South African Harvesting & Transport System Costing Model ©2015

Department of Forest and Wood Science

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1. Introduction to the model

The South African Harvesting & Transport System Costing Model was developed for the South African Forest Industry which includes both large and emerging contractors. The model's function is the costing of harvesting and transport equipment and current and potential harvesting systems. The model requires specific cost-related inputs from which it generates relevant costing information.

The programme contains 20 machine-specific individual equipment costing models and a system costing protocol. Individual equipment models can be used for costing of individual machines, which in turn can be used in the system costing model. The system model accommodates manual, semi-mechanised and mechanised systems and is not aimed only at one specific type of harvesting system or system technology.

The system model balances the number of units of equipment required, a first for a South African costing model. Apart from equipment, the model includes personnel (operators, labour and additional personnel), overheads, risk, incentives, profit and a sensitivity analysis option. The ideal number of units for each activity, costs, production and productivity of the system are all calculated by the programme.

Advantages of the model include:

- Equipment balancing optimisation.
- Facilitates the identification of unnecessary incurred costs.
- Helps in the management of necessary costs.
- Reduces the likelihood of under- or over-quoting for contractors.
- Avoids costs being overlooked.
- Predicts the production of the system over time.
- Allows cost comparison of proposed systems before one is selected.

2. Installation

The model can be downloaded from the forest productivity website, www.forestproductivity.co.za . Once downloaded the user needs to extract the files as they have been compressed to reduce the download size. This can be accomplished with any archiver program that works on a Windows operating system. Extract the files to where you would like the model to be saved on your computer's hard drive. After extraction navigate to the location of the extracted files.

Double click the costingmodel.exe file to open the model and begin using it.

3. Requirements

The model will run on any windows operating system provided the user has Java™ 2 Runtime Environment. Always try to keep Java up to date. Java can be downloaded from a number of websites at no charge. www.oracle.com is the original provider and we recommend downloading from their site. Follow the prompts and wait for java to download and install on your computer.

Minimum Hardware:

- A personal computer with a Pentium (or compatible) 450 MHz or faster processor.
- A minimum of 256 MB of available RAM.
- A hard drive with at least 50 MB of free space.

4. The Manual

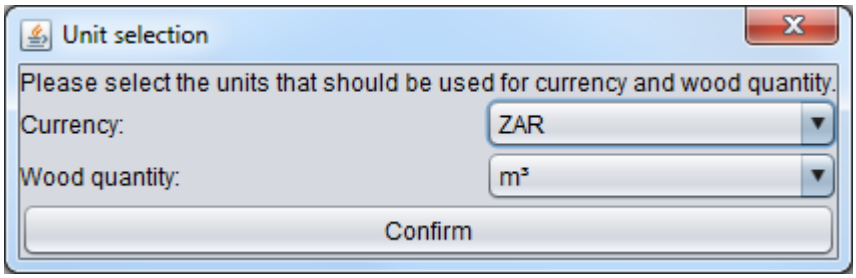
This manual introduces you to the basics of using the model for costing individual equipment or your operations. It is not designed to show you everything about the model, but it does provide a quick summary of some important features. In particular, you will learn how to:

- Open a saved model from file.
- View a summarised or a detailed output sheet for a single machine model.
- Save a model to file.

5. Getting started

At this point we assume that both the model and Java are installed on your computer. If you have not installed the model, please follow the instructions in section 3 before continuing.

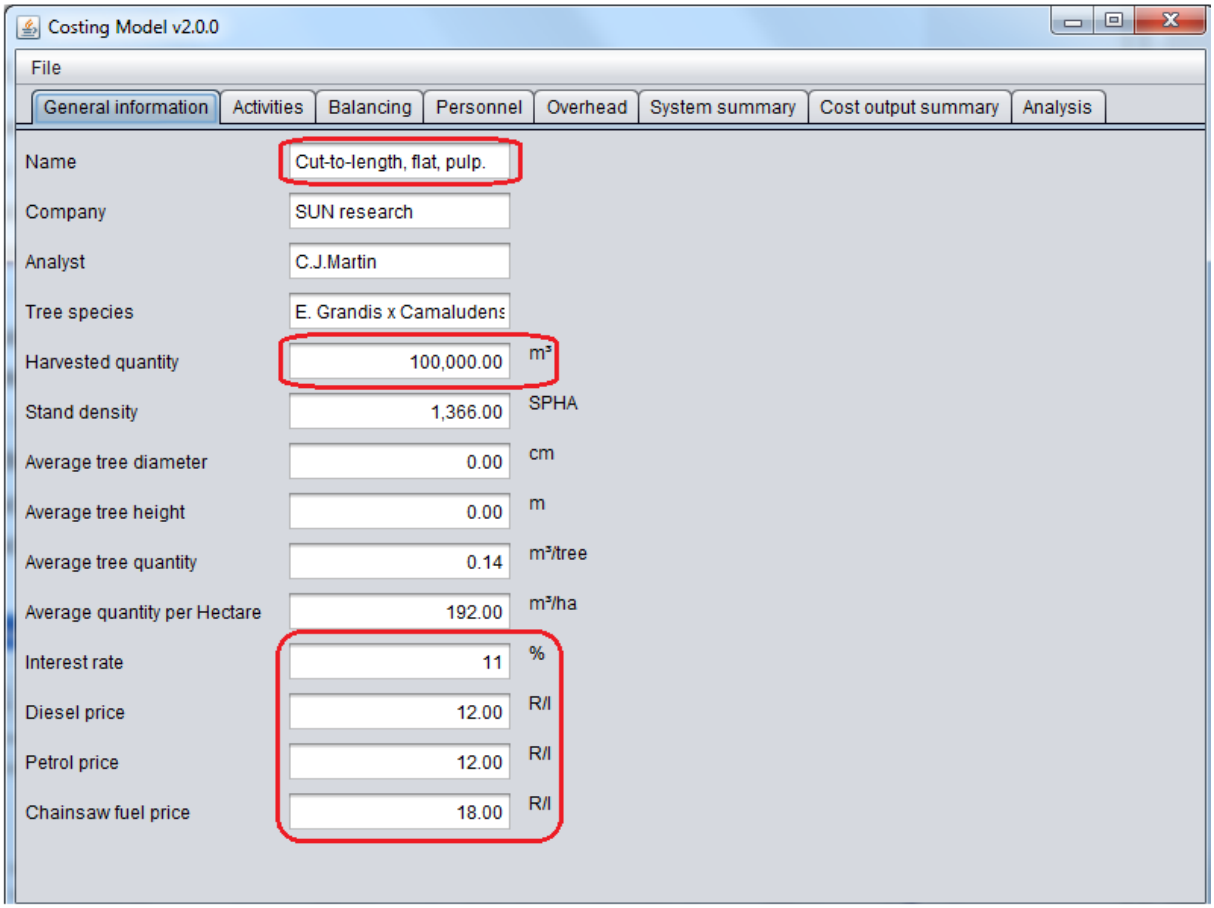
Start the program by double-clicking on the costingmodel.exe file found in the Costing Model folder. A dialog box will appear asking you to select the appropriate currency and unit of production for your system.



Once you have selected the appropriate units click *Confirm* to continue to the general information tab in the model.

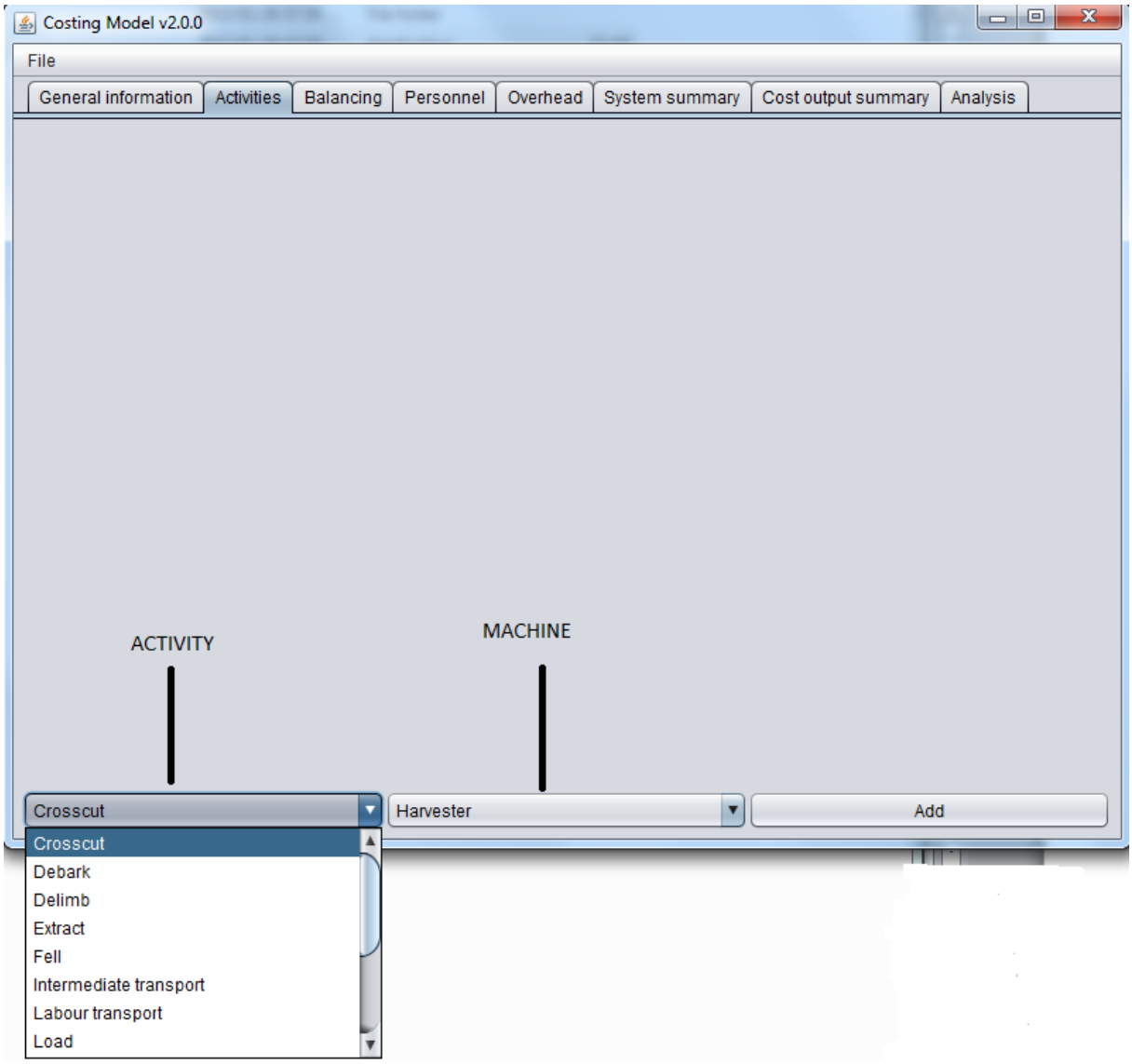
5.1. The General information tab

After confirming the units for your system the model will appear displaying the general information tab as can be seen below. This tab contains 5 fields which need to be filled in for the model to function. Namely, *Harvest quantity, Interest, Diesel price, Petrol price and Chainsaw fuel price.* These 5 fields are highlighted with red boxes below. The remaining fields on this tab are not required in order for the model to function. They merely serve to assist with administrative tasks and to identify the system when loading a previously developed system from the database. The *Name* field specifies the name of the system in the database after saving.

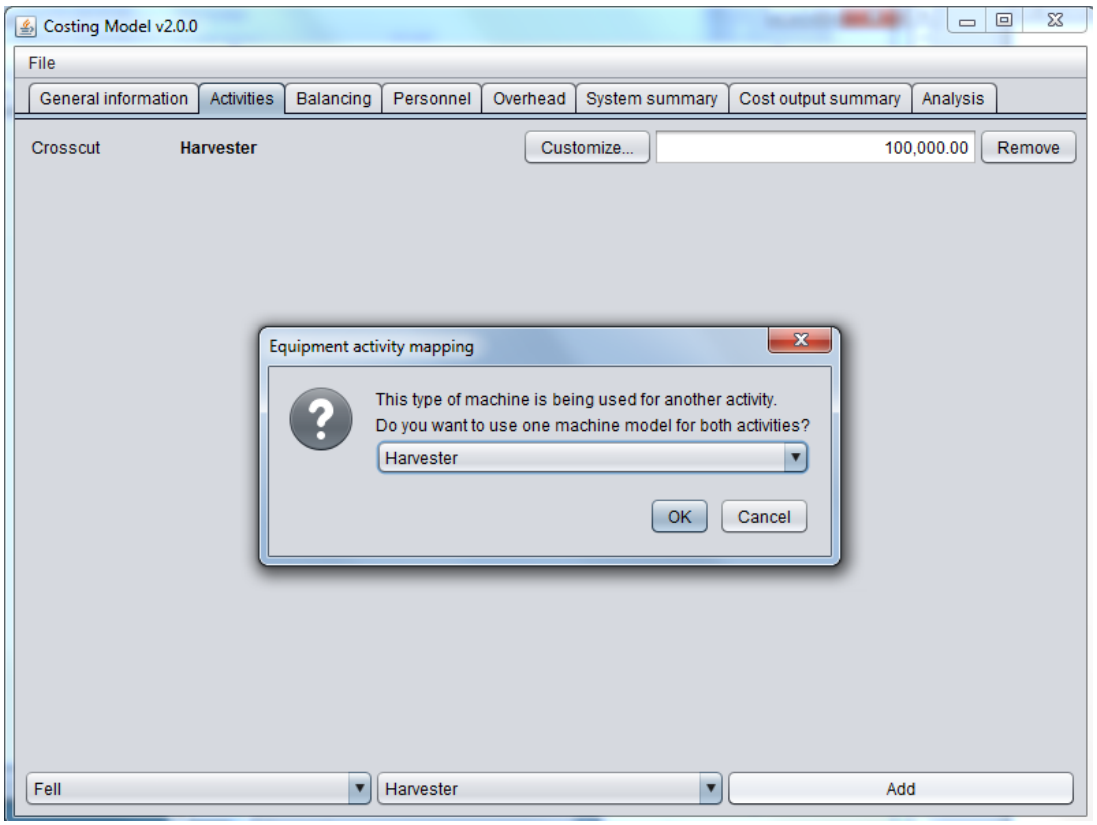


5.2. Activities tab

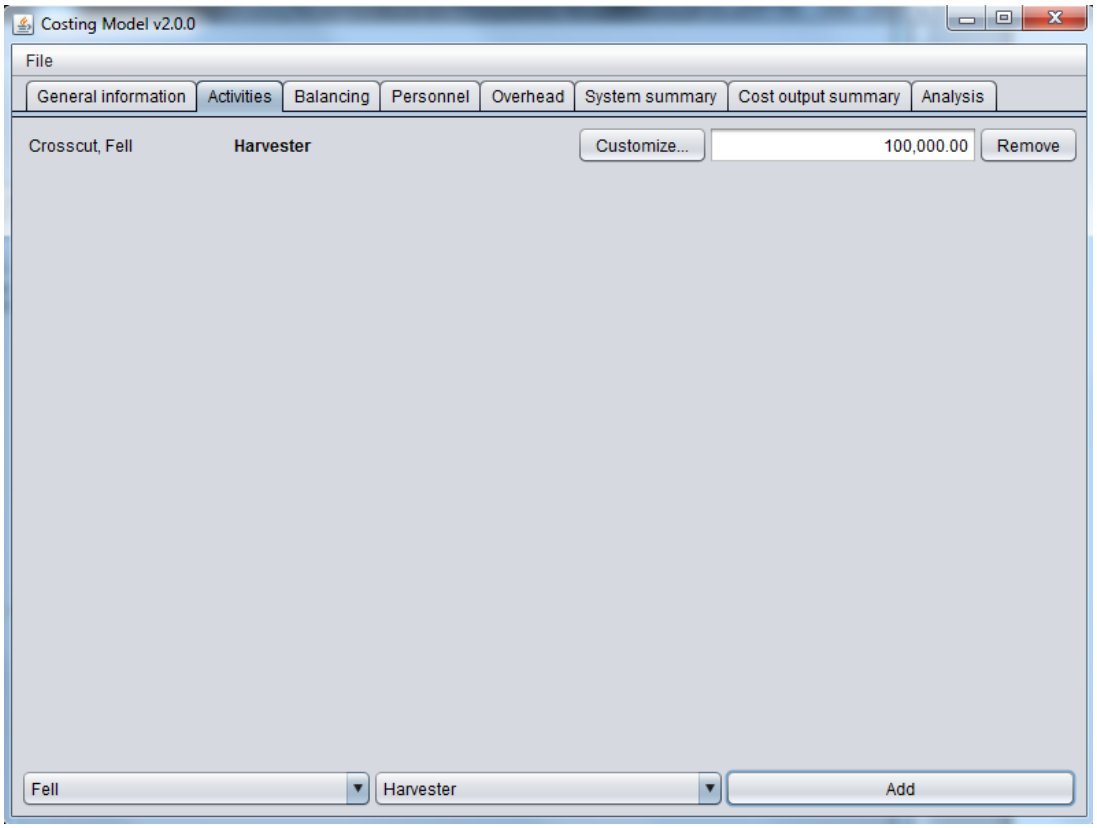
Once finished with the general information tab simply click the activities tab to begin adding machines to the system. Select the activity and corresponding machine from the dropdown menus as seen in the image below.



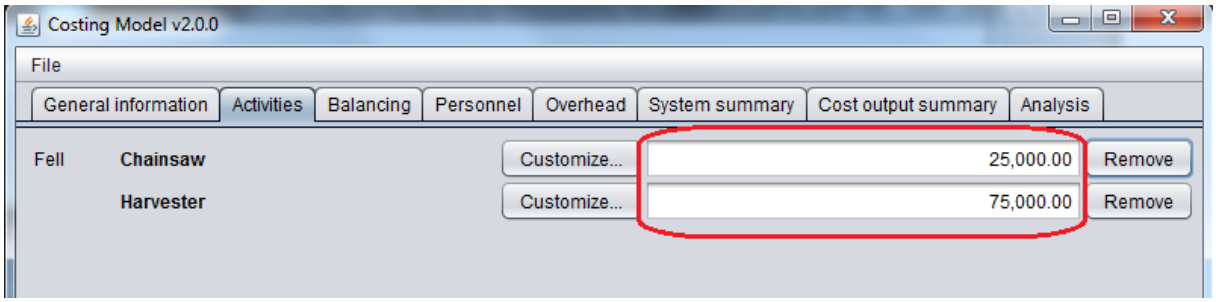
Then click *add* and your machine will be reflected in the system. In order to assign more than one activity to one machine you need only select the second activity and be sure to select the same machine type. Now when you click *add* a dialogue box will appear asking if you would like to allocate one machine for both activities.



After clicking *ok* the two activities will now be allocated to one machine as follows.

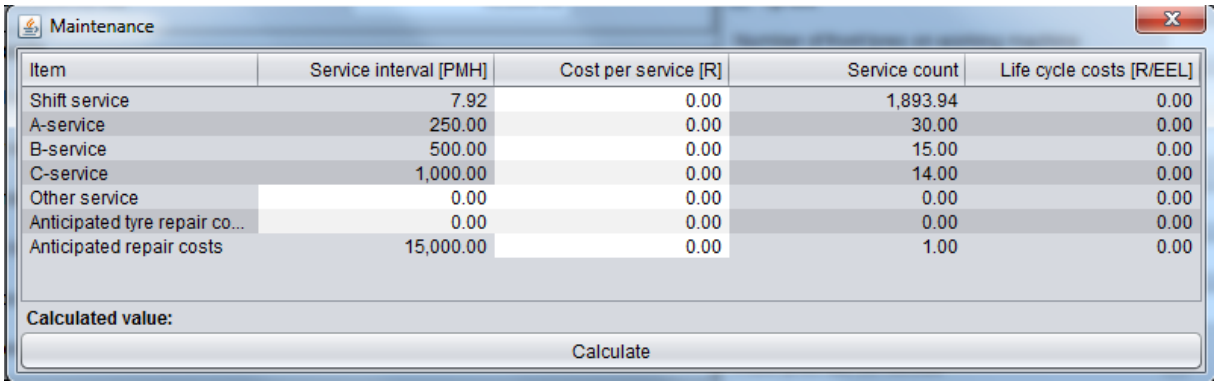


In the event that there are two separate machines performing the same activity, the allocated amount of units per machine can be varied as necessary by clicking on the fields that are highlighted by the red box below. The model will warn you if you have allocated a combined volume that exceeds the specified amount from the general information tab.

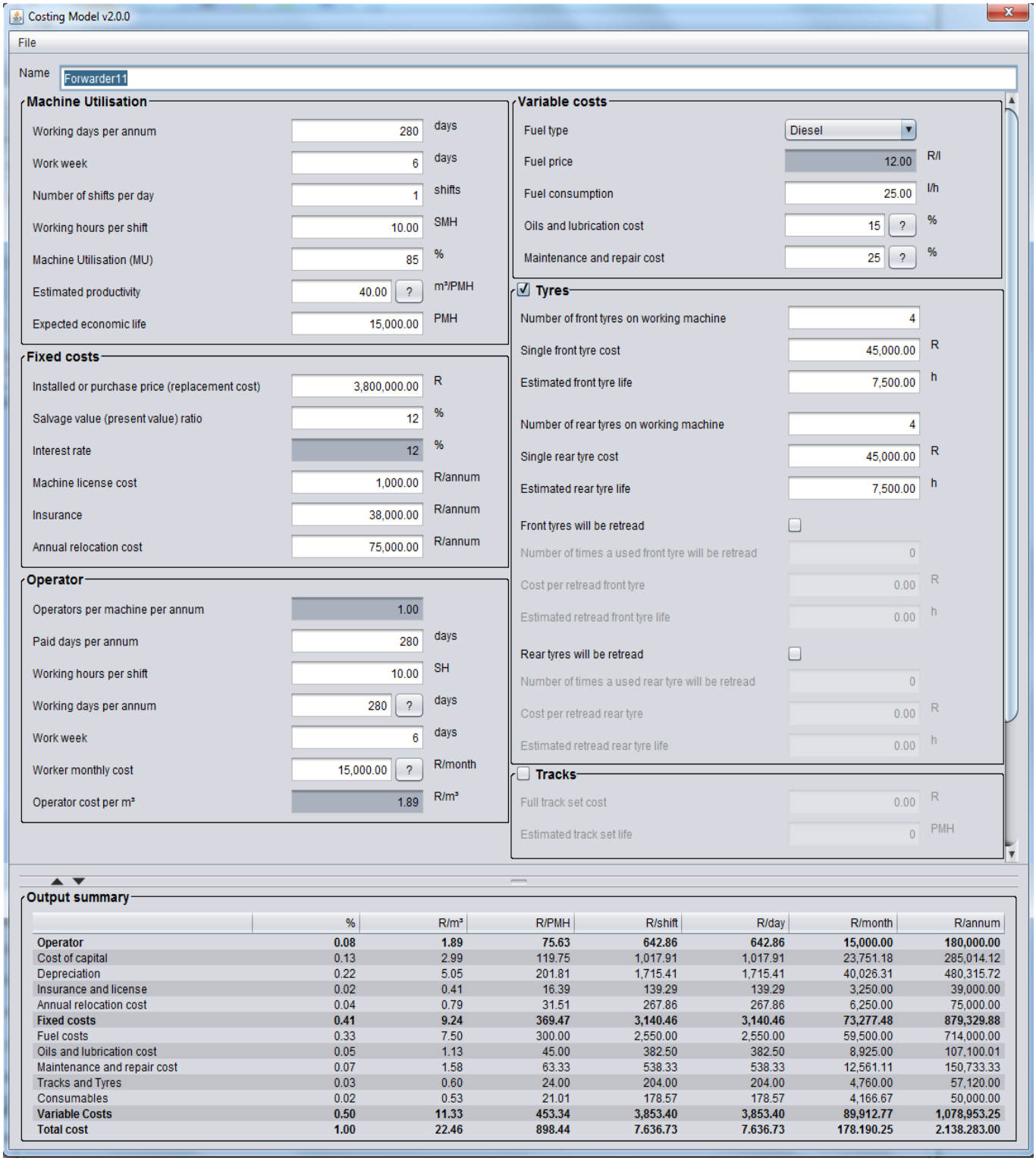


5.2.1. Single Machine Models

Once all the required machines and activities have been added we can begin to customize the machines by inputting relevant data. Each machine model is slightly different to accommodate the differences in the machines. However for the most part they are very similar, for this reason only one machine, Forwarder, will be used as an example. Upon clicking the customize button the image on the next page will appear. Proceed to fill out all the fields as seen in the image (The values in the image do not represent a real machine). Note that some of the fields, i.e. *Maintenance and repair,* have a question mark button next to the input field. This indicates that there is a built in calculator available if you wish the model to calculate the value for you based on relevant information. After clicking the button a tab similar to the image below will appear. Here you can input the relevant data and then click calculate. The model will then provide the appropriate output in the relevant field.

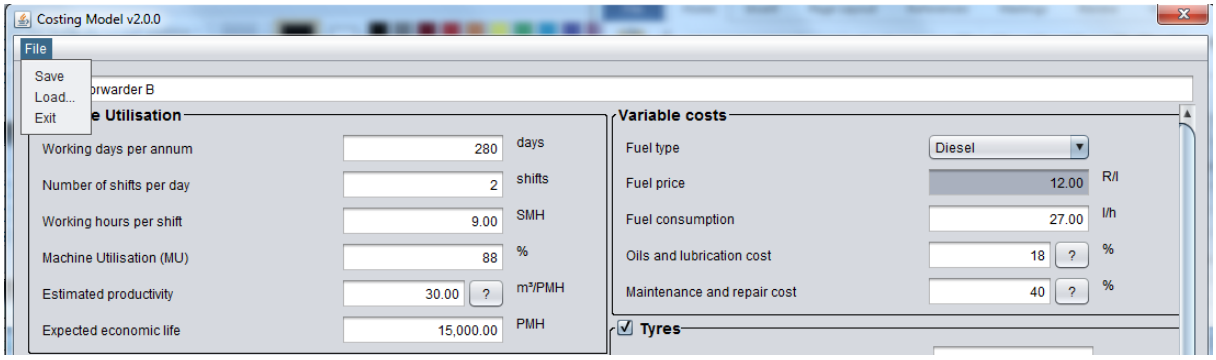


Note the *Output summary* at the bottom of the image on the next page. All cost outputs for the specific machine are displayed there. This summary can be hidden or maximised by clicking on the black arrows directly above the *Output summary* label.



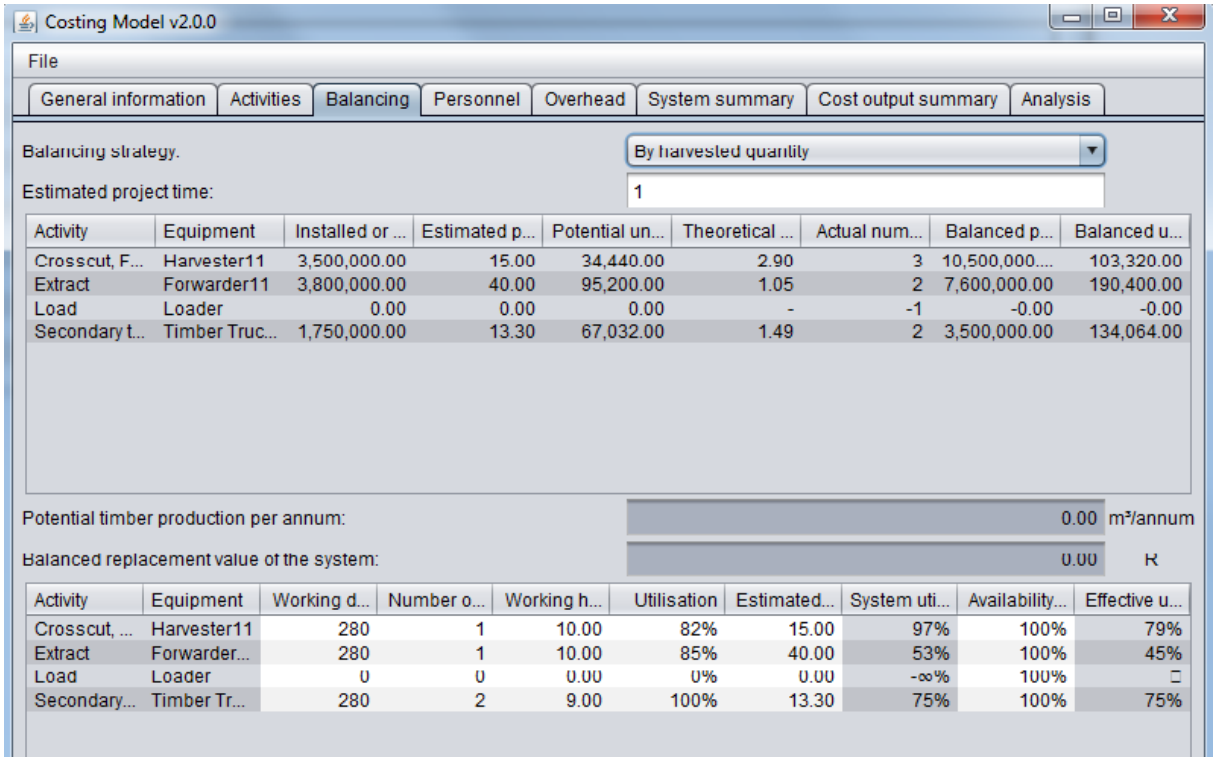
	%	R/m³	R/PMH	R/shift	R/day	R/month	R/annum
Operator	**0.08**	**1.89**	**75.63**	**642.86**	**642.86**	**15,000.00**	**180,000.00**
Cost of capital	0.13	2.99	119.75	1,017.91	1,017.91	23,751.18	285,014.12
Depreciation	0.22	5.05	201.81	1,715.41	1,715.41	40,026.31	480,315.72
Insurance and license	0.02	0.41	16.39	139.29	139.29	3,250.00	39,000.00
Annual relocation cost	0.04	0.79	31.51	267.86	267.86	6,250.00	75,000.00
Fixed costs	**0.41**	**9.24**	**369.47**	**3,140.46**	**3,140.46**	**73,277.48**	**879,329.88**
Fuel costs	0.33	7.50	300.00	2,550.00	2,550.00	59,500.00	714,000.00
Oils and lubrication cost	0.05	1.13	45.00	382.50	382.50	8,925.00	107,100.01
Maintenance and repair cost	0.07	1.58	63.33	538.33	538.33	12,561.11	150,733.33
Tracks and Tyres	0.03	0.60	24.00	204.00	204.00	4,760.00	57,120.00
Consumables	0.02	0.53	21.01	178.57	178.57	4,166.67	50,000.00
Variable Costs	**0.50**	**11.33**	**453.34**	**3,853.40**	**3,853.40**	**89,912.77**	**1,078,953.25**
Total cost	**1.00**	**22.46**	**898.44**	**7.636.73**	**7.636.73**	**178.190.25**	**2.138.283.00**

Once the machine has been customized you can save the machine to the database for safe keeping. This will allow you to call up the machine at a later stage or in a different system without having to fill out all of the fields again. To do this click on the file button found in the top left corner. When you save a machine, ensure that your cursor is not active in the *name* field. This is because the name is only input when you change to the next field. That means the model will ignore what is written there and use whatever the original name was as the save file. After saving you can close the tab and you will be returned to the Activities tab. To load a model simply add the desired machine and activity to the system, click customize to bring up the single machine model in the same way as before. When the single machine model comes up, click File followed by Load. A response box will appear with a drop down menu and this menu contains all saved machines. Find the machine you want from the list, select it and click ok. Now all the fields should be filled out as they were in the saved machine.



5.3. Balancing tab

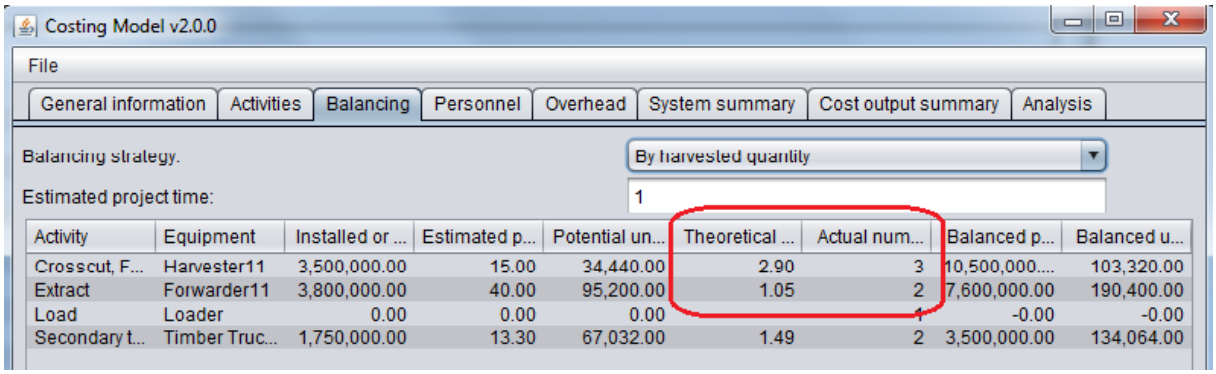
The balancing tab allows the user to customize the operation as a whole. Here you can specify time constraints or machine constraints which will affect the dynamics in the system.



5.3.1. Balancing strategy

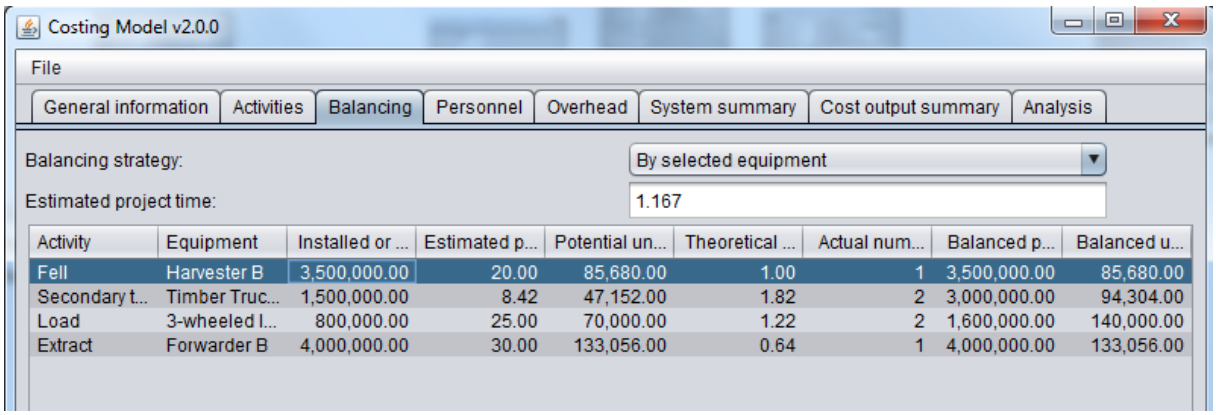
The balancing strategy offers two methods, by harvested quantity (default) or by selected machine.

By harvested quantity:
This method is based on trying to make the system as efficient as possible within a given time frame. The estimated project time in years can be altered which has an effect on the overall system efficiency and the number of machines of each type that will be required.



Note the two fields in the red box, the theoretical number of machines needed per activity and the actual number of machines needed per activity. Changes in project time greatly affect the number of machines required. By ensuring that the theoretical number is as close as possible to the actual number, the system will be as efficient as possible. In the example above the theoretical number for forwarders needed is (1.05) seeing as we cannot get (0.05) of a machine we actually need two forwarders, but one of the forwarders is being used at 5% of its capacity and hence very ineffective. If we were to increase the project time marginally, a month or so, we would not need the second forwarder as the first would be able to cover the excess and be working at close to 100% of its potential. This of course affects the other machines in the system and hence the art of balancing is finding the best fit for the entire system.

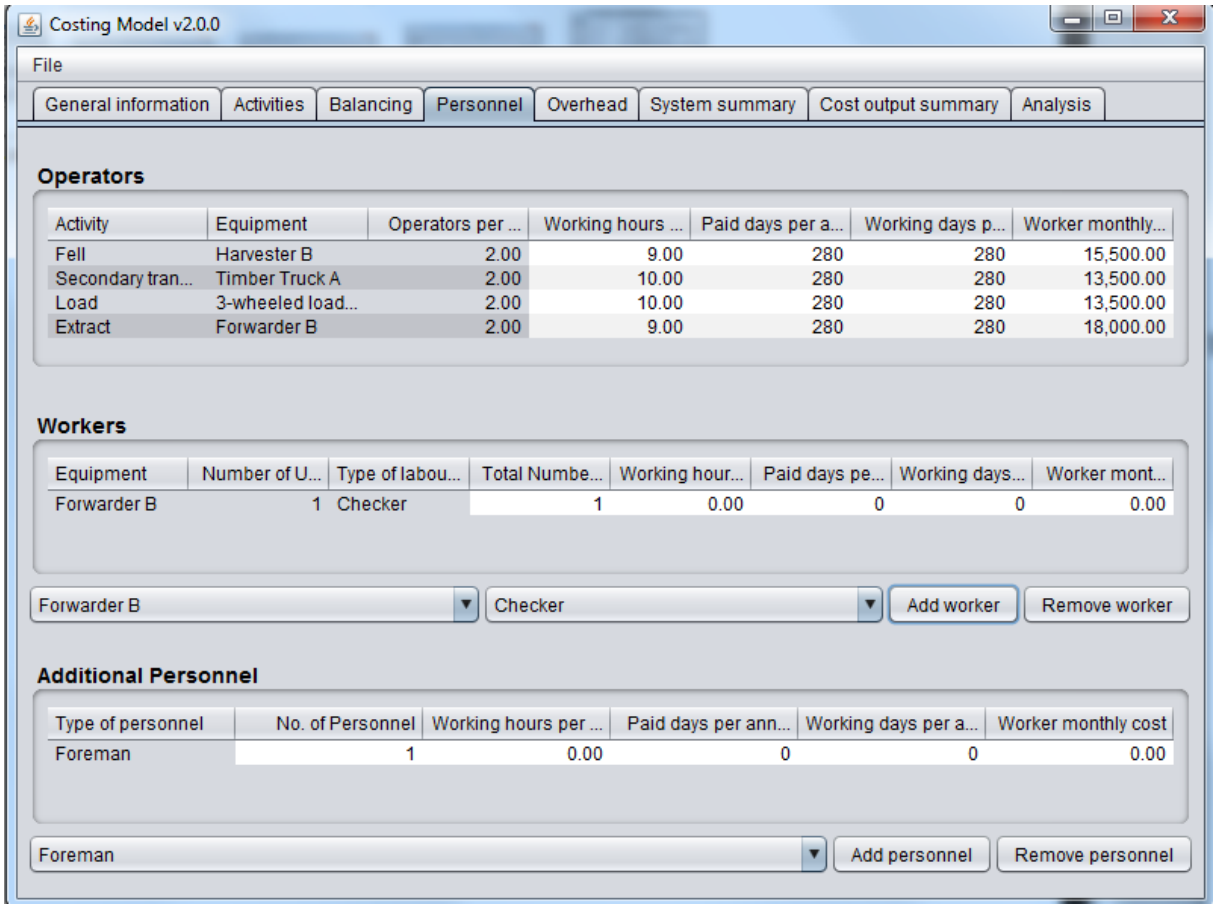
By Selected Equipment:
This method allows you to set a particular machine as a constraint of sort. Whichever machine you chose will be allocated to 100% of its potential and only allowed one machine of that type.



Now the Estimated project time cannot be adjusted and is set to accommodate the selected machine constraint. The number of other machines in the system is decided based on the estimated project time.\

5.4. Personnel tab

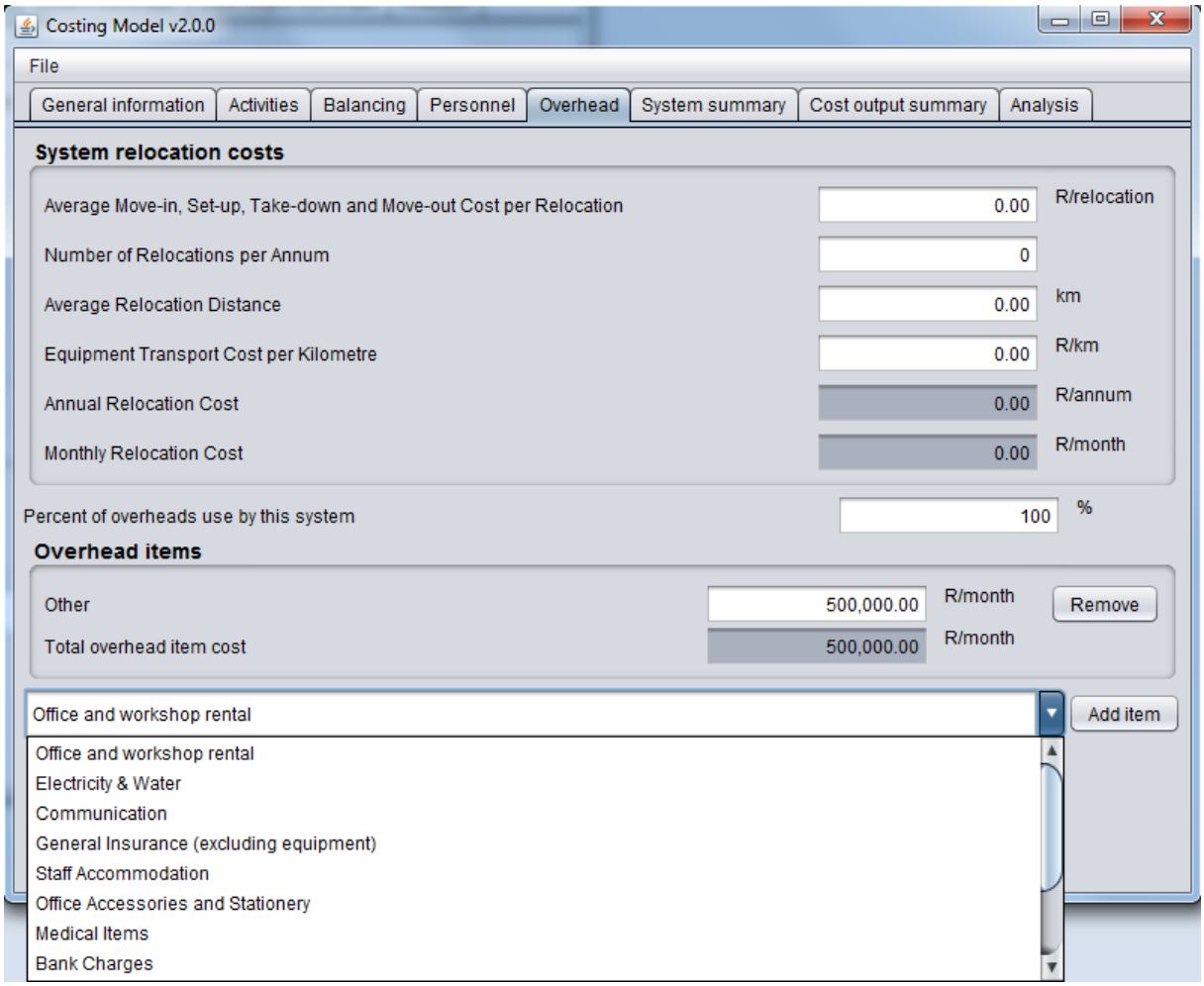
The Personnel tab supplies information regarding the personnel required for the system to function. Here you can see how many operators per machine are needed as well as their monthly costs and work time information. There is also the option to add additional personnel and workers who are not machine operators, i.e. foreman and choker-setter respectively. These personnel are added in the same way as the machines in the Activities tab by using the drop down menus.



Once added your personnel tab should look like the image above. To input data on the added personnel the user must fill in the empty fields available, i.e. *Working hours per day, Paid days per annum, Working days per annum* and *Worker monthly cost.*

5.5. Overhead tab

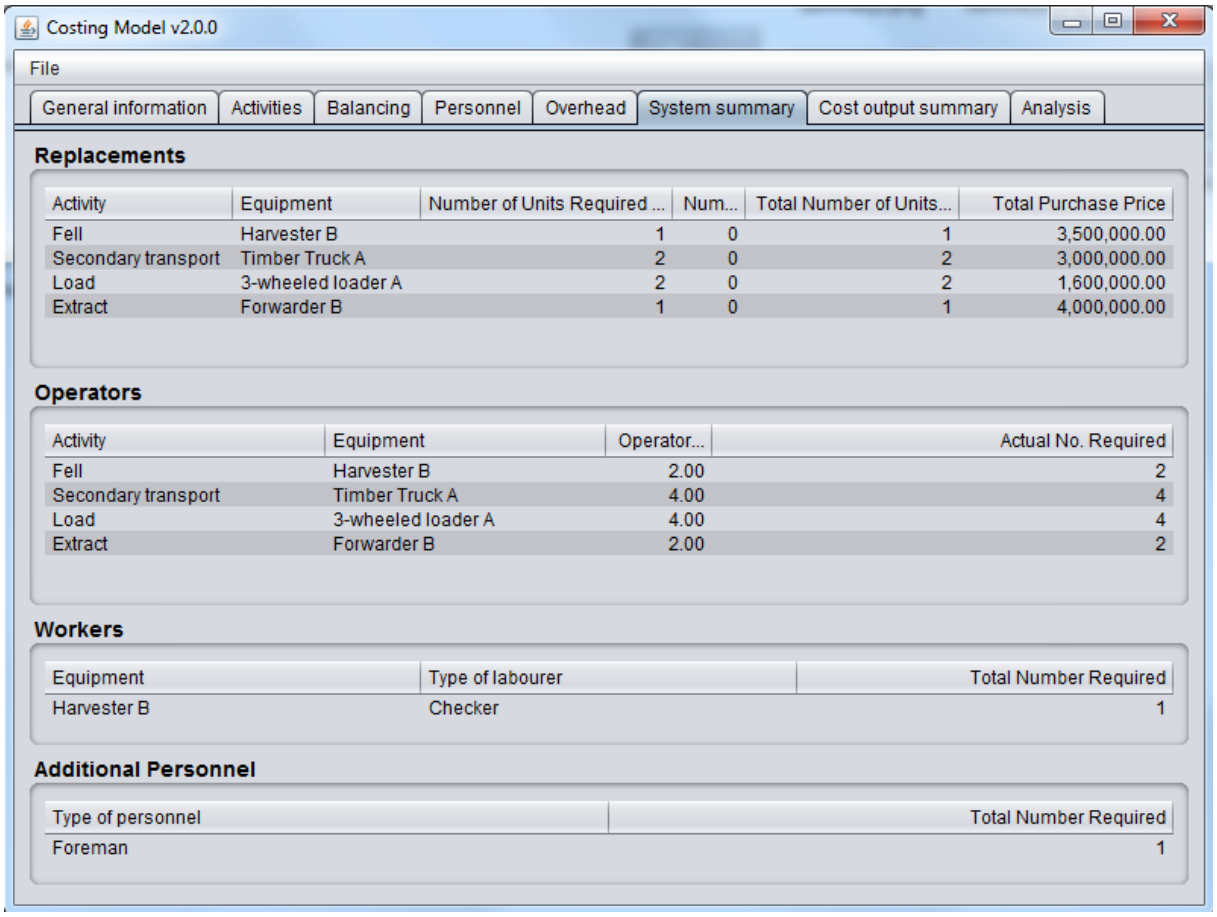
The Overhead tab allows the user to input overhead costs to be incorporated in the system. Notice the first part of this tab is entitled *System relocation costs* in the image below. Bear in mind that each single machine model also has the option to input relocation costs. The model is designed this way so that the user has the option of allocating each machine its own relocation cost or using a single relocation cost for the entire system.



The second part of this tab deals with the overheads of the system. Simply click on the drop down menu as in the image above and add the items required for the system. Once added the user can adjust the monthly cost per item. If the desired item is not found in the list use *other*.

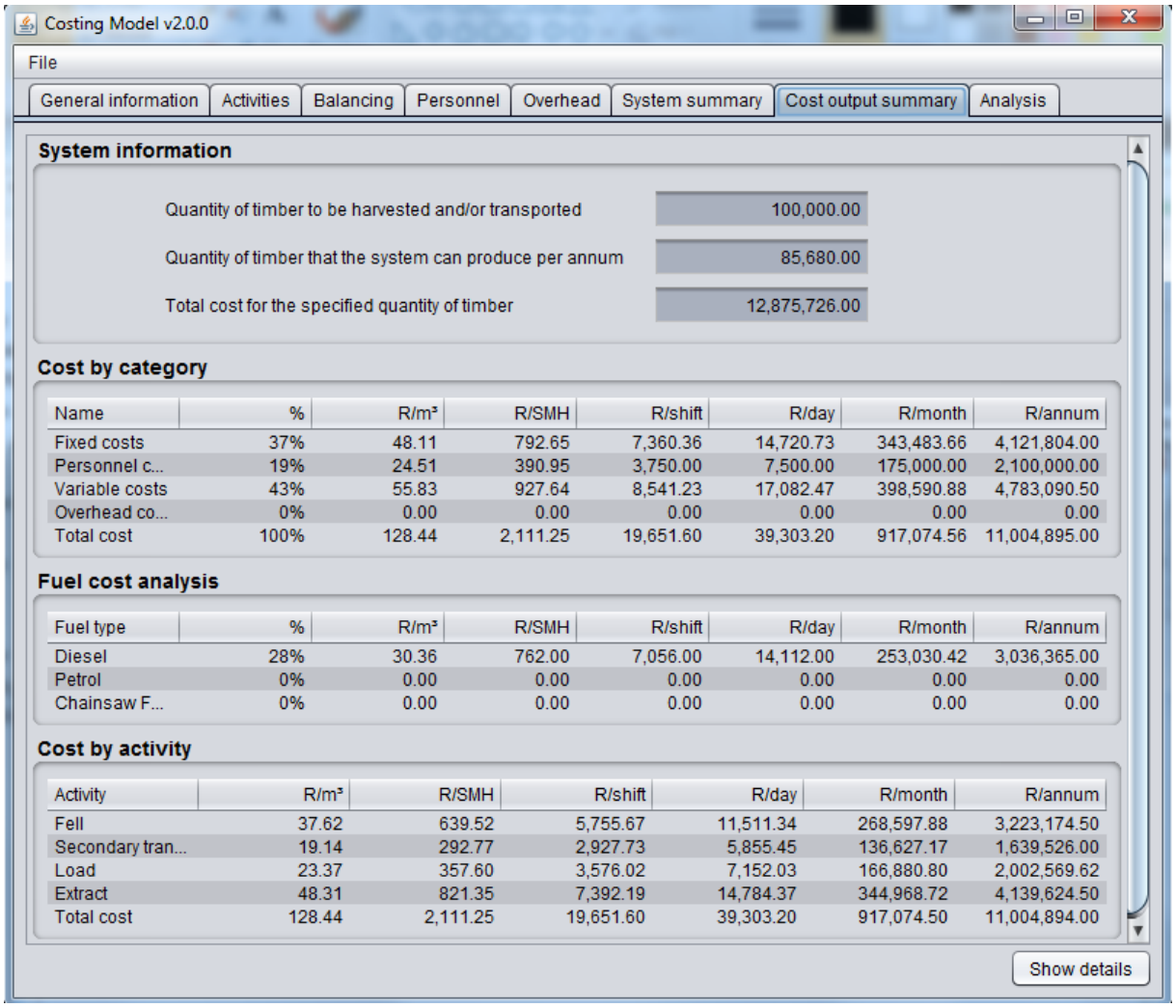
5.6. System summary tab

The System summary tab displays a summary of the items involved in the system. Minimal cost information is displayed as this tab is intended to summarise the amount of machinery and personnel utilised by the system.

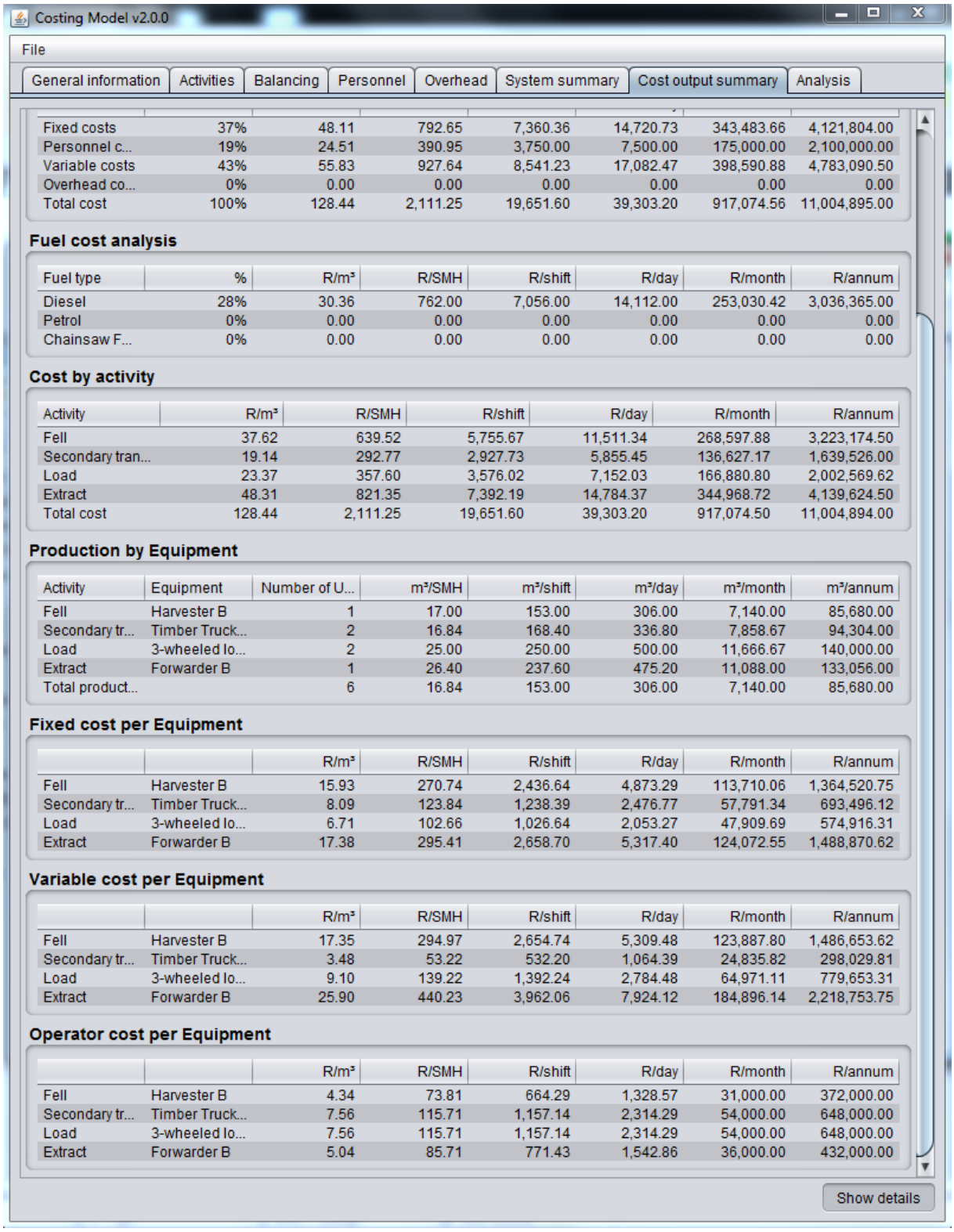


5.7. Cost output summary

This tab gives a detailed breakdown of all the costs involved in the system. When first opening the Cost output summary tab you will see the four headings and subsequent sections as in the image to follow.

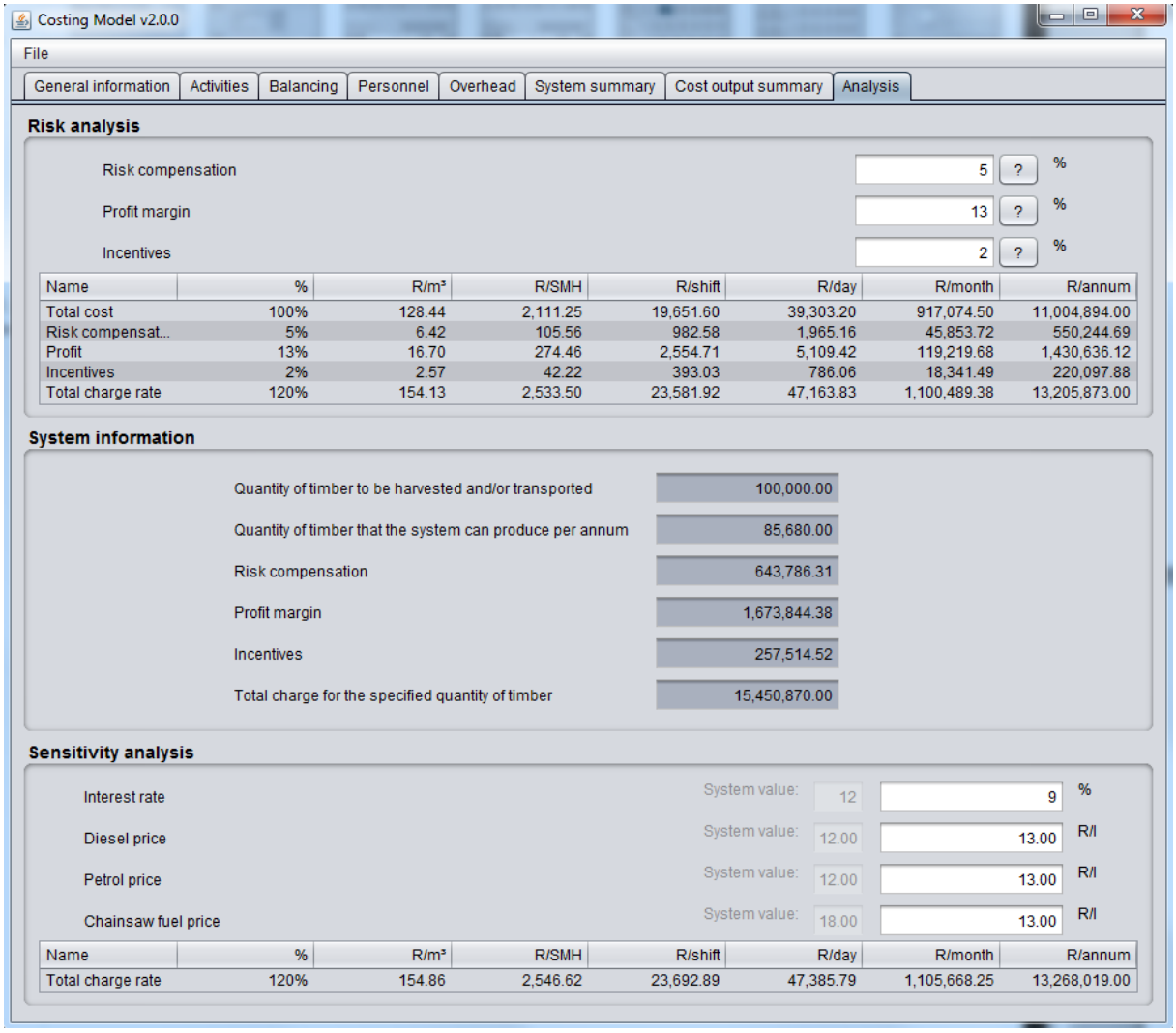


To get more cost information click on the *Show details* button found in the bottom right corner. This enables the user to scroll through additional information as can be seen in the image to follow.



5.8. Analysis tab

The analysis tab is comprised of a risk analysis, general system information and a sensitivity analysis.



The Risk analysis allows the user to specify what percentage of return they expect to receive for the project in terms of Risk compensation, Profit margin and Incentives. Once these values are entered into the model, the table below will show what the original system cost is and what the total charge will be per annum, per month, etc.

The system information merely shows the user the total costs of the operation to completion. Notice that in the Risk compensation section the *R/annum* value is slightly lower than the *Total charge for specified quantity of timber.* This is because the operation will take just over a year to complete.

The sensitivity analysis allows the user to test the effects of changes in interest rates and fuel prices. These aspects have been chosen as they can be considered variable

and generally account for a large portion of the costs. This section shows what the original values are and allows the user to enter different values. The new costs are outputted in a single line table at the bottom of the page. These values can be compared to the last line of the table in the Risk compensation section above, which displays the original system costs.

END NOTE:

If you require further assistance please contact us at packer@sun.ac.za .

This user manual will be available directly from the Costing Model program in the future.