) has also been developed, under a project funded by the Rural Industries Research and Development Corporation (RIRDC). This extends the analysis to take into account the whole-farm financial situation (i.e. costs and returns to agriculture, management of native forests and plantations, and utilization of farm and loan finance). Both financial models – the ACTFM and AFFFM – are currently available free of charge through the Rainforest CRC, although further development and testing is continuing for the latter model.

To help understand how these models operate, increase understanding of the concepts used, and to assist people in developing their own model, an exercise has been developed which involves *the construction of a basic financial model*. For this exercise,

- All the information needed to develop the model is listed in Table 1.

- It is recommended that people work in teams of two or three. Preferably these teams should include one experienced computer user and one inexperienced user each. To facilitate learning, the inexperienced user should operate the computer.

- The various steps to carry out model development outlined below are to be followed. Data should be entered in the same row and column location as in the instructions; otherwise, it will become difficult to follow the cell references (see Figures 2 and 4).

2. THE FORESTRY SCENARIO TO BE EVALUATED

The case study for this exercise is a simple farm forestry scenario limited to a single species, with only one commercial harvest, and a single price paid for all timber on the stump (stumpage price). The following *costs* and *timing of management activities* are to be used, as illustrated in Table 1.

Table 1. Plantation costs and revenues and other input data

Establishment and maint. costs	Year of cost	Amount ($/ha)
Establishment cost	0	$2995.00
Maintenance costs		
Post plant weed control	1	$1,310.00
Post plant weed control	2	$812.00
Post plant weed control	3	$213.00
First prune (plus certification)	4	$880.00
Second prune (plus certification)	8	$648.60
Third prune (plus certification)	12	$864.40
Thinning	8	$501.00
First harvest marking and inventory	44	$80.00
Annual costs		
Insurance		$30.00
Fencing and road maintenance		$25.00
Total		$55.00

Project revenues and other parameters

Mean annual increment (MAI) = 19 cubic metres/ha/year
Revenue = MAI * harvest age * stumpage price
Harvest age = 44 years
Price = $85/cubic metre (stumpage)
Discount rate = 6%

The exercise involves setting up a spreadsheet containing these data, deriving annual cash flows, and calculating the net present value (NPV) and internal rate of return (IRR). The model will then be used to examine the effect on NPV and IRR of changing cost and revenue parameters and the discount rate.

3. STEPS IN SETTING UP THE SPREADSHEET MODEL

The following steps are to be followed to set up the spreadsheet model for assessing the potential financial returns from farm forestry:

1. *Start the computer and open the Excel spreadsheet program* from the 'Start' menu at the bottom left of the screen. (Click 'Start', hold the left button down and move the mouse pointer up to 'Programs', then highlight 'Excel' before releasing the mouse button). A new workbook will appear, as in Figure 1.
2. Insert the floppy disk supplied into the 'A' drive if available. *Open the file named 'Financial exercise'* from the floppy disk. (If this disk is not available, the data of Figures 2 and 4 will need to be typed into the spreadsheet. The computer screen will then appear as in Figures 2 and 4. (If the file is available on disk, use the mouse to access the 'File' menu, holding the left mouse button down highlight 'Open…' then release the button. Use the 'Look in' drop-down text box to highlight the 'A' drive. Release the mouse button, then double-click the name of the file with the left mouse button, and the file should open.)
3. *Enter the costs* for each year in the maintenance costs column (column F). Establishment costs go into Year 0 (cell F2). The costs for each year could be typed directly into the cells as numbers. However, to make the maintenance costs column update automatically when changes are made to the cost parameters in column C, it is necessary to enter cell addresses rather than

numerical values. This can be achieved by typing the entry '=C4' (without the inverted commas) in cell F2, '=C8' in cell F3, '=C9' in cell F4, and so on. Another way to enter cell references into cell formulas is to click on the cell you want to refer to after typing the '=' sign in the cell in which you are writing the formula. First, click on a cell in column F (e.g. F2) then type '='. Next, click on the cell in column C which relates to that year (here C4). Press 'Enter' and the cell should now show the value (e.g. $2,995) (see Figure 3). The same procedure can be carried out for each of the other maintenance costs for Years 1-4, 8, 12 and 44. See Figure 3.

4. To *add the annual costs to column G*, click on cell G2 and type '=$B$20'. The '$' signs in the reference lock the cell reference when they are copied to other cells. Next, position the mouse pointer over the bottom right corner of the cell G2. The pointer should change from a double lined cross shape to a single line cross. When this happens, hold down the left mouse button and drag the pointer straight down the column so that the cells are within a shaded frame. Go to cell G46 then release the mouse button. Now the value of annual costs should appear in G column for each year.

5. *Add the total costs* for each year in column H. First, click on the top cell in the 'total costs' column (H2). Type '=', then click on the adjacent cell for maintenance costs (F2). Next, type '+', then click on cell G2 to add the total annual costs for the year. Press enter. Next, copy the formula in cell H2 down the column to and including cell H46 as in Step 4. Now the total value of costs for each year should appear in H column. Note that omitting the '$' sign in the reference to a cell allows the program to change the formula as you copy down the column so that it always refers to the adjacent two cells rather than the cells referred to in the original formula.

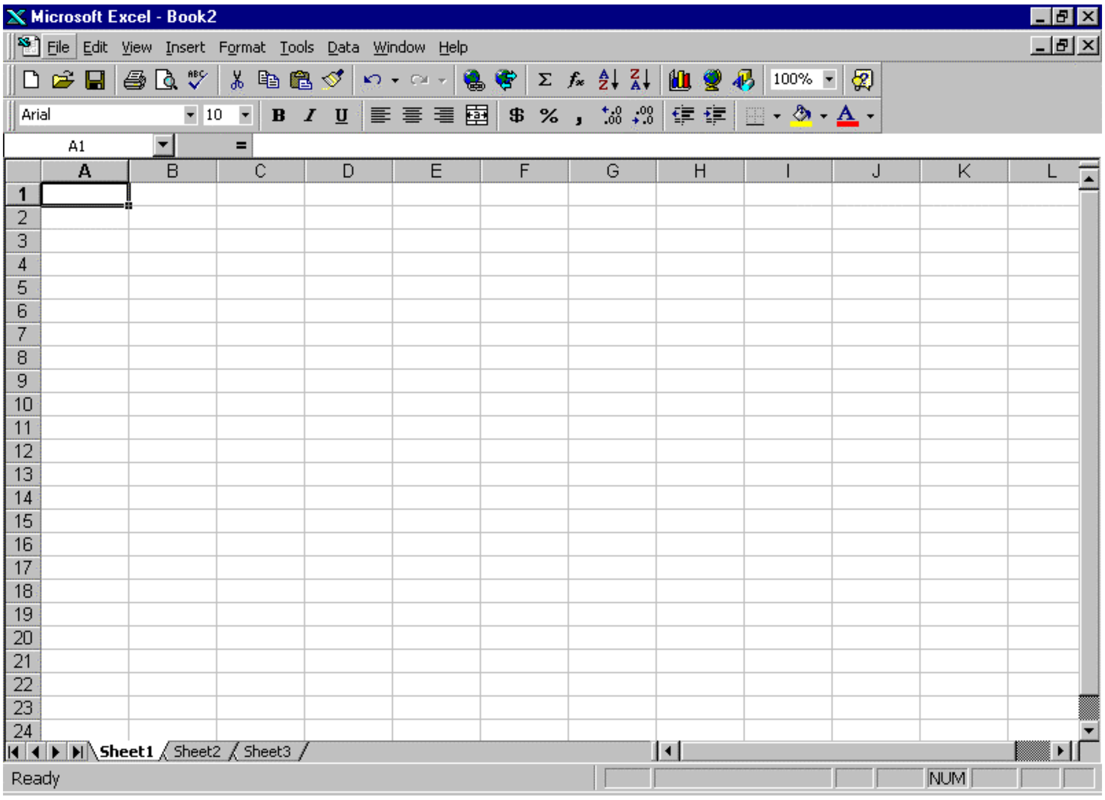
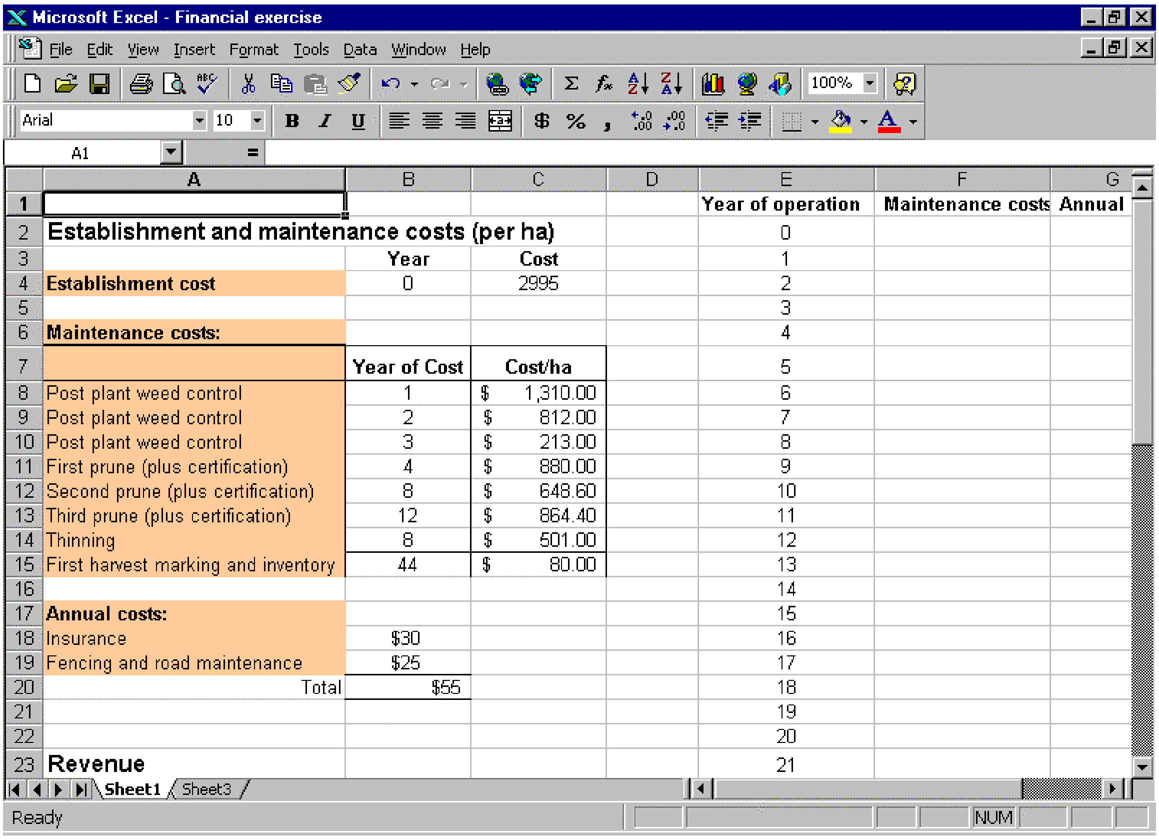


Figure 1. New workbook in Excel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	A	B	C	D	E	F	G
1					Year of operation	Maintenance costs	Annual
2	Establishment and maintenance costs (per ha)				0		
3		Year	Cost		1		
4	**Establishment cost**	0	2995		2		
5					3		
6	**Maintenance costs:**				4		
7		Year of Cost	Cost/ha		5		
8	Post plant weed control	1	$ 1,310.00		6		
9	Post plant weed control	2	$ 812.00		7		
10	Post plant weed control	3	$ 213.00		8		
11	First prune (plus certification)	4	$ 880.00		9		
12	Second prune (plus certification)	8	$ 648.60		10		
13	Third prune (plus certification)	12	$ 864.40		11		
14	Thinning	8	$ 501.00		12		
15	First harvest marking and inventory	44	$ 80.00		13		
16					14		
17	**Annual costs:**				15		
18	Insurance	$30			16		
19	Fencing and road maintenance	$25			17		
20	Total	$55			18		
21					19		
22					20		
23	Revenue				21		

Figure 2. The financial exercise file

6. *Calculate the revenues* from the sale of the timber and enter this amount into the relevant cell in the 'revenue' column. In this case the harvest age is 44 years, so the cell used is 'I46'. Timber revenue is the product of timber volume (the growth rate or MAI multiplied by the harvest age), multiplied by the timber price. To type the formula into the cell, the asterisk symbol is used as the multiplication sign. Type the formula '=b31*b32*b33' into cell B24 (see Figure 4). Next, link the value of the appropriate cell in the revenue column to revenue cell B24. Enter the formula '=$B$24' into cell I46. Note that the revenue amount will change automatically if the values of the MAI, timber harvest age, and timber price are changed, but timing of the revenue in the revenue column will not change automatically if the value of the harvest year is altered in cell B32.

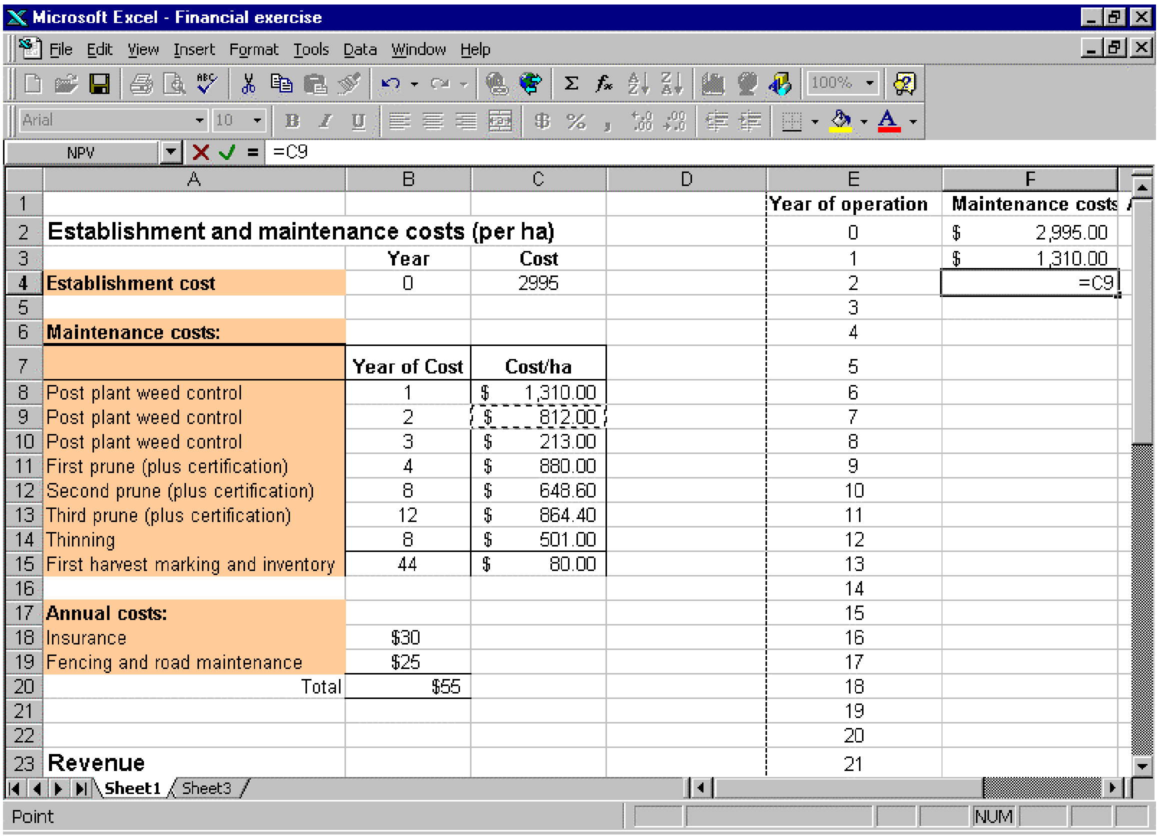
7. *Calculate the net cashflows for each year*. The net cashflows for each year are calculated by subtracting the values in the 'Total costs' column from those in the 'Revenues' column. In cell J2, enter the formula '=I2-H2'. Next, copy the formula down to and including cell J46 by following the same procedure for copying formulas used in Step 4. The values in the cells should then appear as illustrated in Figure 5.

8. *Calculate the net present value (NPV) of the scenario*. Before we can calculate the NPV of the scenario, we need to specify the discount rate to be used (see chapter 11 for an introduction to discounted cashflow analysis). Into cell B35, type the value of the discount rate as either '6%' or '0.06'. Let the NPV formula be placed in cell B37. The NPV formula can be typed directly into the cell once the user knows syntax used for the formula. The syntax for the NPV function in Excel is as follows '=NPV(rate, value1,value 2…)'. References to ranges of cells, such as those containing the net cashflows of the scenario, can be entered into formulas using the colon (':') symbol. Excel assumes that the first value occurs at the end of Year 1, whereas we are assuming that this cost will occur immediately and do not wish to

discount the first year cashflows. In this case the formula for cell B37 should read '=NPV(B35,J3:J46)+J2'.

The other way to access the formulas that are included in the versions of Excel software released before the year 2002 is to use the 'function wizard'. The function wizard can be activated by clicking on the cell to be used, B37, then clicking on the '*fx*' button which is shown on the first row of toolbar buttons in Figures 1 to 5. If using the function wizard then type '0.06' in the rate box, then 'J3:J46' into the values box. Next, press enter and type '+J2' after the closing brackets for the NPV formula so it reads '=NPV(B35,J3:J46)+J2'.

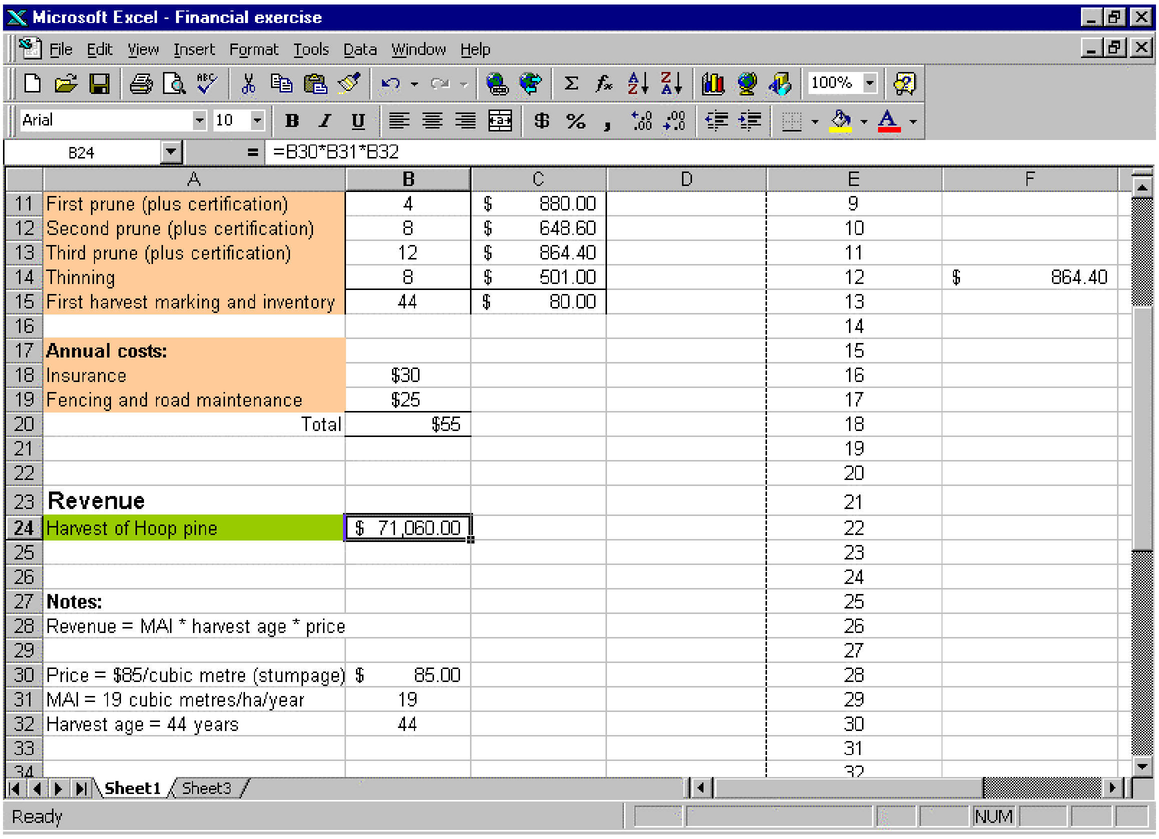
Excel versions released after the year 2002 do not have the function wizard. Help with the syntax for Excel functions for later versions will appear automatically next to the cell once the beginning of the formula is recognised (e.g. by typing '=NPV('. Additional help can be found using the main Excel help system by searching for the word 'function', and accessing the topic 'worksheet functions listed by categories'.



=C9

	A	B	C	D	E	F
1					**Year of operation**	**Maintenance costs**
2	**Establishment and maintenance costs (per ha)**				0	$ 2,995.00
3		**Year**	**Cost**		1	$ 1,310.00
4	**Establishment cost**	0	2995		2	=C9
5					3	
6	**Maintenance costs:**				4	
7		**Year of Cost**	**Cost/ha**		5	
8	Post plant weed control	1	$ 1,310.00		6	
9	Post plant weed control	2	$ 812.00		7	
10	Post plant weed control	3	$ 213.00		8	
11	First prune (plus certification)	4	$ 880.00		9	
12	Second prune (plus certification)	8	$ 648.60		10	
13	Third prune (plus certification)	12	$ 864.40		11	
14	Thinning	8	$ 501.00		12	
15	First harvest marking and inventory	44	$ 80.00		13	
16					14	
17	**Annual costs:**				15	
18	Insurance	$30			16	
19	Fencing and road maintenance	$25			17	
20	Total	$55			18	
21					19	
22					20	
23	**Revenue**				21	

Figure 3. Entering figures into the 'Maintenance costs' column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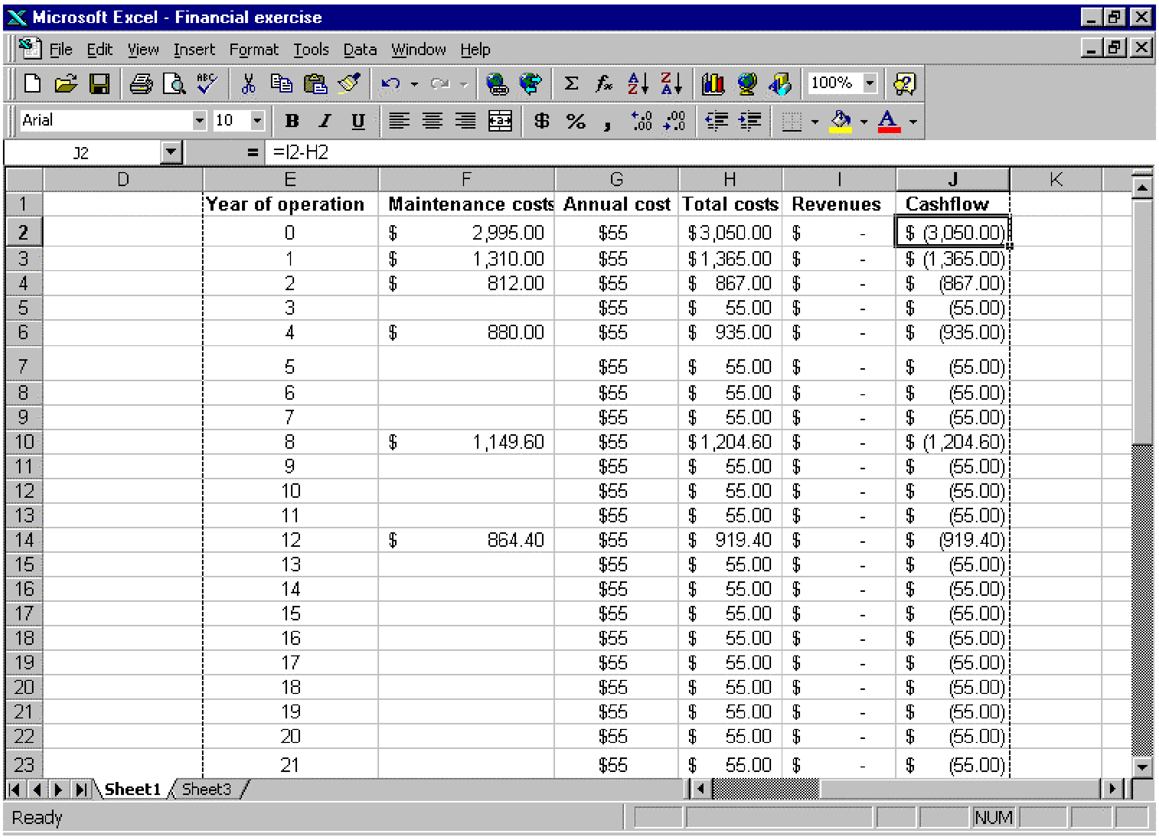
B24 = =B30*B31*B32

	A	B	C	D	E	F
11	First prune (plus certification)	4	$ 880.00		9	
12	Second prune (plus certification)	8	$ 648.60		10	
13	Third prune (plus certification)	12	$ 864.40		11	
14	Thinning	8	$ 501.00		12	$ 864.40
15	First harvest marking and inventory	44	$ 80.00		13	
16					14	
17	**Annual costs:**				15	
18	Insurance	$30			16	
19	Fencing and road maintenance	$25			17	
20	Total	$55			18	
21					19	
22					20	
23	**Revenue**				21	
24	Harvest of Hoop pine	$ 71,060.00			22	
25					23	
26					24	
27	**Notes:**				25	
28	Revenue = MAI * harvest age * price				26	
29					27	
30	Price = $85/cubic metre (stumpage)	$ 85.00			28	
31	MAI = 19 cubic metres/ha/year	19			29	
32	Harvest age = 44 years	44			30	
33					31	
34					32	

Figure 4. Revenues calculated for the scenario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J2 = =I2-H2

	D	E	F	G	H	I	J	K
1		**Year of operation**	**Maintenance costs**	**Annual cost**	**Total costs**	**Revenues**	**Cashflow**	
2		0	$ 2,995.00	$55	$ 3,050.00	$ -	$ (3,050.00)	
3		1	$ 1,310.00	$55	$ 1,365.00	$ -	$ (1,365.00)	
4		2	$ 812.00	$55	$ 867.00	$ -	$ (867.00)	
5		3		$55	$ 55.00	$ -	$ (55.00)	
6		4	$ 880.00	$55	$ 935.00	$ -	$ (935.00)	
7		5		$55	$ 55.00	$ -	$ (55.00)	
8		6		$55	$ 55.00	$ -	$ (55.00)	
9		7		$55	$ 55.00	$ -	$ (55.00)	
10		8	$ 1,149.60	$55	$ 1,204.60	$ -	$ (1,204.60)	
11		9		$55	$ 55.00	$ -	$ (55.00)	
12		10		$55	$ 55.00	$ -	$ (55.00)	
13		11		$55	$ 55.00	$ -	$ (55.00)	
14		12	$ 864.40	$55	$ 919.40	$ -	$ (919.40)	
15		13		$55	$ 55.00	$ -	$ (55.00)	
16		14		$55	$ 55.00	$ -	$ (55.00)	
17		15		$55	$ 55.00	$ -	$ (55.00)	
18		16		$55	$ 55.00	$ -	$ (55.00)	
19		17		$55	$ 55.00	$ -	$ (55.00)	
20		18		$55	$ 55.00	$ -	$ (55.00)	
21		19		$55	$ 55.00	$ -	$ (55.00)	
22		20		$55	$ 55.00	$ -	$ (55.00)	
23		21		$55	$ 55.00	$ -	$ (55.00)	

Figure 5. Completed cash flows for the scenario

9. *Calculate the internal rate of return (IRR) for the scenario*. The syntax for the IRR function of Excel is as follows '=IRR(values,[guess])'. The item in the square brackets, 'guess' can be entered as an estimate of the outcome of the formula to assist the calculation, but is not required for the function to operate. In this case the formula for the IRR function could be entered into cell B38, using the syntax '=IRR(J2:J46)'.

   Assistance with the IRR function of Excel is accessed in a similar way to help with the NPV function of Excel, using the 'function wizard' or help system as described in Step 8.

4. ASKING 'WHAT IF?' QUESTIONS AND PERFORMING SENSITIVITY ANALYSIS

Once a spreadsheet has been developed, it is a powerful tool for examining the impact of variations in assumptions or parameter levels on project performance. In particular, we are able to pose questions such as '*What* will the NPV be *if* the discount rate is reduced to 5%?' Such questions may be formalised into *sensitivity analysis* (exploring the sensitivity of financial performance to levels of various parameters) and *breakeven analysis* (determining the levels of parameter values such that the project just covers costs, i.e. such that the NPV is zero). As an exercise:

1. Determine how the NPV changes for discount rates between 4% and 7%, in steps of 1%.
2. Test how the NPV and IRR change when the timber growth rate (i.e. MAI) is reduced to 15 m^3/ha and increased to 23 m^3/ha.
3. Determine what timber price would be required for the project to break even, at a 6% discount rate.

REFERENCES

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