

# DPL™ 9 Portfolio User Guide



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# 1. Introduction

## 1.1 Welcome to DPL™ 9 Portfolio

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This *DPL 9 Portfolio User Guide* supplements the *DPL 9 User Guide* that you received with your DPL 9 Portfolio software. It contains eleven chapters that cover the features of DPL Portfolio. This manual assumes you have significant experience using DPL, as well as familiarity with portfolio analysis concepts.

If you are new to DPL, you should review the contents of the *DPL 9 User Guide* before proceeding to the features documented in this manual. You may also wish to complete the tutorials contained in those manuals. The *DPL 9 User Guide* also contains information on how to install DPL and how to access resources and get help.

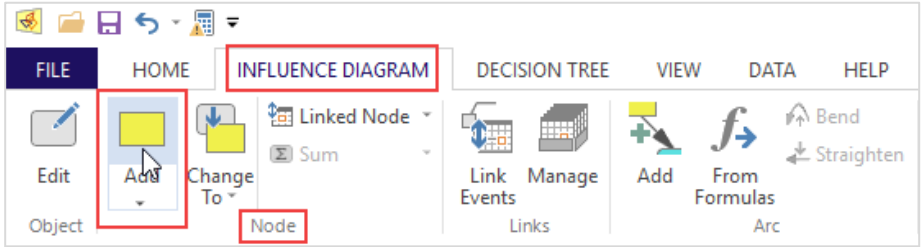
This manual is intended to be read while working with the DPL Portfolio software. The tutorials in many of the chapters follow-on from previous chapters. In particular, the tutorial beginning in Chapter 4 continues through Chapter 8.

A few conventions have been used in the text of the tutorial chapters. An instruction to you in a tutorial will be contained in a bulleted paragraph with an arrow, as follows:

⇒ Please do this step now.

Information to be entered in edit boxes, Excel cells, etc. is typically contained within double-quotes. Do not include the double-quotes when entering the information.

DPL ribbon tab names, groups, and commands are separated by vertical bars (|). For example, "Influence Diagram | Node | Add" refers to the default command indicated by the icon in the Add split button, located in the Node group on the Influence Diagram tab of the ribbon as show in below.



**Figure 1-1. Help Convention: Influence Diagram (Tab) | Node (Group) | Add (Command)**

When a command other than the default indicated by the icon is desired, you will be prompted to drop-down the split button and select the command from the drop-down list.

Within the *DPL 9 User Guide* and various sections within this guide the word "Options" following a vertical bar refers to the dialog box launcher (☐), which is located at the bottom right corner of the given tab group. For example, "Home | Run | Options" refers to the dialog box launcher for the Run group on the Home tab of the ribbon and will launch the Run Settings Dialog.

If there are multiple tabs within a dialog, then the item following the last | refers to the desired tab. For example, File | Options | Outputs refers the Outputs tab of the Options dialog.

## 1.2 Contents of this Manual

A brief outline of the contents of this manual follows.

Chapter 2 of the manual provides an overview of DPL Portfolio, what a portfolio is in DPL and how it works.

Chapter 3 contains a tutorial on how to make a non-portfolio DPL model a portfolio model. The chapter discusses portfolio attributes such as the overall objective, investment, etc.

Chapter 4 provides information on how to set up a spreadsheet-linked portfolio. It contains a tutorial that shows how to start with a spreadsheet-linked model and use it as the basis for a spreadsheet-linked portfolio.

Chapter 5 discusses how to analyze portfolios and covers the portfolio results that are available as part of a Portfolio Analysis run. This chapter also shows you how to create custom output charts from analysis results.

Chapter 6 discusses how to track additional metrics in your portfolio beyond the minimum required by DPL.

Chapter 7 provides a tutorial on how to define project category types and categories as well as how to use these when running a Portfolio Analysis.

Chapter 8 covers Data Reports, which allow you to quickly query and summarize project data across your portfolio.

Chapter 9 contains a tutorial on database-linked portfolios and the database-related features of DPL Portfolio.

Chapter 10 covers DPL program-linked portfolios and provides a tutorial on how to set these up.

Chapter 11 discusses how to handle dependencies between projects in DPL.

Chapter 12 includes a tutorial in which you export the portfolio definition as a CSV text file, so you can make edits to the definition using Excel or a text editor when doing so is more convenient than using DPL's dialogs.

## 1.3 What's New in DPL™ 9 Portfolio

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This section is intended as a reference for users of previous versions of DPL Portfolio. A list of some of the major changes and new features included in the new release are provided below:

- **New Given Success and Subtree Attributes**  
Calculate key metrics given success and under other conditional scenarios automatically as part of a portfolio run.
- **.CSV Definition of Portfolio**  
When just defining the portfolio is half the fun, manage your list in Excel or another program.
- **Element Definition Based on SQL query**  
Dynamic project selection based on project characteristics in the portfolio database.



## 2. DPL™ Portfolio Overview

DPL Portfolio's modeling environment is based on the class-leading decision analysis tool, DPL. It leverages DPL's intuitive graphical Influence Diagram/Decision Tree modeling interface for developing decision models. With the non-portfolio versions of DPL, the focus is most often on analyzing one or more decisions for a single project, asset or business situation. With DPL Portfolio, the focus shifts to analyzing decisions both at the project/asset-level and at the portfolio-level for a set of projects or assets within a portfolio. Typically this is done in a situation where funds to invest in these uncertain ventures are scarce and not all of the ventures can be funded.

At the heart of a portfolio analysis in DPL Portfolio is a set of DPL Influence Diagram/Decision Tree models. That is, DPL Portfolio uses the same modeling environment, ideas and methods as do all the other versions of DPL. DPL Portfolio contains all of the features and capabilities of DPL Enterprise (which itself builds on DPL Professional's features and capabilities) plus portfolio-analytic capabilities.

### 2.1 What is a Portfolio in DPL™?

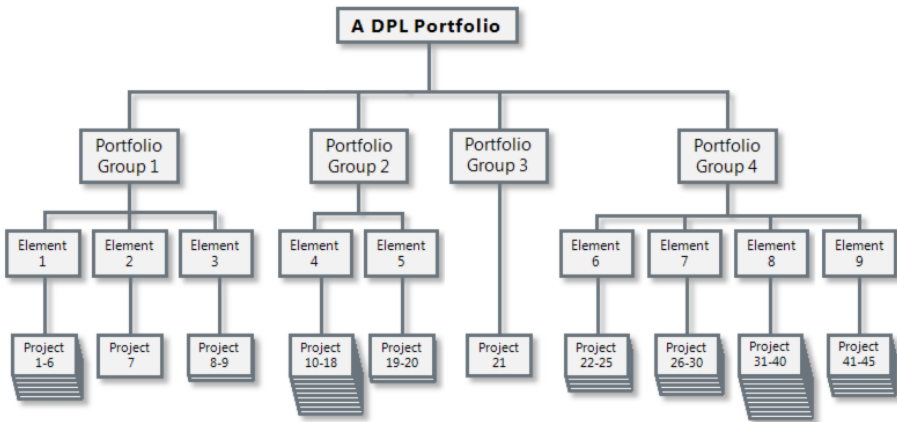
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A portfolio in DPL is a hierarchical representation of a set of projects or assets to be considered using portfolio-analytic techniques. For example, the set of projects represented by a DPL Portfolio may be a set of projects a company is considering pursuing as a part of its research and development (R&D) or new product development (NPD) efforts. Or the set of projects might be various business development activities that a company is considering pursuing. In the situation where the DPL Portfolio represents a set of assets, these assets may be financial instruments under consideration in a portfolio of stocks, bonds, etc. Or they may be physical assets that will return a gain or loss to the company. Alternatively, the DPL Portfolio could represent a set of environmental cleanup activities. Broadly speaking, a DPL Portfolio can be used to represent any set of activities designed to maximize some objective and which are competing for the same pool of limited resources.

The remainder of this manual discusses an example where the DPL Portfolio represents a set of R&D projects. More specifically, you will

consider a situation where the R&D projects are under consideration in a pharmaceutical company's drug development process.

The hierarchical structure of a DPL Portfolio is shown in Figure 2-1. A DPL Portfolio consists of one or more Portfolio Groups. A Portfolio Group has zero or more Portfolio Elements associated with it. A Portfolio Element represents one or more projects.



**Figure 2-1. Hierarchical Structure of a DPL Portfolio**

The following sections define Portfolio Groups and Portfolio Elements in more detail.

### 2.1.1 What is a Portfolio Group in DPL™?

A Portfolio Group is defined by three items:

- A DPL Model,
- An Initialization Link type, and
- A Calculation Link type.

All projects represented by a Portfolio Group have the same decision model, i.e., the same DPL Influence Diagram/Decision Tree (referred to collectively as a DPL Model). These projects share the same set of decisions, sequence of decisions, key uncertainties and relationships among these decisions and uncertainties. DPL Portfolio analyzes all projects represented by a Portfolio Group using the same DPL Model.

In addition to sharing a common DPL Model, the projects represented by a Portfolio Group all have the same Initialization Link type. That is, the data

used to feed the DPL Model for each project is stored in the same way for all the projects. See Section 2.2 for more information on initialization links.

Lastly, all the projects represented by a Portfolio Group share a Calculation Link type. That is, the calculations for each project's value model are executed in a similar way; for example, they may all be done in an Excel spreadsheet. See Section 2.4 for more information on calculation links.

Figure 2-2 shows the Add Portfolio Group dialog, which allows you to specify the three items that define a Portfolio Group among other things. If the Initialization Link type is database, additional options are available to be specified using the Portfolio Group dialog. These will be covered in Chapter 9 of this manual. You may also specify project categorization information via the Portfolio Group dialog. Project Categorization is covered in Chapter 7.

**Add Portfolio Group** [X]

Title:

Model:

Project Categorization

Initialization Links  None  DPL Program  Microsoft Excel  Database

Model ID:

Use value node data for project names Source:

Use database field for project names Field:

Numeric report table:

String report table:

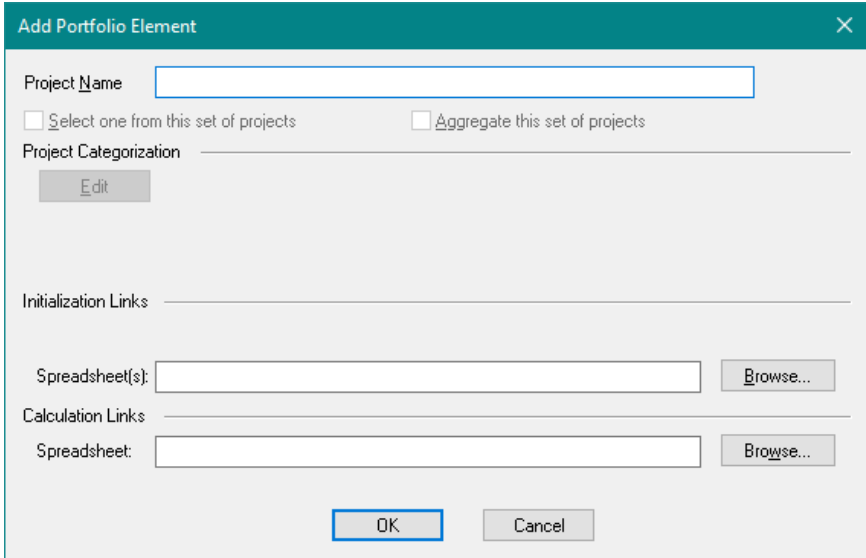
Calculation Links  None  DPL Program  Microsoft Excel

Excel links in one workbook

**Figure 2-2. Add Portfolio Group dialog**

### 2.1.2 DPL™ Portfolio Element

A Portfolio Element provides DPL with additional information about where to find the Initialization Link data and Calculation Link value model information for the project or set of projects that the Element represents. The information that is specified in the Portfolio Element dialog depends upon the Initialization and Calculation Link types. Figure 2-3 shows the Portfolio Element dialog for a Portfolio Group that employs an Excel spreadsheet for both its initialization and calculation links.



**Figure 2-3. Add Portfolio Element dialog with Spreadsheet Links**

## 2.2 How DPL™ Portfolio Works

As mentioned above, a DPL Model is used to represent one or more projects within the Portfolio. When the DPL Model represents a set of projects, it is referred to as a template model.

A template model can be fed by different datasets. A template model may also be able to use a different set of value model calculations to calculate results for each project, e.g., to calculate the objective function and other metrics.

The process for a Portfolio Analysis in DPL is as follows.

For each project in the portfolio, DPL:

- 1) loads the dataset for the project (which may be in a spreadsheet, DPL program or database);
- 2) loads the value model calculations (which may be in a spreadsheet or DPL program);
- 3) compiles the model;
- 4) runs a decision analysis on the compiled project-specific model; and

- 5) stores the project level results for aggregation later.

When all projects have been analyzed, DPL:

- 1) aggregates project level results; and
- 2) produces the requested portfolio results.

DPL is able to aggregate results for each project due to the commonality of attributes across the projects in the portfolio. See Section 2.5 for more information about portfolio attributes. The portfolio analysis process will be covered in more detail in the following chapters.

## 2.3 Initialization Links

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Initialization links are links in a DPL Portfolio that provide data to a DPL Model in a portfolio analysis. The Initialization Link type determines where the data are stored. The Initialization Link type is specified in the Portfolio Group dialog. There are four Initialization Link types in DPL:

- 1) None – indicates that there are no additional datasets for the DPL Model that the Portfolio Group uses. This type is most often used when the Portfolio Group represents a single project in the R&D portfolio for which a custom model has been developed.
- 2) DPL Program – indicates that the datasets are contained in DPL programs. These programs are referred to as Data Definitions Programs. These may be stored in the DPL Workspace or generated from external Excel files. Usually there will be a one-to-one correspondence between these initialization files and projects in the Portfolio. I.e., each set of initialization data will be used for one and only one project. DPL Program initialization links are covered in more detail in Chapter 10.
- 3) Spreadsheet – indicates that the datasets are contained in Excel spreadsheets. These spreadsheets are external to the DPL Workspace and may be stored in multiple locations. Usually there will be a one-to-one correspondence between these initialization spreadsheets and projects in the Portfolio. I.e., each spreadsheet will be used for one and only one project. Spreadsheet initialization links are covered in more detail in Chapter 4.
- 4) Database – indicates that the datasets are stored in records in a database. The dataset may be in multiple tables, but all must reside in a single database. The datasets are identified to DPL using a

unique Project ID field in the database. Usually there will be a one-to-one correspondence between these initialization records (Project IDs) and projects in the R&D portfolio. I.e., each record will be used for one and only one project. Database initialization links are covered in more detail in Chapter 9.

## 2.4 Calculation Links

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Calculation links are links in a DPL Portfolio that provide value model calculations to a DPL Model in a portfolio analysis. The Calculation Link type determines where these calculations are stored. The Calculation Link type is specified in the Portfolio Group dialog. There are three Calculation Link types in DPL.

- 1) None – indicates that there are no additional value model calculations for the DPL Model that the Portfolio Group uses. This type is most often used when the Portfolio Group represents a single project in the R&D portfolio for which a custom model has been developed.
- 2) DPL Program – indicates that the value model calculations are coded in DPL programs. These programs are stored in the DPL Workspace. Often there will be a one-to-many correspondence between these DPL calculation programs and projects in the R&D portfolio. I.e., each DPL program will be used for multiple projects. DPL Program calculation links are covered in more detail in Chapter 10.
- 3) Spreadsheet – indicates that the value model calculations are coded in Excel spreadsheets. These spreadsheets are external to the DPL Workspace and may be stored in multiple locations. Often there will be a one-to-many correspondence between these calculation spreadsheets and projects in the R&D portfolio. I.e., each calculation spreadsheet will be used for multiple projects. Spreadsheet calculation links are covered in more detail in Chapter 4.

## 2.5 Portfolio Attributes

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For any situation in which you are analyzing a portfolio of projects, you need a common set of metrics in order to be able to compare projects within the portfolio to each other and in order to be able to "roll up" portfolio level results for all projects. DPL Portfolio accomplishes this by allowing you to define a common set of Portfolio Attributes.

Each DPL Model in the DPL Portfolio must use this common set of Portfolio Attributes. Chapter 3 provides more information on DPL's mechanism for ensuring this is the case.

In addition to each model using the common set of attributes, DPL requires that the first three Portfolio Attributes are always Objective (i.e., the quantity that you are maximizing, e.g., NPV), Investment (i.e., the scarce resource you are consuming to achieve the objective, e.g., Development Costs) and Success (i.e., an indicator variable – 0/1 – for each project in the portfolio indicating whether it was a success or not, e.g., it reached the market).

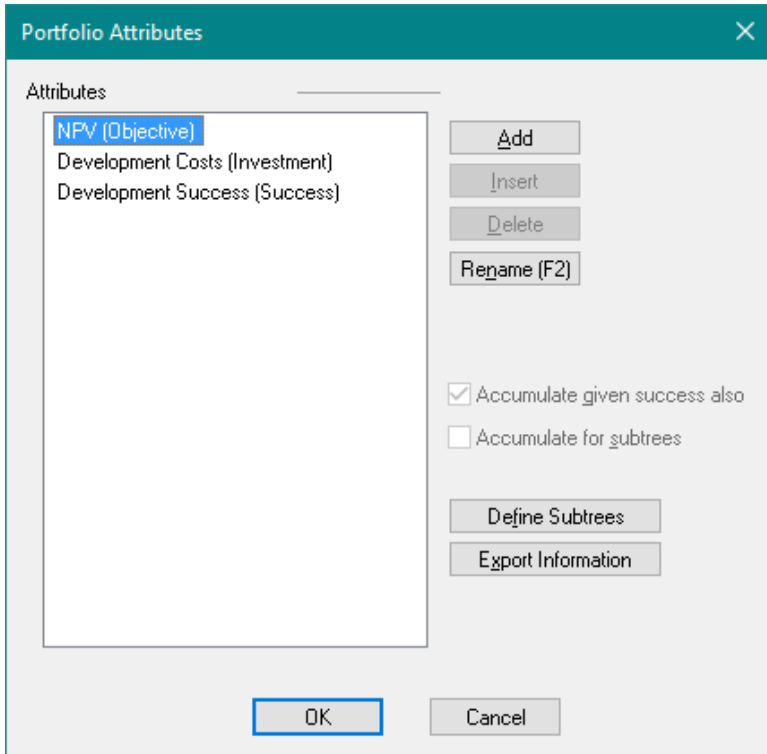
These three attributes must be defined in the order given above. Further, the Objective attribute must be something that you are trying to maximize. You may name these attributes anything you like, and the definition of each attribute and what contributes to it is entirely under your control. For example, in a portfolio of financial assets you might be maximizing return rather than NPV. In a situation where a company is more personnel than cash constrained, the investment attribute might be full time equivalents (FTE's).

The Success attribute is an indicator variable attribute; it is either zero or one in any given scenario (path along the tree). More information about the Success attribute is contained in Chapter 3 of this manual.

Portfolio Attributes are edited in the Portfolio Attributes dialog; see Figure 2 4.

In addition to the three required attributes, DPL also accumulates results for the Objective given success (e.g., the expected value of the project given you make it to market). Note that in Figure 2-4 the *Accumulate given success also* setting is checked and grayed out for the Objective attribute. You can also have DPL accumulate given success results for the Investment or any other attribute you define.





**Figure 2-4. Portfolio Attributes dialog**

Though it's not listed in the dialog, DPL also calculates the value of a derived attribute referred to as the productivity ratio, which is typically a measure of capital efficiency and is the ratio of the Objective attribute over the Investment attribute. Productivity ratio is discussed in more detail in Section 5.7.

Lastly, take note of the Accumulate for subtrees checkbox and the Define Subtrees button below it. The Define Subtrees button launches the Attribute Subtree dialog which provides an interface for defining custom conditional scenarios (subtrees) for which you can accumulate distributions and calculate expected value results for the desired attributes as part of a portfolio run. This will be discussed in more detail in section 6.6.

The Portfolio Attributes dialog also allows you to define further Portfolio Attributes to track additional metrics in the portfolio. Tracking additional portfolio metrics is discussed in Chapter 6 of this manual.

## 3. Portfolio Models

This chapter contains a tutorial on how to turn an existing non-portfolio DPL model into a portfolio model. The example used in the tutorial is a spreadsheet-linked model. However, the information contained in this chapter is applicable regardless of whether you intend to develop a spreadsheet-linked portfolio or not. Even if you intend to develop a portfolio that is not spreadsheet-linked, you should review this chapter.

While it may be easiest to follow the tutorial with the example files provided, you may also complete the tutorial using files of your own that you wish to modify and set up for a Portfolio Analysis. The text of the tutorial assumes you are using the provided example files.

The example model provided with this tutorial is based on a pharmaceutical drug development project. You will explore the DPL Workspace file and Excel spreadsheet now.

- ⇒ Start DPL Portfolio.
- ⇒ Select File | Open.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select R&D Project.da and click Open.

DPL opens the Workspace, which contains one model called Drug Development. This model is a typical yet simple drug development example with a funding level decision up front. The decision is followed by phase I, II and III clinical development uncertainties (technical uncertainties) and then by a regulatory uncertainty. Lastly, there are some commercial uncertainties. If you look at the Decision Tree (if the Influence Diagram pane is maximized press the Tab key to switch between model panes), you'll find that it is asymmetric: failure at any of the technical uncertainties or regulatory uncertainty is a terminal outcome. See Figure 3-1 and Figure 3-2.

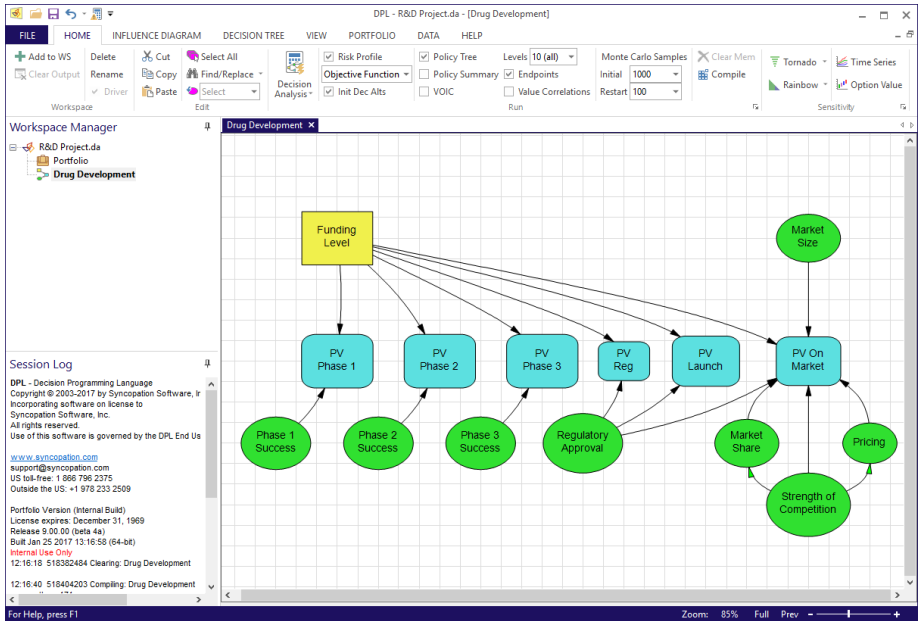


Figure 3-1. Drug Development Model – Influence Diagram

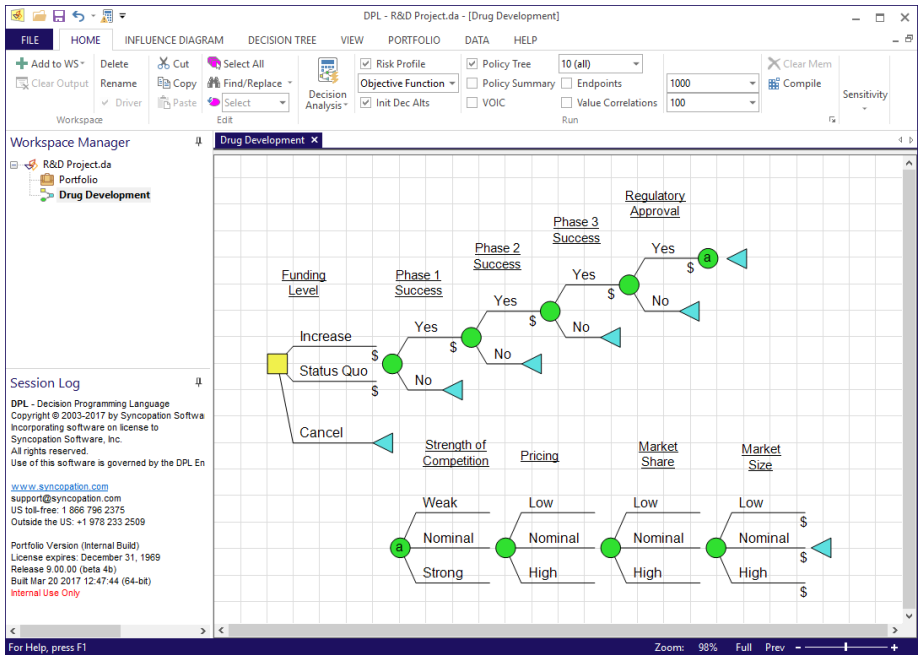


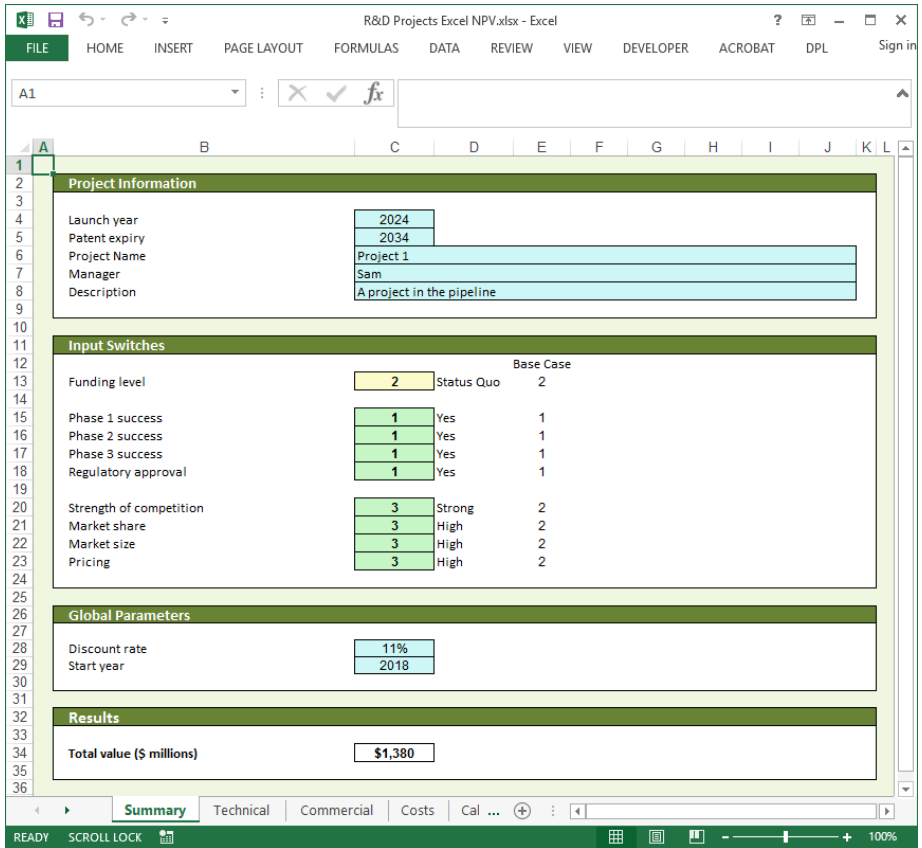
Figure 3-2. Drug Development Model – Decision Tree

Notice that the Workspace Manager has a Portfolio item just beneath the Workspace. Once you have things set up the Portfolio item will have additional items beneath it. More information about the Workspace Manager will be provided in later chapters of this manual.

You'll now explore the linked spreadsheet for this drug development example.

- ⇒ Start Excel.
- ⇒ Select File | Open.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select R&D Projects Excel NPV.xlsx and click Open.

The spreadsheet is a simple cash flow model for the drug development example. It contains several sheets. The first four of these sheets (Summary, Technical, Commercial, Costs) contain assumptions about the project. The last two sheets (Calcs, DCF) contain calculations. The first sheet also contains a number of input switches that are linked to the DPL model as indicated by the shaded cells. See Figure 3-3.



**Figure 3-3. Cash Flow Spreadsheet for Drug Development Example**

- ⇒ Switch back to DPL.
- ⇒ If you wish, run the model by clicking the Home | Run | Decision Analysis icon or pressing F10.
- ⇒ Click Home | Run | Clear Mem or press F9 to clear the run results.

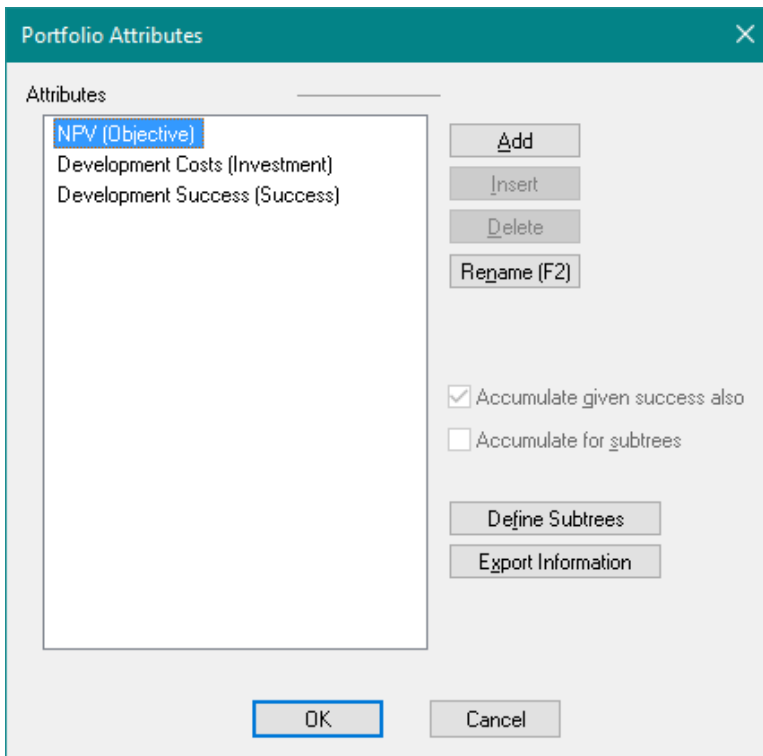
You will now make some modifications to the model to set it up for conducting a DPL Portfolio analysis.

## 3.1 Defining Portfolio Attributes

As mentioned in Chapter 2, all models in a DPL Portfolio must share a common set of attributes. DPL enables you to do this by providing you with a set of Portfolio Attributes.

DPL uses the Portfolio Attributes as the metrics to be tracked when analyzing any model that is a part of a DPL Portfolio.

- ⇒ Click Portfolio | Definition | Attributes. DPL displays the Portfolio Attributes dialog. See Figure 3-4.



**Figure 3-4. Portfolio Attributes dialog**

DPL requires three attributes for a portfolio analysis: Objective, Investment and Success. DPL has created these for you and assigned names of NPV, Development Costs and Development Success, respectively as shown in Figure 3-4. The dialog allows you to rename these three attributes but you'll leave them as they are.

You can also add, insert and delete attributes beyond the required three. Additional attributes are required if you would like to track further metrics for your portfolio. Tracking additional metrics is covered in Chapter 6. Currently you cannot delete any of the existing attributes, since all 3 are required.

As mentioned previously, you can use the two checkboxes in the dialog to accumulate results for given success (on by default and required for the Objective attribute) or custom defined conditional scenarios (i.e., subtrees) for a given attribute.

You will now convert the model so that it uses them.

## 3.2 Portfolio Model Indicator

---

The Drug Development model is currently a single attribute model. The objective function by default is to maximize this attribute. Familiarize yourself with this now.

⇒ With the Drug Development model activated, click Influence Diagram | Objective & Utility | Options.

The Objective tab of the Objective & Utility dialog shows only a single attribute defined, named Attribute1. No objective function is defined so DPL maximizes the single attribute.

⇒ Click Cancel.

⇒ Activate the Decision Tree pane. Note that there is a \$ on the branches of the Increase/Status Quo branches of the Funding Level decision node indicating that there is a get/pay expression on these branches.

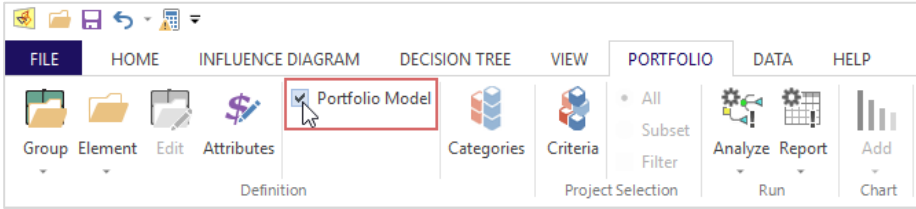
⇒ Double-click the Increase/Status Quo branches of the Funding Level decision to launch the Get/Pay tab of the Branch Definition dialog.

As you can see from the dialog, currently DPL requires a single expression for the single attribute (which is the objective function) in this model.

DPL knows whether to use the Portfolio Attributes or a model's attributes by the status of the Portfolio Model indicator. The Portfolio Model indicator is set within the Portfolio | Definition group.

⇒ Click Cancel to close the Branch Definition dialog.

⇒ Check the checkbox labeled Portfolio Model within the Portfolio | Definition group. See Figure 3-5.



**Figure 3-5. Portfolio Model Indicator Turned On**

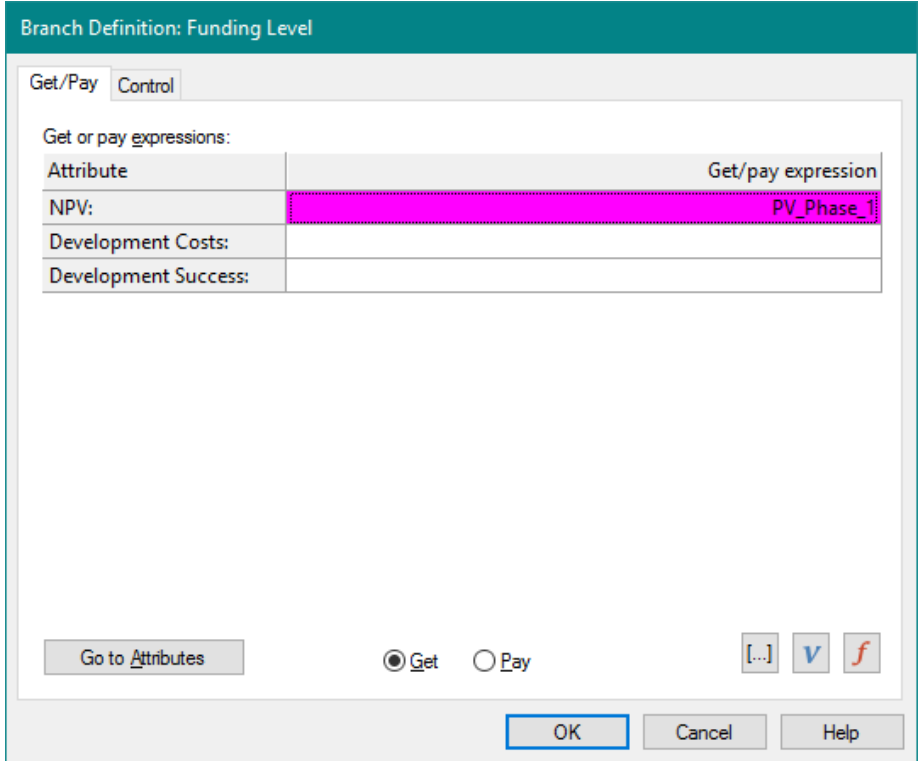
Note that when the Portfolio Model checkbox is not checked the Objective tab within the Objective & Utility dialog is available. When a model is a non-portfolio model, as Drug Development started out, you can specify any set of attributes and any objective function you like.

Once the Portfolio Model item is checked, the Objective tab within the Objective & Utility dialog and the Objective Function Combo box on the ribbon are both disabled. You can no longer specify a model-level objective function or model-level attributes for this model. Instead, it will use the Portfolio Attributes.

⇒ Double-click the Increase/Status Quo branches of Funding Level in the Decision Tree (again).

Now the Get/Pay tab of the Branch Definition dialog indicates that DPL requires three expressions, one for each of the Portfolio Attributes which are currently NPV, Development Costs and Development Success (Figure 3-6).





**Figure 3-6. Get/Pay tab of Branch Definition Dialog for Funding Level Decision with Portfolio Indicator On**

With the Portfolio Model indicator set, DPL will always use the Portfolio Attributes when running the model regardless of whether the model is run as part of a Portfolio Analysis or run individually (via a Decision Analysis, Tornado Diagram, etc.).

⇒ Click Cancel to close the dialog.

You will now modify the model to take into account that it uses the Portfolio Attributes.

## 3.3 Tracking Development Costs Separately

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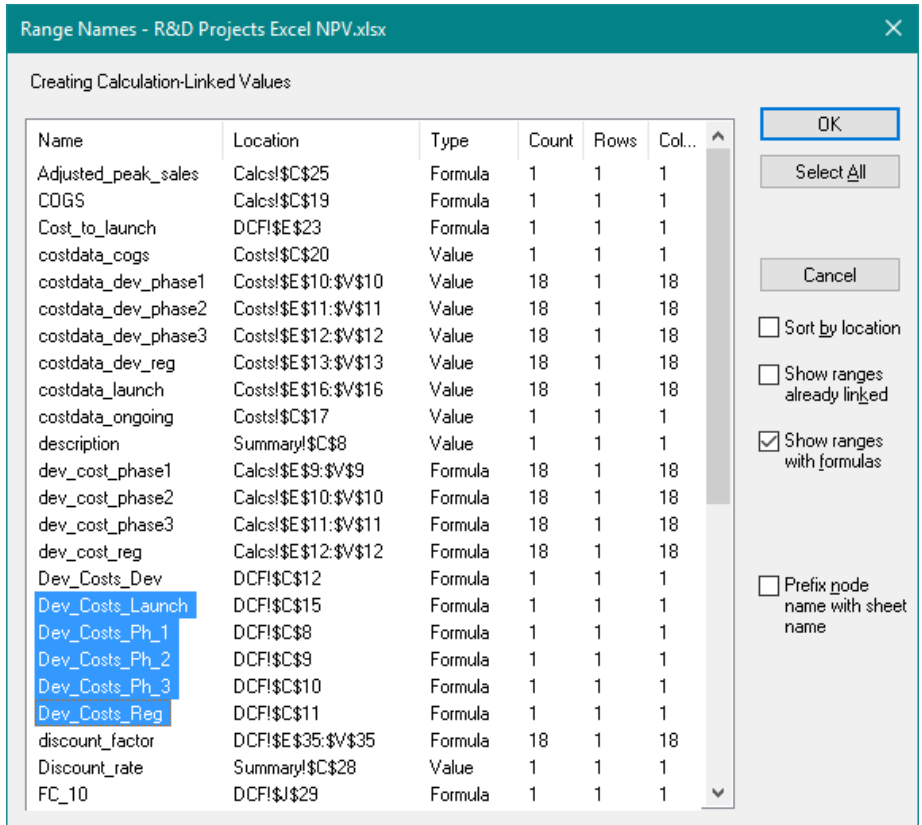
Now that Drug Development is a Portfolio Model, an entry is needed in each get/pay expression for each Portfolio Attribute. As discussed previously, the three required Portfolio Attributes are Objective (NPV in this example), Investment (Development Costs) and Success (Development Success).

Before converting the model to a Portfolio Model, the model was set up to maximize a single attribute which was NPV (though it was unnamed). Since the first Portfolio Attribute is NPV (Objective) and it is to be maximized, nothing needs to be done for the expressions within each get/pay expression for Objective; they are correct. However, expressions are needed for Development Costs and Development Success. This section discusses setting up the expressions for Development Costs.

Previously, there was no need to track development costs separately from NPV. Now, however, you need to track the present value of development costs separately for the investment attribute. When developing an Excel spreadsheet or other value model to be used with a Portfolio Model, you will need to set up the model so that it tracks whatever costs you consider to be Investment costs separately. For example, you might consider any costs incurred prior to launch to be Investment costs, or you might consider any costs up to a proof of concept to be Investment costs. What you wish to include as Investment costs is completely under your control and is part of your portfolio review process design.

The Excel spreadsheet, R&D Projects Excel NPV.xlsx, has been set up to track development costs separately. You will now modify the DPL Model to track these costs. The first step to do is to create several import nodes linked to the spreadsheet.

- ⇒ Activate the Influence Diagram pane.
- ⇒ Click Influence Diagram | Node | Linked Node | Excel Calculation-Linked.
- ⇒ Within the Range Names dialog select Dev\_Costs\_Launch, Dev\_Costs\_Ph\_1, Dev\_Costs\_Ph\_2, Dev\_Costs\_Ph\_3, Dev\_Costs\_Reg as shown in Figure 3-7. Be sure not to select the similarly named dev\_cost\_phase1, dev\_cost\_phase2, etc.

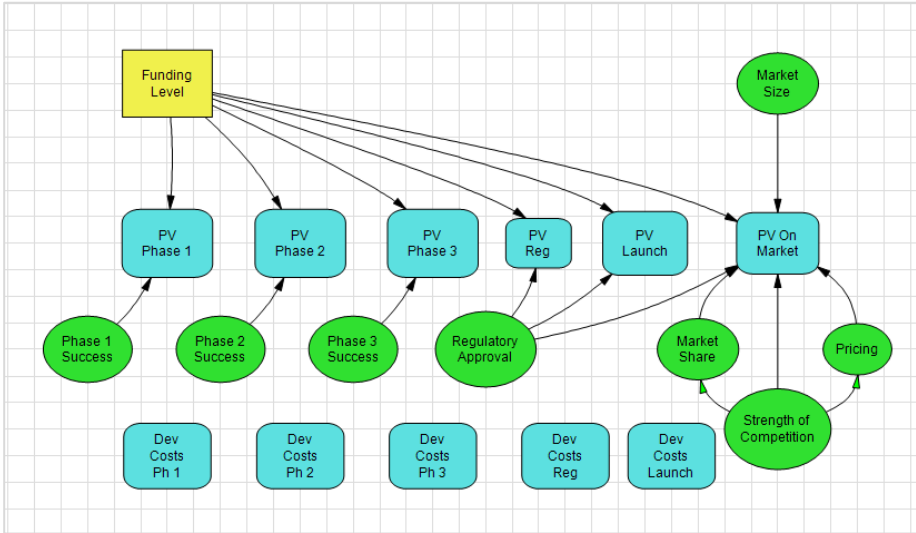


**Figure 3-7. Development Cost Ranges Selected**

⇒ Click OK.


DPL creates the new nodes off to the right of the existing nodes in the Influence Diagram, so you may need to zoom full to see them.

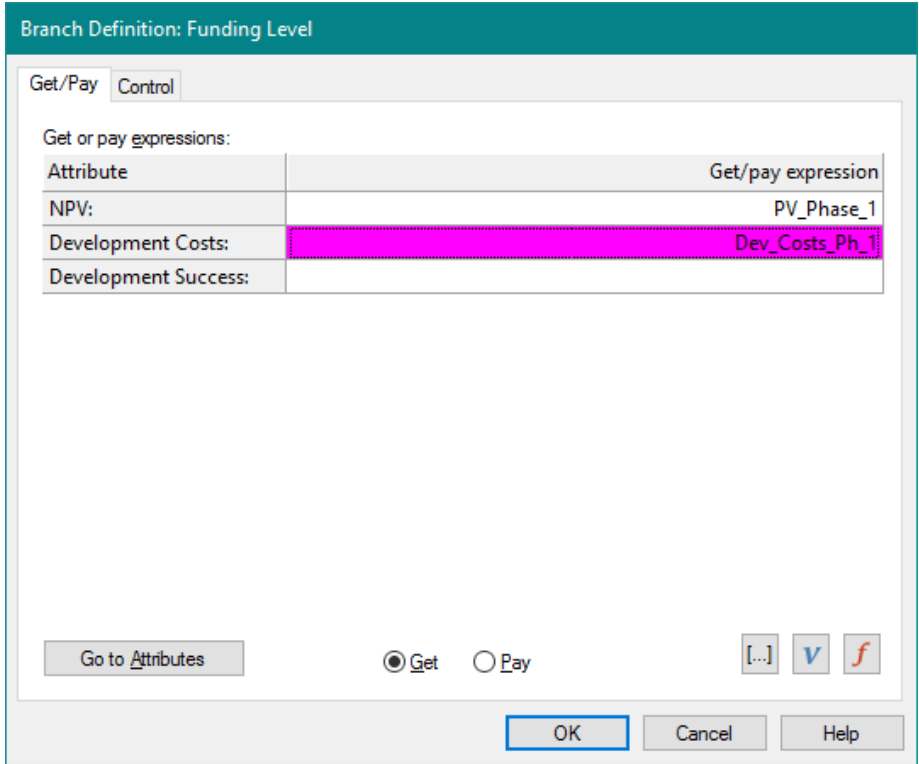
⇒ If you wish, re-arrange the nodes so that the Influence Diagram looks like Figure 3-8.



**Figure 3-8. Influence Diagram with Development Cost Nodes**

Now that you have the necessary import nodes, you need to modify the get/pay expressions in the tree.

- ⇒ In the Decision Tree pane, double-click the Increase/Status Quo branches of Funding Level in the Decision Tree.
- ⇒ Arrow down to the expression cell for Development Costs.
- ⇒ Click the variable button (  ).
- ⇒ Select Dev\_Costs\_Ph\_1 from the list.
- ⇒ Click OK. The Get/Pay tab should now look like Figure 3-9.



**Figure 3-9. Get/Pay tab of the Branch Definition Dialog with Dev\_Costs\_Ph\_1**

- ⇒ Click OK to close the dialog.
- ⇒ Repeat the above process to specify Dev\_Costs\_Ph\_2, Dev\_Costs\_Ph\_3, Dev\_Costs\_Reg, Dev\_Costs\_Launch for the get/pay expression for Development Costs on the branches of Phase 1 Success = Yes, Phase 2 Success = Yes, Phase 3 Success = Yes, and Regulatory Approval = Yes, respectively.

There is also a get/pay expression on the branches of Market Size. In this Drug Development example model, there are no development costs once the drug has gotten regulatory approval other than the launch costs (which have been accounted for on the Regulatory Approval = Yes branch). No further development costs need to be associated with the get/pay expression on the branches of Market Size; however the get/pay expression does need to be modified to tell DPL that nothing needs to be associated with development costs.

- ⇒ Double-click the branches of Market Size. The get/pay expressions for Development Costs and Development Success are currently empty.

When editing a get/pay expression for multiple attributes, DPL will fill in zeroes for any expression for an attribute that you leave blank. In this instance, you want the get/pay expression for both Development Costs and Development Success to be zero. In the previous edits you made to get/pay expressions, DPL filled in zero for Development Success after you clicked OK.

- ⇒ Click OK. DPL fills in zeroes for you.

You have now completed the setup of the model in order to track development costs as a separate attribute. The last step to setting up the model to use the Portfolio Attributes is to modify the get/pay expressions for the Success attribute.

## 3.4 The Success Attribute

---

The Success Attribute is an indicator attribute. An indicator attribute is an attribute that is either zero or one for each path through the tree. It should be one for those paths in the tree that are considered a success and zero for those paths considered a failure.

The definition of success is entirely up to you, and it depends on the portfolio situation you are modeling. For example, in a new product development context the definition of success might be that a product is launched. There is still uncertainty as to how well the product does commercially, but it has made it to the market. For other research and development processes, success may mean that a prototype has been developed or that a proof of concept has been achieved, even if no commercial product has been released yet.

For the drug development example, a project is considered successful if it achieves regulatory approval. There is still uncertainty about how well the drug will do commercially but it has cleared all the technical and regulatory uncertainties.

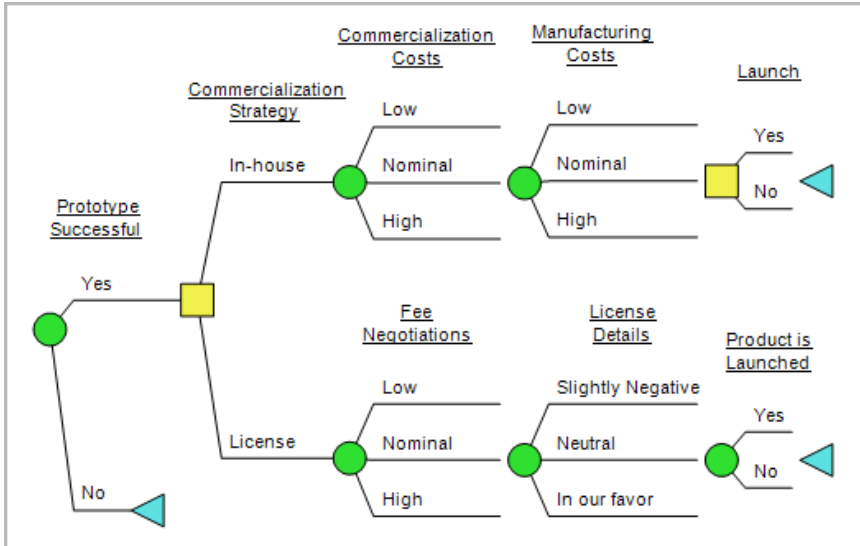
You indicate success in a DPL Model by putting a one in the get/pay expression for the Success attribute at the appropriate point in the tree, and a zero in other get/pay expressions for the Success attribute along the path. This way, the sum of the get/pay expressions for "successful" paths will be one while the sum for "unsuccessful" paths will be zero.

- ⇒ Double-click the Yes branch of Regulatory Approval to edit its get/pay expression. Note that DPL has entered a zero for Development Success attribute after you edited this get/pay expression previously.
- ⇒ Arrow down to the expression for Development Success.
- ⇒ Type "1".
- ⇒ Click OK.

As mentioned above, DPL put a zero in for Development Success after you edited the remainder of the get/pay expressions in the tree and clicked OK. The remainder of these expressions should be zero for Development Success, so you do not need to edit them now.

The get/pay expressions in the Decision Tree are now set up to properly handle Development Success. For any path through the tree, the attribute is either zero (all the paths that terminate before Regulatory Approval = Yes) or one (all the paths that follow Regulatory Approval = Yes).

For some applications, it may be necessary to put a one in several different get/pay expressions for the Success attribute. For example, consider a new product development context where success for a project is defined to be that a product is launched based on some new technology. This technology may have more than one route to market. Consider the section of an example Decision Tree in Figure 3-10.



**Figure 3-10. Hypothetical Decision Tree for a New Product Development Case**

To indicate success (i.e., that the product launched) for the tree in Figure 3-10, you would put a one in the get/pay expression for Success on the Yes branch of the Product is Launched *chance* node **and** a one in the get/pay expression for Success on the Yes branch of the Launch *decision* node. Even though it is necessary to put a one for Success in two get/pay expressions in this example, when the get/pays are summed up, the Success attribute is still zero or one on any path through the tree.

For the Success attribute to work properly, it should never be anything except a zero or one on any path in a tree. That is, if you trace through the Decision Tree, you should never encounter two or more get/pay expressions on the same path that both have a one for the Success attribute.

In the drug development example, you could have indicated success by putting a one for Development Success in the get/pay expression on the branches of Market Size *instead of* putting the one for Development Success on the Yes branch of Regulatory Approval. It would be incorrect, however, to put a one in both locations since both the get/pay expressions are encountered for any path where regulatory approval is yes (and hence the value of the Success attribute would be two on those paths).

⇒ Save your Workspace file under a new name so you can use it in subsequent chapters.



## 4. Spreadsheet-Linked Portfolios

This chapter discusses how to set up a spreadsheet-linked portfolio. The starting point for this chapter is a DPL Workspace with a DPL Model that uses the Portfolio Attributes (i.e., the Portfolio Model indicator has been set and the get/pay expressions in the tree have been modified so that they are correct for the required Portfolio Attributes). The DPL Model is linked to a spreadsheet to calculate values for the Objective and Investment attributes.

The tutorial in this chapter starts where the tutorial in Chapter 3 left off. If you do not have an example of your own that you are working on and have not completed the tutorial in Chapter 3, you may wish to do so before beginning the tutorial in this chapter.

The text of the tutorial assumes you are using the example files provided with DPL Portfolio.

### 4.1 Spreadsheet Design

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In general when developing spreadsheet models, it is a good idea to keep data and assumptions on separate sheets from calculations. This is particularly true if you are going to use the spreadsheet as the starting point for developing a spreadsheet-linked portfolio model in DPL.

If you haven't done so already, explore the linked spreadsheet (R&D Projects Excel NPV.xlsx) for the drug development example discussed in Chapter 3.

- ⇒ Start Excel.
- ⇒ Select File | Open.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncoption\DPL9Portfolio\Examples.
- ⇒ Select R&D Projects Excel NPV.xlsx and click Open.

This spreadsheet separates data from calculations. Specifically, it has assumptions (inputs to the model) on the first four of the sheets (Summary, Technical, Commercial, Costs). These sheets contain no calculations that are used anywhere else in the spreadsheet (the only

calculations they contain display the sum of a set of probabilities). The last two sheets (Calcs, DCF) contain only calculations and no data.

Separating the data from the calculations in this manner makes it possible to feed in different sets of inputs to the model while maintaining one common set of value model calculations. The ability to feed multiple sets of inputs to the value model is precisely what is required when you are setting up a DPL Portfolio.

The first steps in the tutorial below are designed to modify the DPL Model so that it can be used to send different sets of inputs to the Excel model.

## 4.2 Separating Initialization Links from Calculation Links

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If it is not already open, open the file you were working on for the tutorial in Chapter 3.

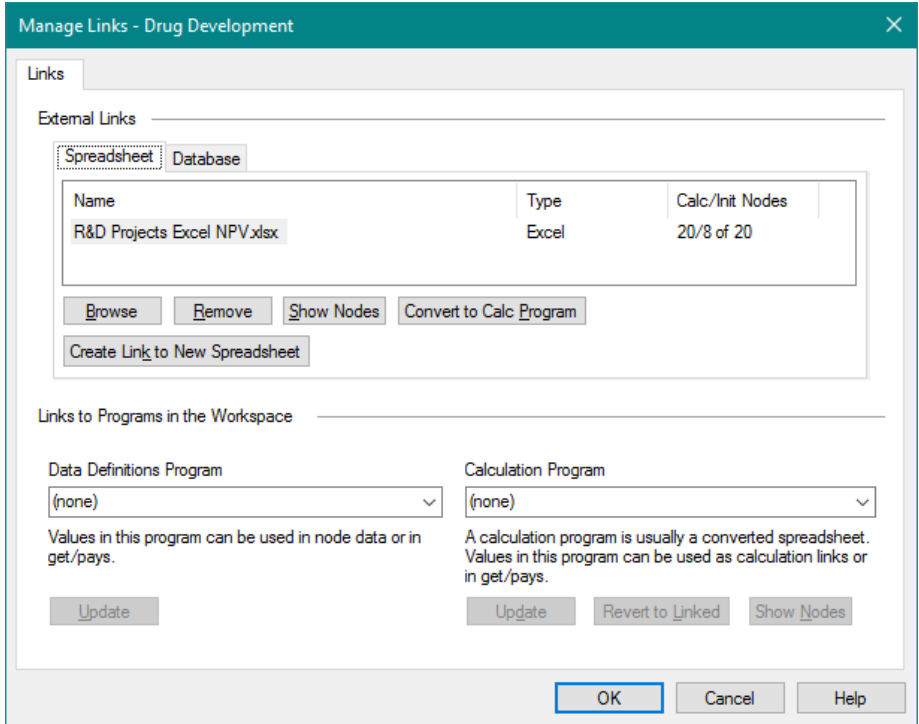
- ⇒ If necessary, start DPL Portfolio.
- ⇒ Select File | Open.
- ⇒ If you have a working file from Chapter 3:  
Navigate to the folder where you saved your file and open it.
- ⇒ If you don't:  
Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.

Select Excel-Linked Portfolio Prepared.da and open it.

You will familiarize yourself with the links in this model.

- ⇒ Click Influence Diagram | Links | Manage.

The Manage Links dialog displays information about the links in the model. As shown in Figure 4-1, the dialog indicates that the model is linked to R&D Projects Excel NPV.xlsx. It also indicates that all 20 nodes in the model have calculation links and that eight of them also have initialization links.



**Figure 4-1. Manage Links Dialog for Single Spreadsheet**

⇒ In the *External Links* section of the dialog beneath the Spreadsheet list box, click the Show Nodes button.

The Linked Nodes dialog tells you which nodes are linked and how each of the nodes is linked. A node may appear more than once. For example, Figure 4-2 indicates that Phase 1 Success is linked as a driver node (which is a calculation link) and that its probabilities are also initialization linked. In fact, the probabilities of all eight of the uncertainties in the model are initialization linked to the Excel spreadsheet.

Linked Nodes - R&D Projects Excel NPV.xlsx

Name	Cell	Link Type	Node Type
Funding Level	Summary!Funding_level	Driver	Decision
Phase 1 Success	Summary!Phase_1_success	Driver	Discrete Chance
Phase 1 Success (probs)	Technical!prob_phase_1	Init	Discrete Chance
Phase 2 Success	Summary!Phase_2_success	Driver	Discrete Chance
Phase 2 Success (probs)	Technical!prob_phase_2	Init	Discrete Chance
Phase 3 Success	Summary!Phase_3_success	Driver	Discrete Chance
Phase 3 Success (probs)	Technical!prob_phase_3	Init	Discrete Chance
Regulatory Approval	Summary!Reg_approval	Driver	Discrete Chance
Regulatory Approval (probs)	Technical!prob_reg_approval	Init	Discrete Chance
Strength of Competition	Summary!Strength_of_compe...	Driver	Discrete Chance
Strength of Competition (...)	Commercial!probs_strength_...	Init	Discrete Chance
Pricing	Summary!Pricing	Driver	Discrete Chance
Pricing (probs)	Commercial!probs_pricing	Init	Discrete Chance
Market Share	Summary!Market_share	Driver	Discrete Chance
Market Share (probs)	Commercial!probs_market_sh...	Init	Discrete Chance
Market Size	Summary!Market_size	Driver	Discrete Chance
Market Size (probs)	Commercial!probs_market_size	Init	Discrete Chance
PV Phase 1	DCF!PV_Phase_1	Metric	Value
PV Phase 2	DCF!PV_Phase_2	Metric	Value
PV Phase 3	DCF!PV_Phase_3	Metric	Value
PV Phase 4	DCF!PV_Phase_4	Metric	Value

Close

Go to Node

Go to Cell

Show unlinked nodes

**Figure 4-2. Linked Nodes for R&D Projects Excel NPV.xlsx**

- ⇒ Click Close to close the Linked Nodes dialog.
- ⇒ Click Cancel to close the Manage Links dialog.

You will now move the initialization links to a new spreadsheet. The example files delivered with DPL Portfolio include a set of Excel files containing data only, which match the set of inputs contained within the R&D Projects Excel NPV.xlsx spreadsheet. To start, explore one of these spreadsheets that includes only data.

- ⇒ If necessary, start Excel.
- ⇒ Select File | Open.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select R&D Projects Excel Data 1.xlsx and click Open.

This spreadsheet contains four sheets (Summary, Technical, Commercial, Costs) which have the same set of assumptions as found on the equivalent

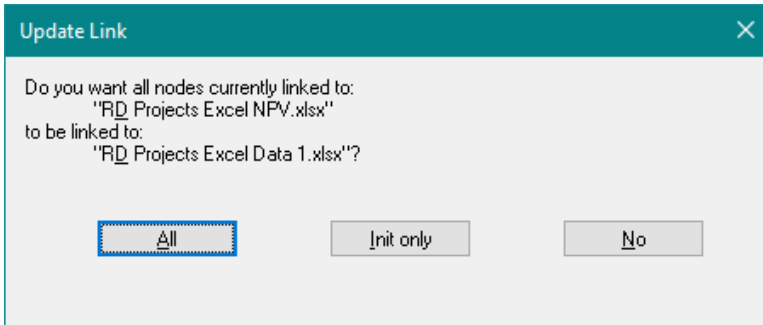
four sheets in the R&D Projects Excel NPV.xlsx spreadsheet. There are some slight differences between the Summary sheet in R&D Projects Excel Data 1.xlsx and the equivalent sheet in R&D Projects Excel NPV.xlsx. This will be discussed later in this section.

In total four example files were delivered with DPL Portfolio that have the same set of inputs as R&D Projects Excel Data 1.xlsx (R&D Projects Excel Data 1 - 4.xlsx). While the set of inputs is the same, the values of these inputs are different and each of the files contains a different dataset for one of the four different R&D projects in the portfolio.

Note that the four example files are relatively simple spreadsheets. The assumptions entered into each spreadsheet need to be internally consistent. For example, the Launch Year in the Summary sheet needs to make sense when compared with the Costs sheet (e.g., you likely would not still have development costs in 2022 if the project is to launch in 2019). If you were developing an input template for use in a real portfolio review process, you would want to have various data validations and additional logic built into the template to prevent errors. For example, you might want to make sure market shares are between 0% and 100%, and/or that development costs are not entered in years after the launch year.

You will now set up the DPL Model to use a separate spreadsheet for initialization links.

- ⇒ Switch back to DPL.
- ⇒ Double-click the node Phase 1 Success to edit its definition.
- ⇒ Switch to the Links tab.
- ⇒ Within the *Initialization links* section uncheck *Same as calc links workbook*.
- ⇒ Use the Browse button to select R&D Projects Excel Data 1.xlsx as the Initialization workbook.
- ⇒ Click Open.
- ⇒ Click OK to close the Node Definition dialog. The Update Link dialog will appear. See Figure 4-3.



**Figure 4-3. Update Link Dialog**

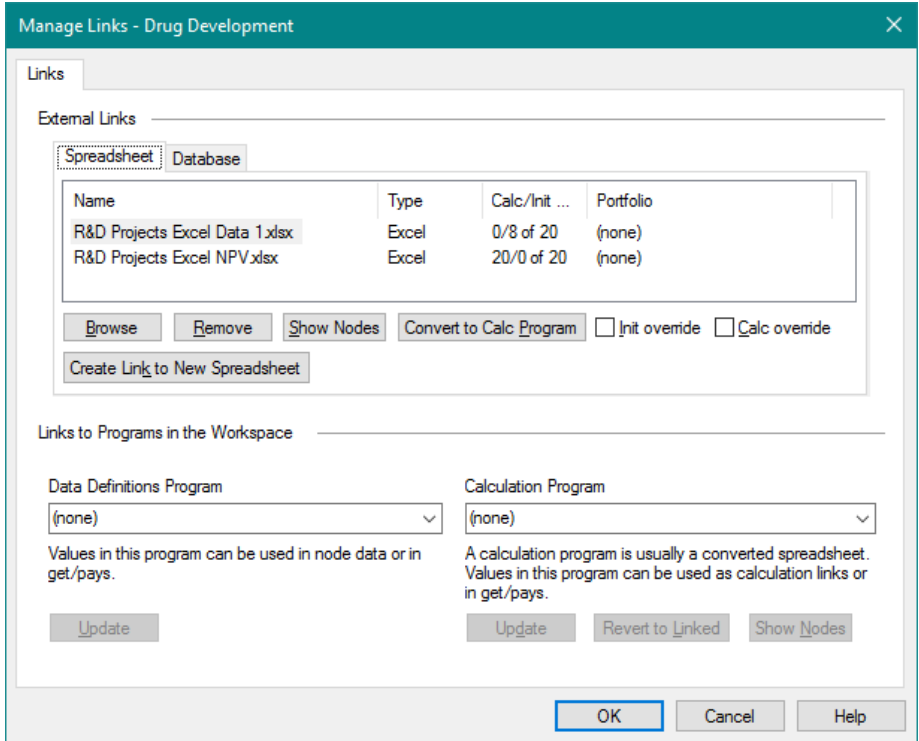
DPL is asking whether you would like to move all links to the new workbook, only the initialization links or no other links. You are separating initialization links from calculation links so in this situation you want to move only the initialization links.

⇒ Click Init only.

By clicking Init only, you have moved all initialization links to the new workbook and left the calculation links in the model still linked to R&D Projects Excel NPV.xlsx. Had you clicked No in the Update Link dialog, only the initialization link for Phase 1 Success would have been moved. Had you clicked All, then both initialization links and calculation links for all nodes would have been moved to the new workbook.

⇒ Click Influence Diagram | Links | Manage.

As indicated in Figure 4-4, the model now has links to two separate spreadsheets. R&D Projects Excel Data 1.xlsx has only initialization links to it, and R&D Projects Excel NPV.xlsx has only calculation links to it.



**Figure 4-4. Manage Links Dialog for Two Spreadsheets**

- ⇒ If you wish, click Show Nodes for each spreadsheet to see the details of which nodes are linked to each spreadsheet and how each is linked.
- ⇒ Click Close/Cancel to exit the dialog(s).

In the next section you will complete the last step that is necessary to modify the example so that it is ready to be used as a template model in a DPL Portfolio.

### 4.3 Creating Nodes to "Pass Through" Data

The Drug Development model as it was originally set up is designed to look at a single R&D project in a pharmaceutical development pipeline. As such, there are a number of inputs to the model that are contained in the spreadsheet but that are not linked to DPL.

- ⇒ Switch to Excel.

If it's not already open, open R&D Projects Excel NPV.xlsx.

⇒ Go to the Commercial tab.

There are a number of inputs to the model on this sheet which do not appear in DPL. For example, look at the numbers which appear under Strength of competition section for the Revenue loss effect, and the numbers in the Revenue – Peak Sales table, as well as two others (Years to peak and the values for Pricing effect). These are all inputs that are not treated as uncertainties in the Drug Development model and therefore were not included in the non-portfolio DPL Model as it was initially set up.

However, all these inputs are inputs that one would expect to vary on a project-by-project basis. In addition, there are inputs on the Summary sheet and the Costs sheet that vary from project to project. Since you are setting up the Drug Development model to be a template model for multiple projects, you will now incorporate these inputs into the DPL Model.

⇒ Switch back to DPL.

⇒ Click the Influence Diagram| Node | Linked Node icon. Note that Excel Calculation-Linked should be the current default indicated.

⇒ In the Create Calculation-Linked Values from Excel dialog, make sure that the spreadsheet you are adding linked values from is R&D Projects Excel NPV.xlsx (not R&D Projects Excel Data 1.xlsx). At this point, you are creating calculation-linked values, and all calculation links are to R&D Projects Excel NPV.xlsx.

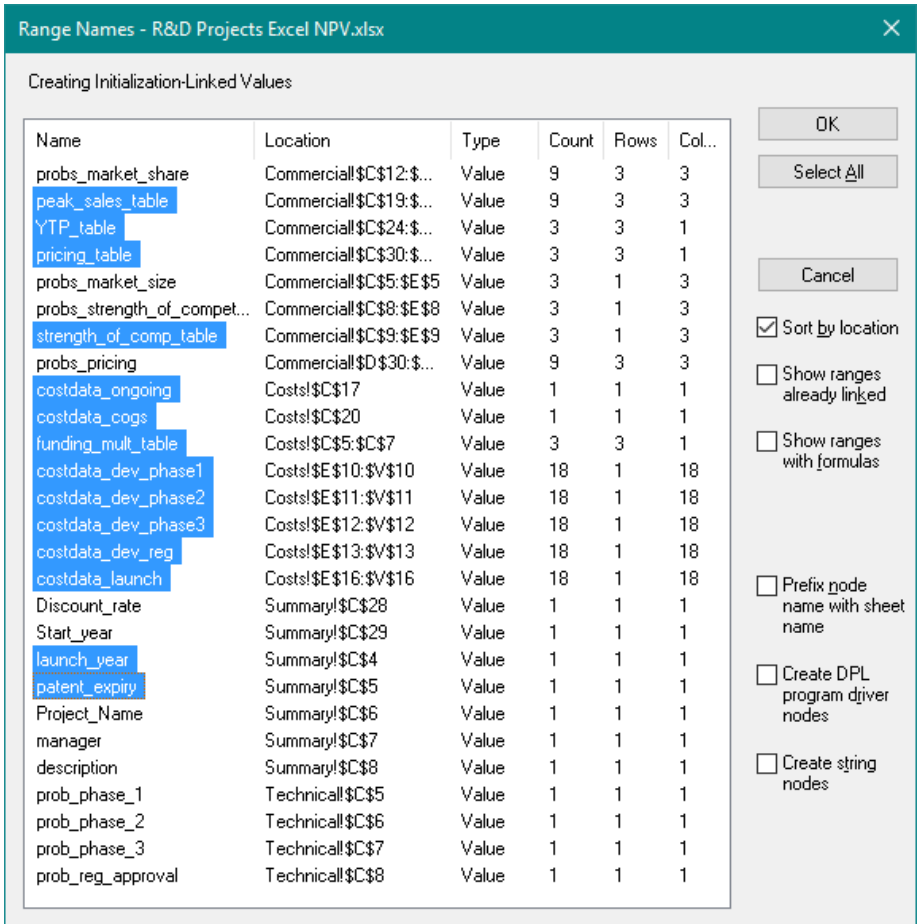
⇒ Click OK.

⇒ In the Range Names dialog, check Sort by Location so that the named ranges are grouped by sheet.

⇒ Also un-check Show ranges with formulas. All the named ranges you are selecting contain values.

⇒ In the list box, select the ranges as shown in Figure 4-5.





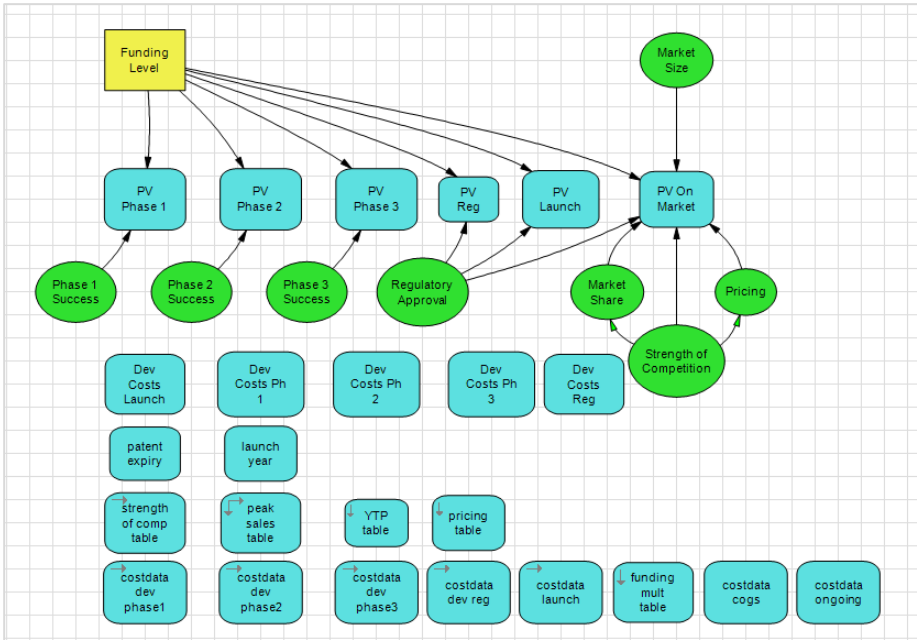
**Figure 4-5. Linked Value Ranges Selected in Range Names Dialog**

You should have selected 14 ranges: four of the ranges on the Commercial sheet (all the ones that do not start with "probs\_"), all eight of the ranges on the Costs sheet, and two ranges (launch year and patent expiry) on the Summary sheet. Notice that many of these ranges are arrays. DPL will create multi-dimensional value nodes as needed from the data. Refer to Chapter 9 of the *DPL User Guide* for more information on multi-dimensional value nodes.

⇒ Click OK.

DPL creates the new value nodes off to the right of the existing nodes in the Influence Diagram. You may need to zoom full to view them.

If you'd like, re-arrange your Influence Diagram so that it looks like Figure 4-6.



**Figure 4-6. Drug Development Model with New Linked Values**

⇒ Double-click the node funding mult table to edit its definition. You can see that DPL has brought in the data contained in the range from R&D Projects Excel NPV.xlsx that this node is linked to.

⇒ Switch to the Links tab to verify the Calculation links.

Now that you have created these linked values and they are calculation-linked to R&D Projects Excel NPV.xlsx, you are going to initialize link these to R&D Projects Excel Data 1.xlsx.

⇒ In the Initialization links section of the Links tab, select Microsoft Excel.

⇒ Uncheck *Same as calc links workbook*.

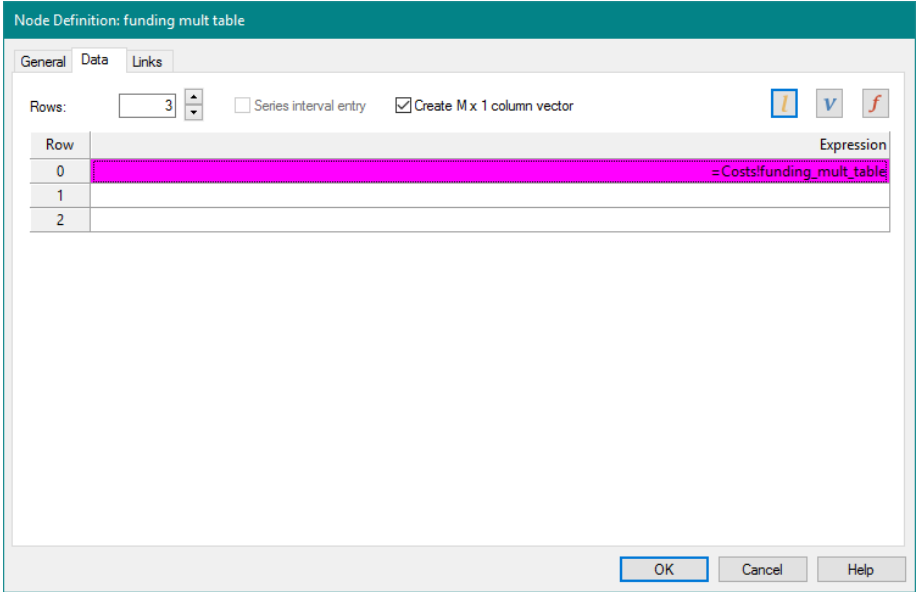
⇒ Use the Browse button to select R&D Projects Excel Data 1.xlsx as the Initialization workbook.

⇒ Switch to the Data tab. The first date input cell should be selected for editing.


⇒ Click the Links () button.

- ⇒ In the Range Names dialog, select `funding_mult_table`.
- ⇒ Click Select. Notice that the data previously entered in rows 1 and 2 has been removed, which is what you want.

The Node Definition dialog should now look like Figure 4-7.

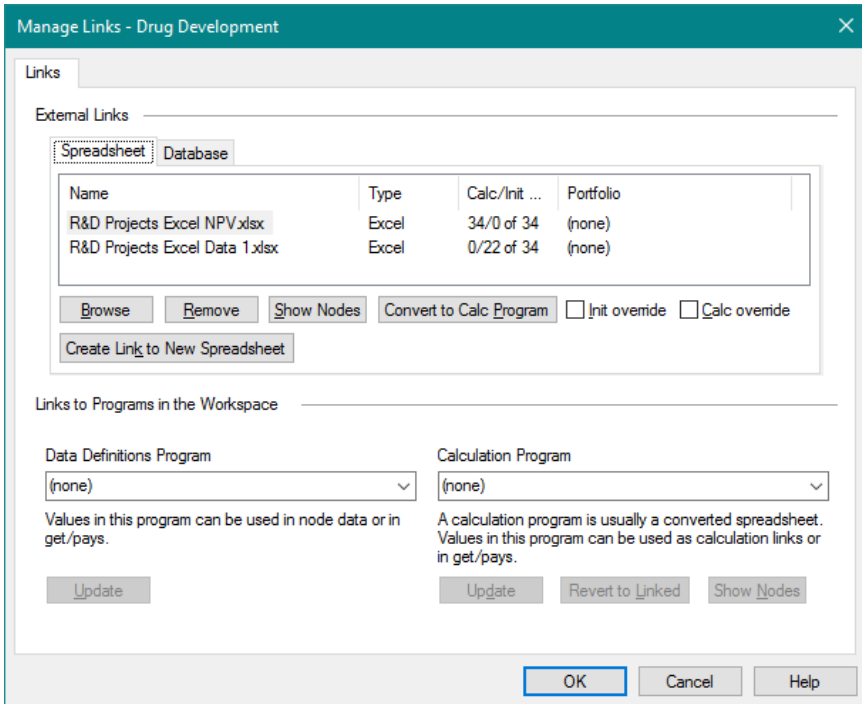


**Figure 4-7. Initialization Linked Data for funding mult table**

- ⇒ Click OK to close the dialog.
- ⇒ Double-click the node strength of `comp_table` to edit its definition.
- ⇒ Switch to the Links tab.
- ⇒ In the *Initialization links* section of the Links tab, select Microsoft Excel.
- ⇒ Uncheck *Same as calc links workbook*. Note that DPL now fills in R&D Projects Excel Data 1.xlsx as the Initialization workbook for you.
- ⇒ Switch to the Data tab.
- ⇒ Click the Links (  ) button.
- ⇒ In the Range Names dialog, double-click `strength_of_comp_table` to select it. The remaining node data will be deleted.
- ⇒ Click OK.

- ⇒ Repeat the above process for the remainder of the new linked values you just created (twelve additional nodes).
- ⇒ When you are done, verify the links by viewing the Manage Links dialog (Influence Diagram | Links | Manage).

The dialog should look like Figure 4-8. You should have 34 calculation links to R&D Projects Excel NPV.xlsx and 22 initialization links to R&D Projects Excel Data 1.xlsx.



**Figure 4-8. Manage Links Dialog with Calc and Init Links**

- ⇒ If you wish, click Show Nodes for each spreadsheet to see more information on the links.
- ⇒ If you clicked Show Nodes, close the Linked Nodes dialog when you are done verifying the links. Leave the Manage Links dialog open for the next steps.

There are two further things you need to specify now that you have two spreadsheets linked to your model. As mentioned earlier, DPL analyzes a portfolio by feeding a set of inputs and/or value model calculations to a template model for each project represented by the template model. In

order to do this, DPL needs to know which spreadsheet links are the Initialization Override links (i.e., the links which will be used to feed different sets of inputs to the model) and which spreadsheet links are the Calculation Override links (i.e., the links which will be used to incorporate different value model calculations into the model). You may have only one Initialization Override spreadsheet and only one Calculation Override spreadsheet. These specifications are set in the Manage Links dialog. You may have noticed in the dialog that there is now a Portfolio column in the Spreadsheet Links list. As indicated in Figure 4-8, neither spreadsheet has been set as the Initialization Override link nor the Calculation Override link. You will set both of these now.

- ⇒ Select the item in the list for R&D Projects Excel NPV.xlsx.
- ⇒ Check the *Calc override* box.
- ⇒ Select the item in the list for R&D Projects Excel Data 1.xlsx.
- ⇒ Check the *Init override* box. The dialog should now look like Figure 4-9.

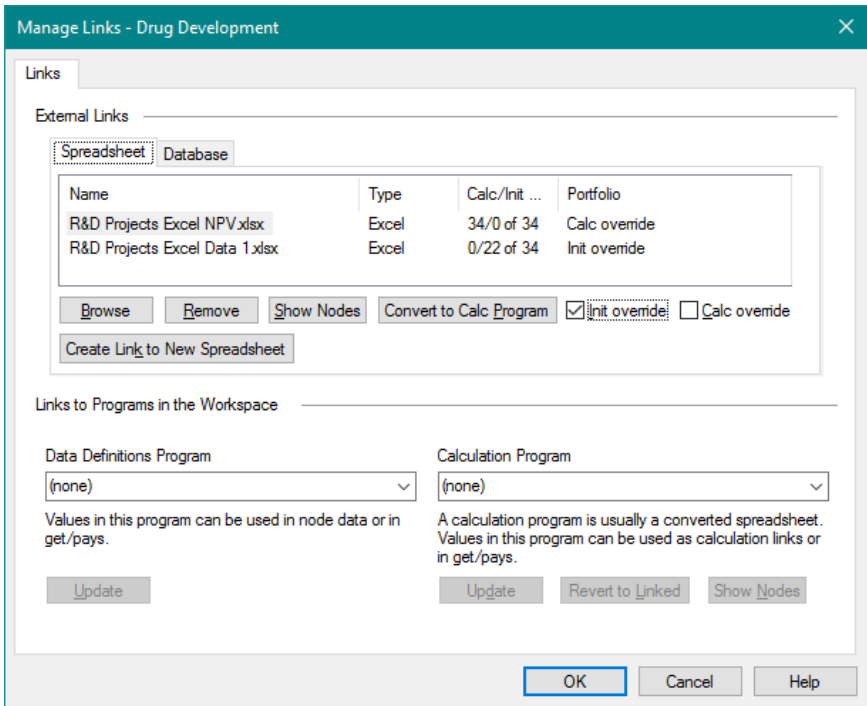


Figure 4-9. Manage Links dialog After Specifying Overrides

You have told DPL that the links to R&D Projects Excel Data 1.xlsx should be swapped out for links to the spreadsheets that you will specify as Initialization links when you define the portfolio in DPL. You have also told DPL that the links to R&D Projects Excel NPV.xlsx should be swapped out for links to the spreadsheets that you will specify as Calculation links when you define the portfolio in DPL.

⇒ Click OK to close the Manage Links dialog.

You will make one more modification to the model before defining the portfolio.

## 4.4 Adding a String Node for Project Names

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⇒ If you haven't already, save your spreadsheet-linked Workspace under a new name.

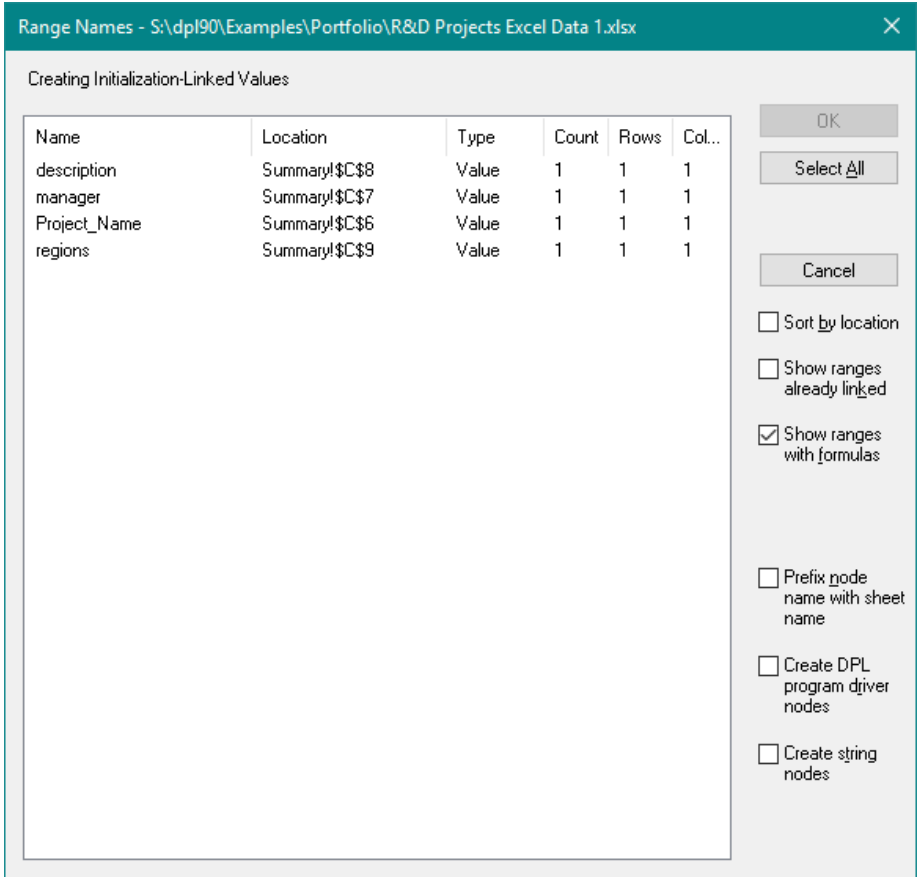
You will now create a string (text) value node to be used to name the projects in your portfolio.

⇒ Click Influence Diagram | Node | Linked Node | Excel Initialization-Linked.

⇒ The spreadsheet that appears in the dialog should be R&D Projects Excel Data 1.xlsx. If not, you can drop down the list to select the correct spreadsheet.

⇒ Click OK.

The Range Names dialog appears as in Figure 4-10.



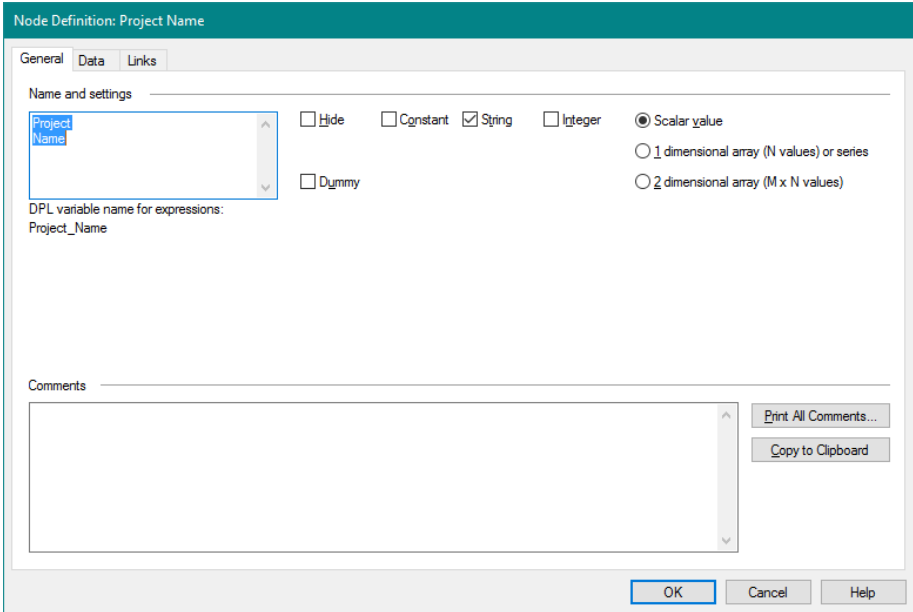
**Figure 4-10. Range Names dialog**

- ⇒ Check the *Create string nodes* box (the last checkbox on the right).
- ⇒ Select *Project\_Name* from the list so that it is highlighted.
- ⇒ Click OK.

DPL creates the Project Name value node off to the right in the Influence Diagram. You can move it if you like.

- ⇒ Double-click the Project Name node and look at the General, Data and Links tabs.

The General tab appears in Figure 4-11.



**Figure 4-11. General Tab for String-Value Project Name Node**

The node is a string node that is initialization-linked, just like all the other initialization-linked nodes. It is not calculation-linked because it is not needed in calculations; it is solely used to label your outputs.

⇒ Click OK to close the Node Definition dialog.

When you define the portfolio, you will tell DPL to use this node to label projects.

When you run your Portfolio Analysis in Chapter 5, the four projects will have the labels Project 1 through Project 4, which are the default project names you can see in the four initialization data workbooks, R&D Projects Excel Data 1 - 4.xlsx, on the Summary worksheets. These project names could, of course, be changed to something more descriptive in the spreadsheet files.

⇒ If you haven't already, please save your spreadsheet-linked portfolio Workspace.

You are now ready to define your portfolio, which you will do in the next section.



## 4.5 Editing a DPL™ Portfolio

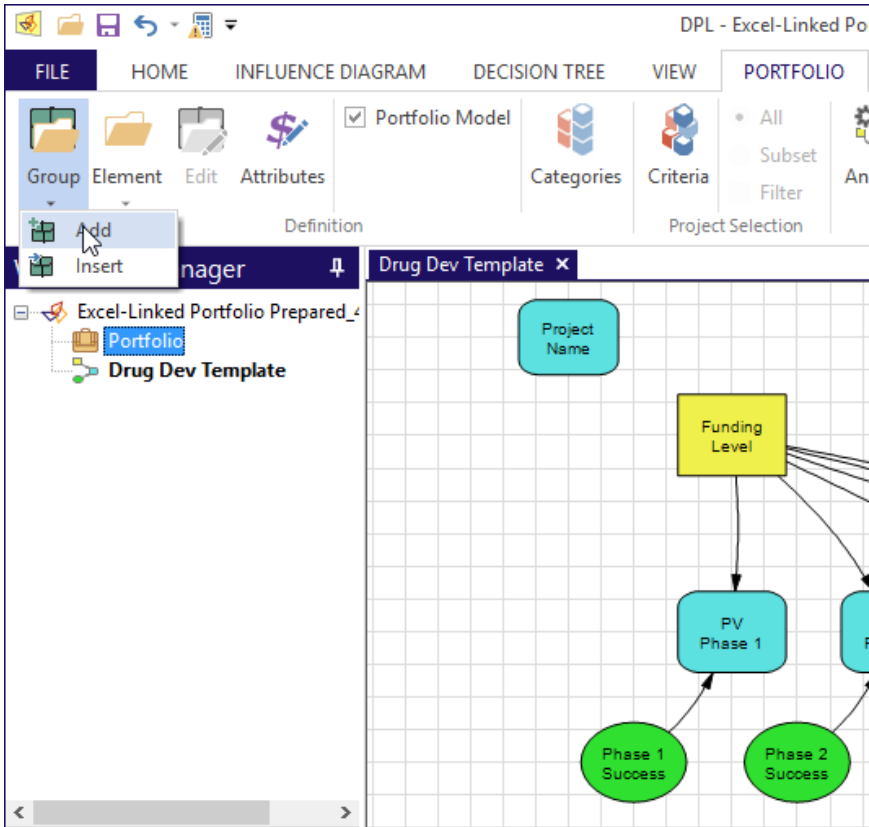
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You have completed the tasks necessary to convert a non-portfolio DPL Model into a template model for use in a DPL Portfolio, plus you have set up your model so that a value node will provide the project names in the portfolio. You will now define the portfolio in DPL. Before doing so, you will rename your model to indicate it is a template model.

- ⇒ Select the item in the Workspace Manager for the Drug Development model.
- ⇒ Press F2 to rename it.
- ⇒ Call it Drug Dev Template.

To define a portfolio in DPL, you need to create one or more Portfolio Groups. For each Portfolio Group, you typically need to create one or more Portfolio Elements. In some portfolios, each Portfolio Element corresponds to a single project. In other portfolio structures, an Element may correspond to more than one project. You will see an example of this at the end of this chapter.

- ⇒ Select the Portfolio item in the Workspace Manager and select Portfolio | Definition | Group | Add as shown in Figure 4-12.



**Figure 4-12. Adding Portfolio Group to Model via the Ribbon**

The Add Group dialog appears as shown in Figure 4-13.

**Figure 4-13. Blank Add Portfolio Group dialog**

A Portfolio Group is defined by a model, the type of Initialization Link it uses and the type of Calculation Link it uses. You will specify these now.

- ⇒ In the *Title* edit box, name the Group "Drug Dev Group".
- ⇒ In the *Model* drop-down list, select Drug Dev Template.

Note that DPL has updated the Initialization Links type and the Calculation Links type to be Microsoft Excel. DPL has examined the model Drug Dev

Template and found that it has those types of links so DPL correctly proposes that these are the link types you would like to use.

- ⇒ In the Initialization Links section, check the checkbox *Use value node data for project names*.
- ⇒ Select *Project\_Name* from the drop-down list labeled *Value Node*. (It is the only option because it is the only string value node you have defined.) The Edit Portfolio Group dialog should look like Figure 4-14.

**Add Portfolio Group** [X]

Title:

Model:

Project Categorization

Initialization Links

None  DPL Program  Microsoft Excel  Database

Model ID:

Use value node data for project names Value Node:

Use database field for project names Field:

Numeric report table:

String report table:

Calculation Links

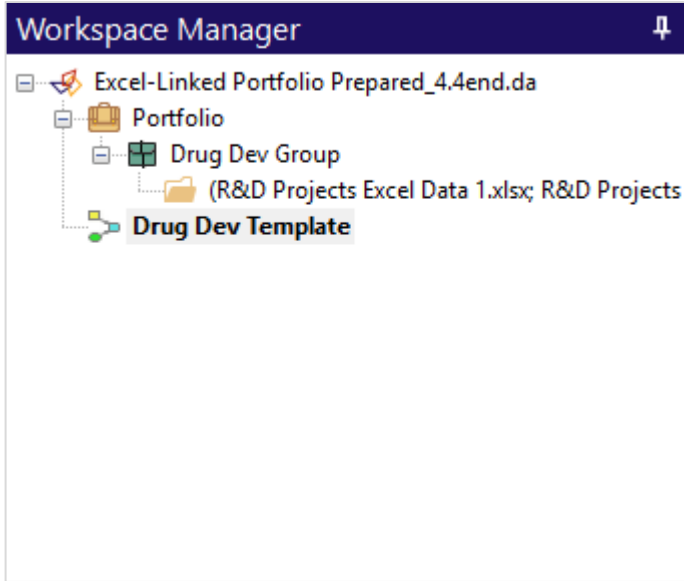
None  DPL Program  Microsoft Excel

Excel links in one workbook

**Figure 4-14. Completed Add Portfolio Group dialog**

There is nothing further to specify on this dialog at this time. With Project Categories defined, you can specify the categories of projects represented by this Group. Project Categorization is covered in Chapter 7. If this Group were a Database initialization linked, additional settings could be specified here. These are covered in Chapter 9.

- ⇒ Click OK to close the Add Portfolio Group dialog. The Workspace Manager should now look like Figure 4-15.



**Figure 4-15. Workspace Manager with One Group/One Element**

The tree structure now indicates that the portfolio has one Portfolio Group named Drug Dev Group and that this group has one Element associated with it. DPL automatically added an Element to the Group for the current set of Initialization Links and Calculation Links in the Drug Dev Template model.

- ⇒ Double-click the item for the new Portfolio Element within the Workspace Manager to edit it. The Edit Portfolio Element dialog appears as in Figure 4-16.

The screenshot shows the 'Edit Portfolio Element' dialog box. It features a teal header bar with the title 'Edit Portfolio Element' and a close button (X) on the right. Below the header, there is a text input field for 'Element Name'. Underneath are two checkboxes: 'Select one from this set of projects' and 'Aggregate this set of projects'. The 'Project Categorization' section includes an 'Edit' button. The 'Initialization Links' section has a text box containing 'R&D Projects Excel Data 1.xlsx' and a 'Browse...' button. The 'Calculation Links' section has a text box containing 'R&D Projects Excel NPV.xlsx' and a 'Browse...' button. At the bottom, there are 'OK' and 'Cancel' buttons.

**Figure 4-16. Edit Portfolio Element Dialog**

Notice that DPL has filled in the spreadsheet name for the Initialization Links and Calculation Links. You will only need to name the element within the dialog.

- ⇒ In the *Element Name* edit box enter "Element 1".
- ⇒ Click OK to close the Edit Portfolio Element dialog.

Note that the Element is now displayed with the element name you supplied within the Workspace Manager. You will now create three additional elements, one for each of the remainder of the projects in the portfolio.

- ⇒ Select the Drug Dev Group item within the Workspace Manager.
- ⇒ Click Portfolio | Definition | Element | Add. This will launch the Add Portfolio Element dialog.
- ⇒ Name the Element "Element 2".
- ⇒ Use the Browse button in the *Initialization Links* section to select R&D Projects Excel Data 2.xlsx for the initialization link spreadsheet.
- ⇒ R&D Projects Excel NPV.xlsx is already specified for the calculation link spreadsheet.
- ⇒ Click OK.

- ⇒ Repeat the above procedure to add two more elements to the Portfolio group. Name them "Element 3" and "Element 4", respectively. The Calculation Link spreadsheet is the same (R&D Projects Excel NPV.xlsx) for each. The Initialization Link spreadsheet is the Excel file with Data 3 and Data 4 at the end of its name, respectively.
- ⇒ Save your Workspace.

You have completed the portfolio definition for this simple example. The portfolio consists of four elements (each of which represents one project). All of these projects share a common decision model (Drug Dev Template). In this example, the projects also all use the same value model calculations (R&D Projects Excel NPV.xlsx). Each project has a separate dataset in the Excel spreadsheets R&D Projects Excel Data 1 – 4.xlsx.

If the portfolio were to include projects that require a different decision model, you would incorporate that model into the Workspace (e.g., via Home | Workspace | Add to WS | Imported Model...), set it up to be a template model using the steps discussed in this chapter and Chapter 3, add a Group to the Portfolio using the new template model and add Elements for the projects with that template model to the Group.

The portfolio might also include projects that require a different value model. For example, it might include projects where a partner is involved or there are licensing agreements which may mean that revenues and/or costs are being shared. Or there may be projects that require different financing calculations. If these projects share the same decision model, they could be added via a new Element of the existing Portfolio Group with a Calculation Link to the different value model.

Additional projects with the same value model and decision model can be added via a new Element of the existing Group using the same spreadsheet for the calculation links and a new file for the initialization links.

This portfolio could have been set up with four different Excel spreadsheets that contained the data and calculations needed for each project. For simple spreadsheets, this might make sense. Or if you had a situation where each project had a unique set of value model calculation you might take this approach. If you were to do so, you'd check the Excel links in one workbook checkbox on the Portfolio Group dialog.

However, separating the data from the calculations has the advantage of being able to update value model calculations in a single file should changes need to be made or if errors are found. If the value model calculations are duplicated in each file, making updates becomes quite difficult once you have more than a handful of projects in the portfolio.

The next (and final) section of this chapter is optional. You will not save the changes you make to your portfolio Workspace in the next section. The section shows you how you can re-configure your Portfolio so that it will easily accommodate a much larger number of spreadsheet-linked projects.

If you prefer, you can skip to Chapter 5 now and learn how to analyze portfolios. You will want to refer back to Section 4.6 later if your portfolio has many projects that are all spreadsheet initialization-linked.

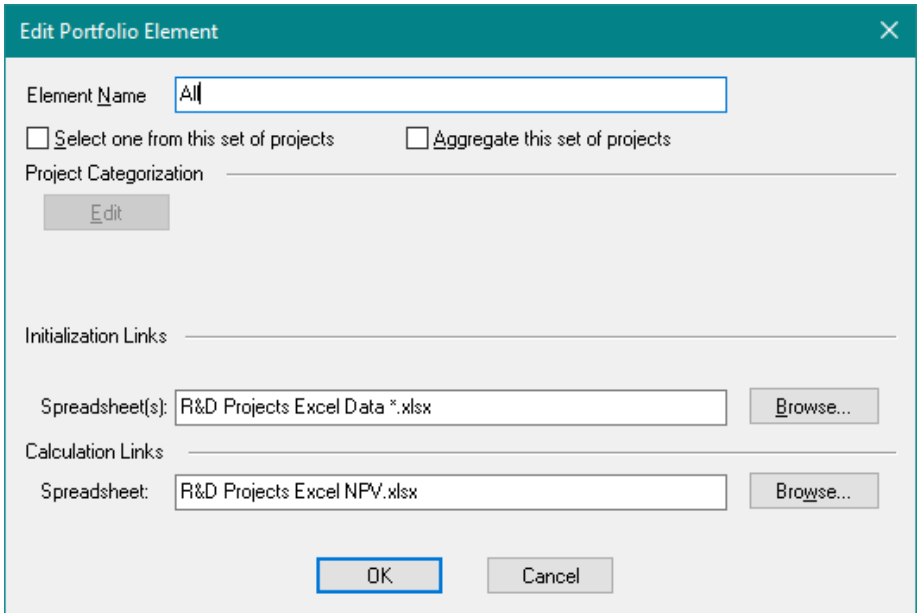
## 4.6 Using Wildcards for Spreadsheet Initialization Links

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Earlier in this chapter, you set up four distinct Elements in your portfolio. Each Element corresponds to one project. Within the Add Portfolio Element dialog you told DPL which spreadsheet contained the initialization data for each element. This was not hard for only four projects; but what if you have 50 projects in your portfolio, each with a separate initialization spreadsheet? DPL provides you a way to link all the initialization data files by using wildcard characters ("\*", "?") in the initialization filename. You will use this method now.

- ⇒ Make sure you saved your Workspace from the previous section. In order to avoid over-writing it now, you may wish to save it again under a new name before proceeding with the steps below.
- ⇒ Expand the Drug Dev Group within the Workspace Manager so you can see Elements 1 through 4.
- ⇒ Select the item in the Workspace Manager for Element 4 and press the Delete key to remove it from the Workspace.
- ⇒ Similarly, remove Elements 2 and 3. You should have only Element 1 remaining in the Workspace Manager.
- ⇒ Double-click Element 1 within the Workspace Manager to edit it.
- ⇒ In the Initialization Links section, edit the link so that the filename is R&D Projects Excel Data \*.xlsx (instead of "1.xlsx" at the end). If there is a path, leave it as is. You are simply replacing the "1" with a "\*" (no quotes). No changes are needed to the Calculation Links section.
- ⇒ Edit the Element Name to be "All". See Figure 4-17.





**Figure 4-17. Element that Incorporate a Wildcard Initialization linked Filename**

⇒ Click OK to close the dialog.

You have just modified the DPL Portfolio so that instead of having four Elements, each corresponding to a unique project whose initialization data filename you specified, the Portfolio now has one Element representing a set of projects, i.e., all Excel spreadsheets in the specified folder whose filenames begin with "R&D Projects Excel Data ". If you added the file R&D Projects Excel Data 12.xlsx to the folder specified in the Initialization Link path, it will be included in the portfolio when it is analyzed. If you added the file R&D Projects Excel Data 1.txt it would not be included.

Note that when you specify your portfolio this way, you can have any number of projects in your portfolio without specifically telling DPL how many there are. You could duplicate the initialization data files and make changes so that you have files numbered through R&D Projects Excel Data 50.xlsx, and DPL would include all 50 projects in the portfolio.

By using the wildcard method, the portfolio definition becomes "any file matching the wildcard criteria in the specified folder". If you accidentally put a file with a name that matches the wildcard into that folder, the "extra" file will be included as a project in the portfolio. Therefore, you need to be a bit cautious with file management when using this method of

portfolio definition. Further, you can have multiple Elements using wildcards, e.g., you might have multiple folders with different types of projects stored within each.

You are now ready to run a Portfolio Analysis. How to do so is covered in Chapter 5. Chapter 5 also discusses a number of the outputs available from a Portfolio Analysis run.

⇒ Make sure to either save your current Workspace under a new name, or discard it.

An example file named Excel-Linked Wildcard Done.da was provided with your license that matches the end result of the tutorial completed in this section. It can be used as a reference for the wildcard feature. Note that you will use your previously saved Workspace from the end of Section 4.5 (with four separate Portfolio Elements) for the tutorials in Chapter 5.

## 5. Analyzing Portfolios

Portfolio analysis is conducted to answer the types of questions decision makers ask when faced with decisions about allocating funds or other scarce resources to R&D projects or other risky assets in their portfolio. For example:

- Which of my projects is the most risky? Which has the highest potential reward (value, e.g., NPV), if successful?
- How do my projects compare in terms of the risk/reward tradeoff?
- How should my projects be ranked on various metrics related to risk and reward?
- How does each individual project contribute to overall risk and value?
- What is the "bang for the buck" (i.e. relative payback or Productivity Ratio) of each project?
- Which projects should I fund, and at what level, given a particular constraint on capital resources?

DPL Portfolio provides a variety of analysis tools, output charts, and other results to help the portfolio analyst answer these and other questions. In addition, DPL Portfolio allows you to create custom charts based on the results from a Portfolio run or from Data Reports (covered in Chapter 8).

The tutorials in this chapter show you how to create and interpret all of the standard charts and results available from the Portfolio Analysis dialog, except for the Time Series results, which are covered in Chapter 6. This chapter also shows you how to export results and how to create additional custom charts.

Before beginning the tutorials below, you may wish to complete the tutorials in the previous chapters (3 and 4). The simple, spreadsheet-linked portfolio created in Chapter 4 and saved in Section 4.5 is what will be used to generate the output charts you will examine in this chapter.

- ⇒ If necessary, start DPL Portfolio.
- ⇒ If you did the tutorials in Chapters 3 and 4, open the Workspace you saved at the end of Section 4.5.

- ⇒ If you did not complete the tutorials or did not save your Workspace, navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.  
Select Excel-Linked Portfolio Done.da and open it.

## 5.1 Before Running a Portfolio Analysis

---

Once you have set up each of the models that will be used in your portfolio, it is a good idea to compile each model before you run a Portfolio Analysis. When compiling a model via the compile command, DPL reports errors interactively. This allows you to correct any potential errors more easily. In a Portfolio Analysis run, DPL reports errors to the Session Log for a project, aborts the analysis of that project and continues with the next project in the portfolio. It is easier to diagnose and correct errors interactively via the compile command than it is during a Portfolio Analysis run.

If you have a spreadsheet-linked portfolio set up (as you do now) and you compile it, DPL will compile using the spreadsheets that are specified as calculation and/or initialization links in the various node definitions. You can see these links summarized via the Manage Links dialog (Influence Diagram/Decision Tree | Links | Manage).

- ⇒ In the Home | Run group, click the Compile command (or press F7).

If the model fails to compile, DPL will give you an error message and open the node with the error. See online help (press F1 in DPL) for correcting errors you may encounter during compilation.

If the model successfully compiles, double chevrons ("»» ««") will appear around the model name in the Workspace Manager. Once you have corrected any errors, you are ready to run a Portfolio Analysis.

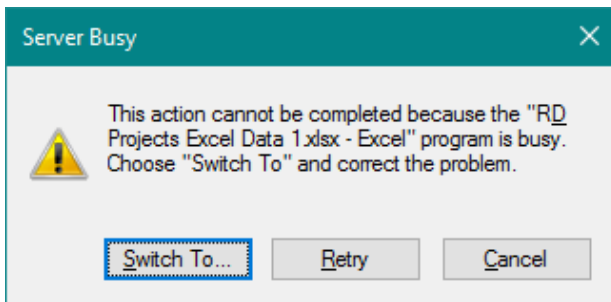
- ⇒ Click Clear Mem (or press F9) to clear the compile structures from memory.

## 5.2 Preparing Spreadsheet-Linked Portfolios for Portfolio Analysis

When you run a Portfolio Analysis for a spreadsheet-linked portfolio, DPL needs to communicate with Excel in order to open files, send data to Excel and/or retrieve data from Excel. The amount of communication between DPL and Excel is large and larger than when you run a non-portfolio model individually via a Decision Analysis for example.

To facilitate the communication between DPL and Excel, we recommend the following best practices.

- 1) Open Excel yourself before starting the run.  
If it is not open, DPL will open it but this process takes time. And it may end up in a situation where Excel is taking too long to load. If this happens, you will see the dialog shown in Figure 5-1.



**Figure 5-1. Server Busy dialog**

If this happens, click the Retry button. If the problem persists, it may be because Excel is waiting for a response from you. Click the Switch To button and see if there is a dialog waiting for a response in Excel.

- 2) Once Excel is open or if Excel is already open, close any spreadsheets in it (including the blank spreadsheet Excel starts with) so that Excel is running with no spreadsheet open within it.
- 3) Do not use Excel for other purposes while DPL is communicating with it (i.e., during the run or during the generation of a Data Report).
- 4) Minimize the number of applications other than DPL and Excel that are open while you are doing a run.




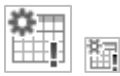
- 5) Depending on the size of your portfolio and the memory you have on your computer, you may wish to open all Excel files that will be used in the portfolio. For large portfolios or for portfolios with very large Excel files, this will not be practical. But for portfolios with fewer projects and/or smaller files, this will improve the elapsed time of a Portfolio Analysis or Data Report run because DPL will not have to have Excel open each file.

Following the above guidelines will help ensure that the communication between DPL and Excel is uninterrupted.

## 5.3 Running a Portfolio Analysis

In this section, you will run a Portfolio Analysis and generate all the basic results including a Results Report.

Within the Portfolio | Run group both the Analyze and Report commands are split buttons that provide two commands: run the report/analysis immediately or specify options and then run report/analysis. The icons with the gears indicate options. These commands will be referenced as shown in Table 5-1.

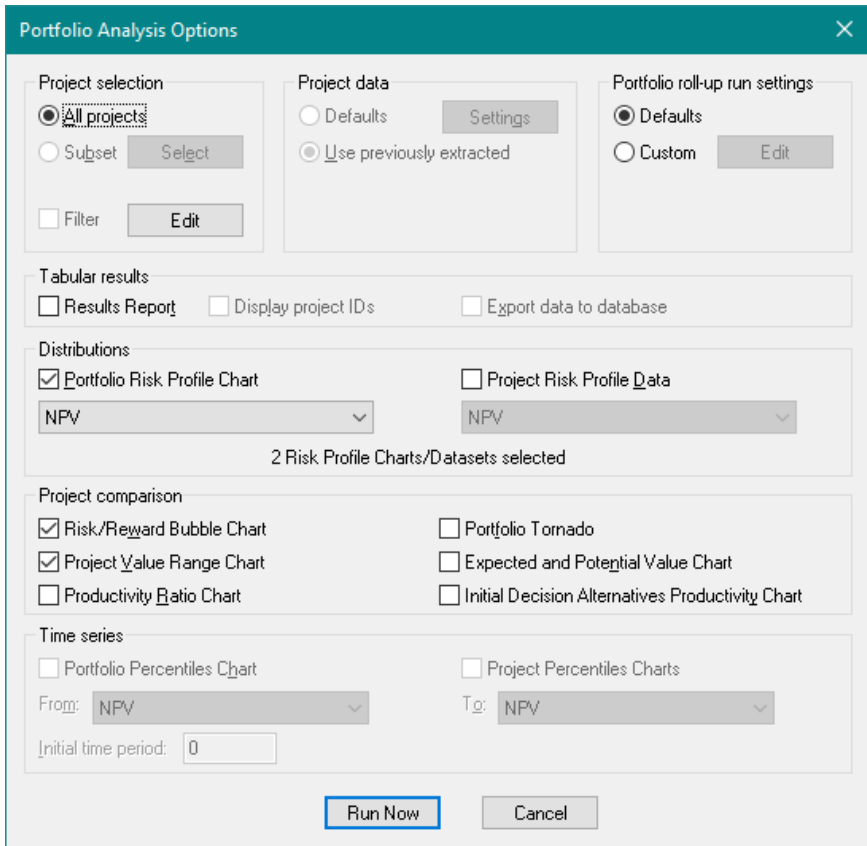
<b>Portfolio   Run   Analysis Commands</b>	<b>Portfolio   Run   Report Commands</b>
Portfolio   Run   Analysis (Now) 	Portfolio   Run   Report (Now) 
Portfolio   Run   Analysis (Options) <i>Launches Portfolio Analysis Options dialog</i> 	Portfolio   Run   Report (Options) <i>Launches Data Report Options dialog</i> 

**Table 5-1. Portfolio Analysis/Report Commands**

- ⇒ If necessary, start Excel.
- ⇒ Close all files that may be open within Excel (including the blank spreadsheet if you just started Excel).
- ⇒ Switch back to DPL.

⇒ Click Portfolio | Run | Analyze (Options).

The Portfolio Analysis Options dialog appears as in Figure 5-2.



**Figure 5-2. Portfolio Analysis Options dialog**

- ⇒ Within the *Tabular results* section make sure Results Report is checked.
- ⇒ Within the *Distributions* section make sure Portfolio Risk Profile Chart and Project Risk Profile Data are checked. NPV (the objective function) should appear as the selected attribute in the drop-down lists.
- ⇒ Make sure the six outputs in the *Project comparison* section are all checked.
- ⇒ Click Run Now.

If you've previously produced outputs, you may receive a message that DPL will delete any unsaved Policy Tree™, Policy Summary™ and Risk

Profile data. This just means that DPL will clear any previously existing results. If you receive this message,

⇒ Click Yes.

DPL will analyze the four projects in the portfolio one at a time, opening the necessary Excel files for each project and substituting in the project data from each of the four initialization-linked Excel data files. When the four individual project analyses are complete, DPL aggregates them and generates the output results for the portfolio.

Double-click the Portfolio Results item in the Workspace Manager to view it. The Portfolio Results Report and Workspace Manager should appear as shown in Figure 5-3.

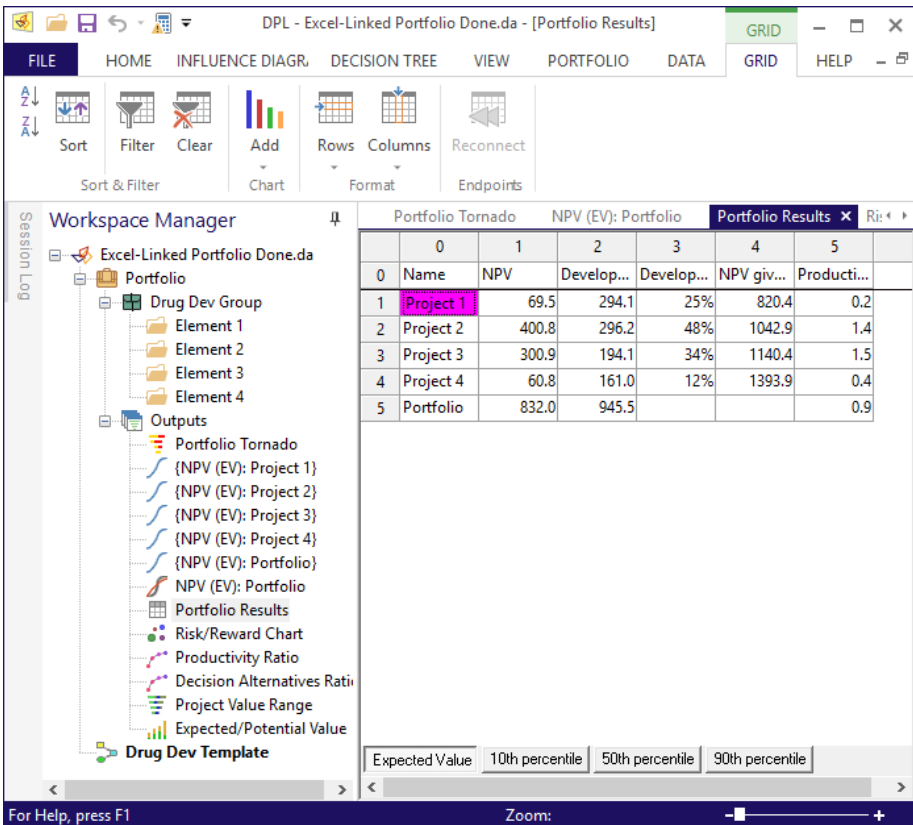


Figure 5-3. Workspace Manager with Outputs and Results Report



⇒ Examine the Results Report.

The report contains the expected values for NPV and development costs, the probability of success, NPV given success, and the Productivity Ratio for each project in the portfolio. The report also contains the overall expected NPV, expected development costs, and Productivity Ratio for the entire portfolio.

⇒ Verify that the Productivity Ratio for the portfolio is equal to the expected NPV divided by the expected development costs.

⇒ Change Decimal places (File | Options | Outputs) to a larger number (e.g., 2) so that you can see the values of the Productivity Ratio more accurately.

Note that the Results Report has four tabs: Expected Value as well as the 10th, 50th, and 90th percentiles of the distribution for each attribute for each project and the portfolio.

⇒ Click on the 90th percentile tab.

The percentile values are only provided for the Expected NPV and Expected Development Costs attributes. For the other three attributes, percentiles are not relevant, so they are not shown.

Note that the 90th percentile for the overall portfolio NPV is about 2838. This means that there is a 10% chance that the overall portfolio NPV will be greater than 2838.

⇒ Examine the other percentile tabs if you like

⇒ Click on the Expected Value tab again.

The Results Report gives you a tabular quantitative summary of the expected values and percentiles of the portfolio attributes. Some of the values shown in the report are also displayed in the output charts you will examine next. Note, however, that you do not have to generate the Results Report in order to generate other charts; the Results Report is simply an output like any other in the Workspace.

## 5.4 Risk Profile Charts

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When you ran the Portfolio Analysis, you requested both a Portfolio Risk Profile Chart and Project Risk Profile Data. The Portfolio Risk Profile is the Risk Profile for the portfolio as a whole, i.e. a Risk Profile of the NPV of the entire Portfolio consisting of the four example projects in this case. The Project Risk Profile data are the data that correspond to the Risk Profiles for each individual project.

The Project Risk Profile data are the same as you would obtain if you were to run a separate decision analysis on each project. Refer to Chapter 3 of the *DPL User Guide* for more information on Risk Profile data and Risk Profile charts. DPL generates the Risk Profile data for each individual project if you request it, but it does not produce a chart of the data for each project.

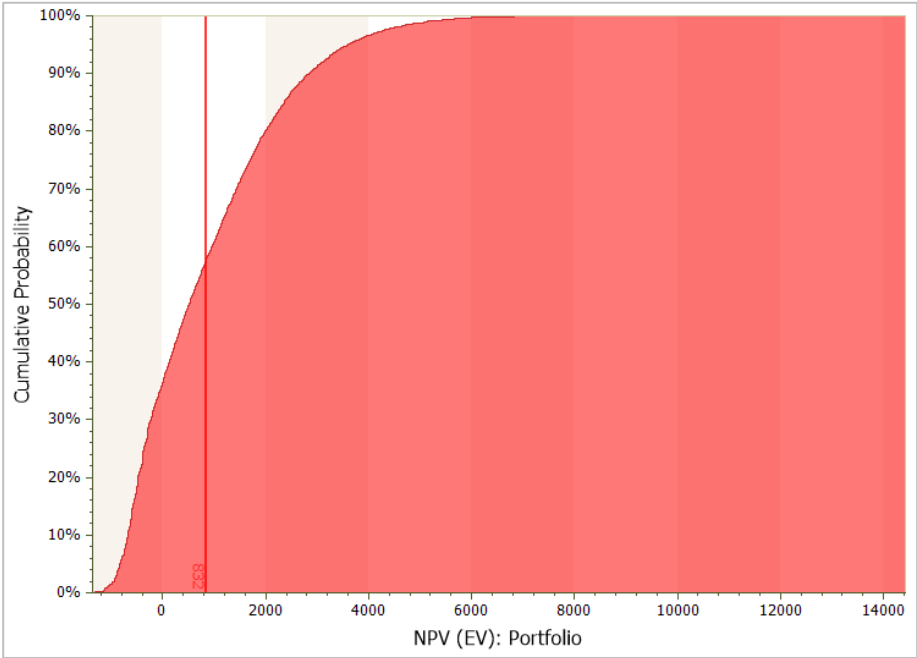
In the Workspace Manager, DPL has created one Risk Profile Data item for each project and the overall portfolio. DPL has also created a Risk Profile chart for the overall Portfolio. Note also that DPL has labeled the projects according to the Project Name value node you added in Section 4.5, so the Workspace items for the Risk Profile data are named "{NPV (EV): Project 1}" through "{NPV (EV): Project 4}". If you double-click on any of these Risk Profile Data items, DPL will create a Risk Profile chart from the data and activate it.

⇒ Double-click on the item labeled {NPV (EV): Project 4}. Note that DPL has created a new item in the Workspace Manager for the chart.

This project has approximately a 12% probability of success, which is reflected in the Risk Profile chart. I.e., there is approximately an 88% chance that the NPV is less than zero which represents all the scenarios in which the project fails prior to or at regulatory approval.

⇒ Double-click on the item labeled NPV (EV): Portfolio. This is the Risk Profile chart for the entire portfolio.

Note that the overall portfolio has only about a 35% probability of having a negative NPV. See Figure 5-4.



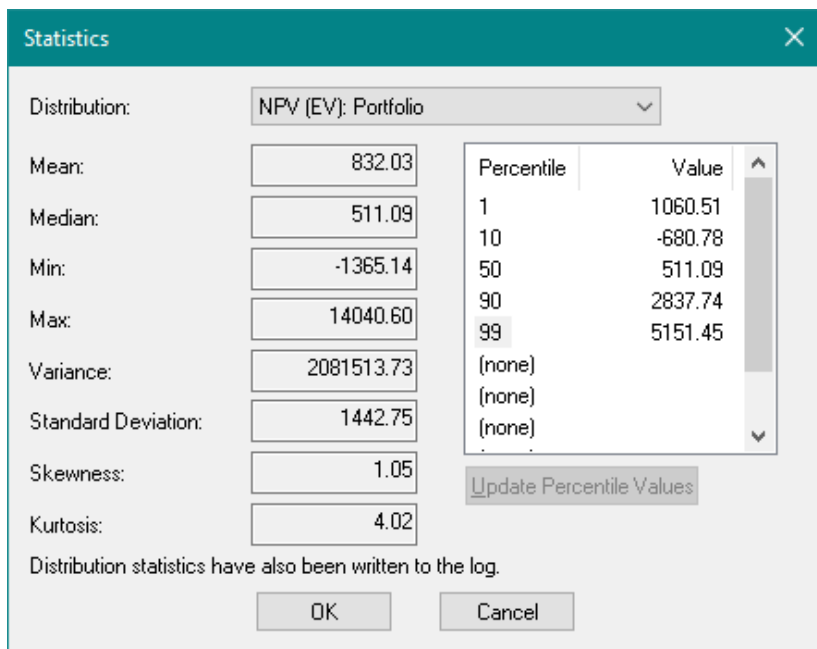
**Figure 5-4. Risk Profile Chart for the Portfolio**

Risk Profile data and charts are over-written when you run a new Portfolio Analysis unless you rename them to save them. If you want to save a Risk Profile chart or dataset, select its item in the Workspace Manager and press F2 to rename it, thereby, saving it.

If you have a portfolio that is much larger than this example, you will not usually want to request all the Project Risk Profile data, since a large number of outputs will be created. However, the Portfolio Risk Profile is very useful for examining the overall portfolio risk.

⇒ With the Portfolio Risk Profile chart still open, click Data | Distributions | Statistics. See Figure 5-5.

This dialog allows you to view the exact percentile values from the Risk Profile. You can also edit any of the Percentile values shown in the dialog and click Update Percentile Values to see the value corresponding to the percentile specified. In the figure below the 1<sup>st</sup> and 99<sup>th</sup> percentiles have been added. Furthermore, you can display the percentiles defined within the percentiles list box directly on the Risk Profile chart by checking the Percentiles box within the Chart | Series | Labels group. The Percentiles list box can also be accessed via Chart | Series | Labels | Options.



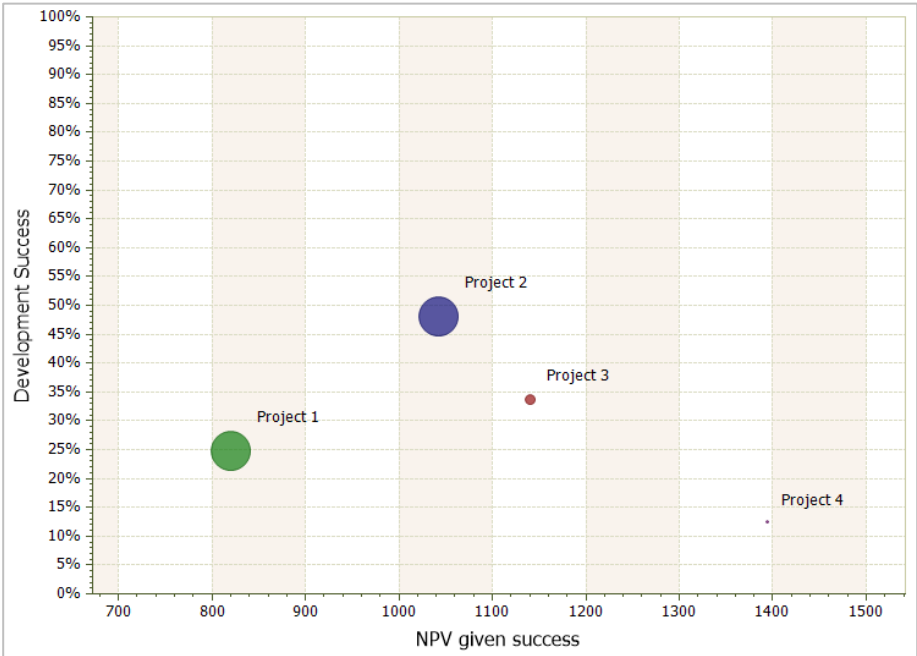
**Figure 5-5. Risk Profile Statistics and Percentiles for the Portfolio**

- ⇒ Click Cancel to close the Statistics dialog.
- ⇒ If you'd like, check the box labeled Percentiles within the Chart | Series | Labels group to display percentiles on the chart.

## 5.5 Risk/Reward Charts

⇒ Double-click on the Risk/Reward Chart item in the Workspace Manager to view it.

The bubble chart appears as in Figure 5-6.



**Figure 5-6. Risk/Reward Bubble Chart**

Risk/reward bubble charts are a useful tool in R&D Portfolio Analysis. In DPL, the default Risk/Reward chart shown in Figure 5-6 plots Expected NPV given success (the reward) on the X-axis; Probability of Development Success (the risk) on the Y-axis; and Expected Development Costs as the bubble size. Note that each of these measures is one of either the three required or two derived Portfolio Attributes that you examined earlier in the Results Report.

The Expected NPV given success is defined as the expected value of the objective (NPV) over all the "success" scenarios for a particular project. This is a measure of the potential reward of the risky investment in the project given that success has been achieved (i.e., in this example given that you don't fail at any of the technical or regulatory uncertainties).

⇒ Hold your mouse over each of the bubbles to examine the underlying attribute values. (If you do not see the box containing values, you may need to turn on Show Tips in View | Tips.)

Note that Project 2 has the largest probability of development success, but also the largest expected development cost (bubble size).

Project 4 has the largest expected NPV given success and the smallest expected development cost, but also the smallest probability of development success.

You can modify the formatting of this bubble chart using the Chart | Format and Chart | Series tabs. For example, you can remove the data labels within the chart and add a legend to display this information instead. To do so:

⇒ Un-check Show in Chart | Series | Labels.

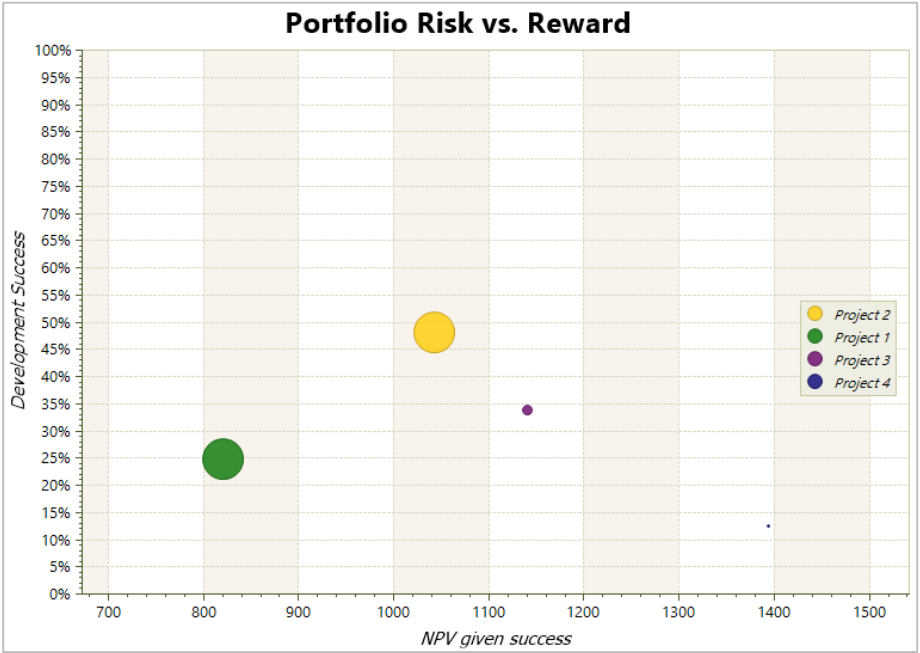
⇒ Within Chart | Format | Legend check the Show, Centered, and Inside boxes. Set the Legend placement drop-down to Right.

To modify bubble color you can check the Palette checkbox and utilize the palettes available within the Palette Gallery to format the color of the bubbles in the chart. Or, with the Palette checkbox not checked, you can select a bubble in the chart and use the Color Fill bucket drop-down to select a pre-set or custom color for the selected bubble.

The Color Options dialog (Chart | Format | Color | Options) allows you to further control how bubbles within the chart are colored. By default the bubbles are colored by project, i.e., DPL assigns a new color for each project. You can also choose to color bubbles in the chart by size (bubbles are colored on a blue to red scale from small to large) or, if defined in the Portfolio, by Category Type (a new color for each project category).

⇒ Review the commands within the Chart | Format | Color group and/or Color Options dialog to format the color of the bubbles to your liking.

⇒ Click the Chart checkbox within Chart | Format | Titles. Give the chart a title of "Portfolio Risk vs. Reward". You can change the font, style, or size of the title or any most other text within the chart by selecting it and using the commands within the View | Font Group.



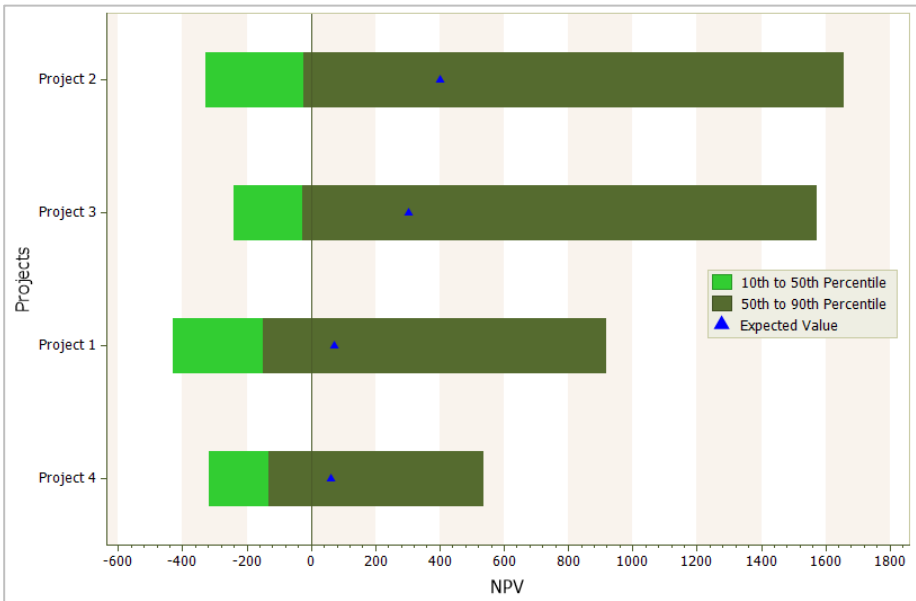
**Figure 5-7. Formatted Risk/Reward Chart with Legend and Title**

Figure 5-7 above shows a modified Risk/Reward chart in which labels have been replaced by a legend, a chart title was added, the font for the title and other text was changed, and the bubble color was formatted using the Bucket Fill command. Next you will examine a Project Value Range chart.

## 5.6 Project Value Range Charts

⇒ Double-click on the item for the Project Value Range Chart within the Workspace Manager to activate it.

The chart appears as in Figure 5-8.



**Figure 5-8. Project Value Range Bar Chart (with Legend moved)**

Project Value Range Charts display the expected value of the objective function (NPV, in this case) for each project in the portfolio as well as the range of value from the 10<sup>th</sup> to the 90<sup>th</sup> percentile (the bar ends). The bar changes color at the 50<sup>th</sup> percentile (from bright green to dark green by default). A separate bar is displayed for each project.

Projects in a Project Value Range Chart are sorted by their 90<sup>th</sup> percentile value. The project with the largest 90<sup>th</sup> percentile is at the top of the chart. The light green portion of each bar is the range from the 10<sup>th</sup> to the 50<sup>th</sup> percentile, and the dark green region is the range from the 50<sup>th</sup> to the 90<sup>th</sup> percentile. The expected value is shown as a blue triangular marker.

Note that it is possible for one or more of the color regions not to appear. For example, the 10<sup>th</sup> and 50<sup>th</sup> percentiles could be the same value, in which case there would be no light green region.



You can change the formatting of the chart to suit your needs.

- ⇒ With the Project Value Range chart active, check the Additive checkbox within Chart | Format | Display.
- ⇒ On the same tab, within the Legend group, check the Centered and Inside checkboxes. Right should already be selected within the Legend Placement drop-down list (this had already been done in Figure 5-8).
- ⇒ In the Chart | Series | Labels group, check the Show checkbox.

The chart is now an additive bar chart as shown in Figure 5-9. In Project Value Range Charts, the additive option is based on the expected value of the project. The value range of the project in the chart is displayed around the sum of the expected values of all the projects represented by the bars beneath it. You can change other formatting options as well using Chart | Series and Chart | Format tabs.

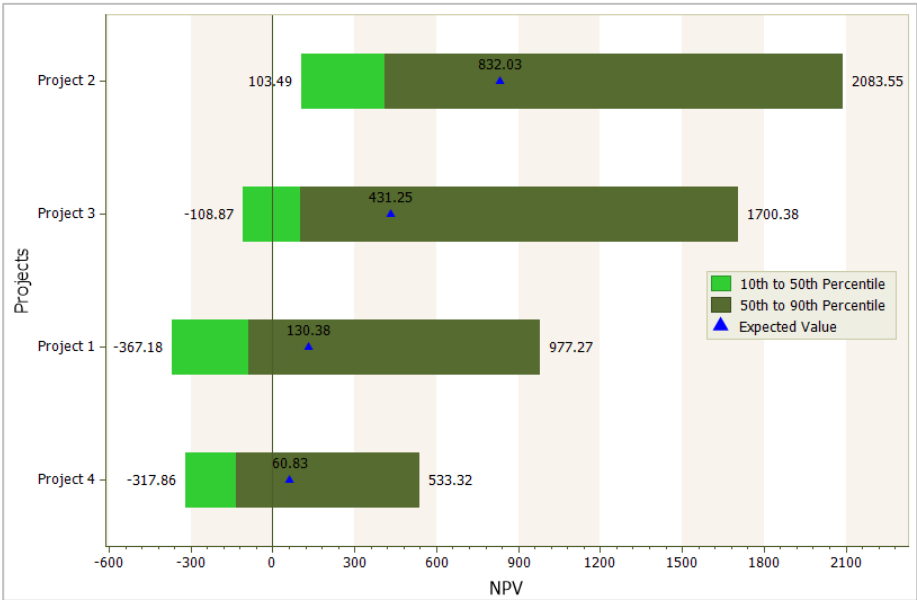


Figure 5-9. Formatted Additive Project Value Range Bar Chart

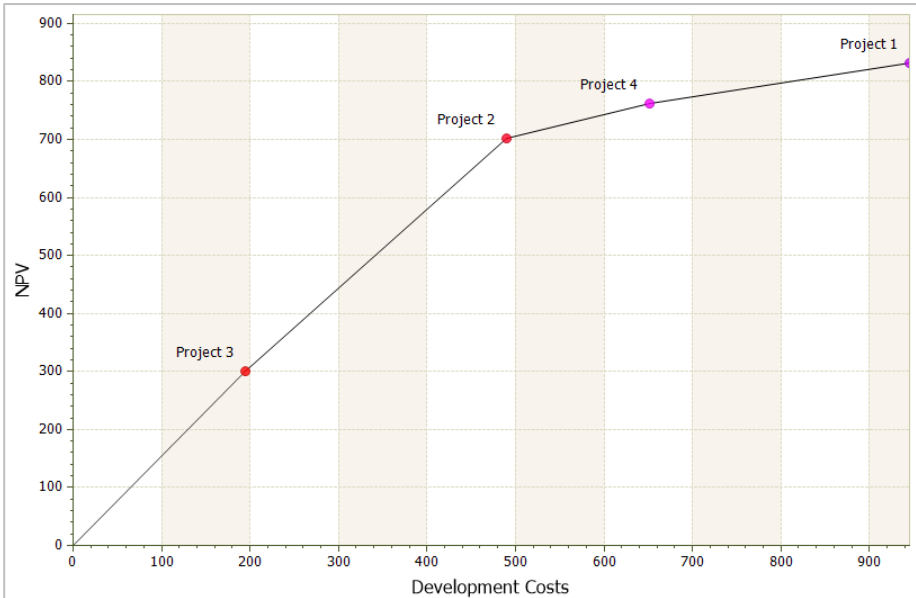
## 5.7 Productivity Ratio Charts

Productivity Ratio Charts are a useful Portfolio Analysis tool to help you rank projects. As mentioned earlier, the Productivity Ratio (also sometimes called "bang for the buck") is calculated as the expected value of the objective (in this example, NPV) divided by the expected value of the investment (in this example, development costs). The purpose of a Productivity Ratio Chart is to help the decision maker compare projects and decide which projects deserve funding before others according to this ratio.

If resources are constrained (as they usually are), the Productivity Ratio Chart can help the decision maker select the projects to fund. The most efficient method for allocating scarce capital resources is to fund the project with the highest productivity ratio first, followed by the other projects in descending order of the ratio, until funds run out. You will examine how this works now.

⇒ Double-click on the item for the Productivity Ratio Chart within the Workspace Manager to activate it.

The chart appears as in Figure 5-10.



**Figure 5-10. Productivity Ratio Chart**

You can determine the rank order of the projects in terms of Productivity Ratio by moving from the lower left to the upper right of the productivity curve. Project 3 has the highest productivity ratio; Project 1 has the lowest.

⇒ Hold your mouse over the bubble for Project 3.

You can see that Project 3 has development costs of about 194, and a Productivity Ratio of about 1.5. Therefore, the first 194 in development costs should be funded to Project 3 for the greatest expected NPV return.

⇒ Hold your mouse over the bubble for Project 2.

Project 2 has development costs of about 296, and a Productivity Ratio of 1.4. This project should be the second project funded. If both Project 3 and Project 2 are funded, the cumulative development costs will be about 500 and the expected NPV will be about 700, as you can see from looking at the axes on the chart; the axis values correspond to the cumulative development costs and cumulative NPV that are achieved when all projects to the left of a particular point are funded.

You can use the Productivity Ratio chart to determine which project(s) to fund at any given budget. "Draw" a line up from the X-axis at your budget constraint, until you hit the curve. Projects to the left of this point on the curve are good candidates to be funded; projects to the right are not.

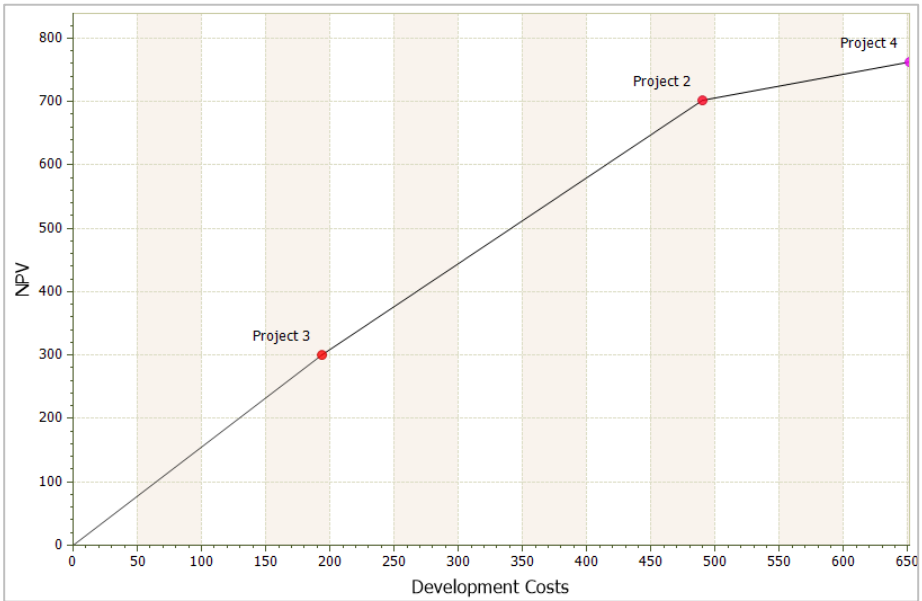
Note that the Productivity Ratio Chart does not actually display the Productivity Ratio itself (except by means of holding the mouse over each bubble and viewing the values). You can also see the actual Productivity Ratios in the Results Report.

As with the other charts you have examined so far, there are a number of formatting options you can modify on this chart.

⇒ Select the bubble for Project 1 within the chart (it will turn magenta).

⇒ Check the Hide checkbox within Chart | Series | Point.

The chart now omits Project 1, which was the project with the lowest Productivity Ratio. See Figure 5-11.



**Figure 5-11. Productivity Ratio Chart with Project 1 Removed**

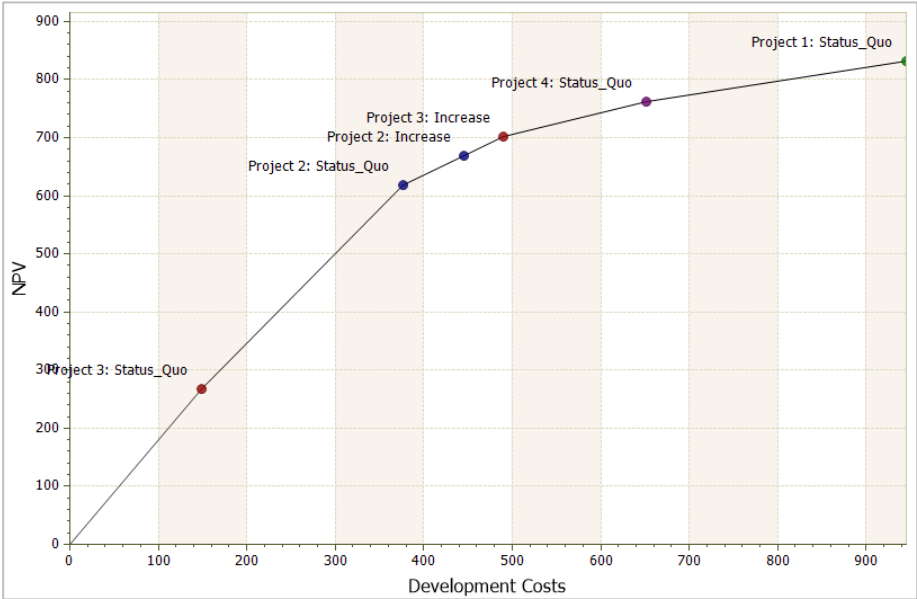
Note, to unhide Project 1 you need to click Chart | Series | Point | Options (the dialog box launcher) and select it from within the Unhide dialog.

For Ratio charts you can choose to have the bubbles within the chart colored by ratio as they are currently (bubbles are colored on a red to blue scale from highest to lowest ratio) or by project via the Color Options dialog (Chart | Format | Color | Options).

Next you will examine a slightly more complex version of the Productivity Ratio Chart.

## 5.8 Initial Decision Productivity Ratio Charts

⇒ Double-click on the item for the Decision Alternatives Ratio Chart within the Workspace Manager to activate it. See Figure 5-12.



**Figure 5-12. Initial Decision Alternatives Productivity Ratio Chart**

The Initial Decision Alternatives Productivity Ratio Chart is similar to the regular Productivity Ratio Chart, except that for each project each alternative for the initial decision is considered as a separate allocation of capital and the incremental productivity ratio for each level of investment is calculated and used to create the chart.

In this portfolio, recall that the initial decision is to decide on a Funding Level. The three initial decision alternatives are Status Quo, Increase, and Cancel. On the Productivity Ratio Chart you examined in Section 5.7, the development costs and NPV were plotted for the optimal decision alternative only for each project. On an Initial Decision Alternatives Ratio Chart, incremental investments are plotted for each project. In the chart, you can see that there are now six bubbles plotted; Projects 2 and 3 have been broken into two levels of incremental investment: Status Quo and Increase.

For projects 2 and 3, the initial decision alternative "Status Quo" has a higher productivity ratio than the alternative "Increase", although "Increase" has a higher expected NPV. Therefore, if capital is constrained, the chart shows us that the first investment funded should be the Status Quo level of Project 3, followed by the Status Quo level of Project 2, and then the Increase levels of Project 2 and Project 3. Continuing to the upper right along the curve first Project 4 and then Project 1 should be funded at the Status Quo level if enough funds are available.

Note that the Increase levels for Projects 1 and 4 do not appear on the chart. This is because the optimal (highest NPV) decision alternative for these projects is Status Quo; increasing funding to the Increase level actually reduces value for these projects. Therefore, regardless of the availability of funds, you would not pursue the Increase level for Projects 1 and 4, so this level is not included on the chart.

In general, not all levels of the initial decision alternatives are included for all projects on the Initial Decision Alternatives Productivity Ratio Chart, as you see in this example. Decision alternatives are included when lower levels of investment yield higher productivity ratios, and investment can be increased to yield higher NPV (though at lower incremental productivity ratios), as is the case for Projects 2 and 3.

⇒ Hold your mouse cursor over the Project 2: Status Quo bubble.

The productivity ratio for this level of investment is 1.54, as shown in the text box.

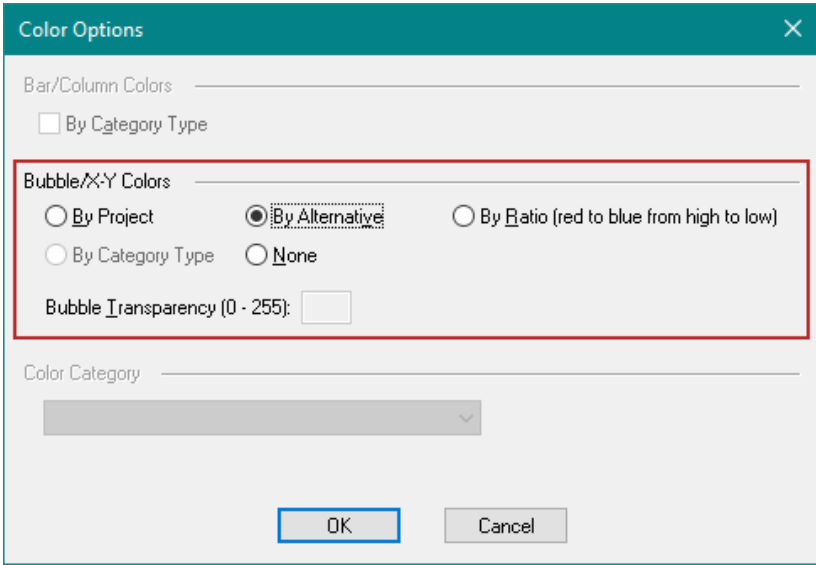
⇒ Hold your mouse cursor over the Increase bubble for Project 2.

The text box shows you the *incremental* development cost, NPV, and productivity ratio for moving up to the Increase level from the Status Quo level of funding. The text box also shows you the *overall* development cost, NPV, and productivity ratio, which are 401, 296, and 1.35, respectively. Recall that these overall measures are the same as shown in the Project 2 bubble on the regular Productivity Ratio Chart you examined earlier. On the chart shown in Figure 5-10, only the highest NPV initial decision alternative (Increase) is shown.

The bubbles within the Ration chart are currently colored red to blue by ratio. You can optionally choose to have the bubbles colored by project or by decision alternative via the Color Options dialog. You'll update this setting now so that the bubbles are colored by decision alternative.

⇒ Select Chart | Format | Color | Options. This will launch the Color Options dialog (Figure 5-13).

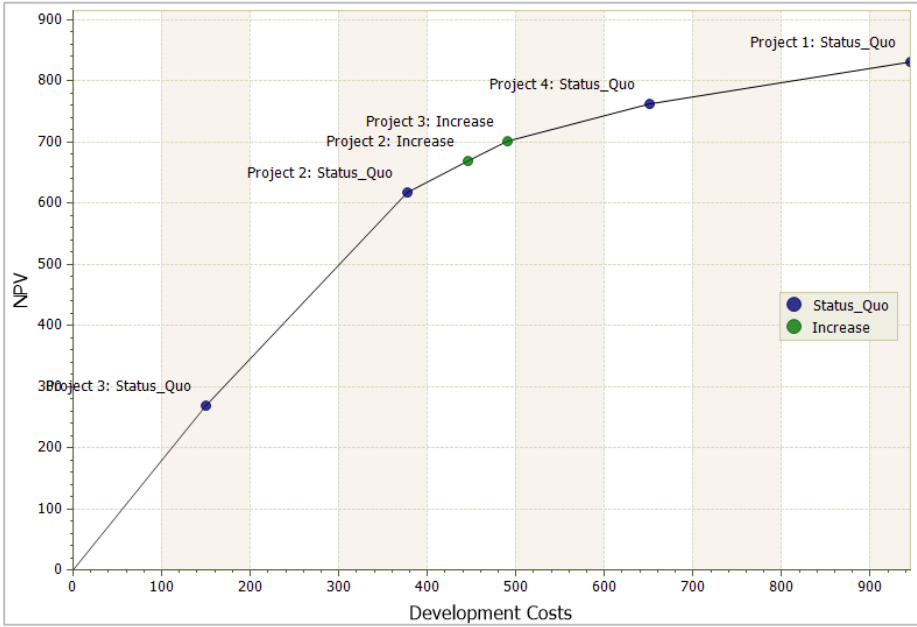
- ⇒ Within the *Bubble/X-Y Colors* section select the *By Alternative* radio button.



**Figure 5-13. Color Options dialog**

- ⇒ Within Chart | Format | Legend check the Show, Centered, and Inside boxes. Set the Legend placement drop-down to Right.

You can see that blue has been assigned to the "Status Quo" alternative and green to the "Increase" alternative (Figure 5-14).



**Figure 5-14. Initial Decision Alternatives Productivity Ratio Chart Colored by Decision Alternative**

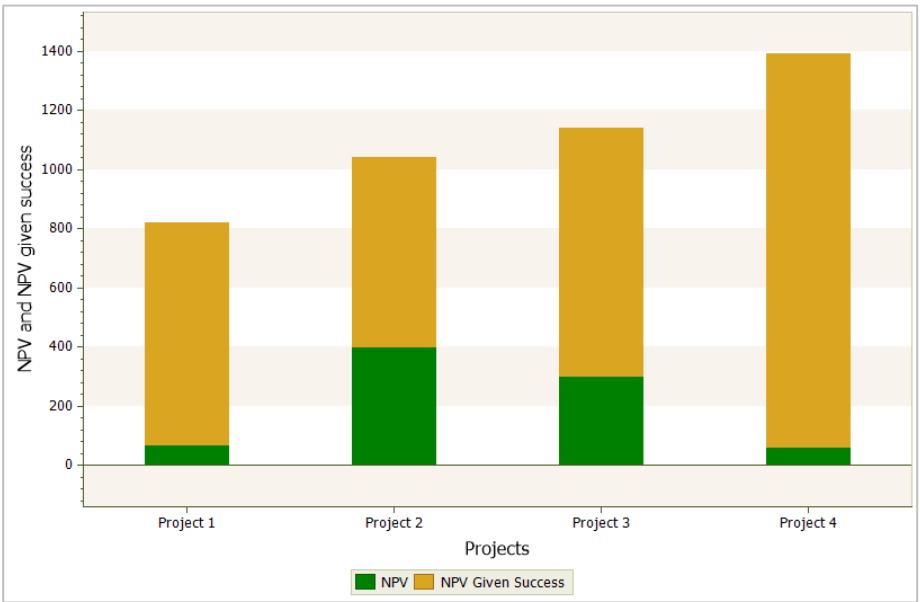


## 5.9 Expected and Potential Value Charts

The Expected/Potential Value Chart is a column chart which depicts, for each project, the expected value of the project's objective function and the project's expected value given success (or potential value). Note that these quantities are two of the five standard Portfolio Attributes and can be seen in the Portfolio Results Report as well.

⇒ Double-click on the item for the Expected/Potential Value Chart within the Workspace Manager to activate it. See Figure 5-15.

The chart appears as in Figure 5-15.

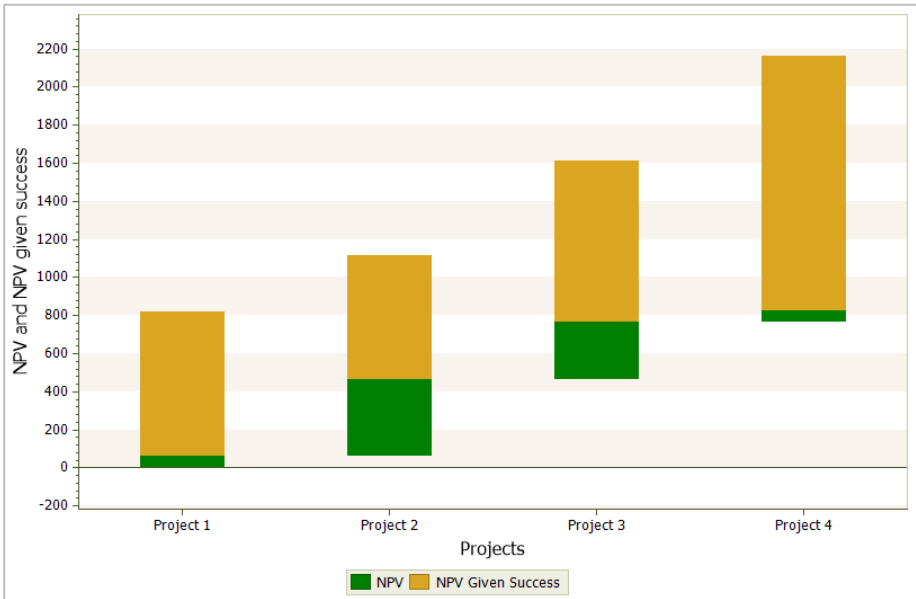


**Figure 5-15. Expected/Potential Value Chart**

The height of the green portion of each bar is the expected value for the project. The total height of the column (including the orange portion) is the potential value, or expected value given success, for the project. Projects are sorted by overall height of the bar (expected objective function value given success).

⇒ Check the Additive checkbox within Chart | Format | Display.

The chart now looks like Figure 5-16.



**Figure 5-16. Additive Expected/Potential Value Chart**

When the chart is additive, the expected value of the objective function is used to display the bars cumulatively. The second bar starts at the expected value for the first bar, and so forth. You can see this if you examine the green regions of the chart you just re-formatted.

In the next section, you will examine the final type of standard chart in DPL Portfolio.

## 5.10 Portfolio Tornado Charts

Portfolio Tornado Charts are a special type of Deterministic Event Tornado. Refer also to Chapter 14 of the *DPL User Guide* for more information on this type of tornado chart.

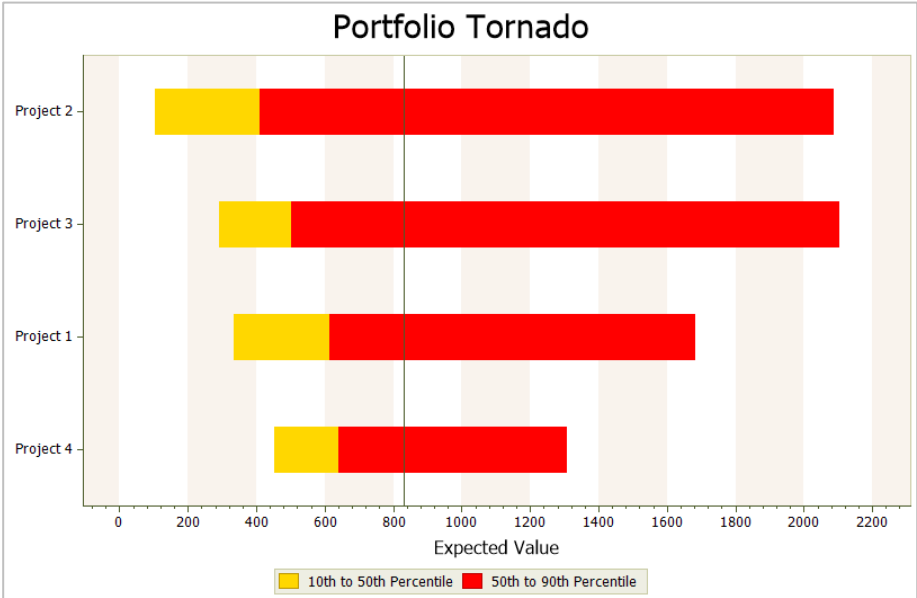
Portfolio Tornado Charts are created by setting the value for each project in the portfolio to its expected value, except one project. The range of uncertainty (10th, 50th, and 90th percentile) in portfolio value is then calculated assuming only one project has uncertain outcomes.

DPL repeats this process for each project in the portfolio. The results are plotted as the bars on the Portfolio Tornado Chart. Each project's bar on the final Portfolio Tornado Chart depicts the range of uncertainty in the

overall portfolio value, assuming that project is the only project with uncertainty.

- ⇒ Double-click on the item for the Portfolio Tornado within the Workspace Manager to activate it.

The Portfolio Tornado Chart appears as in Figure 5-17.



**Figure 5-17. Portfolio Tornado Chart**

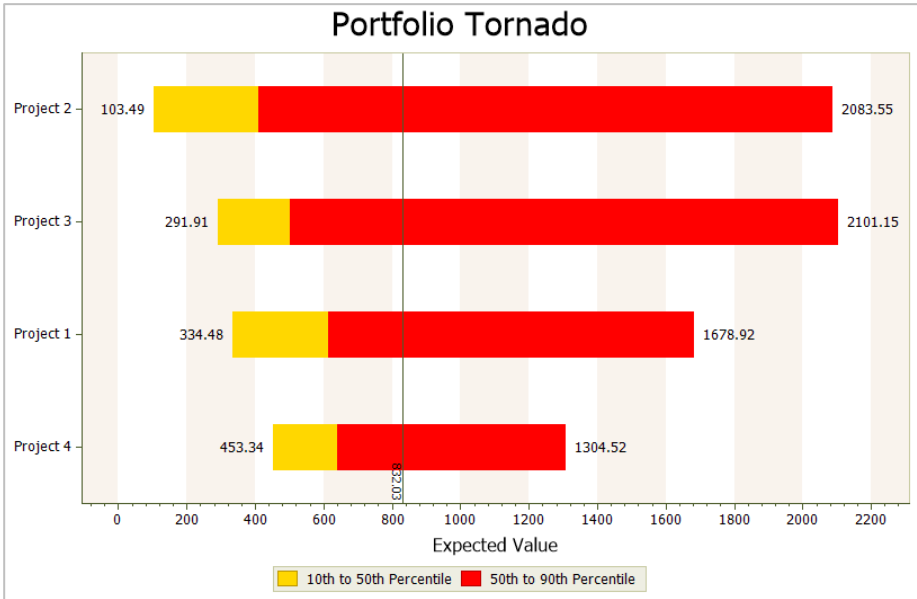
You can see from the chart that Project 2 contributes the widest range of uncertainty to the portfolio value (within the 10th to 90th percentile range), when all other projects are set to their expected values. Project 4 contributes the least uncertainty within this percentile range. However, all four projects have a significant effect on the portfolio value range.

The vertical bar in the middle of the chart corresponds to the expected value for the portfolio. The yellow bar regions correspond to the 10th to 50th percentiles of value, and the red bar regions correspond to the 50th to 90th percentiles of value.

- ⇒ Check the Show checkbox within Chart | Series | Labels
- ⇒ Check the EV/CE Values checkbox within Chart | Format | Display.

The tornado chart now looks like Figure 5-18. You can see the expected value for the portfolio, as well as the 10th and 90th percentiles of portfolio

value that result from each project being the only uncertainty in the portfolio.



**Figure 5-18. Portfolio Tornado Chart with Values Displayed**

Note in this section of the chapter, you used the Portfolio | Run | Analyze (Options) command to tell DPL which outputs to generate prior to a run. If you had previously set the output options within the Portfolio Analysis Options dialog and wish to analyze the portfolio again without changing them, you can drop down the Portfolio | Run | Analyze split button and choose the Analyze Now command (Portfolio | Run | Analyze (Now)). DPL will run the portfolio (bypassing the Portfolio Analysis Options dialog) and create the output options selected previously.

## 5.11 Exporting Portfolio Results

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When analyzing your portfolio in DPL, you may find it necessary to use your results in external spreadsheets, presentations, or other documents. Exporting results from DPL is easy and convenient. There are three main methods you may use to export results:

- Copy a chart or tabular results directly to another application,
- Export tabular results or data underlying a chart to a table in .CSV (Comma Separated Value) or .XML format;
- Export attribute expected values to a linked database.

Copying a chart directly to another application is covered in Section 3.7 of the DPL 9 User Guide. Exporting to a database will be covered in Chapter 9 of this manual. Below you will carry out the second export methods.

### 5.11.1 Copy the Portfolio Results Report to Excel

Occasionally you may find that you want to copy your Portfolio Results Report, or other tabular results i.e. Data Reports, to another application such as Excel. Data Reports are covered in Chapter 8.

- ⇒ Switch to Excel (or open Excel) and open a new blank Workbook.
- ⇒ Switch back to DPL and activate one of the Portfolio Results Report you created earlier.
- ⇒ Click Ctrl+A to Select All the data within the report.
- ⇒ Click Home | Edit | Copy (or press Ctrl+C).
- ⇒ Switch back to Excel and select a Worksheet for your data and a cell, e.g., cell A1 of a blank Worksheet.
- ⇒ Click Home | Clipboard | Paste (or Ctrl+V). The data from the Results Report is pasted.

You could have selected only part of the Results Report to copy, by highlighting a selection of the Report in DPL.

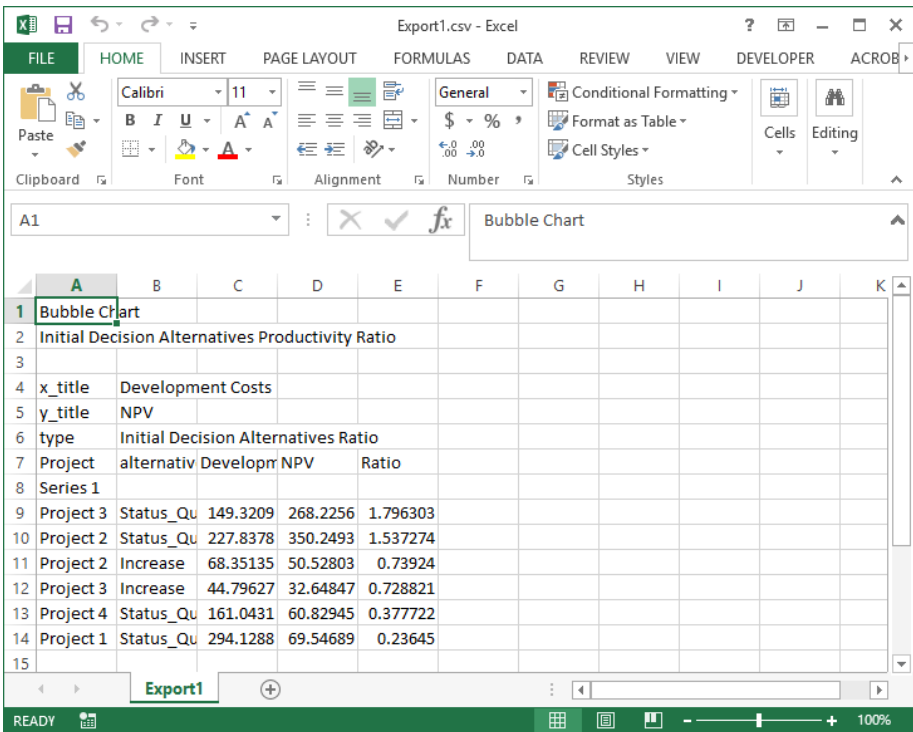
- ⇒ Close the Excel Workbook without saving; you don't need it later.

### 5.11.2 Export a Chart to a .CSV File

In this section you will see what happens when you export (not copy) a DPL chart to a .CSV file.

- ⇒ Switch back to DPL.
- ⇒ Activate the Decision Alternatives Ratio chart.
- ⇒ Click the Export icon in Data | Export and select Data from the list.
- ⇒ Browse to find the location where you wish to save the .CSV file. You can also change the name of the file. Click Save.
- ⇒ Locate the .CSV file you just saved (you may need to change file type to All Files) and open it in Excel.

The .CSV file appears as in Figure 5-19.



**Figure 5-19. .CSV File for Exported Chart Data**

The .CSV file contains all the data underlying the Decision Alternatives Ratio Chart. Note that the Expected Development Costs, Expected NPV, and Productivity Ratio shown in the data file are incremental values.

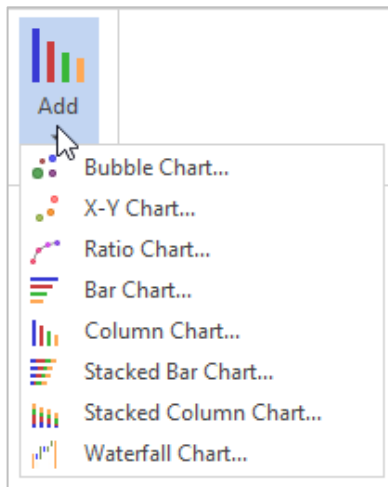
See Chapter 8 of this manual for another example of exporting results (from Data Reports).

The final section of this chapter shows you how to create custom charts directly in DPL.

## 5.12 Creating Custom Charts in DPL™

### 5.12.1 Creating Charts from Stored Portfolio Results

When you run a Portfolio Analysis, DPL saves the expected values of all the attributes from the run. As long as you do not modify the portfolio (by adding Groups, Elements or attributes), you can create charts directly from these stored results. You can add Bubble Charts, X-Y Charts, Ratio Charts, Bar Charts, Column Charts, or Waterfall Charts (Figure 5-20) either via results stored from a previous Portfolio Analysis or from a Results Report. This section discusses the former and the next section discusses the latter.

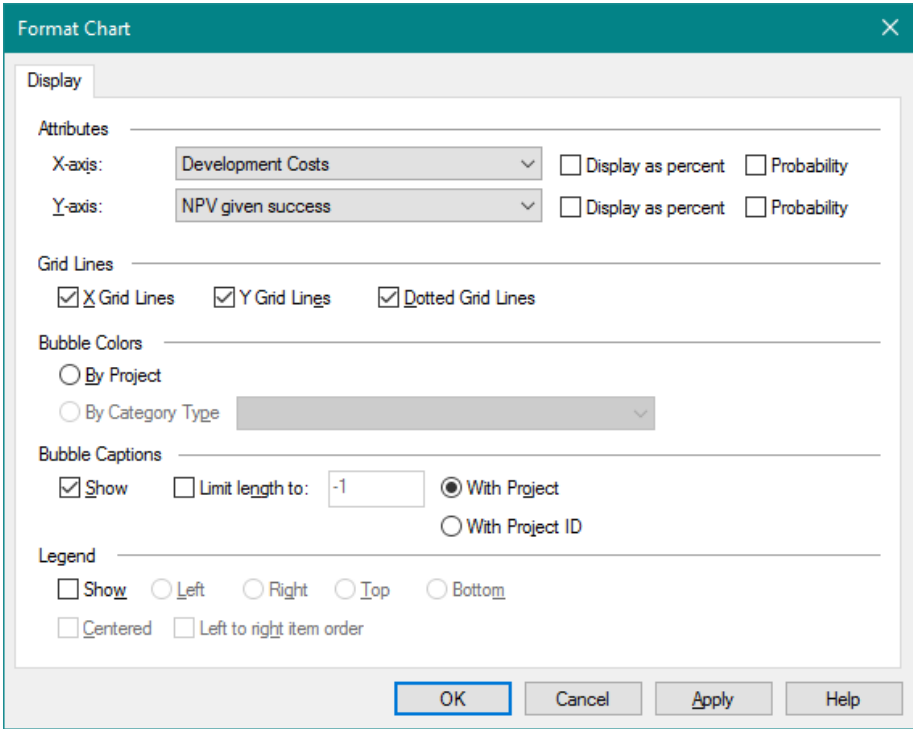


**Figure 5-20. Add Custom Chart Drop-down List**

You will add a custom X-Y Chart to the Workspace now.

- ⇒ Drop-down the Portfolio | Chart | Add split button and select X-Y Chart from the list.
- ⇒ In the *Attributes* section, select Development Costs for the X-axis.
- ⇒ Select NPV given success for the Y-axis.
- ⇒ Leave everything else the same.

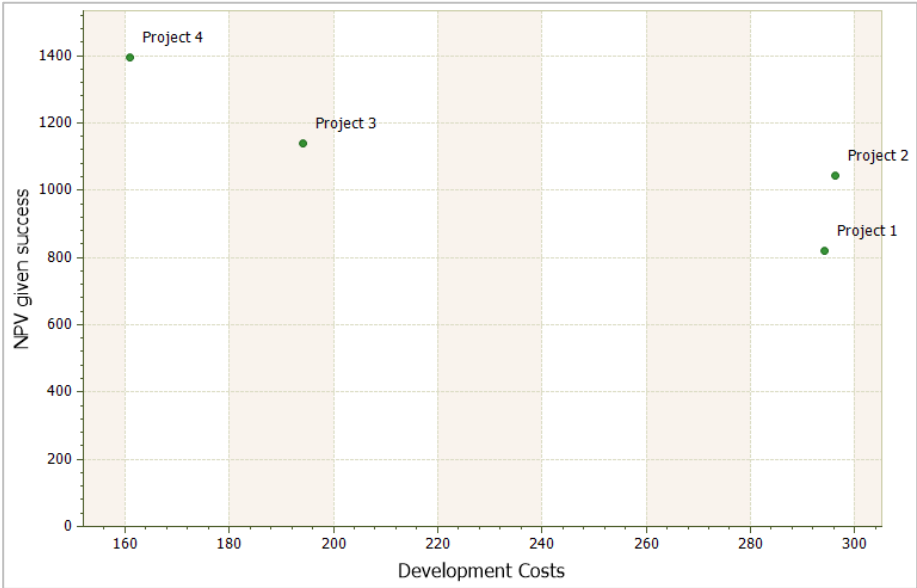
The dialog should look like Figure 5-21.



**Figure 5-21. Custom X-Y Chart Settings**

⇒ Click OK to create the chart. See Figure 5-22.





**Figure 5-22. Custom X-Y Chart**

This X-Y chart shows the potential value of each project (the expected value if it succeeds) as a function of its expected development costs. Note that expected development costs and expected NPV given success are also part of the standard DPL Risk/Reward chart, but in that chart the expected development costs served as the bubble size.

The process for adding other types of charts is similar. You will add one more chart now.

- ⇒ Drop-down the Portfolio | Chart | Add split button and select Bar Chart from the list.
- ⇒ Within the *Data Layout* section select the Columns/bars clustered by project radio button.
- ⇒ Within the Clusters tab, click the Add Cluster button and click Select All to the select all 4 projects within the Select Series to Add dialog.
- ⇒ Click OK.
- ⇒ Select the Bars tab, click the Add Bar button and select both Development Costs and NPV given success.
- ⇒ Click OK. The dialog should look like Figure 5-23 and Figure 5-24.

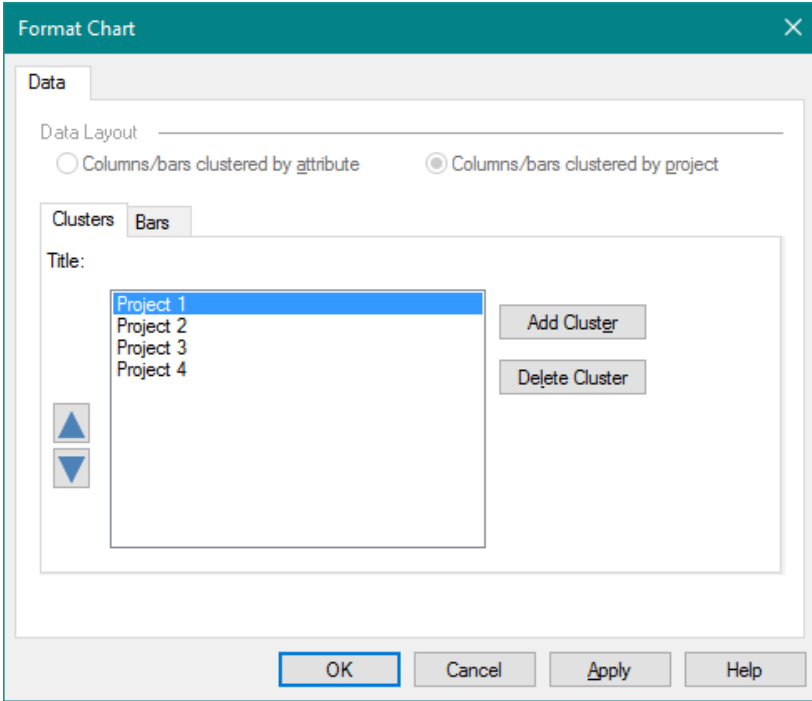
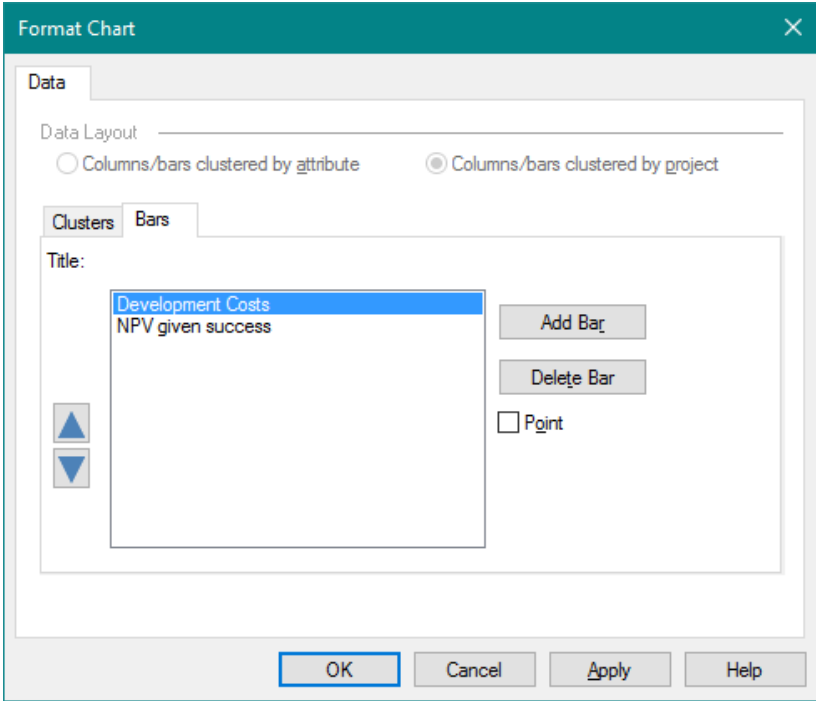


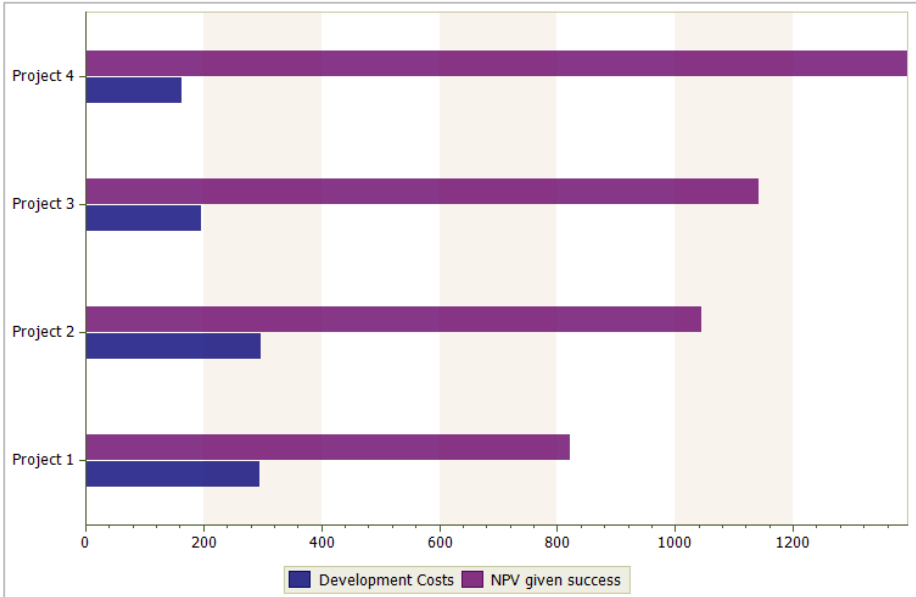
Figure 5-23. Clusters Tab for Custom Bar Chart



**Figure 5-24. Bars Tab for Custom Bar Chart**

- ⇒ Click OK to create the bar chart.
- ⇒ Change the Legend position to be at the bottom. Check the box for Centered and select Bottom from the Legend Placement drop-down list and L to R from the Legend Order drop-down list within the Chart | Format | Legend group.

The chart should look like Figure 5-25.



**Figure 5-25. Custom Bar Chart**

Note that this chart contains the same data as the X-Y chart you created previously.

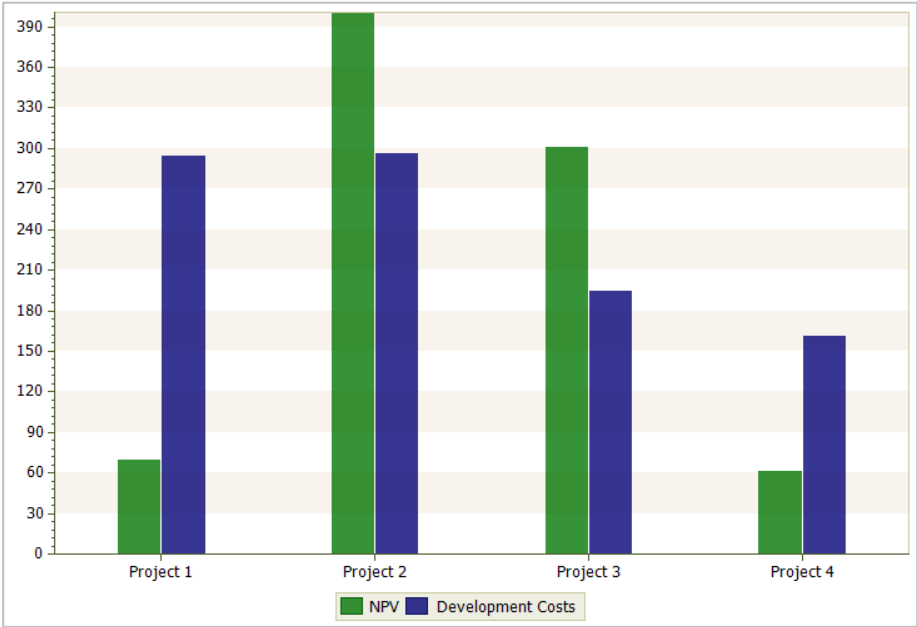
You will now create a custom Column chart from the Results Report.

### 5.12.2 Creating Charts from the Portfolio Results Report

If you have created and saved a Portfolio Results Report, you can create custom charts directly from it. In order to create a chart from the Portfolio Results Report, you need to activate the report and select the data you wish to chart.

- ⇒ Double-click to activate the Portfolio Results Report.
- ⇒ Use your mouse to select eight cells in the report: the NPV and Development Cost columns for the four project rows. (Do not select the last Portfolio row.)
- ⇒ With the eight cells highlighted, drop-down the Grid | Chart | Add split button and select Column Chart from the list.
- ⇒ Answer Yes to the "Create chart with report columns clustered by project?" prompt.

DPL creates the column chart as shown in Figure 5-26.



**Figure 5-26. Custom Column Chart**

Each project has two columns in the chart, one for NPV and one for Development Costs.

The process for adding bar, X-Y and bubble charts from the Portfolio Results Report is similar. The process is also similar for adding charts from Data Reports, which are covered in Chapter 8.

⇒ Save your Workspace under a new name if you would like to keep the results you have generated and re-formatted in this chapter.

In Chapter 6, you will continue with this spreadsheet-linked example, but you will be further modifying your model to generate new results and outputs. Therefore, do not worry if you have experimented with your outputs, added or modified charts, etc., in this tutorial.

## 5.13 Updating Outputs When Data Changes

After doing a Portfolio Analysis run and customizing charts from it, you may need to update the results based on new information. This can be done without having to re-create all of the outputs. In order to use this feature,

you must generate a Results Report along with whatever graphical charts you want.

- ⇒ Activate the Portfolio Results Report from the earlier Portfolio Analysis run.
- ⇒ Select the Data tab on the Ribbon.

Note that the Data | Update | Updatable checkbox is checked.

- ⇒ Activate the Risk/Reward chart from the earlier Portfolio Analysis run.

Note that the Updatable checkbox is checked. Once you have created Portfolio Results Reports (and/or Data Reports, see Chapter 8) and charts, you can update some or all of them using the Data | Update | This Report/Chart or Data | Update | All Reports/Charts commands. For any report or chart that is updatable, DPL will reproduce the output using the latest portfolio data. For charts that you have customized, the customized settings will be preserved. All of the outputs in the *Project Comparison* section of the Portfolio Analysis Options dialog are updatable with the exception of the Portfolio Tornado. Any custom chart created from a Portfolio Results Report or Data Report is also updatable.

If you have a report or chart that you do not want to be updated activate the chart and uncheck the Updatable checkbox in Data | Update. Note if you uncheck the Updatable checkbox for a Portfolio Results Report or Data Report, then none of the charts that were created from it will be updated.

## 6. Additional Portfolio Metrics

In Chapters 4 and 5, you created and edited a spreadsheet-linked Portfolio model, generated Portfolio Analysis results and exported those results. The model you created and used in those chapters was a relatively simple Portfolio model whose attributes consisted only of the three required attributes: Objective, Investment, and Success, as well as the two derived attributes. These five attributes are sufficient to describe and evaluate some Portfolios. However, in many situations you may find that you need additional metrics in order to further quantify the value of your portfolio, generate additional output charts, and facilitate decision making. The first few sections of this chapter discuss adding additional portfolio attributes to track portfolio metrics beyond the three required. The final section discusses DPL's ability to accumulate distributions on attributes for specified subtrees (or set of scenarios) in the portfolio.

### 6.1 Tracking Additional Portfolio Metrics

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The basic steps for tracking additional portfolio metrics are:

- 1) Add new Portfolio Attributes,
- 2) Modify the model (or models) in the portfolio to calculate values for the new attributes (note in a spreadsheet linked portfolio, this may mean modifying the spreadsheet to calculate values and adding a metric node to the DPL model),
- 3) Modify the get/pay expressions in your model to provide expressions for the new attributes.

Any portfolio metric whose expected value and/or Risk Profile you wish to calculate is a candidate for a new attribute. DPL will calculate the expected value, Risk Profile, and Risk Profile statistics for every attribute you specify in the portfolio.

Cash flow values over time (e.g., annual sales or annual profits) are a typical example of a set of metrics you might want to track. In the sections below, you will add Portfolio Attributes and a value node to your Influence Diagram for an 18-year cash flow series, then you will modify your model's get/pay expressions to include expressions for these new cash flows. In the

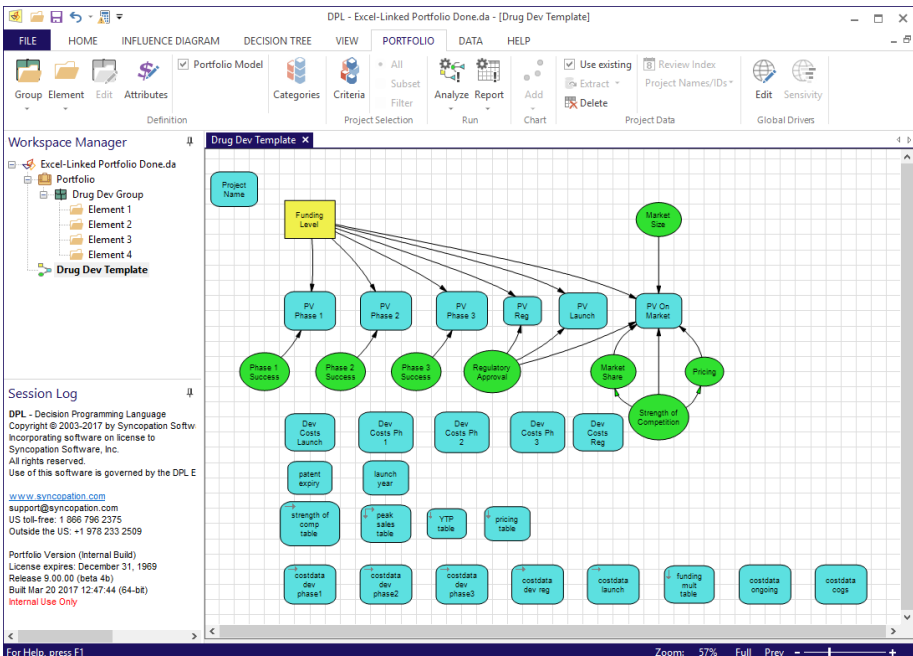
final section of this chapter, you will examine the Time Series charts that can be created from the 18 new Portfolio Attributes you have added.

## 6.2 The Portfolio Attributes Dialog

For the tutorial that follows, you will start with the Workspace you saved after Section 4.5 of this manual. Alternatively, you can start with an example Workspace that was provided: Excel-Linked Portfolio Done.da.

- ⇒ Start DPL Portfolio, if not already open.
- ⇒ Open the Workspace you saved at the end of Section 4.5. Or, open the Workspace provided with DPL: Excel-Linked Portfolio Done.da. This Workspace can be found in the Examples folder beneath the folder where you installed DPL Portfolio.

The Workspace should look something like Figure 6-1.

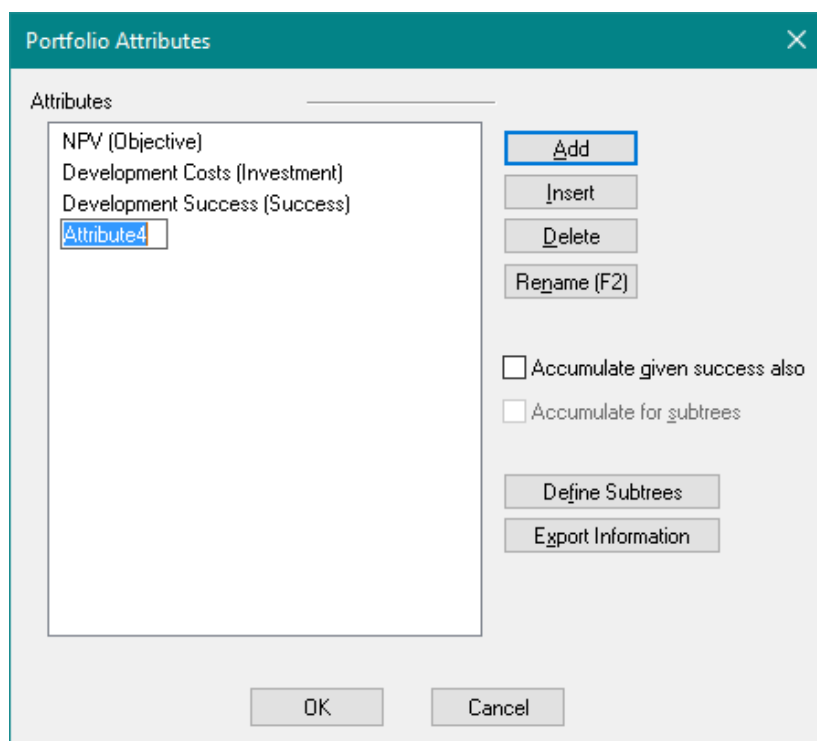


**Figure 6-1. Portfolio Workspace prior to Adding Attributes**

- ⇒ Select Portfolio | Definition | Attributes.
- ⇒ Click the Add button.

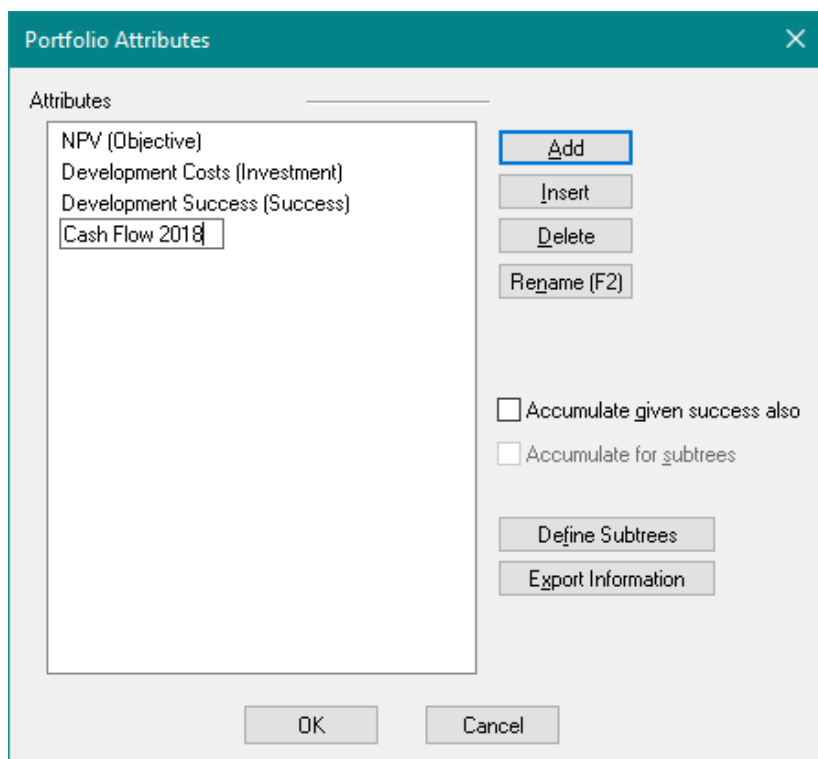


You will see a new attribute called Attribute4 selected for editing. See Figure 6-2.



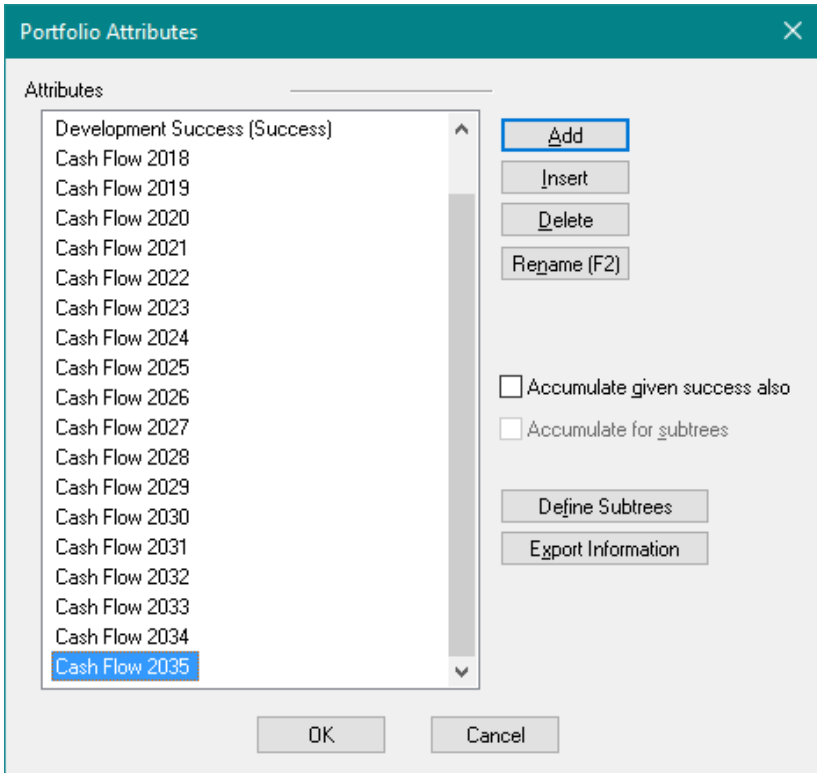
**Figure 6-2. Portfolio Attributes dialog**

⇒ Rename the attribute Cash Flow 2018. See Figure 6-3.



**Figure 6-3. Portfolio Attributes Dialog with Attribute Renamed**

- ⇒ Click the Add button again. DPL adds an attribute called Cash Flow 2019, which is what you want.
- ⇒ Repeat this process until you have a total of 18 new attributes called Cash Flow 2018 through Cash Flow 2035. The dialog should look like Figure 6-4.



**Figure 6-4. Portfolio Attributes Dialog with 18 New Attributes**

⇒ Click OK.

You have set up your portfolio so that DPL can calculate expected values and Risk Profiles for the 18-year cash flow series. In the next section, you will add a value node to import this series from your calculation-linked spreadsheet.

## 6.3 Adding a One-Dimensional Metric Node

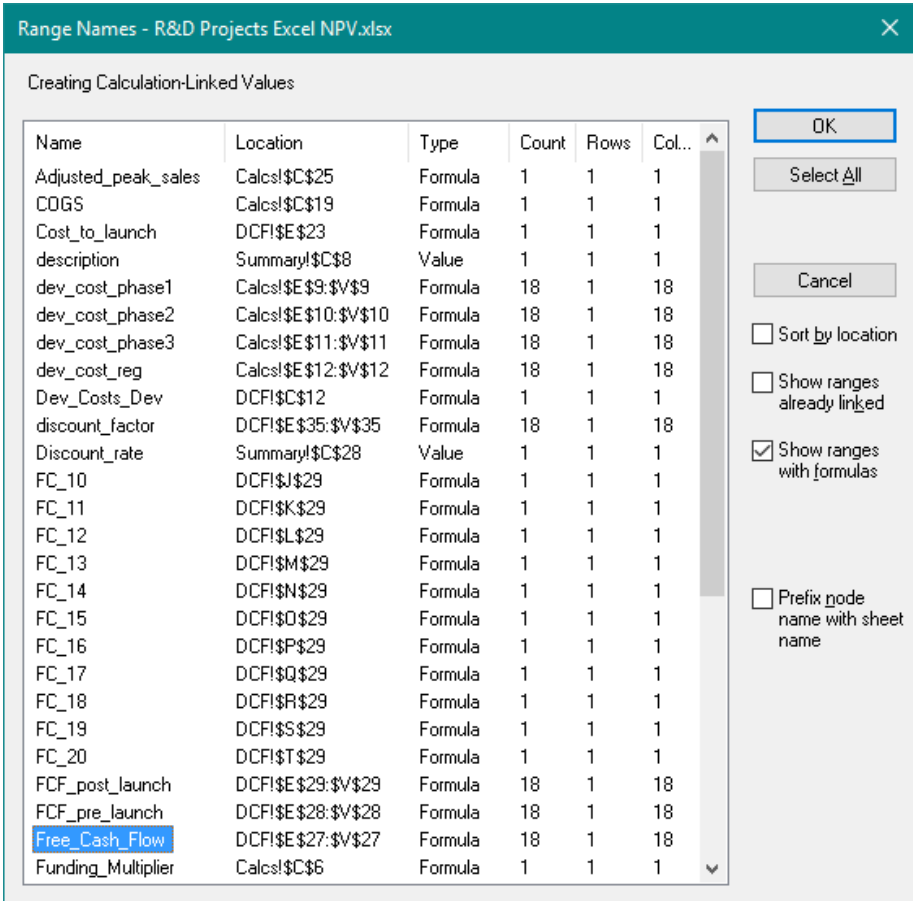
You can create a single, one-dimensional value node in DPL to link to the calculated cash flow values in the calculation-linked spreadsheet. The spreadsheet is already set up to calculate these cash flows and the named range containing the cash flows exists in the spreadsheet.

⇒ To create a new calculation-linked node, click Influence Diagram | Node | Linked Node | Excel Calculation-Linked.

⇒ Check the spreadsheet name that appears in the dialog. It should be R&D Projects Excel NPV.xlsx. If not, select it from the drop-down list.

⇒ Click OK.

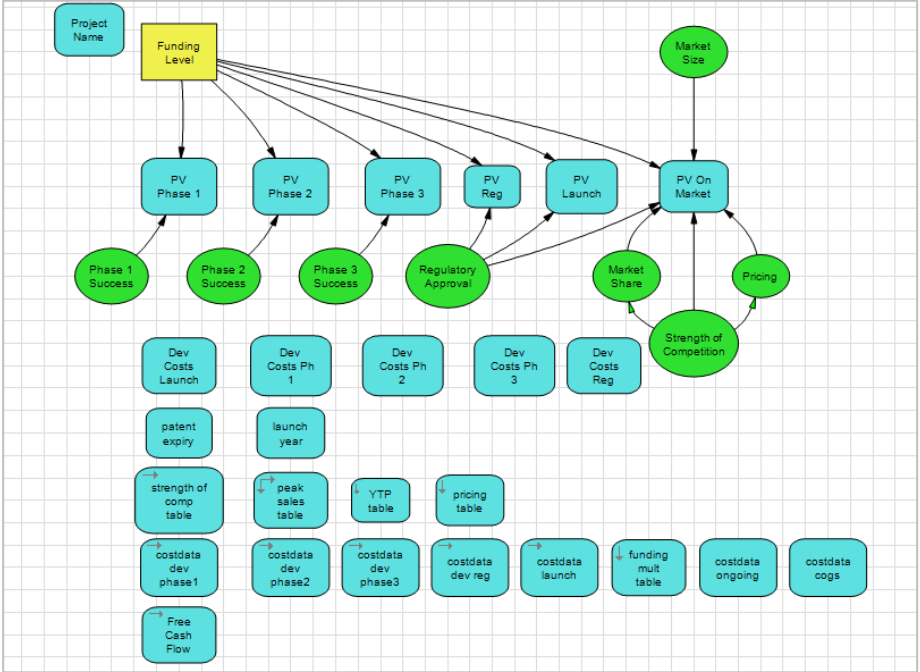
DPL will locate and open the cash flow spreadsheet if it is not already open. The Range Names dialog appears as in Figure 6-5.



**Figure 6-5. Range Names dialog with Free\_Cash\_Flow Selected**

⇒ Scroll down and select the range named Free\_Cash\_Flow. Note that this range is 1 row by 18 columns and contains formulas. Click OK.

DPL creates a node called Free Cash Flow off to the right of the Influence Diagram. You can move this node if you like. In Figure 6-6, the node has been moved to the bottom left section of the diagram.



**Figure 6-6. Influence Diagram with New Free Cash Flow Node**

⇒ Double-click the Free Cash Flow node to examine its definition.

On the Data tab, note that DPL has set up the node as a series with a single interval. The interval's bounds are 0 and 17 (which is 18 years' worth of cash flows). The node has been created with series interval entry because the named range in Excel it is linked to is a row with formulas in it. It has no data because it is a metric node.

⇒ Click on the Links tab to confirm that the node is a metric node.

⇒ Click OK to close the Node Definition dialog.

You are ready to modify the get/pay expressions in your model so that the new attributes are accounted for.

## 6.4 Editing Get/Pay Expressions

As currently set up, the get/pay expressions in the model provide value for only three attributes: NPV, Development Costs, and Success. Now that you have added the new cash flow attributes, the get/pay expression need to

be modified. Recall that get/pay expressions for each attribute are accumulated as you traverse the tree, with the end result being the total value for each attribute.

Both NPV and Development Costs were set up in a "pay as you go" format. The metric value nodes in the Influence Diagram that begin with the words "PV" and "Dev Costs" each provide the net present value of either the project or the development costs from a single development phase. The sum of the "Dev Costs" nodes and the sum of the "PV" nodes equals the total development costs or NPV for the project.

- ⇒ To see this, switch to the Decision Tree pane by hitting the Tab key.
- ⇒ Double-click on the Yes branch of the Phase 3 Success chance node.

On this branch, the get/pay expressions for NPV and Development Costs are PV\_Reg and Dev\_Costs\_Reg because it is assumed that when Phase 3 succeeds, you incur the amount Dev Costs Reg, and you accrue the additional NPV associated with registration at that point. These amounts are added to the other get/pay expressions for NPV and Development Costs that occur as you proceed down any particular path in the tree.

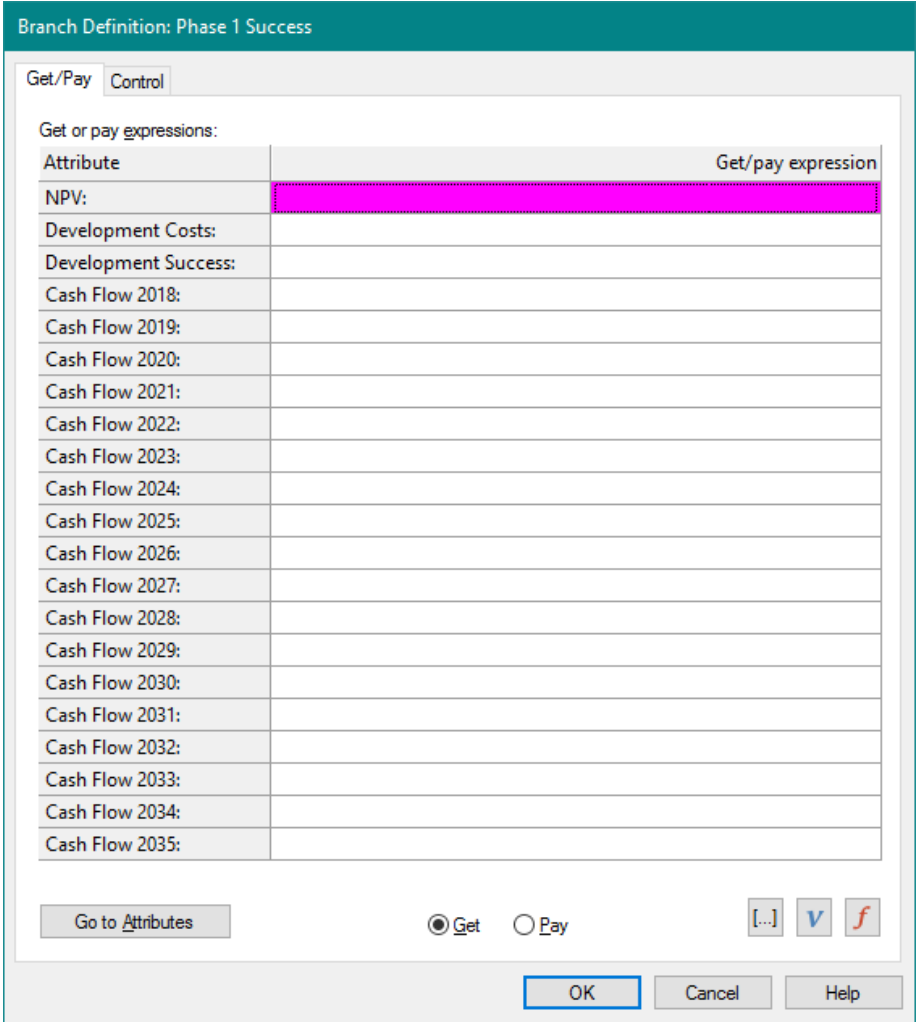
- ⇒ Click OK to close the Branch Definition dialog without making any edits.
- ⇒ If you like, switch to (or open) the R&D Projects Excel NPV.xlsx cash flow spreadsheet and examine the DCF worksheet to see how it is set up.

The Free Cash Flow is not set up as a part-sums calculation as are the PV and Dev Costs quantities discussed above. Rather, it is a series of 18 annual values whose quantities vary depending upon which scenario you are in (i.e., the location in the Decision Tree determines the settings of the DPL switches on the Summary sheet which flow through to the calculations for the Free Cash Flow series). Therefore, rather than Free Cash Flow being set up for use in a "pay as you go" format on the various Yes or success branches of the tree, it is set up to be located on the endpoints: i.e., the No branches and the final endpoint of the Decision Tree.

- ⇒ If you are in Excel, switch back to DPL.

You will modify all of the get/pay expressions on the decision tree endpoints (except the first endpoint) to account for the Free Cash Flow in each year. You do not need to modify the Cancel endpoint at the very beginning of the tree, since if you immediately decide to Cancel, nothing happens and all values are zero.

- ⇒ Double-click the No branch of Phase 1 Success in the decision tree. The Branch Definition dialog comes up. See Figure 6-7.



**Figure 6-7. Get/Pay tab of Branch Definition dialog for Phase 1 Success = No**

Currently the get/pay expressions for this branch are all zero or blank. This is because, as discussed above, the get/pay expressions for the original three attributes are set up so that they are accumulated on the Yes branches of each chance node rather than the No branch.

- ⇒ Select the Get/pay expression cell for Cash Flow 2018 (the fourth cell down).
- ⇒ Click the variable ( **V** ) button. The Select Variable dialog appears.

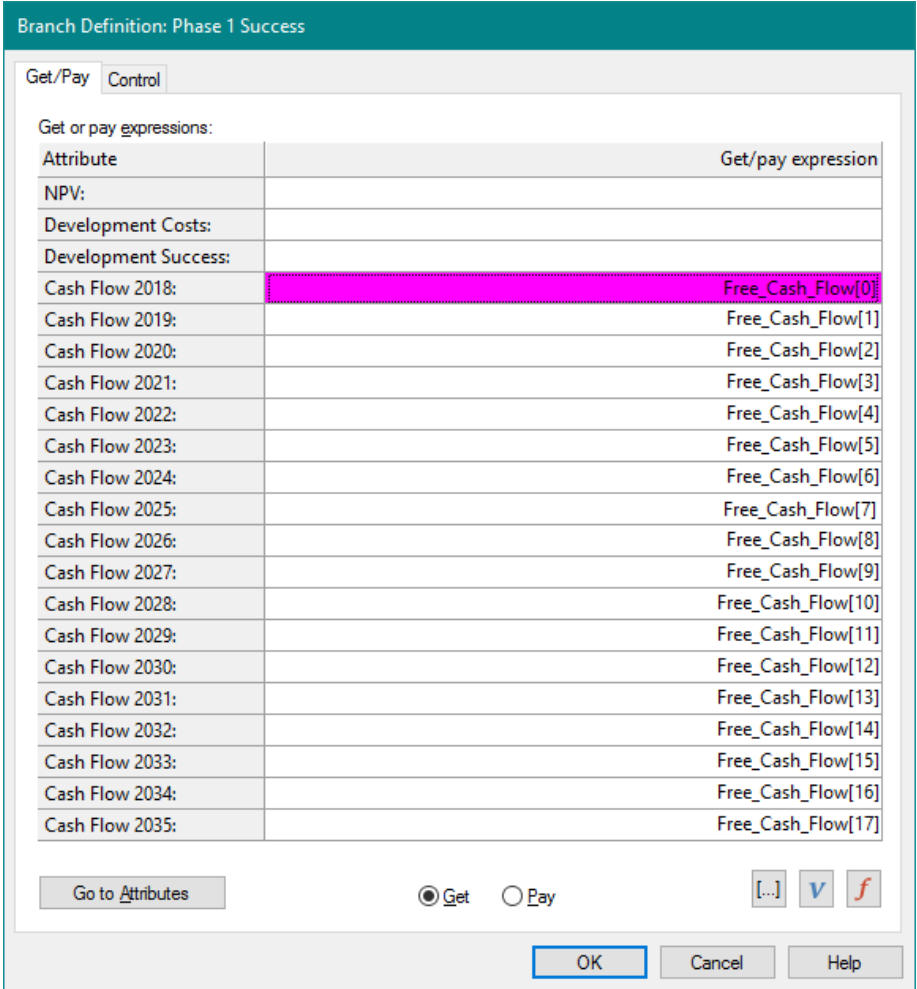
⇒ Double-click on Free\_Cash\_Flow to select it.

The Branch Definition dialog shows Free\_Cash\_Flow as the value for the Cash Flow 2018 attribute. However, Free Cash Flow is actually a series of 18 values. You will use the Fill Down (⌵) button to fill in the 18 values for the attributes.

⇒ With the Free\_Cash\_Flow value still highlighted in the cell, click the Fill Down (⌵) button.

DPL fills in all 18 Cash Flow attributes with the elements of the Free Cash Flow series. Note that DPL indexes these from 0 to 17, rather than from 1 to 18. See Figure 6-8.



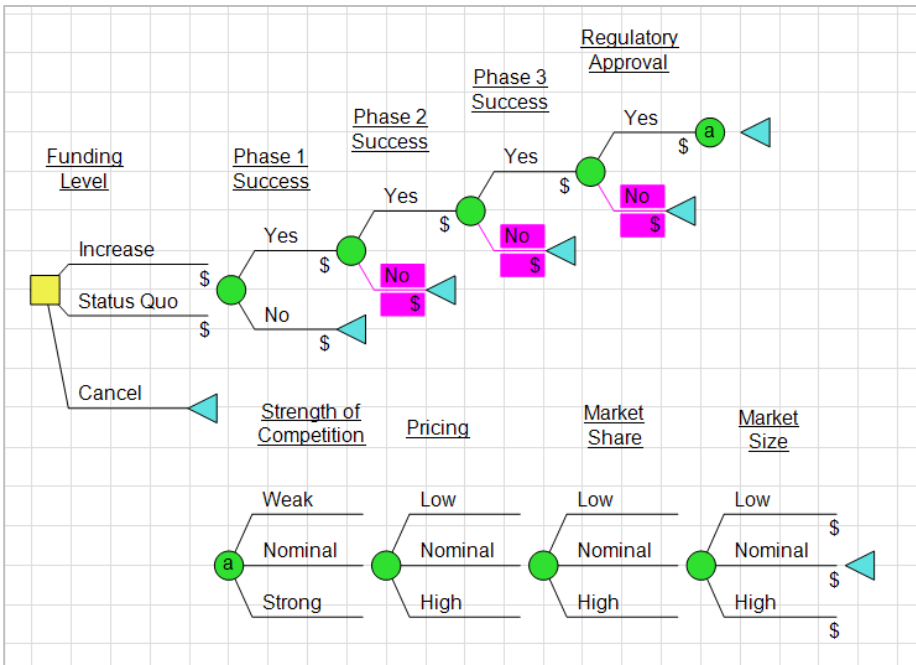


**Figure 6-8. Branch Definition dialog with Free Cash Flow Values**

Because of the way the Decision Tree and the cash flow spreadsheet are set up, you need to put the same get/pay expression on the branch of each endpoint on the asymmetric Decision Tree. For any particular path on the decision tree, when the endpoint is reached, DPL will accumulate the 18 cash flow values from the spreadsheet calculated for that point on the tree. You can do this by copying and pasting the get/pay from one branch to another.

As it stands now, if the get/pay expression were fully displayed on the No branch of the Phase 1 Success node it would be very long and difficult to display on the branches of the tree. This is why the get/pays within the model are instead displayed by an indicator ("\$\$") in the tree. This get/pay display can be modified via the radio buttons within the Decision Tree | Get/Pay group. For this example, you'll leave this setting as is.

- ⇒ Click OK to close the Branch Definition dialog.
- ⇒ Select the No branch of the Phase 1 Success node in the Decision Tree.
- ⇒ Press Ctrl+C to copy the get/pay expression to the clipboard.
- ⇒ Select the No branches for the Phase 2 Success, Phase 3 Success, and Regulatory Approval nodes in the Decision Tree all at once by using Ctrl+Click.
- ⇒ Press Ctrl+V to paste the get/pay expression to each of these branches. The get/pay indicator will now be displayed on all of the No branches in the model. See Figure 6-9.



**Figure 6-9. Decision Tree with Pasted Get/Pay Expressions on No Branches**

- ⇒ Finally, double-click on the branches of the last node on the tree, Market Size. Note that all three branches have the same get/pay expressions, since this node is symmetric.
- ⇒ Fill in the expressions for the 18 Free Cash Flow attributes as you did when editing the get/pay expression on the No branch of Phase 1 Success. Note that the first three attributes already contain get/pay expressions which is why you can't paste the entire expression.
- ⇒ Click OK to close the Branch Definition dialog.

You have fully specified the 18 Cash Flow attributes for your model, except for one additional step. You need to tell DPL that the Cash Flow attributes are zero for the get/pay expressions for the "Yes" branches on the tree.

- ⇒ Double-click on the Increase and Status Quo branches of the Funding Level decision. Note that the values are blank for all but the first three (original) attributes.
- ⇒ Click OK.

DPL will fill in all zeros for the 18 new attributes.

- ⇒ To see this, open Branch Definition dialog for the Increase and Status Quo branches of the Funding Level decision again. See Figure 6-10.

Branch Definition: Funding Level

Get/Pay Control

Get or pay expressions:

Attribute	Get/pay expression
NPV:	PV_Phase_1
Development Costs:	Dev_Costs_Ph_1
Development Success:	0
Cash Flow 2018:	0
Cash Flow 2019:	0
Cash Flow 2020:	0
Cash Flow 2021:	0
Cash Flow 2022:	0
Cash Flow 2023:	0
Cash Flow 2024:	0
Cash Flow 2025:	0
Cash Flow 2026:	0
Cash Flow 2027:	0
Cash Flow 2028:	0
Cash Flow 2029:	0
Cash Flow 2030:	0
Cash Flow 2031:	0
Cash Flow 2032:	0
Cash Flow 2033:	0
Cash Flow 2034:	0
Cash Flow 2035:	0

Go to Atributes

Get  Pay

[...] V f

OK Cancel Help

**Figure 6-10. Get/Pay Expression with Zeros Filled in for Funding Level node**

- ⇒ Click OK to close the dialog.
- ⇒ Follow the same steps for the "Yes" branches of Phase 1 Success, Phase 2 Success, Phase 3 Success and Regulatory Approval.

The get/pay expressions for all attributes on all relevant branches are now fully specified and you are ready to run an analysis.

- ⇒ Save your Workspace.

## 6.5 Generating Time Series Outputs

---

You will now run a Portfolio Analysis to generate time series outputs showing project-level and portfolio-level cash flows over time.

- ⇒ Click Portfolio | Run | Analyze (Options).
- ⇒ Within the *Tabular results* section be sure that Results Report is checked.
- ⇒ Within the *Time series* section check the Portfolio Percentiles Chart and Project Percentiles Chart checkboxes near the bottom of the dialog.
- ⇒ In the *From* and *To* drop-down lists, select Cash Flow 2018 and Cash Flow 2035, respectively.
- ⇒ In the Initial time period edit box, type 2018.
- ⇒ Un-check all other checkboxes in the *Distributions* and *Project comparison* sections, unless you wish to generate other portfolio analysis outputs.

The dialog should look like Figure 6-11.

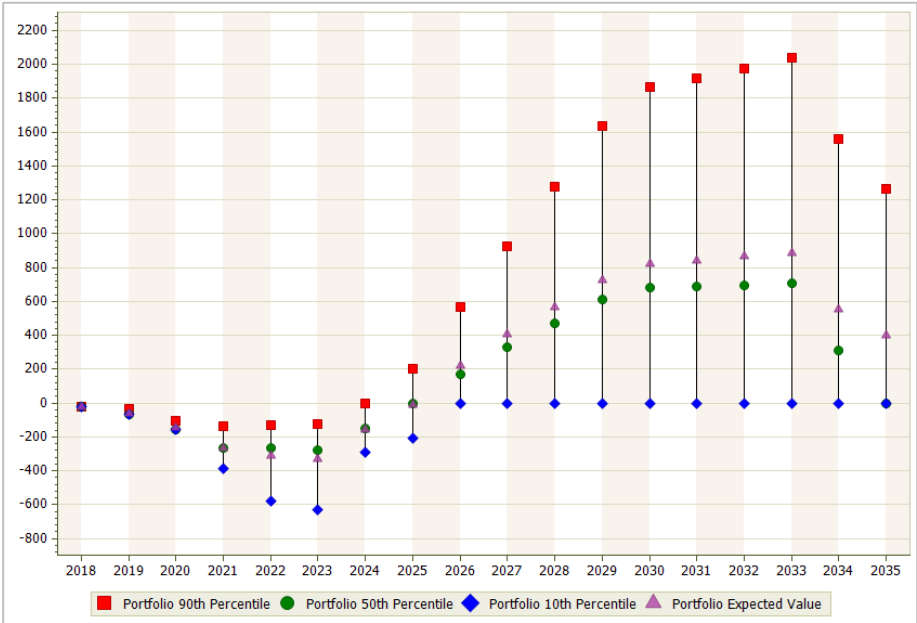
**Figure 6-11. Portfolio Analysis Options dialog for Time Series Outputs**

⇒ Click Run Now.

DPL runs the analysis and creates a Time Series Percentiles chart for each of the four projects and for the overall portfolio.

⇒ Double-click the item in the Workspace Manager for the Portfolio time series chart to open it.

The chart appears as in Figure 6-12.



**Figure 6-12. Portfolio Time Series Percentiles Chart**

Chapter 10 of the *DPL User Guide* provides more information on Time Series Percentiles Charts. The Portfolio Time Series Percentiles chart is set up the same way as the Time Series Percentiles charts for individual projects. However, the Portfolio chart displays the expected value and 10th, 50th and 90th percentile values of the selected attributes (in this case, cash flow) in each of the time periods for the entire portfolio rather than for just one project.

There is a considerable amount of uncertainty in the portfolio cash flow over time. The 90th percentile of cash flow through 2035 is very high, but the 10th percentile of cash flow in all years is 0 or less. This is because the probability that all four projects fail to achieve regulatory approval is greater than 10%.

- ⇒ If you like, examine the individual Project Time Series Percentiles charts as well.
- ⇒ Examine the Portfolio Results Report.

You can see that DPL now includes all the Cash Flow attributes in the report, with four tabs for expected value and 10th, 50th, and 90th percentiles. The Time Series Percentiles Charts display the same results graphically that you can see in the four tabs of the Results Report.

⇒ Save your Workspace. You will continue from this point in Chapter 7.

## 6.6 Defining and Generating Outputs for Subtrees

---

DPL Portfolio allows you to accumulate distributions and calculate expected values of attributes for subsets of the full decision trees within the portfolio models. For example, you might have some technical uncertainties in your models and want to know the expected value of attributes given success for one or more of these technical uncertainties. Or, perhaps you want to view expected values for NPV given certain market conditions. The Attribute Subtree Definitions dialog allows you to define the subtrees for which you'd like to accumulate distributions.

### 6.6.1 Defining Attribute Subtree Definitions

In this section, you will define three attribute subtrees, each of which assume incremental success at the three technical hurdles (Phases 1 – 3).

As explained previously in Section 2.5, by default DPL will accumulate results for the Objective attribute given success for use in various outputs (e.g., the Results Table). Given success results are calculated using the optimal policy decisions from the full run of the model but only accumulate distribution values in the success scenarios. Attribute subtree results allow policy changes to occur. E.g., in this example, the optimal decision alternative for a project might be to fund it at the status quo level in the full run of the model while in a defined subtree the optimal might be to increase funding.

To replicate the given success results, you could form a probability weighted sum of the optimal success endpoints in the Endpoint Database™ and divide by the probability of success. To replicate the subtree results, you could branch control the appropriate events in the model and run a decision analysis.

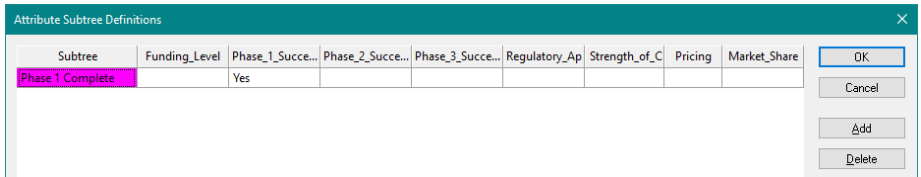
- ⇒ Click Portfolio | Definition | Attributes.
- ⇒ Click the Define Subtrees button. This will launch a blank Attribute Subtree Definitions dialog.
- ⇒ Click the Add button to add and define your first subtree.



DPL will add a row to the table with the first cell selected for editing. Each row in the table represents a subtree. You will specify a name for the subtree within the first cell. The remaining columns are for all the events (decision and discrete chance nodes) in the portfolio. Each column is labeled with the name of the event. The rows within each column have drop downs for the states of each event plus a blank entry. You will use these drop downs to define the subtree. If a particular drop down is left blank for an event within a subtree row, it means that the event is allowed to vary across its states in the subtree. If a state is specified for an event within a subtree row, then the event is fixed to that state for the subtree.

- ⇒ Within the Subtree column enter the name "Phase 1 Complete".
- ⇒ Select the cell in the Phase\_1\_Success column. It will become active with a drop-down arrow.
- ⇒ Drop-down the list for the row and select Yes.

For the Phase 1 Complete subtree, the Phase 1 Success uncertainty is set to the Yes state; the rest of the events in the model are allowed to vary across their states (Figure 6-13).



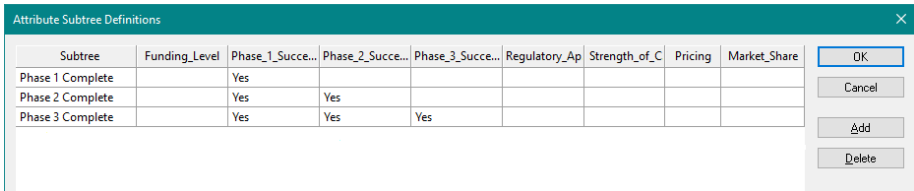
**Figure 6-13. Attribute Subtree Definitions dialog with Phase 1 Complete Subtree Defined**

You will add and define two more subtrees that assume success in Phase 2 and Phase 3.

- ⇒ Click the Add button to define a second subtree. DPL adds a second row to the table.
- ⇒ Name this Subtree: "Phase 2 Complete".
- ⇒ Within this second row, select the cell within the Phase\_1\_Success column and select the Yes outcome.
- ⇒ Repeat to select the Yes outcome for the cell within the Phase\_2\_Success column.
- ⇒ Click the Add button to define a third subtree. Name it: "Phase 3 Complete".

- ⇒ Define this subtree as the Yes outcome for the Phase\_1\_Success, Phase\_2\_Success, and Phase\_3\_Success events.

Your Attribute Subtree Definitions dialog should look like Figure 6-14.



**Figure 6-14. Attribute Subtree Definitions for Three Subtrees**

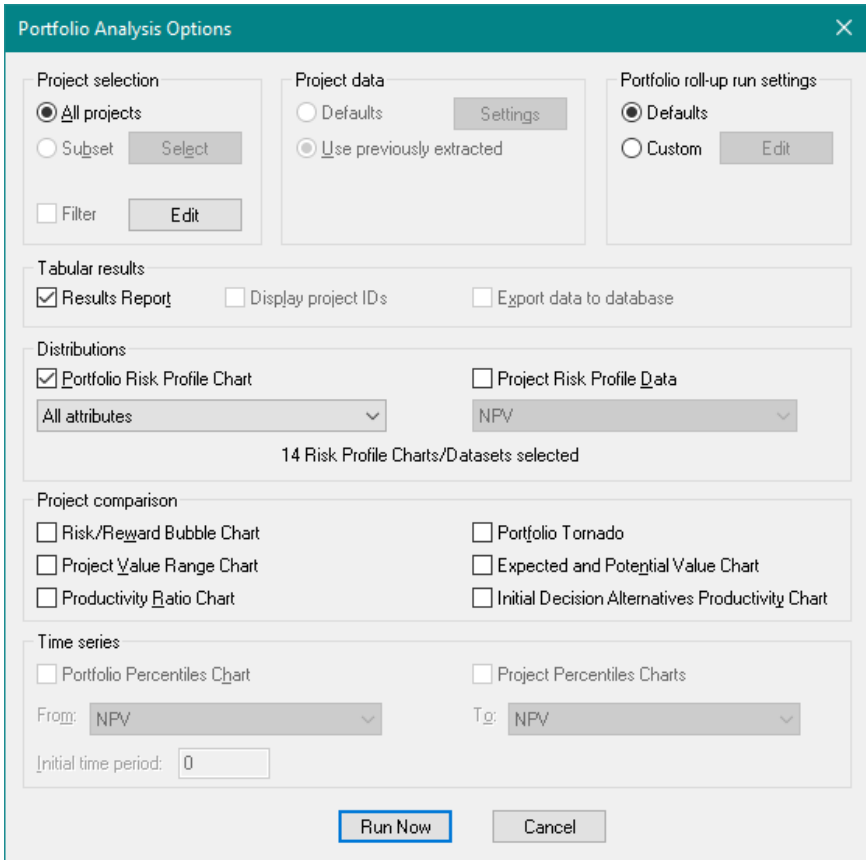
- ⇒ Click OK to close the dialog.

Now you need to tell DPL for which attributes you'd like to accumulate subtree results. In this example, you are only going to accumulate distributions of NPV for these subtrees.

- ⇒ Select the NPV (Objective) within the Attributes list box.
- ⇒ Check the box labeled Accumulate for subtrees.
- ⇒ Click OK to close the dialog.

You're now ready to run an analysis on the portfolio in order to view results for the defined subtrees. You'll compare the risk profiles for each subtree to the one generated from the current model, with all of the uncertainties uncontrolled. You'll first re-name the previously generated portfolio risk profile to save it for comparison.

- ⇒ Select the item for the "NPV (EV): Portfolio" risk profile chart in the Workspace Manager and press F2.
- ⇒ Rename it to be "All Uncertainties".
- ⇒ Click Portfolio | Run | Analyze (Options).
- ⇒ Within the *Tabular results* section Results Report should be checked.
- ⇒ Within the Distributions section, make sure Portfolio Risk Profile Chart is checked. Un-check Project Risk Profile Data.
- ⇒ Within the drop-down list beneath the Portfolio Risk Profile Chart, select All Attributes. You're telling DPL to generate a Risk Profile chart for all Attributes (which will include the subtrees you just defined).
- ⇒ Un-check all outputs within the *Project comparison* and *Time series* sections. Your Portfolio Analysis Options dialog should match Figure 6-15.



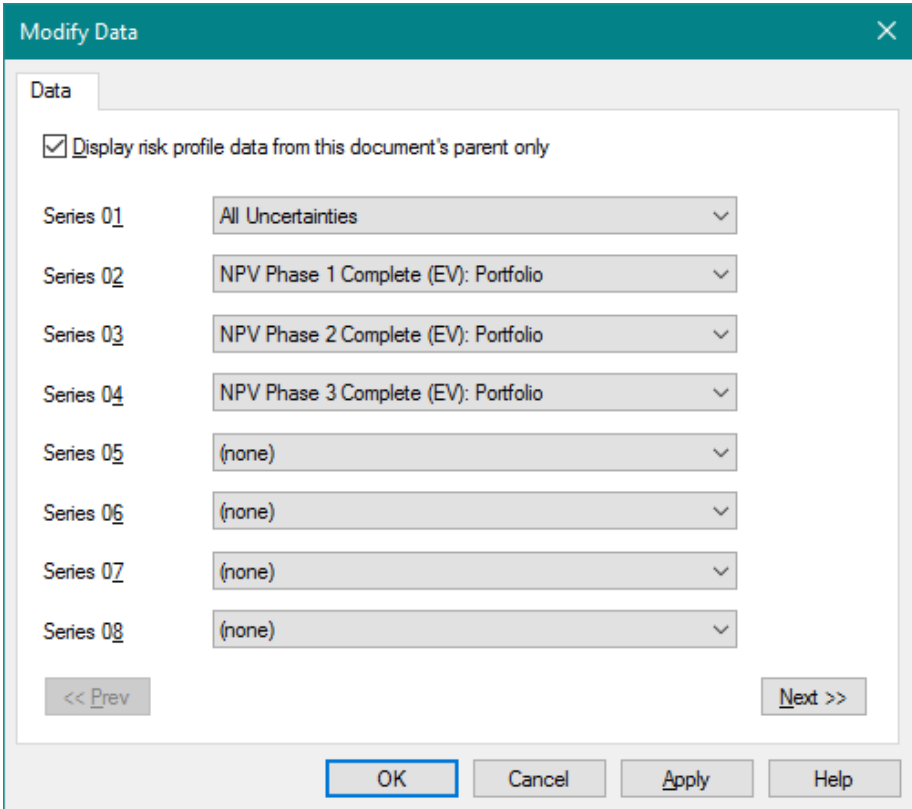
**Figure 6-15. Portfolio Analysis Options for Subtree Results**

- ⇒ Click the Run Now button. Click OK to the overwrite prompt (you've already saved the Risk Profile you wanted to retain for comparison).
- ⇒ Review the Portfolio Results1 table and Attribute Risk Profiles if you'd like. (DPL names the Results Report Portfolio Results by default; if a report of that name exists in the Workspace then DPL finds a unique name for the report.)

DPL allows you to display up to 32 risk profiles in a single chart window for comparison. You'll use this capability now to see how achieving success at each of the three phases affects the range of NPV for the overall Portfolio.

- ⇒ Activate the Risk Profile chart saved for the all uncertainties.
- ⇒ Select Chart | Series | Data | Modify. This will launch the Modify Data dialog with the All Uncertainties distribution already set for Series 01.

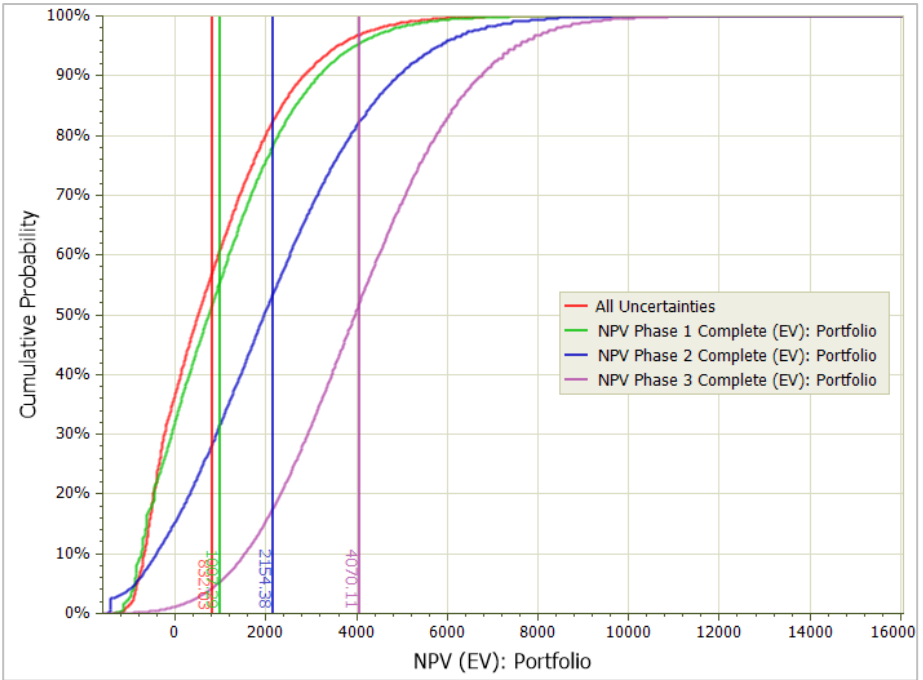
- ⇒ Drop-down the list for Series 02 and select NPV Phase 1 Complete (EV): Portfolio.
- ⇒ Set Series 03 and 04 to the NPV Phase 2 Complete and NPV Phase 3 Complete, respectively. Your Modify Data dialog should look like Figure 6-17.



**Figure 6-16. Modify Data dialog with All Uncertainties and Subtree Risk Profiles Selected**

- ⇒ Within the Chart | Format | Color group, un-check the Color Fill box.
- ⇒ If percentiles are turned on, remove them by un-checking the Percentiles box within the Chart | Series | Labels.
- ⇒ Within the Chart | Format | Legend group, check the Show, Centered, and Inside boxes.
- ⇒ Remove background shading by un-checking the Shading box within Chart | Format | Display.

⇒ Turn on gridlines (X and Y) by checking those boxes within the same group. The output should now look similar to Figure 6-17.



**Figure 6-17. Formatted Risk Profile Chart containing 4 Series**

You can see that as uncertainty is resolved the expected value of the portfolio increase. However, the range of outcomes from the 10<sup>th</sup> to the 90<sup>th</sup> percentile doesn't change dramatically until Phase 3 is complete.

In the next section of this chapter, you will see how to export portfolio results. Creating custom charts within DPL Portfolio is covered in the final section of this chapter.

## 7. Project Categorization

When running a Portfolio Analysis or a Data Report (see Chapter 8), you may find that you want to run the analysis or the report for only a subset of the projects in your portfolio. For example, you might want to analyze only projects that will reach the market during the next five years, only projects that will launch in a particular geographic region, or projects from a particular company division, etc.

The tutorial in this chapter demonstrates how to set up project category types and assign projects to categories within each category type. This tutorial also shows you how to run a Portfolio Analysis for a particular set of projects as selected by their category setting(s).

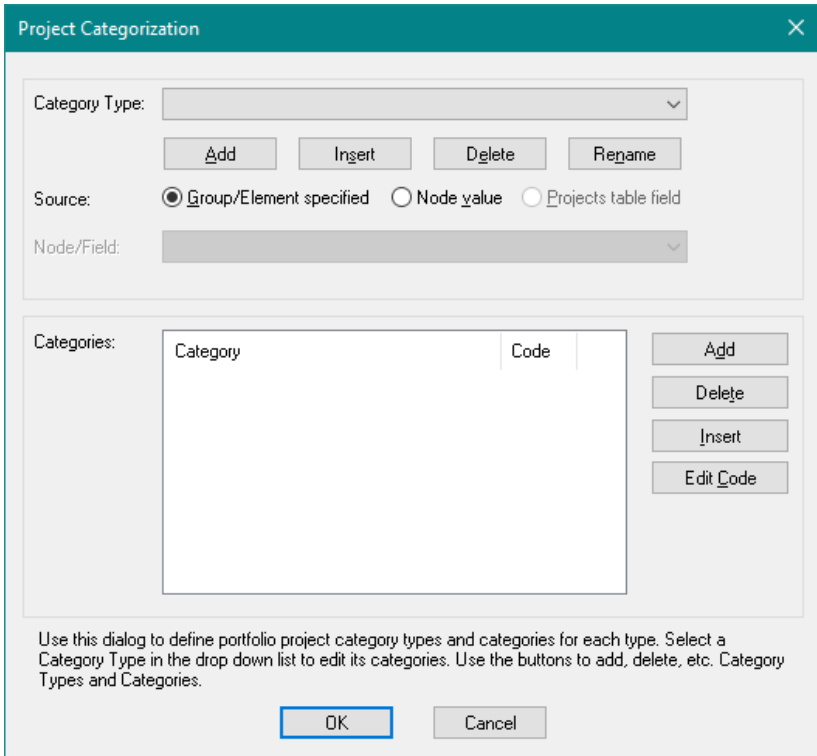
### 7.1 Defining Category Types and Categories

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A Category Type is simply a classification method. Examples of Category Types might include Market Region, Launch Timeframe, or Therapeutic Area. Examples of Categories within these Category Types might include U.S. or Asia (for Market Region); Next 5 Years or More than 5 Years Out (for Launch Timeframe); or Antibiotics, Neurology, Cardiovascular, etc. (for Therapeutic Area).

You will start with the Workspace you saved at the end of Chapter 6 and add two project category types to that portfolio.

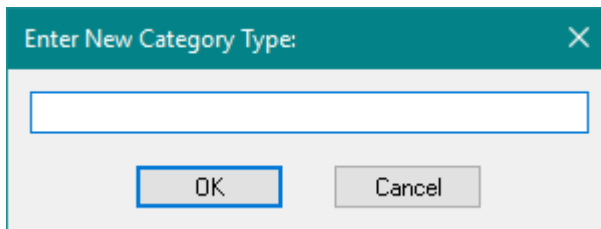
- ⇒ If necessary, start DPL.
- ⇒ Open the Workspace file you saved at the end of Chapter 6, if not already open. Or open the file Excel-Linked Metrics Done.da which is located within the Examples folder beneath where you installed DPL.
- ⇒ Click Portfolio | Definition | Categories. The Project Categorization dialog appears as in Figure 7-1.



**Figure 7-1. Project Categorization dialog**

You will use this dialog to create and modify category types and categories within those types.

- ⇒ Beneath the drop-down list for *Category Type*, click Add. The New Category Type dialog appears as in Figure 7-2.

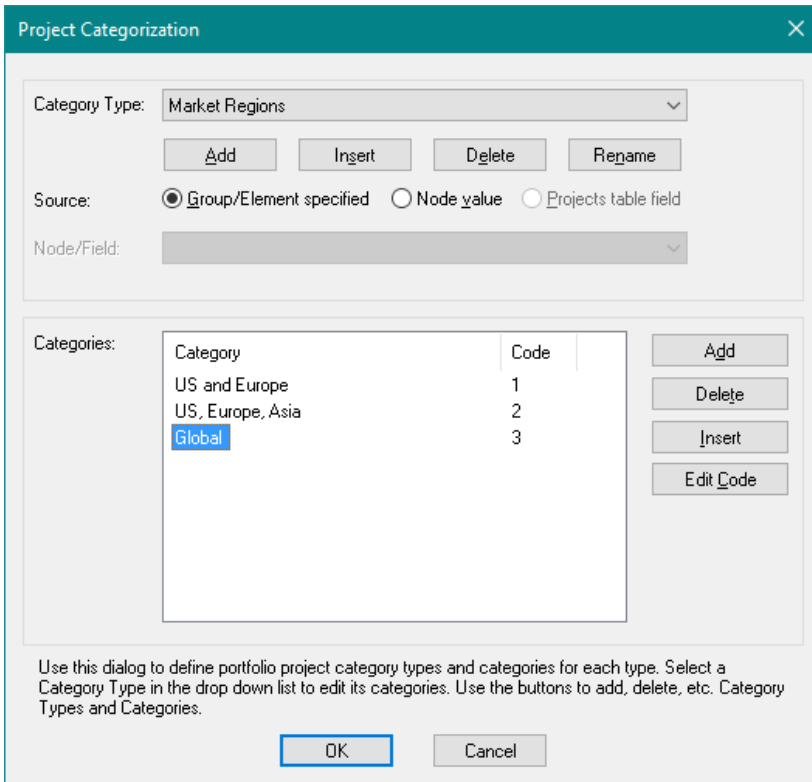


**Figure 7-2. Enter New Category Type dialog**

- ⇒ In the dialog, type "Market Regions" (no quotes).
- ⇒ Click OK.

- ⇒ Within the *Categories* section click the Add button that's located to the right of the list box.
- ⇒ DPL names the first category Category 1. With Category 1 highlighted, rename it to be "US and Europe" (no quotes) to rename it.
- ⇒ Press Enter.
- ⇒ Repeat this procedure to add two more categories. Rename them to "US, Europe, Asia" and "Global" (no quotes).

The dialog should now look like Figure 7-3.



**Figure 7-3. Categories Listed for Market Regions**

- ⇒ In the Category Type section, click Add again.
- ⇒ Name the second Category Type to be: "Therapeutic Area" (no quotes).
- ⇒ Click OK.



- ⇒ With the Therapeutic Area selected in the *Category Type* drop-down list, move to the *Categories* section again, clicking Add twice and naming the two categories "Vaccines" and "Other" (no quotes).
- ⇒ When you have finished setting up these two categories, click OK to close the dialog.

You have set up two project category types and their respective categories so that you can classify your projects. However, at this point DPL does not know which projects fall into which categories for either of the category types. In the next section, you will modify your portfolio so that the Market Regions categorization is determined by an initialization-linked value node.

Note: in setting up the above categories within each Category Type, you left the default code values at 1, 2, etc. See below for information on the Edit Code button.

- ⇒ Save your portfolio Workspace under a new name at this point.

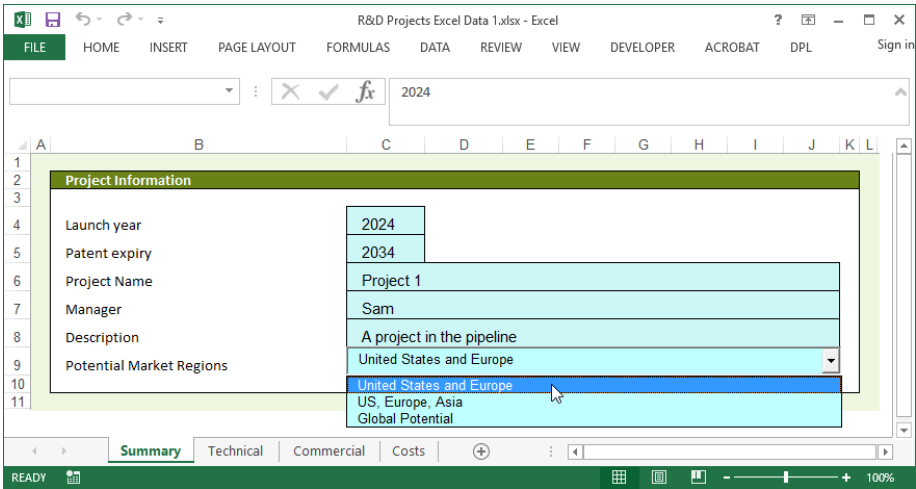
## 7.2 Influence Diagram-Sourced Category Types

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- ⇒ Switch to Excel or open it.
- ⇒ Open the initialization-linked spreadsheet you have examined several times in previous chapter tutorials: R&D Projects Excel Data 1.xlsx.
- ⇒ Click on the Summary tab.

As shown in Figure 7-4, the Summary worksheet contains several descriptive fields about the project. The last field on this worksheet is Potential Market Regions.

- ⇒ Click on the drop-down list for Potential Market Regions.



**Figure 7-4. Potential Market Regions Drop-down List**

You can see that the categories defined in this drop-down list are the same as the categories you just defined in DPL. This project is set to "United States and Europe." The drop-down list is a Combo Box control that is set up so that any of the three market regions can be selected. Depending on which is selected, the value in cell C9 is either one, two, or three. Cell C9 is also a named range called "regions".

Refer to your Microsoft Excel documentation for information about how to set up combo boxes and other controls. Note that this cell did not need to be a combo box in order to be used in DPL project categorization. Instead of having a combo box, this cell could simply be set to 1, 2, or 3 to indicate the Market Regions for the project. Cells that provide the data for a Category Type should be set up in such a way that the only valid values match the category codes for the Category Type.

⇒ Switch back to DPL and activate the Influence Diagram.

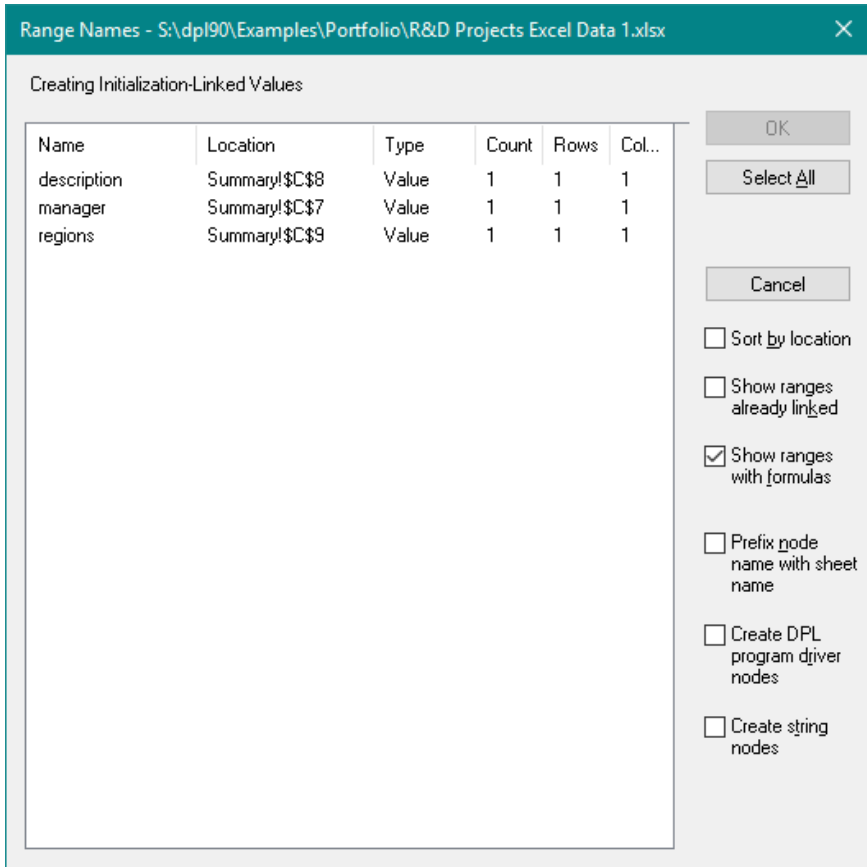
You will create an initialization-linked node for region linked to the initialization-linked spreadsheets.

⇒ Click Influence Diagram | Node | Linked Node | Excel Initialization-linked.

⇒ The spreadsheet selected should be R&D Projects Excel Data 1.xlsx. If not, use the drop-down list to select it.

⇒ Click OK.

The Range Names dialog appears as in Figure 7-5.



**Figure 7-5. Range Names Dialog for Project Categorization**

⇒ Select the named range "regions" in the Name column. Make sure Create string nodes is not checked, and click OK.

DPL creates the regions node off to the right in the Influence Diagram. You can move it if you like.

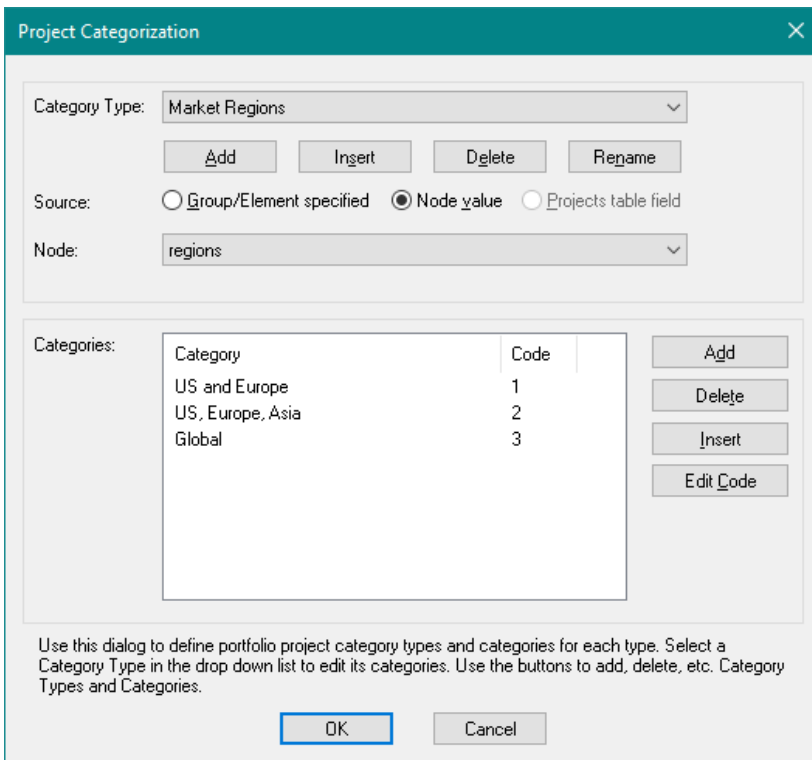
Note that the values for the regions will be imported as one, two, or three. The labels you saw in the drop-down list on the spreadsheet are not imported. This is why you used the Project Categorization dialog to create the labels for the three categories of Market Regions. Also, note that the labels you entered in the Project Categories dialog were not exactly the same as the labels used in the spreadsheet; there is no requirement that they be identical.

Finally, note that when you entered the categories in Project Categorization dialog, DPL automatically assigned codes of one, two, and three to them,

respectively. If you enter the categories in the same order as they were in the spreadsheet and the codes for the categories in Excel are consecutive integers starting with one, then you do not need to edit the codes. If the codes in Excel are not consecutive integers starting with one, then use the Edit Code button to edit the codes and specify any positive integer to match the codes used in Excel.

You will now tell DPL to use this new value node to provide the data for Market Regions.

- ⇒ Select Portfolio | Definition | Categories to open the Project Categorization dialog. Market Regions should be the selected for *Category type*.
- ⇒ Select the *Node value* radio button for the *Source*.
- ⇒ In the *Node* drop-down list, scroll down to select "regions" from the list. See Figure 7-6.



**Figure 7-6. Project Categorization with Source Specified for Market Regions**

⇒ Click OK.

You have finished specifying one Category Type so that it is sourced from a value node which is initialization-linked to a named range in the project data spreadsheets. Next you will categorize projects for the other Category Type using a different method.

## 7.3 Portfolio Definition-Based Category Types

---

An alternative to a Category Type's data being supplied by a value node (as it is for Market Regions) is to define Portfolio Groups and/or Elements aligned with project categorization and specify the category at either the Portfolio Group or Portfolio Element level. Recall that although the present example has only one Portfolio Group, you could have more than one Group in your portfolio. In this situation, you might want to assign each Portfolio Group to a different project category. Or you might want to assign project categories at the Element level. DPL allows you to use either or both of these methods.

In the steps below, you will first assign your entire Portfolio Group to a specific category for the Therapeutic Area category type. Then you will override this by re-assigning two projects at the Element level.

⇒ Select the Drug Dev Group item in the Workspace Manager and click Portfolio | Definition | Edit. The Edit Portfolio Group dialog appears as in Figure 7-7.

**Edit Portfolio Group** [X]

Title:

Model:

Project Categorization   
Therapeutic Area: Defined by element(s)

Initialization Links  
 None     DPL Program     Microsoft Excel     Database

Model ID:

Use value node data for project names    Value Node:

Use database field for project names    Field:

Numeric export table:

String export table:

Calculation Links  
 None     DPL Program     Microsoft Excel

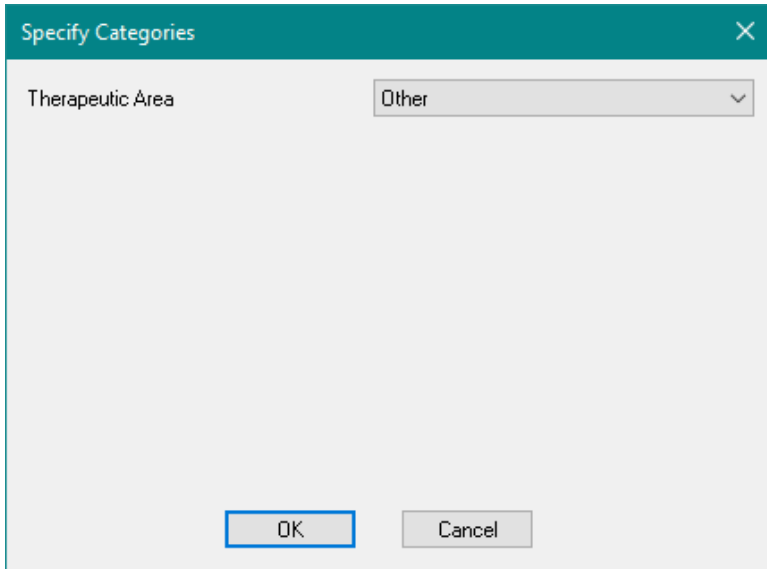
Excel links in one workbook

**Figure 7-7. Edit Portfolio Group dialog**

- ⇒ Note that the *Project Categorization* section says "Therapeutic Area: Defined by element(s)". Click the Edit button within this section. The Specify Categories dialog appears.
- ⇒ In the Specify Categories dialog, select Other within the drop-down list for *Therapeutic Area*.

The dialog should look like Figure 7-8.



**Figure 7-8. Specify Categories dialog with Other Selected**

⇒ Click OK.

The Edit Portfolio Group dialog now shows that all the projects represented by the Elements of this Portfolio Group are categorized as Other for Therapeutic Area.

Two of your four projects are actually Vaccines. You need override the Group level setting to specify two of the projects as Vaccines. You will do this by overriding the Portfolio Group categorization at the Element level.

⇒ Click OK to close the Edit Portfolio Group dialog.

⇒ Within the Workspace Manager, click on the "+" to expand the Drug Dev Group and display the Portfolio Elements, if necessary.

⇒ Double-click on Element 1 to edit it. The Edit Portfolio Element dialog appears as in Figure 7-9.

Element Name: Element 1

Select one from this set of projects       Aggregate this set of projects

Project Categorization

**Edit**

Therapeutic Area: Group Setting

Initialization Links

Spreadsheet(s): R&D Projects Excel Data 1.xlsx      Browse...

Calculation Links

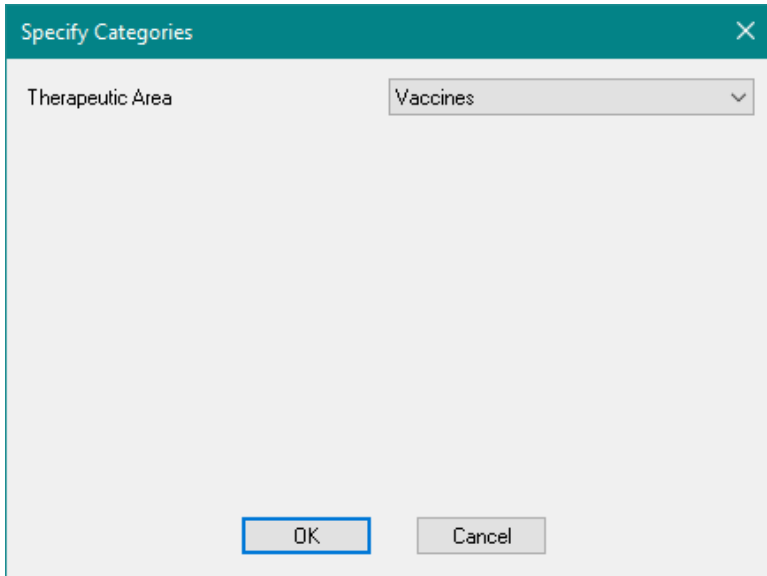
Spreadsheet: R&D Projects Excel NPV.xlsx      Browse...

OK      Cancel

**Figure 7-9. Edit Portfolio Element Dialog for Element 1**

- ⇒ Note that the *Project Categorization* section says "Therapeutic Area: Group Setting". Click on the Edit button within this section.
- ⇒ Note that within the Specify Category dialog the *Therapeutic Area* is set to (Use group setting), which as you know is Other. Change the setting to Vaccines. See Figure 7-10.





**Figure 7-10. Vaccine Category Override Specified for Element 1**

- ⇒ Click OK.
- ⇒ Click OK again to close the Edit Portfolio Element dialog.
- ⇒ Repeat the above steps for Element 4: edit Element 4 so that its Therapeutic Area is Vaccines, instead of (Use group setting).
- ⇒ Click OK to close all dialogs.

As you have seen, the Element-level project categorization can be set up so that it overrides the Group-level categorization. This tutorial was designed to illustrate how Element-level and Group-level categorization work. Instead of defining the categorization this way, you could have set all the categorizations at the Element level, and omitted the Group-level categorization.

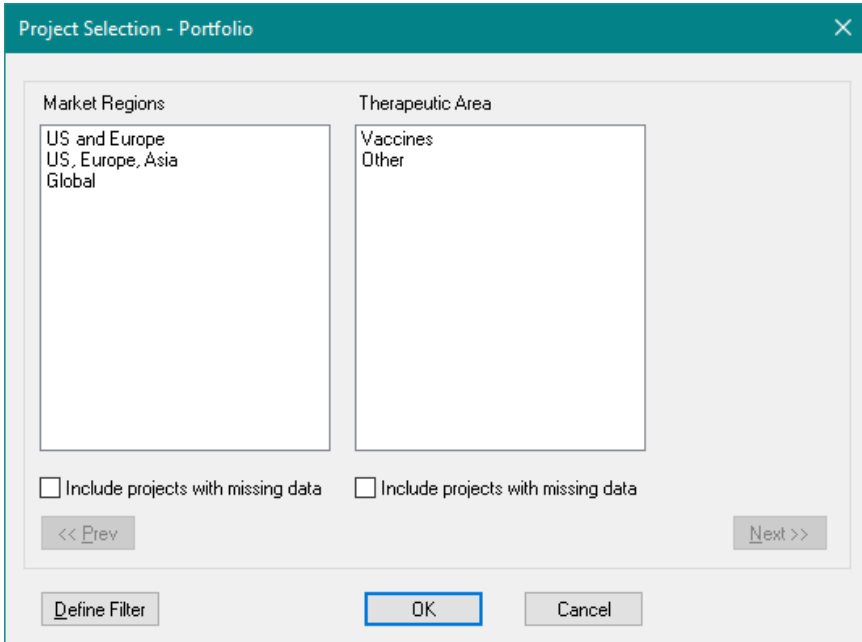
Note that in the Portfolio Group, Portfolio Element and Specify Categories dialogs only the non-value node-sourced Project Category Types appear. This is because you may only specify project categories via the portfolio definition for Category Types that are not sourced from Influence Diagram value node data.

Your project categorization is now fully specified for the portfolio. In the final section of this chapter, you will see how to use project categories in a Portfolio Analysis.

## 7.4 Selecting Projects by Category for Analysis

You will run two Portfolio Analyses using project category selection.

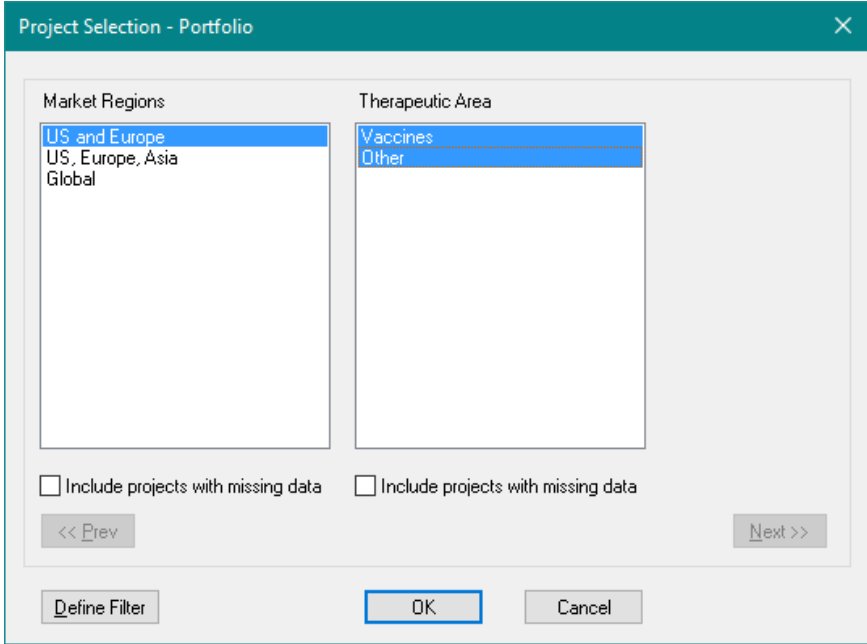
- ⇒ Click Portfolio | Project Selection | Criteria.
- ⇒ The Project Selection dialog appears as in Figure 7-11.



**Figure 7-11. Project Selection dialog**

- ⇒ In the Market Regions list, select US and Europe.
- ⇒ In the Therapeutic Area list, select both Vaccines and Other (use Ctrl+Click to select both).
- ⇒ Leave both of the *Include projects with missing data* checkboxes unchecked.

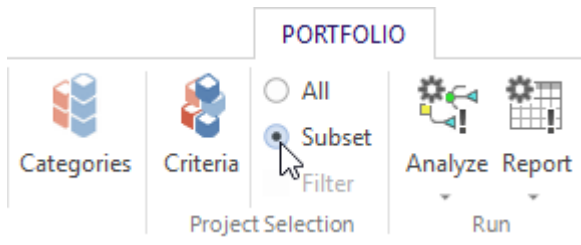
The dialog should now look like Figure 7-12.



**Figure 7-12. Project Selection Dialog with US and Europe Selected**

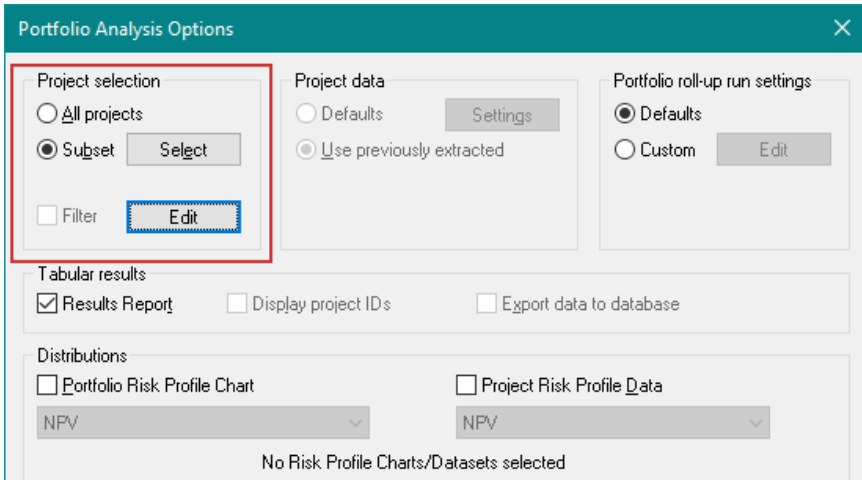
⇒ Click OK.

Now you have the choice of analyzing and generating outputs/reports for all of the projects in the portfolio or a subset of projects based on the settings specified in the Project Selection dialog. You can specify your selection directly on the ribbon via the All/Subset radio buttons within the Portfolio | Project Selection group as shown in Figure 7-13.



**Figure 7-13. All/Subset Radio Buttons within the Portfolio | Project Selection group**

If you use the Portfolio | Run | Analyze (Options) command you can specify All Projects/Subset within the *Project Selection* section of the Portfolio Analysis Options dialog as shown in Figure 7-14. The Select button within this section will open the Project Selection dialog. You're going to use the latter method.



**Figure 7-14. Subset specified within Project Selection section of Portfolio Analysis Options dialog**

- ⇒ Select Portfolio | Run | Analyze (Options). The Portfolio Analysis Options dialog will open.
- ⇒ Select the Subset radio button within the *Project selection* section as shown in Figure 7-14. With the Subset button selected DPL will select projects based on the settings in the Project Selection dialog for analysis.
- ⇒ Check Results Report and Portfolio Risk Profile Chart.
- ⇒ Un-check all other output options.
- ⇒ Click Run Now to run the analysis and generate the outputs for the subset of projects.

DPL opens each of the four initialization data files and checks their Project Categories. Only the projects whose data are stored in R&D Projects Excel Data 1.xlsx and R&D Projects Excel Data 2.xlsx qualify because they are designated US and Europe. DPL includes only these two projects in the portfolio and produces the results.

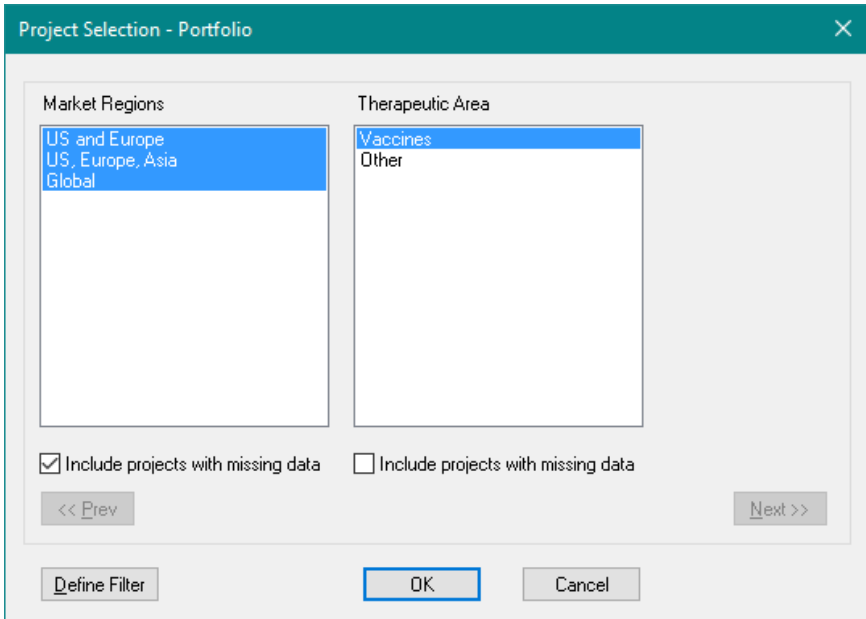
- ⇒ Examine the Portfolio Results Report.

⇒ If you like, examine the Portfolio Risk Profile Chart. The Risk Profile now is aggregated from only the two projects.

You will run one more analysis with a selection of projects by category.

- ⇒ Activate the model by double-clicking its item in the Workspace Manager.
- ⇒ Click Portfolio | Project Selection | Criteria.
- ⇒ This time, select all the Market Regions and also check the Include projects with missing data checkbox under Market Regions.
- ⇒ In the Therapeutic Area list, select only Vaccines. Do not check the Include projects with missing data checkbox.

The dialog should look like Figure 7-15.



**Figure 7-15. Project Selection Dialog with Vaccines Selected**

You are setting it up so that the analysis includes all projects that are in the Vaccines category (as you know, these are the projects whose data are contained in R&D Projects Excel Data 1.xlsx and R&D Projects Excel Data 4.xlsx). At the moment you do not care which Market Regions the projects are in, and in fact, you do not care if the Market Regions category data happens to be missing, so you check the Include projects with missing data checkbox.

⇒ Click OK to close the dialog.

You wish to generate the same outputs as before for a subset of the projects.

⇒ Therefore, select the Portfolio | Run | Analyze (Now) to bypass the Portfolio Analysis Options dialog and run the analysis immediately.

⇒ Examine the Portfolio Results Report and the Risk Profile Chart.

You can see that DPL included only two projects, the Vaccines, this time. You can see from the Risk Profile that developing vaccines is a risky business, and from the Results Report that the productivity ratio for the two-vaccine portfolio is only 0.29.

⇒ Save your Workspace for use in the next chapter's tutorials.

This chapter has shown you how to use Portfolio Categories in a very small portfolio. If you are analyzing large portfolios, it may become important for reporting or analysis purposes to break the portfolio into subsets by category. Sometimes project funding is allocated by corporate division, region, target market, etc.

## 8. Data Reports

A DPL Portfolio will often contain a substantial amount of data for each project in the portfolio. You may wish to produce and review summaries of this project data. You may also find that you need to review and modify your project data many times throughout the portfolio analysis process before finalizing the inputs. In addition, you may also wish to report on various "base case" calculated quantities to provide more insight into the portfolio. DPL Portfolio provides a Data Reports feature for reporting purposes.

Data Reports are tabular summaries of the data from a selection of Influence Diagram nodes for every selected project in the portfolio. The data displayed in a Data Report can include "raw" input data, including data that comes from initialization-linked spreadsheets, databases, or DPL Programs. The data can also include intermediate calculations that are specified in a value node in DPL, whether or not they are used for any other purpose in the model. Data summarized in Data Reports can also include final calculations, such as NPV.

Data Reports do not summarize expected values from a Portfolio Analysis run. Data Reports are a deterministic report. They produce output for either the set of default states for the events in a model or will enumerate the outputs for all conditioning state combinations.

You can vary the settings in a Data Report to indicate how to group and display results, depending on the characteristics of the node(s) you are reporting. However, a Data Report always consists of one or more tabular report(s) in which each row of the report corresponds to a single project (or an aggregated set of projects). Depending on the characteristics of the Data Report you construct, the result could be a report with multiple tabs (similar to a multiple-tab spreadsheet) or a single-tabbed report.

You can generate a Data Report for a subset of projects in the portfolio by using project category selection as discussed in Chapter 7.

The tutorials in this chapter show you how to generate a few types of Data Reports. When generating larger Data Reports or Data Reports that include intermediate calculations, you may find that it takes some time for DPL to communicate with Excel and import the intermediate calculations. DPL has a feature that allows you to convert a calculation-linked spreadsheet to a DPL program. This typically speeds up analysis and reporting by a factor of tenfold or more. In the last two sections of this chapter, you will convert your portfolio's calculation-linked cash flow spreadsheet to a DPL program

and practice using some of DPL's code syntax in order to create an intermediate value node that is a series from the DPL program. You will also run a Data Report on that series value node.

At the conclusion of this chapter, you will have completed the tutorial you have built consecutively beginning in Chapter 3. You will have the skills you need to build an Excel-linked portfolio in DPL, analyze that portfolio, report on various aspects of the portfolio, and convert the cash flow spreadsheet to a DPL program.

## 8.1 Creating a Simple Data Report

---

In this section, you will see how to generate a Data Report to summarize several nodes in your Influence Diagram. You will start with the file you saved at the end of Chapter 7.

- ⇒ Launch DPL if not already open.
- ⇒ Open the Workspace you saved at the end of Chapter 7.
- ⇒ Or open the file Excel-Linked Categories Done.da that has been provided for you in the \Examples folder underneath where you installed DPL.

You will be including all the Projects within the Portfolio in your Data Report:

- ⇒ Within the Portfolio | Project Selection group, ensure that the All radio button is selected.

You will create a Data Report for the following nodes in your Influence Diagram:

- All the chance nodes.
- All the value nodes that are not metric nodes and are not used only for project names or project categories.

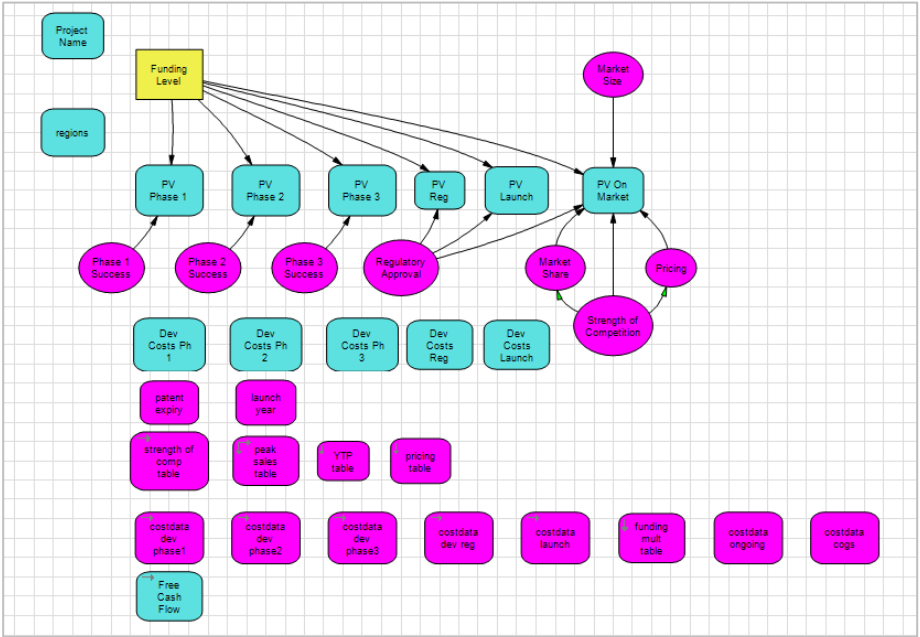
The easiest way to generate a Data Report is to first select the nodes you wish to report in the Influence Diagram.

- ⇒ Adjust the Influence Diagram pane (zoom in or out as needed; drag the splitter bar if needed) so that you can see all the nodes.
- ⇒ Select all the chance nodes in the diagram. Recall that you can use the Ctrl key while clicking on each node to select multiple nodes.



⇒ Also select the 14 value nodes that are not metric nodes and are not Project Name or regions. These nodes all contain data that is initialized from the project data spreadsheets and then exported to the NPV cash flow spreadsheet.

A total of 22 nodes should be selected as shown in Figure 8-1.



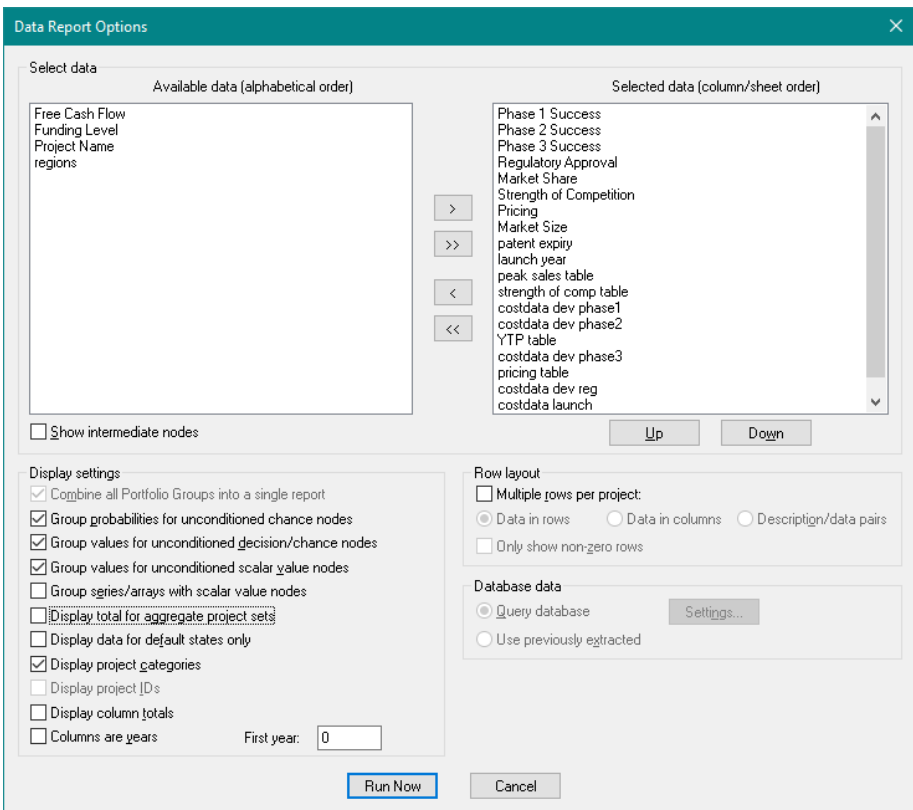
**Figure 8-1. 22 Nodes Selected for Data Reports**

⇒ With the nodes selected, click Portfolio | Run | Report (Options), which should be the default indicated. The Data Report Options dialog appears.

You can see that the dialog has moved all the nodes you just selected in the Influence Diagram to the *Selected data* list box. Those left un-selected in the Influence Diagram remain in the *Available data* list box. There are several settings to consider within the *Display settings* section of the dialog prior to running the report.

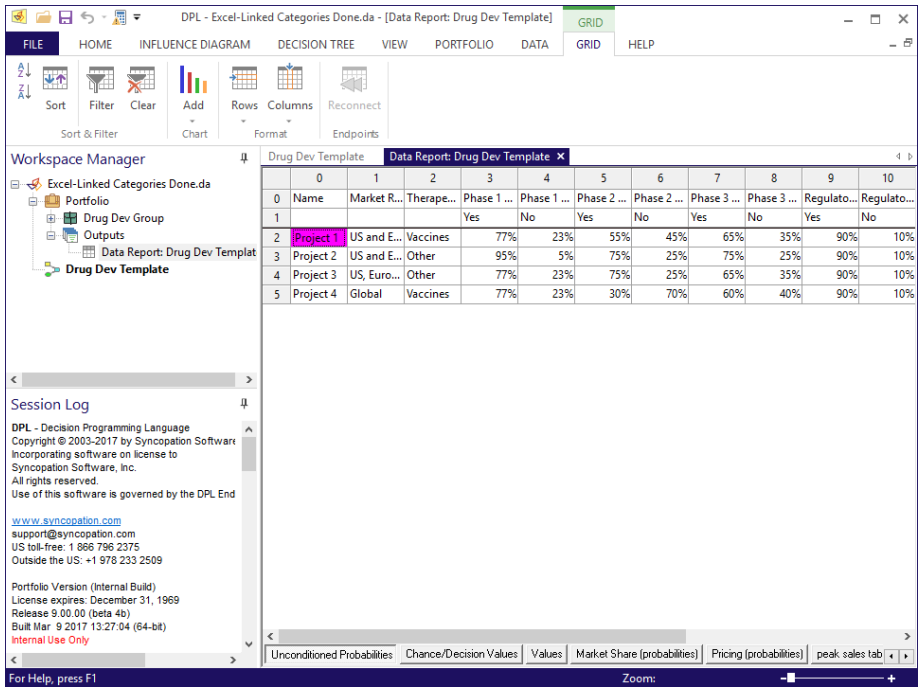
⇒ Make sure any checkboxes regarding unconditioned nodes are checked, or the 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> checkboxes listed. These settings tell DPL to put the data for unconditioned nodes on fewer sheets when possible.

- ⇒ Make sure to un-check Group series/arrays with scalar value nodes, Display total for aggregate project sets, and Display data for default states only. The latter option will be discussed in the next section.
- ⇒ Make sure Display Project Categories is checked.
- ⇒ Leave the Display column totals and Columns are years boxes unchecked.
- ⇒ Within the *Row layout* section, leave Multiple rows per project unchecked. The setting within the dialog should match Figure 8-2.



**Figure 8-2. Data Report Options dialog for 22 Nodes with Display Settings Specified**

⇒ Click Run Now. DPL generates the report. The first tab of the report, named Unconditioned Probabilities, is shown in Figure 8-3.



**Figure 8-3. Data Report for 22 Selected Nodes**

By un-checking Group series/array with scalar value nodes you told DPL to create a separate tab for each array value (e.g., strength of comp table, funding multi table, etc.). By checking Group values for unconditioned scalar nodes, all scalar nodes included in the report are included in one tab named "Values". Had you left the Group series/array with scalar values checked, all array values would have also been included in the Values tab. The end result is a report with a number of tabs in it. You will look at several of them now. Use the scroll bars or arrows to move left or right within a report tab. Use the arrow keys at the bottom right to move across tabs, or click on a tab to see it.

⇒ Look at the first tab named Unconditioned Probabilities (shown in Figure 8-3.)

This tab contains the probability data for all the unconditioned chance nodes (there are six).

⇒ Click on the Chance/Decision Values tab.

This tab contains the values data for each of the same six chance nodes (you did not select the decision node to be included in the Data Report). Note that it also contains the values data for the chance nodes Market Share and Pricing, because their values are not conditioned (only the probabilities are).

⇒ Click on the Values tab. It contains the data for the four unconditioned value nodes that are scalars.

The rest of the tabs in the report contain either:

- the data for a row or column vector value node, e.g., YTP table or costdata launch;
- the data for a two-dimensional value node, e.g. peak sales table, or
- the probability data for the conditioned chance nodes, Market Share and Pricing.

⇒ Click on the Market Share (probabilities) tab.

This tab contains all the probability data for Market Share, which is conditioned by Strength of Competition.

⇒ Click on the next tab, Pricing (probabilities).

This tab contains all the probability data for Pricing, which is also conditioned by Strength of Competition.

⇒ If necessary, click the right arrow key at the bottom right of the Data Report until you can see peak sales table tab. Click on this tab.

The peak sales table is two-dimensional. The input data is labeled according to the row (R0, etc.), and column (C0, etc.) of each data element. See Figure 8-4.

	0	1	2	3	4	5	6	7	8	9
0	Name	Market R...	Therape...	R0	R0	R0	R1	R1	R1	R2
1				C0	C1	C2	C0	C1	C2	C0
2	Project 1	US and E...	Vaccines	450	500	650	990	1100	1430	1300
3	Project 2	US and E...	Other	450	500	650	990	1100	1430	1300
4	Project 3	US, Euro...	Other	450	500	650	990	1100	1430	1300
5	Project 4	Global	Vaccines	1450	1500	1650	1990	2100	2430	1500

<
>

Values	Market Share (probabilities)	Pricing (probabilities)	peak sales table	strength of comp table	costdata dev pf
--------	------------------------------	-------------------------	------------------	------------------------	-----------------

**Figure 8-4. Data Report for Peak Sales Table**

⇒ Click on the funding mult table tab.

Funding mult table is a column vector with three rows, so the data are labeled in the Data Report as R0, R1, R2: the data for each row. See Figure 8-5.

	0	1	2	3	4	5
0	Name	Market R...	Therape...	R0	R1	R2
1	Project 1	US and E...	Vaccines	1.3	1	0
2	Project 2	US and E...	Other	1.3	1	0
3	Project 3	US, Euro...	Other	1.3	1	0
4	Project 4	Global	Vaccines	1.3	1	0

YTP table costdata dev phase3 pricing table costdata dev reg c ◀ ▶

**Figure 8-5. Data Report for Funding Mult Table**

You did not have to create any new nodes in the Influence Diagram in order to produce the Data Report of this section. In the next section, you will create a metric node to report a calculated value from the cash flow spreadsheet.

## 8.2 Creating a Node for Reporting Intermediate Calculations

---

- ⇒ Activate the Drug Dev Template model again and look at the Influence Diagram.
- ⇒ If the 22 nodes are still selected from your Data Report, click in whitespace to un-select them.

Recall that the metric nodes in your Influence Diagram include the net present values at each phase of development for each project. These nodes are called PV Phase 1, etc., up through PV On Market. In addition, there are import nodes for tracking development costs at each phase through launch. (Although you have not run a Data Report on these nodes, you could easily do so.)

Assume you want to know the total, undiscounted cost (not present value) of development for each of the projects in the portfolio if each project succeeds until launch. You will create a metric node in DPL and run a Data Report to get this information.

The named range you need for the DPL metric node has already been created for you in Excel.

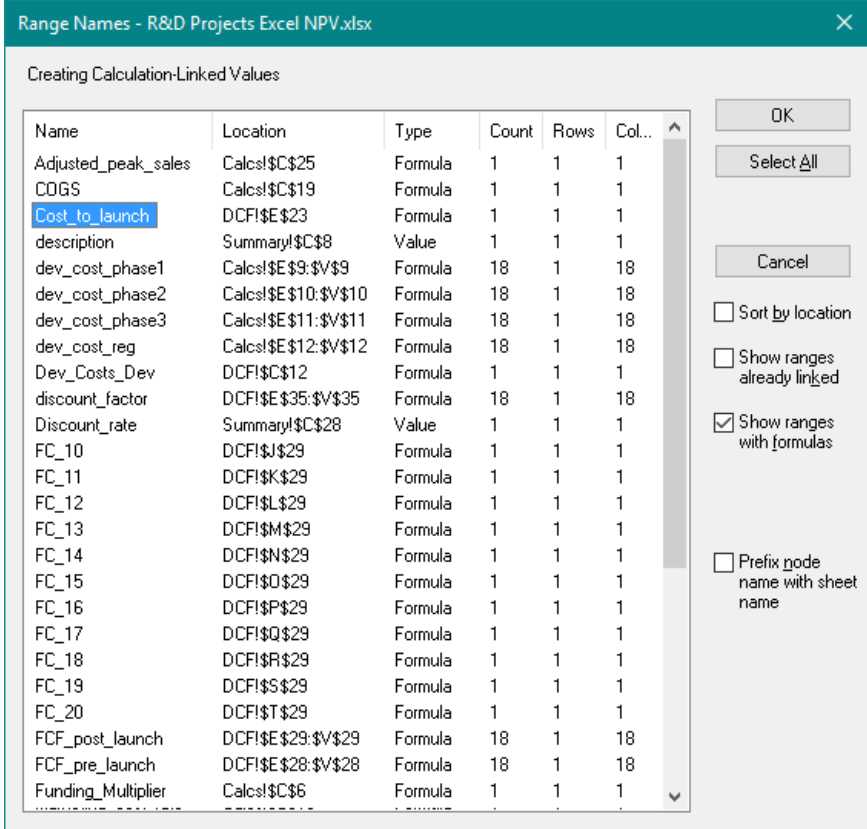
- ⇒ Switch to Excel and open the cash flow spreadsheet, R&D Projects Excel NPV.xlsx, if it is not already open.
- ⇒ Click on the DCF tab.
- ⇒ In the Costs section, find the label "Undiscounted total costs to launch". The named range is called "Cost\_to\_launch" and is cell E23 to the right of the label. This is the quantity you need. See Figure 8-6.

	A	B	C	D	E	F
13						
14		<b>Marketing costs</b>				
15		Launch costs	199	(199)	-	-
16		Ongoing expenditure (% of sales)			-	-
17		<b>Total</b>			-	-
18						
19		<b>Other costs</b>				
20		Manufacturing			-	-
21		<b>Total</b>			-	-
22						
23		<b>Undiscounted total costs to launch</b>			959	
24						
25		<b>Revenues</b>			-	-
26						
27		<b>Total Free Cash Flow</b>			(20)	(43)
28		Free cash flow through launch		(647)	(20)	(43)

**Figure 8-6. Undiscounted Total Cost to Launch Range**

- ⇒ Switch back to DPL.
- ⇒ Click Influence Diagram | Node | Linked Node | Excel Calculation-Linked.
- ⇒ Make sure the Spreadsheet Name is your cash flow spreadsheet, R&D Projects Excel NPV.xlsx; if not, use the drop-down list to select it.
- ⇒ Click OK.
- ⇒ Within the Range Names dialog select Cost\_to\_launch in the list as shown in Figure 8-7. Note that the range is a formula and it is a single scalar value.

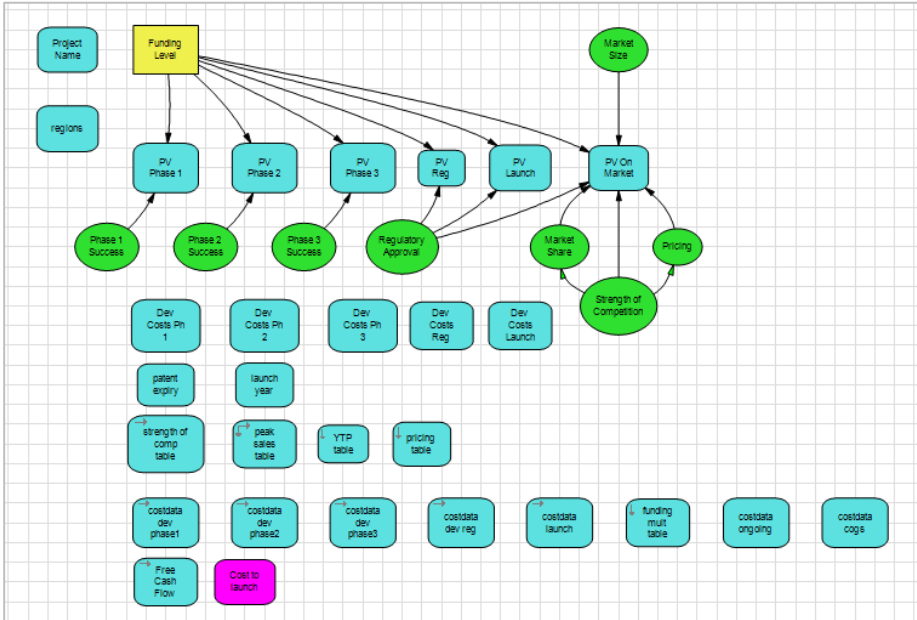




**Figure 8-7. Range Names Dialog with Cost\_to\_Launch Range Selected**

⇒ Click OK to create the node.

DPL creates the new import node off to the right. You can move it if you like. In Figure 8-8, the node has been moved to just to the right of the Free Cash Flow node.



**Figure 8-8. Influence Diagram with Cost to Launch Node Added**

You can now run a Data Report on this node.

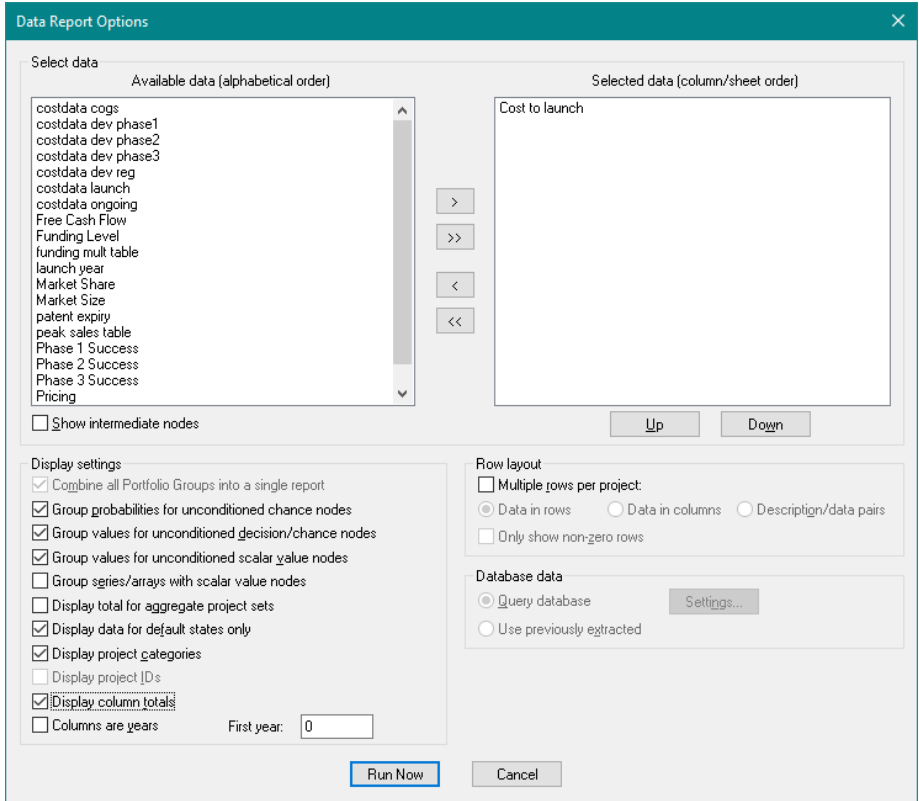
- ⇒ Select the new Cost to Success launch node.
- ⇒ Select Portfolio | Run | Report (Options).

The new node is shown in the *Selected data* list box. Note that Cost to launch is an intermediate node containing calculations, rather than a direct input. If you had not selected the node in the Influence Diagram prior to opening the Data Report Options dialog, you would have needed to check the Show intermediate nodes checkbox located just below the Available data list box. The Cost to launch node would then appear and would need to be selected and moved over to the *Selected data* list box using the right arrow button.

In addition to the Display options already selected from the previous analysis:

- ⇒ Check the Display data for default states only checkbox.
- ⇒ Check the Display column totals checkbox.

The dialog should look like Figure 8-9.



**Figure 8-9. Data Report Options dialog with Display Settings Specified**

When you ran a Data Report in the previous section, you left the "default states" checkbox un-checked. This was fine because the data you were reporting for the most part did not depend on the events in the model (though the probabilities of two of the chance nodes did depend on one other chance node). Now, you are reporting data that is calculated in the NPV spreadsheet using all of the inputs in the model; this data depends on all events in the model. When you check the "Default states only" checkbox, DPL sets the state of all events in the model to their default state for the Data Report and reports only the data for that single scenario (rather than for all combinations of event states that influence each data item).

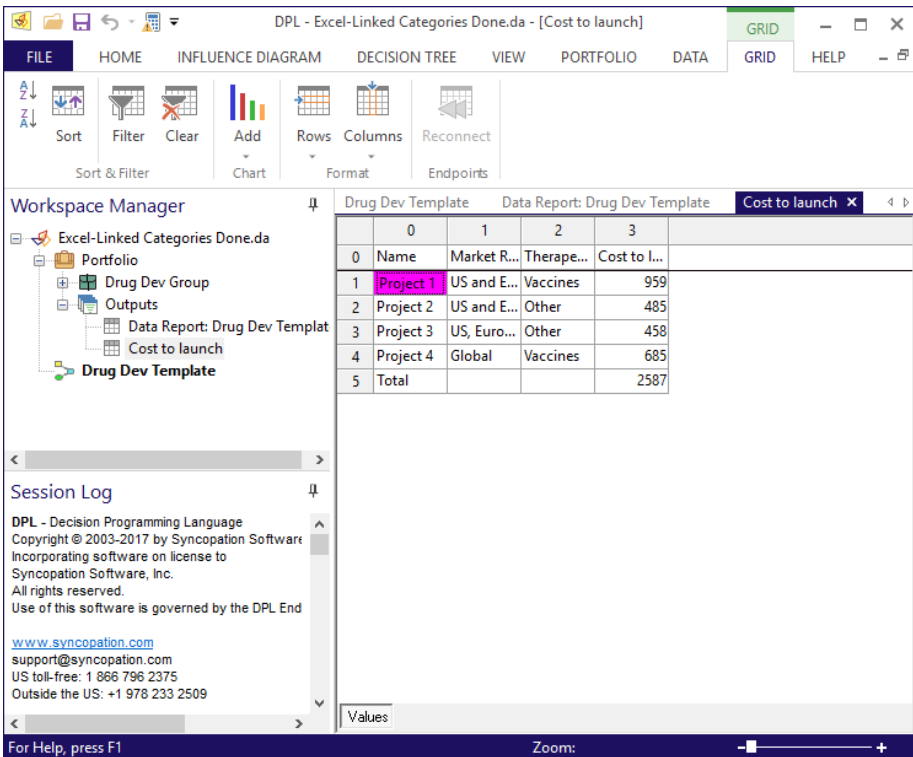
In this case, the default states are the Yes branches for each of the succeed/fail chance nodes that occur before launch, and the Nominal (middle) branches for the four commercial or post-launch chance nodes. Therefore, the node's value is being calculated assuming each project

succeeds through launch and then is in the "nominal" state of the world for the four commercial chance nodes.

If you had not checked the "default states only" checkbox, DPL would have created a Data Report showing the node's value for each possible combination of outcomes of events that influence the node, in this case for each endpoint on the decision tree.

⇒ Click Run Now to generate the Data Report.

The Data Report looks like Figure 8-10.



**Figure 8-10. Data Report for New Import Node**

DPL has calculated the quantities for the intermediate node you requested, and also computed the total cost for the four projects, which is about 2587.

Note: for your reference, an example file named Excel-Linked Data Reports Done.da that is the end result of the tutorial completed in this chapter has been provided within the Examples folder of your DPL installation directory. In the next section you can continue with your current file or use the Excel-Linked Data Reports Done.da example file provided.

## 8.3 Selecting Projects by Category for a Data Report

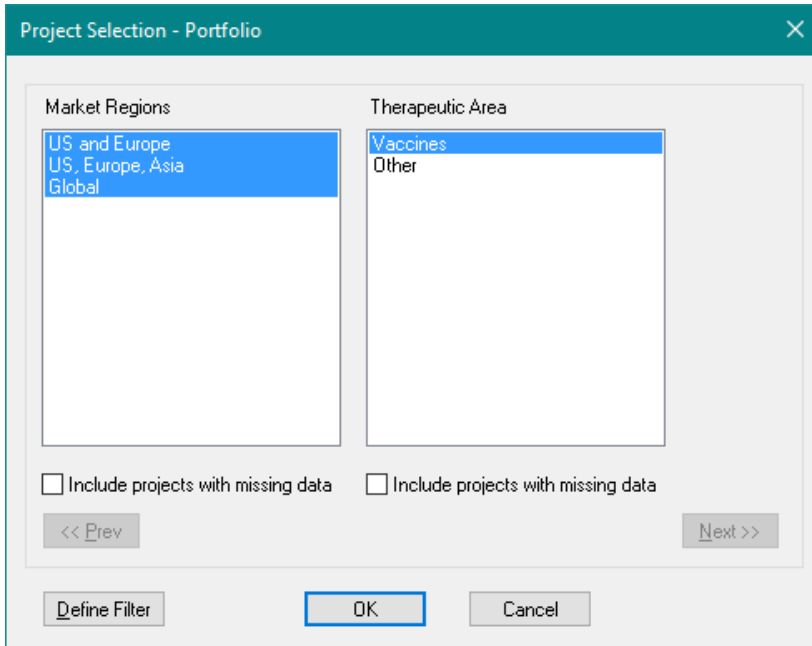
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In Chapter 7, you learned about Project Categorization and ran Portfolio Analyses for selected project categories. You can also create Data Reports by project category. The steps are very simple. First, however, notice that within the Workspace Manager the Data Report you created in Section 8.2 for a single node is named for the node, "Cost to launch", by default. While the Data Report you created in Section 8.1 for several nodes was provided a default name of "Data Report: Drug Dev Template". You will provide a more descriptive name for this report now.

- ⇒ In the Workspace Manager, select the Data Report: Drug Dev Template report item.
- ⇒ Press F2 to rename.
- ⇒ Rename the Data Report to "All Inputs All Projects".

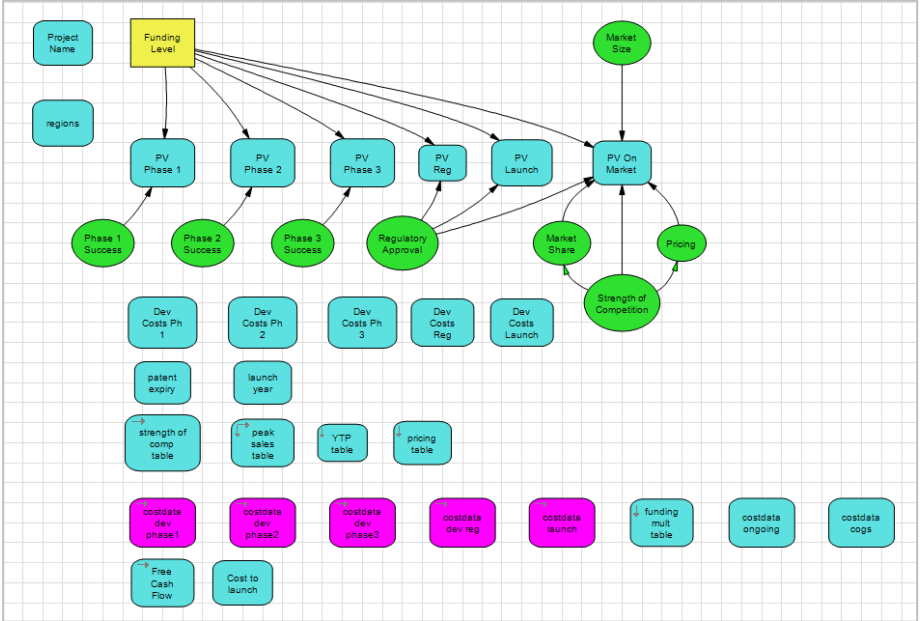
You'll leave the Cost to launch Data Report as it is. You have been asked to create a Data Report containing all the annual cost data for the Vaccines project category only.

- ⇒ Click Portfolio | Project Selection | Criteria.
- ⇒ In the Project Selection dialog, select all the Market Regions and Vaccines only for Therapeutic Area. See Figure 8-11.



**Figure 8-11. Project Selection dialog for Vaccines Only**

- ⇒ Click OK to close the Project Selection dialog.
- ⇒ On the ribbon, select the Portfolio | Project Selection | Subset radio button.
- ⇒ In the Influence Diagram, select the five value nodes that begin with costdata and are row vectors (the value nodes have arrows pointing to the right). See Figure 8-12.

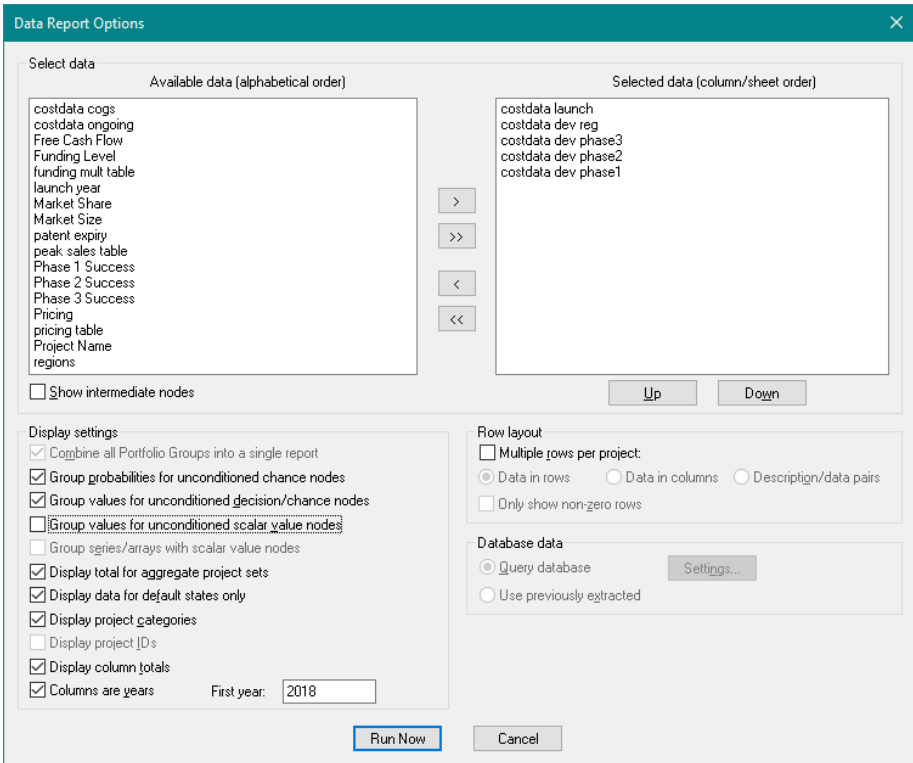


**Figure 8-12. Node Selections for Cost Data Report by Category**

- ⇒ Click Portfolio | Run| Report (Options).
- ⇒ Check all available checkboxes within the *Display settings* section with the exception of the Group values for unconditioned scalar value nodes setting.

Keeping this checkbox un-checked will result in each scalar value, or development phase, having its own tab, as opposed to all being contained in one table. Note when you un-check this box, the Group series/arrays with scalar value nodes became grayed out.

- ⇒ Make sure to check the Columns are years setting. To the right of this setting, in the *First year* edit box, type 2018. The dialog should look like Figure 8-13.



**Figure 8-13. Select Data Dialog for Cost Data Report by Category**

⇒ Click Run Now.

DPL generates the Data Report for the vaccines projects only.

⇒ Examine the Data Report tabs.

This time you told DPL that Columns are years and to Display column totals, so the Data Report labels the columns as years and includes totals for each column, i.e., each year. Before checking the Columns are years checkbox, you should make sure that columns really are years for all the row vector nodes in your Data Report, and you need to know what the first year is.

Each tab shows you the annual development costs for a particular development phase for each project and the total. You can quickly compare the schedules and amounts of development costs for these two Vaccines projects. The new data report has been provided a default name of "Data Report: <<Model Name>>".



- ⇒ Select the item for the Data Report you just created in the Workspace Manager and press F2 to rename it.
- ⇒ Rename it to be "Vaccine Annual Dev Costs".
- ⇒ Save your Workspace under a name of your choosing.

## 8.4 Additional Ways to Create Data Reports

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If you are creating a number of Data Reports for different nodes and for which you do not want to change other Data Report setting, select the nodes and click Portfolio | Run | Report (Now). DPL will immediately create a report for the nodes selected with the previously specified report options.

If you would like to base a new report off of an existing one, activate that report and select Portfolio | Run | Report (Options). The Select Data dialog will come up with the settings of the active report. You may modify and then click Run Now to create the report. You can optionally replace the original report with the new one by checking the Replace existing report checkbox. If you don't, then the new report is created and the one it's based off of remains in the Workspace.

Try each of the above techniques now if you would like.

In the next section, you will export the All Inputs All Projects Data Report that you created in Section 8.1.

## 8.5 Exporting Data Reports

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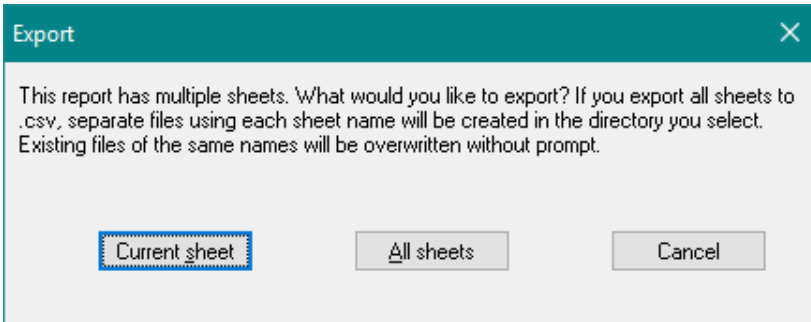
In Chapter 5, you exported Portfolio Analysis Results to .CSV files. You will do the same thing with a Data Report.

- ⇒ Activate the All Inputs All Projects Data Report you created and renamed earlier.

Recall that this Data Report has quite a few tabs. You want to save the report outside of DPL for analysis purposes.

- ⇒ Click the Export button in the Data | Export group and select Data from the drop-down list.

Since there are multiple sheets, DPL asks whether you'd like to export the Current Sheet or All Sheets. DPL also tells you that it will create separate files using the sheet name for each sheet in your Data Report. **Note: if files of the same name exist in the folder you choose, they will be overwritten without prompting.** See Figure 8-14.



**Figure 8-14. Export All Sheets Prompt**

- ⇒ Click All sheets.
- ⇒ Select a folder where you want to save the Data Report. Note that DPL will be saving several exported .CSV files to this folder, and that you will not need these files following this section of the tutorial. You may want to choose a temporary folder so that you can delete the files later. DPL suggests that you name the file Export1.csv. You do not need to change this; DPL ignores it when you are exporting all sheets.
- ⇒ Click Save.

DPL creates a .CSV file for each Data Report tab and saves it to the folder you selected. If you like, you can examine the files. You can also delete them, as you will not need them for the remainder of this tutorial.

## 8.6 Converting a Calculation-Linked Spreadsheet to a DPL™ Program

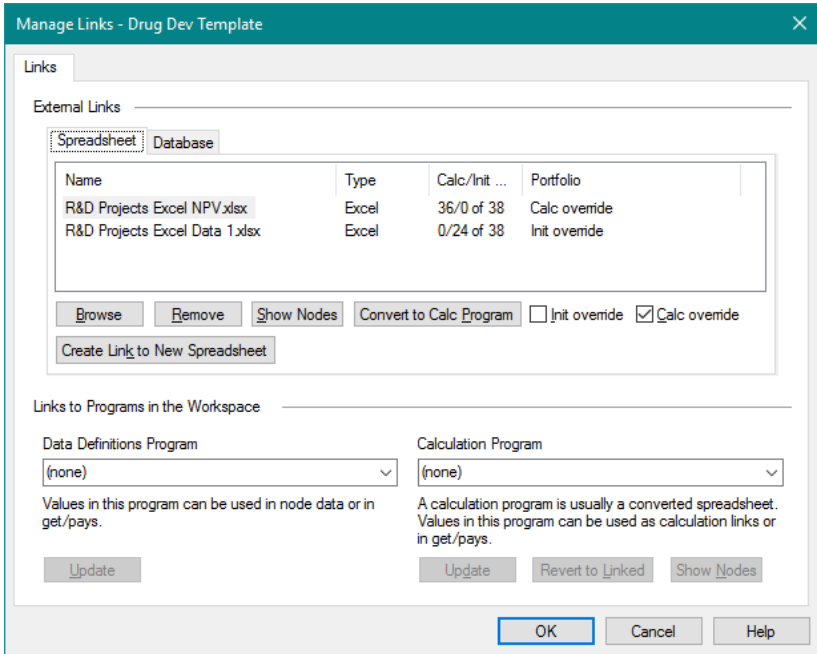
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So far in this chapter, you have seen how to create Data Reports to summarize inputs and calculations in your model across all projects in the portfolio. You have also created an import node for intermediate calculations and created a Data Report to summarize that node.

Data Reports and Portfolio Analyses can be run much more quickly if you convert a calculation-linked Excel cash flow spreadsheet to a DPL program. You will do that now. Note that converting linked spreadsheets to DPL programs is also covered in Chapter 16 of the *DPL 9 User Guide*. You may want to review that documentation as well.

⇒ Activate the model and click Influence Diagram | Links | Manage.

The Manage Links dialog appears as in Figure 8-15.



**Figure 8-15. Manage Links dialog**

The last time you looked at this dialog, there were fewer nodes linked to Excel. The dialog tells you that there are now 36 calculation-linked nodes and 24 initialization-linked nodes.

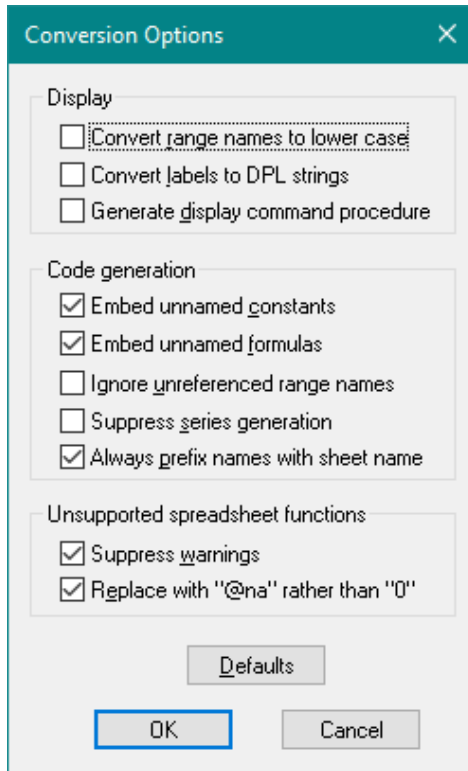
As you know, all of your Elements are linked to the same value model calculations spreadsheet, R&D Projects Excel NPV.xlsx. You will convert this spreadsheet to a DPL Program.

⇒ Within the spreadsheet list box select the R&D Projects Excel NPV.xlsx spreadsheet.

⇒ Click the Convert to Calc Program button.

The Convert Spreadsheet to Program dialog appears.

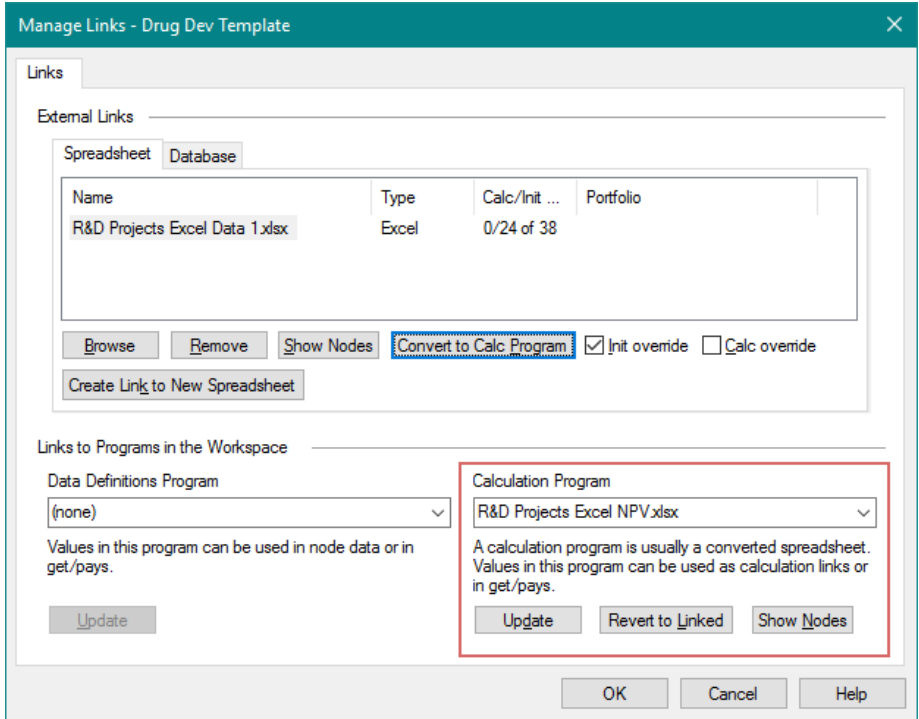
⇒ Click Options. See Figure 8-16.



**Figure 8-16. Conversion Options dialog**

- ⇒ The options in the dialog should be checked as shown in Figure 8-16. If they are not, click Defaults.
- ⇒ Click OK.
- ⇒ Click OK again to convert the spreadsheet to a program.

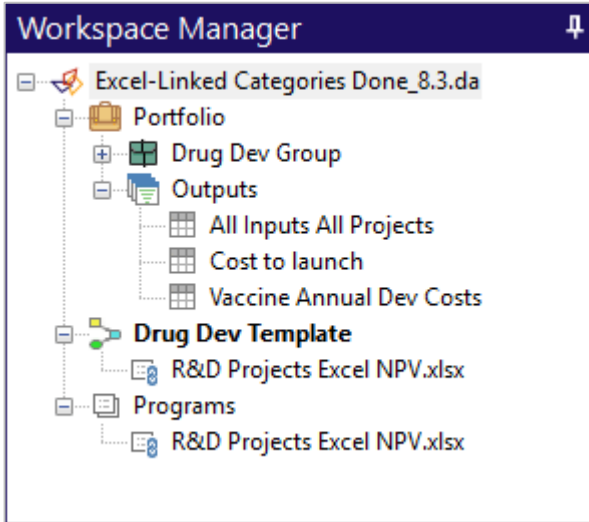
As shown in Figure 8-17, DPL converts the spreadsheet to a DPL calculation program of the same name. The spreadsheet's name is removed from the Spreadsheet list box, and it now appears in the *Calculation Program* section at the bottom right.



**Figure 8-17. Manage Links dialog with Converted Spreadsheet**

- ⇒ Click OK to close the Manage Links dialog.
- ⇒ Examine the Workspace Manager.

As shown in Figure 8-18, there is now a section for Programs in the Workspace Manager. DPL has added the converted program to this section. Also, the converted program appears as an item under the Drug Dev Template item. The program item appears under the item for the Drug Dev Template model because the program is linked to the model. In the process of converting the spreadsheet, DPL also changed the calculation links in the Influence Diagram to be DPL Program links rather than spreadsheet links.



**Figure 8-18. Workspace Manager with Converted DPL Program**

Now that you have converted the NPV spreadsheet to a Calculation Program, you need to modify the portfolio.

- ⇒ Select Drug Dev Group in the Workspace Manager and click Portfolio | Definition | Edit (or double-click the item in the Workspace Manager).

The Edit Portfolio Group dialog now appears as in Figure 8-19. Note the message in the Calculation Links section.

**Edit Portfolio Group**

Title:

Model:

Project Categorization

Therapeutic Area: Other

Initialization Links

None  DPL Program  Microsoft Excel  Database

Model ID:

Use value node data for project names Value Node

Use database field for project names Field:

Numeric export table:

String export table:

Calculation Links

None  DPL Program  Microsoft Excel

The model for this group has program calculation links defined in the influence diagram. You will need to either change the link type here or change the model links to spreadsheet calculation links before running the portfolio.

Excel links in one workbook

**Figure 8-19. Edit Portfolio Group Dialog with DPL Program Link**

- ⇒ Under the *Calculation Links* section, select the DPL Program radio button. The message will be removed.
- ⇒ Click OK. DPL shows a message telling you to edit the elements of the portfolio group.
- ⇒ Click Yes.
- ⇒ If necessary, expand the Drug Dev Group item in the Workspace Manager so you can see the four elements.

- ⇒ Double-click Element 1 to edit its calculation links.
- ⇒ In the drop-down list under *Calculation Links*, select R&D Projects Excel NPV.xlsx.
- ⇒ Click OK.

DPL asks if you would like to change all calculation links of other elements from the Excel spreadsheet to the new program. This is what you want to do.

- ⇒ Click Yes.

You have linked all the Calculation Links in your portfolio to the newly converted DPL Program. You can now run an analysis with the converted program to make sure it works.

- ⇒ In the Portfolio | Project Selection Group on the ribbon, select the All radio button so that all projects are included in the run.
- ⇒ Click Portfolio | Run | Analyze (Now) unless you wish to change output options.

DPL runs the analysis and produces the currently specified results, which should look identical to the Portfolio Analysis results you have produced previously.

In the final section of this chapter, you will create one more node for a Data Report. The method you will use is different from the method you used previously when your model had spreadsheet calculation links instead of DPL Program calculation links.

## 8.7 Creating a Series Value Node from a Calculation-Linked DPL™ Program

---

Your Workspace is now calculation-linked to a DPL Program and the process is slightly different for creating value nodes for reporting intermediate calculations via a Data Report. The linked DPL Program is now performing the calculations on your input data to generate results, so you need to add a DPL Program Calculation-linked node.

The node you will add contains the free cash flows for years following launch, i.e. cash flow including revenues, marketing and manufacturing costs but not development costs.



- ⇒ To see this range in the Excel spreadsheet, switch to Excel.
- ⇒ If it is not open, open the cash flow spreadsheet you converted to a DPL Program in the previous section: R&D Projects Excel NPV.xlsx.
- ⇒ In the DCF sheet, locate the named range FCF\_post\_launch. (Use the F5 key to Go to a named range.)

This range begins in 2018 and ends in 2035. It is in cells E29:V29 of the DCF sheet.

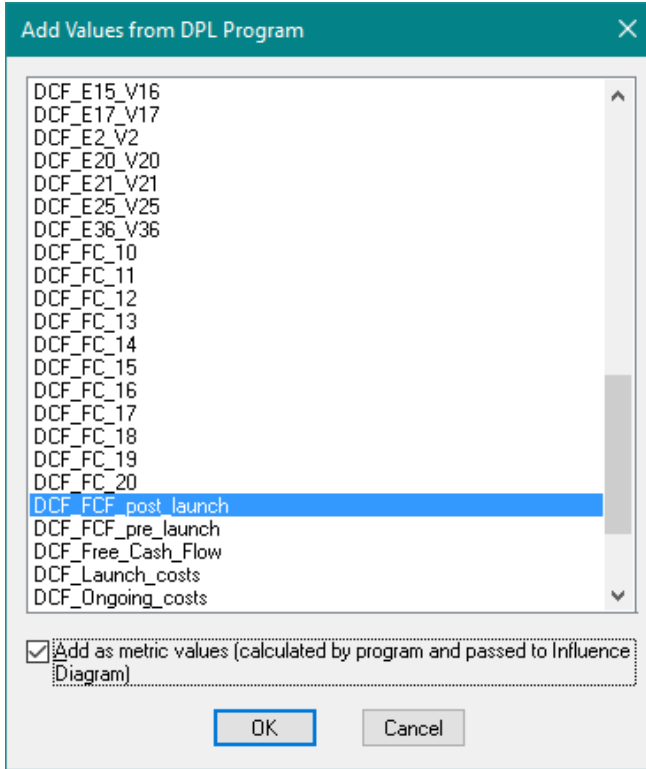
Now you will locate the same range in the DPL Program you created.

- ⇒ Close the file in Excel. You do not need to save changes if prompted.
- ⇒ Switch back to DPL.
- ⇒ Activate the DPL Program by double-clicking its item within the Workspace Manager. Like the spreadsheet it came from, it is called R&D Projects Excel NPV.xlsx.
- ⇒ Use the scroll up and scroll down arrows to look at the program.
- ⇒ Locate the line that begins "series DCF\_FCF\_post\_launch" near the bottom of the program. (If you like use Home | Edit | Find/Replace or Ctrl+F).

Note: the series is named DCF\_FCF\_post\_launch because in the conversion options dialog you told DPL to prefix all range names with sheet names. In Excel, the FCF\_post\_launch range was on the DCF sheet.

When DPL converts spreadsheets to programs, named, single row ranges are either converted to arrays or to series. You can see that DPL has created quite a few series in this program, including DCF\_FCF\_post\_launch. You want to create a value node that will import this series from the DPL program.

- ⇒ Switch back to the model "Drug Dev Template".
- ⇒ Click Influence Diagram | Node | Linked Node | DPL Program Calculation-Linked.
- ⇒ Select DCF\_FCF\_post\_launch from the list.
- ⇒ Check Add as metric values. (This node is calculated by the program and the data passed to the Influence Diagram). See Figure 8-20.



**Figure 8-20. Add Values from Program Dialog**

⇒ Click OK to close the Add Values from Program dialog.

DPL places the node off to the right of the existing Influence Diagram nodes. You will now run a Data Report on this series value node.

⇒ Zoom Full so you can see the new node.

⇒ Select it.

⇒ Be sure that the All radio button is selected within the Portfolio | Project Selection group.

⇒ Select Portfolio | Report | Run (Now).

DPL immediately runs the Data Report.

⇒ Scroll to the right to see some non-zero data. See Figure 8-21.

0	1	2	9	10	11	12	13	14	15	16	17	18	19
Name	Market R...	Therape...	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
1	Project 1	US and E... Vaccines	97.4	194.9	292.3	389.7	487.1	584.6	682	682	682	682	682
2	Project 2	US and E... Other	0	106.9	213.7	320.6	427.4	534.3	641.1	748	748	748	0
3	Project 3	US, Europ... Other	0	0	110	220	330	440	550	660	770	770	770
4	Project 4	Global Vaccines	0	0	0	201	402	603	804	1005	1206	1407	1407
5	Total		97.4	301.7	616	1131.3	1646.6	2161.9	2677.1	3095	3406	3607	2859

**Figure 8-21. Data Report on DCF FCF Post Launch Node**

You can see that there are no post-launch cash flows until 2024, because this is the earliest launch year of all the projects.

Recall that the "default states only" checkbox in the Select Data dialog was checked previously. DPL has set all events to their default states for purposes of the Data Report. This means that these are the post-launch cash flows if each chance node is set to the Yes state (for success/failure nodes) or the Nominal state (for post-launch nodes). This is essentially a report of the "base case" cash flows if all projects are launched. Note that these are not the same as the expected values of the cash flows (which would need to be obtained using a Portfolio Analysis rather than a Data Report).

- ⇒ Scroll right to see how the post-launch cash flows change over time assuming the default event state settings.
- ⇒ Save your Workspace.

For your reference, an example file named Excel-Linked Data Reports Converted Done.da that is the end result of the tutorials completed in this chapter has been provided within the Examples folder of your DPL installation directory. This completes the tutorial you have built consecutively beginning in Chapter 3. You should also review Chapter 9 (which contains a separate tutorial) if you will be linking your portfolio to a database.

Chapter 10 contains an additional separate tutorial which is intended for DPL Portfolio users who wish to set up a program-linked portfolio for both calculation links and initialization links.

Chapter 11 provides information on Portfolio Global Drivers and on handling dependencies in portfolios.

## 9. Database-Linked Portfolios

This chapter introduces you to the process of designing and configuring a database-linked portfolio in DPL. As mentioned in Chapter 2, a database-linked portfolio is a portfolio for which the input data for each project in the portfolio is stored in an external database. The portfolio is, therefore, initialization-linked to a database. The portfolio can be calculation-linked to a spreadsheet or to a DPL Program (which is usually a program converted from a spreadsheet).

Storing portfolio and project data in a central database takes some extra initial effort and may require the help from a corporate database administrator or other IT specialist, but it also has a number of significant advantages. Storing data centrally helps ensure consistency in the data and reduces duplication of effort. It allows multiple users to access and update the data without conflict, and it also facilitates "revision tracking," or storage of how revisions of the data have changed over time.

The tutorial in this chapter begins with a small portfolio that has already been set up with database links. The process of using database links in DPL is covered in Chapter 17 of the *DPL User Guide*. If you have not previously linked a database to DPL, you may wish to review that chapter before continuing with this chapter. You will need to refer to the *DPL User Guide* in the next section.

### 9.1 Designing Database-Linked Portfolios

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A portfolio analysis system that stores its data in a database will likely consist of three separate components. A typical portfolio analysis system would include:

- 1) a data entry template,
- 2) a database to store the data, and
- 3) DPL Portfolio to conduct analyses and do reporting.

The data entry template may be a custom application designed to collect the project-level and portfolio-wide data needed to support the process. The application would be designed to read data from the database and store data to it. Alternatively, the data entry template may be an Excel

spreadsheet with supporting macros and/or routines to transfer data to and from the database.

The database may be any database for which you can configure a Windows ODBC Data Source. More information on configuring an ODBC Data Source is provided in Section 17.2 of the *DPL User Guide* and is referred to below.

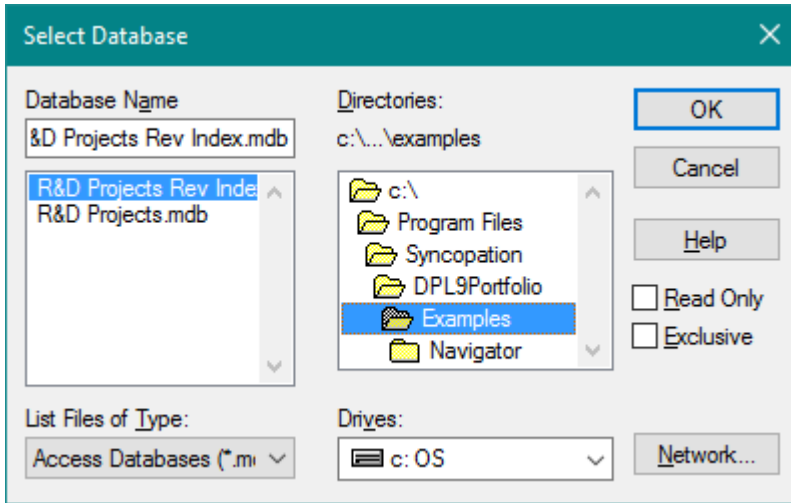
When you store your portfolio data in a database, you will likely do your value model calculations for the portfolio with either a spreadsheet or DPL Program. The example portfolio in this chapter is database initialization-linked and DPL Program calculation-linked. The DPL Program is a converted Excel spreadsheet.

The first step in this chapter's tutorial is to configure your system to access the example database provided with this tutorial: R&D Projects Rev Index.mdb, a Microsoft Access database.

⇒ If you haven't done so earlier, please locate and refer to Section 17.2 of the *DPL User Guide* (which was provided with your DPL 9 Portfolio license).

Section 17.2 of the *DPL User Guide* shows you how to set up an ODBC Data Source for the database you are linking to DPL. If you completed the tutorial in that section, you should have one ODBC Data Source for the Microsoft Access database R&D Projects.mdb set up. For this Portfolio tutorial, you will follow the same steps to set up an ODBC Data Source for R&D Projects Rev Index.mdb.

- ⇒ Follow the steps in Section 17.2 of the *DPL User Guide*, and create another new Data Source of the type Microsoft Access Driver (\*.mdb).
- ⇒ Name the Data Source "R&D Projects Portfolio". (See Figure 17-5 in the *User Guide*).
- ⇒ With the *Database* section click Select...
- ⇒ Within the Select Database dialog, browse to the Examples folder below where you installed DPL Portfolio. Select R&D Projects Rev Index.mdb for the Database Name (Figure 9-1).



**Figure 9-1. Select Database dialog with R&D Projects Rev Index.mdb Selected**

If you have Microsoft Access, you should be able to examine the example database directly, as in Section 17.3 of the *DPL User Guide*. If you do not have Access (or another database program that can open and display .mdb files), the remainder of this tutorial will still work, but you will not be able to see your database tables or exported results easily.

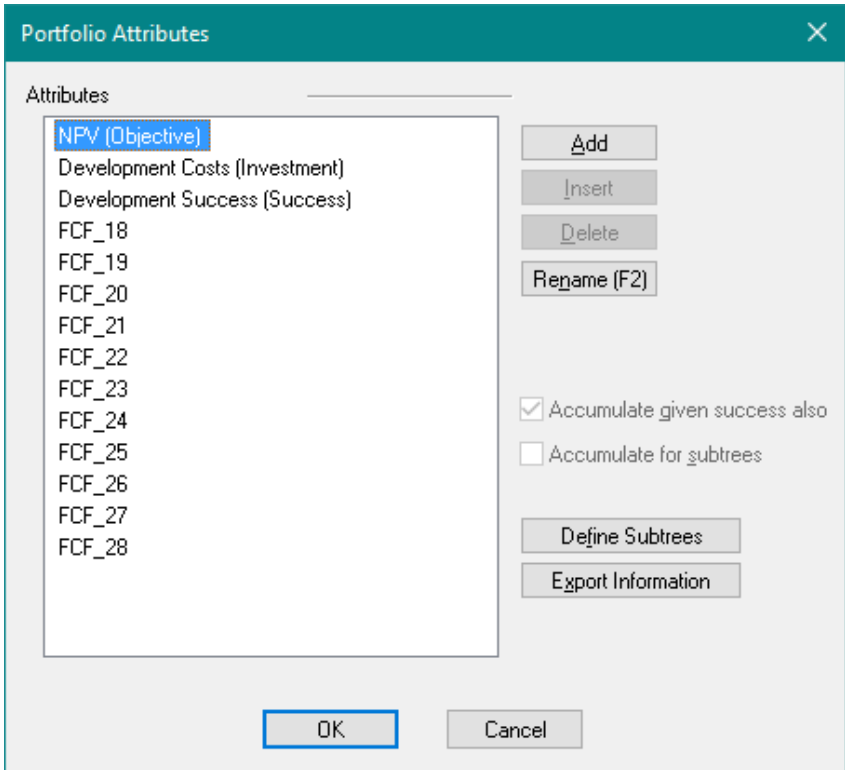
You are ready to open the Workspace file for this tutorial.

- ⇒ Start DPL Portfolio.
- ⇒ Open the Workspace called DB-Linked Portfolio Ready.da and examine the Workspace.

This Workspace has one model that is essentially the same as the drug development example you used in Chapters 3 through 8 of this manual. However, as you proceed through the tutorial, you will notice that the underlying data stored in the database is different from the example data used in Chapters 3 through 8.

When you first open this Workspace, you may also notice that the Portfolio has not been fully set up yet. You will define the Portfolio in the next section. The Portfolio Attributes have been defined for you.

- ⇒ Click Portfolio | Definition | Attributes. See Figure 9-2.



**Figure 9-2. Portfolio Attributes for Drug Development Model**

The Portfolio Attributes include the three required attributes, the two derived attributes, and eleven attributes called FCF\_18 through FCF\_28. These eleven attributes represent the post-launch cash flows in years 2018 through 2028.

⇒ Click Cancel without changing the Portfolio Attributes.

The model in the Workspace has had the Portfolio Model indicator set within the Portfolio | Definition group and the get/pay expressions in the Decision Tree have been edited to correspond to the Portfolio Attributes.

The model in the Workspace is calculation-linked to a DPL Program, R&D Projects Excel NPV.xlsx that was converted from the cash flow spreadsheet of the same name. This spreadsheet program is the same as the one converted and used within the tutorials in Sections 8.6 and 8.7 of this manual.

For the tutorial in this chapter, you will not need to re-convert or otherwise make any changes to the calculation-linked DPL Program. Detailed

information about creating program-linked portfolios (including both initialization-linked and calculation-linked DPL Programs) is provided in Chapter 10 of this manual.

## 9.2 The Database Specification Dialog

In this section you will examine the Database Specification dialog, which has been partially set up for you.

⇒ Select Data | Database | Set Up. The Database Specification Dialog appears as in Figure 9-3.

The screenshot shows the 'Database Specification' dialog box with the following settings:

- Data Source:** Login: [ ], Password: [ ], Source: R&D Projects Portfolio, Driver Type: Access, Schema: [ ].
- Field Names:** Model ID field: ModelID, Project ID field: ProjectID, Node ID field: NodeID, Dimensions field: Dims, Rows field: Rows, Columns field: Cols, Data fields prefix: Data\_, String fields prefix: Str\_, Revision ID field: RevisionID, Revision Date field: RevisionDate.
- Data Export:** Record ID field: [ ], Record ID value provided by: Auto-increment/identity (selected), Run date field: [ ], Category fields prefix: [ ].
- Projects Table:** Table: [ ], Description: Table which stores project information that may be used in Project Categorization or to filter projects in a Portfolio Analysis run.
- Review Index:** Review Period field: [ ], Review Tag field: [ ], Description: Note: if Review Index table is not specified, then Review Period and Review Tag fields must appear in each data table in the database.

**Figure 9-3. Database Specifications for R&D Projects Portfolio**

The Source has been set to R&D Projects Portfolio, which is what you want. Within the Field Names section, each field is set to the standard default. If you were setting up your own database, you may need to



change the required field names to be something other than the defaults. Section 17.4 of the *DPL User Guide* also discusses the Database Specification dialog and field names.

Note that on the right-hand side of the *Data Source* section, the *Database configured for revision tracking* checkbox is checked. In the *Field Names* section, you see that the Revision ID field and the Revision Date field are set accordingly. Also note that the *Configured with review index* checkbox is not checked. See Section 17.7 of the *DPL User Guide* for more information on Revision Tracking. Revision Tracking is not required with database-linked portfolios, but it is usually recommended. More information on using previous revisions and a review index is also provided in Section 9.7 of this chapter.

You do not need a Login or a Password for this example database (although in a real database, you might). Some databases require a Schema to further specify which tables and objects within the database you can access; this example database does not.

The database is also not yet set up for Analysis Results Export. Exporting results is covered later in Section 9.5 of this chapter.

⇒ Click OK to close the dialog without making any changes.

## 9.3 Loading Database Schema

---

At this point, your DPL model is set up to link to the R&D Projects Portfolio database but you have not loaded the database schema information. A database schema describes the structure of the database in terms of the tables, views and queries in it; the fields within tables, etc.; and other relationships. A number of actions within DPL such as extracting data from the database (via a Portfolio Analysis, Data Report or explicitly), editing a database-linked node or editing a Portfolio Group, require that DPL know the current structure of the database. If this schema information is not loaded, DPL will either prompt you to load it when it needs it (e.g., when editing a Portfolio Group) or load it without prompting (e.g., when extracting data).

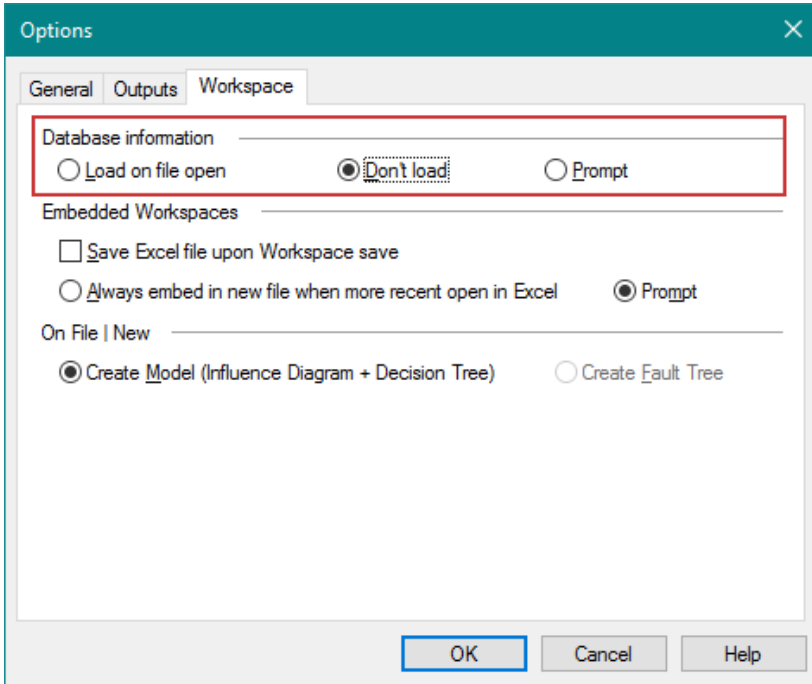
You may also explicitly request that DPL load this schema information. Lastly, you may set up your Workspace so that this schema information is automatically loaded when you open the Workspace file.

Note that DPL does not load the actual data stored in the tables when it loads schema information. Data is extracted only when you explicitly

extract, run a database-linked model (if previously extracted data does not exist) or create a program from a database-linked model.

Currently your options are set so that DPL does not automatically load schema information. You will review this setting now.

⇒ Select File | Options | Workspace. See Figure 9-4.



**Figure 9-4. Workspace Options for Loading Database Information**

Within the *Database information* section the Don't load option is selected, which means DPL does not load the database information upon opening the Workspace file.

⇒ Click Cancel to close the dialog.

DPL stores the schema information in the Workspace file when it is saved. Once you have loaded the schema information, you do not need to load it again if the structure of the database has not changed. Changes to the database that would require you to re-load the schema include new tables, views or queries being added to the database or additional fields being added to tables/views. Both the Prompt and Load on file open options are handy when you are in development mode and still making changes to the structure of the database.

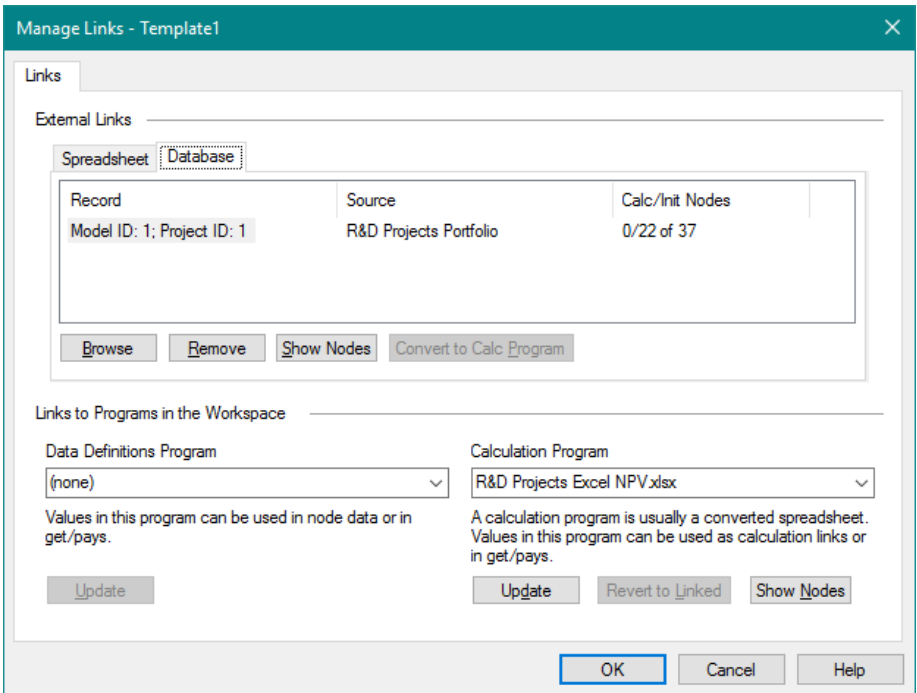
⇒ Click Data | Database | Load Schema to load the database information explicitly right now.

Once you have loaded the schema information, the next time you ask DPL to load it you will receive a confirmation prompt since it only needs to be re-loaded if the database structure has changed.

## 9.4 Defining a Database-Linked Portfolio

Now that you have set up your data source and loaded schema information, you are ready to define your portfolio. Note: As mentioned in the beginning of this chapter, this DPL model is already fully database-linked, as you will verify now.

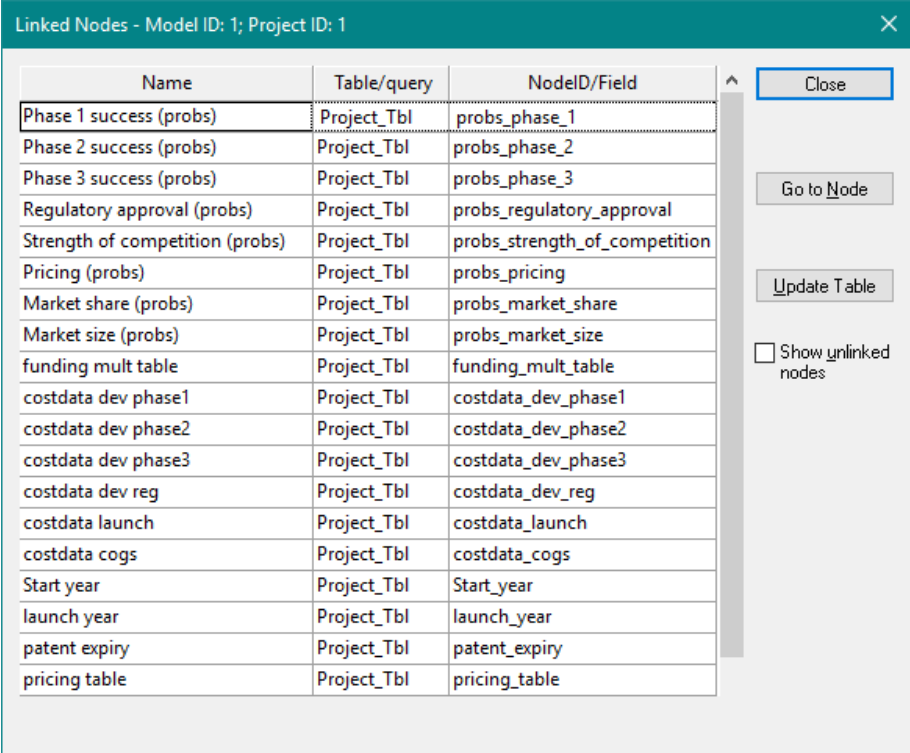
⇒ Click Influence Diagram | Links | Manage. See Figure 9-5.



**Figure 9-5. Manage Links Dialog with Database List Box Active**

The dialog shows you in the *External Links* section (within the Database list box) that the model is initialization-linked to the R&D Projects Portfolio database. There are 22 nodes linked and all the links are to Model ID 1, Project ID 1.

⇒ Click Show Nodes button beneath the Database list box. The dialog should look like Figure 9-6.



Name	Table/query	NodeID/Field
Phase 1 success (probs)	Project_Tbl	probs_phase_1
Phase 2 success (probs)	Project_Tbl	probs_phase_2
Phase 3 success (probs)	Project_Tbl	probs_phase_3
Regulatory approval (probs)	Project_Tbl	probs_regulatory_approval
Strength of competition (probs)	Project_Tbl	probs_strength_of_competition
Pricing (probs)	Project_Tbl	probs_pricing
Market share (probs)	Project_Tbl	probs_market_share
Market size (probs)	Project_Tbl	probs_market_size
funding mult table	Project_Tbl	funding_mult_table
costdata dev phase1	Project_Tbl	costdata_dev_phase1
costdata dev phase2	Project_Tbl	costdata_dev_phase2
costdata dev phase3	Project_Tbl	costdata_dev_phase3
costdata dev reg	Project_Tbl	costdata_dev_reg
costdata launch	Project_Tbl	costdata_launch
costdata cogs	Project_Tbl	costdata_cogs
Start year	Project_Tbl	Start_year
launch year	Project_Tbl	launch_year
patent expiry	Project_Tbl	patent_expiry
pricing table	Project_Tbl	pricing_table

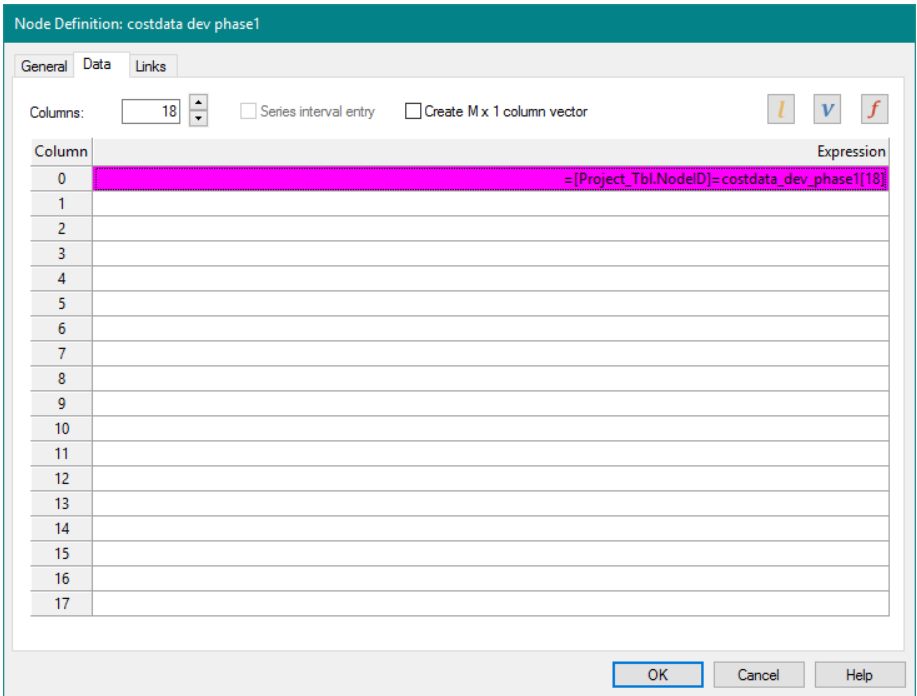
**Figure 9-6. Database Initialization-Linked Nodes**

You can see that all of the linked nodes are obtaining their data from the table: Project\_Tbl. All eight of the chance nodes are initialization-linked to the database; they are obtaining their probability data from it. Also, most of the value nodes are initialization-linked to the database; they are set up as "pass-through" nodes so that project-specific data is obtained from the database and passed through to the calculation-linked DPL program.

There are also several value nodes that are not initialization-linked to the database. These include the metric nodes (such as PV post launch and FCF post launch), which obtain results back from the DPL program for use in the get/pay expressions. They also include two nodes (costdata ongoing,

and DiscRate), that are linked to Global Drivers rather than directly to the database. Global Drivers are covered in Chapter 11 of this manual. For now, you do not need to worry about the Global Drivers-linked nodes.

- ⇒ Click Close to close the Linked Nodes dialog.
- ⇒ Click Cancel to close the Manage Links dialog.
- ⇒ Double-click the costdata dev phase 1 to view its node data. The Data tab looks like Figure 9-7.



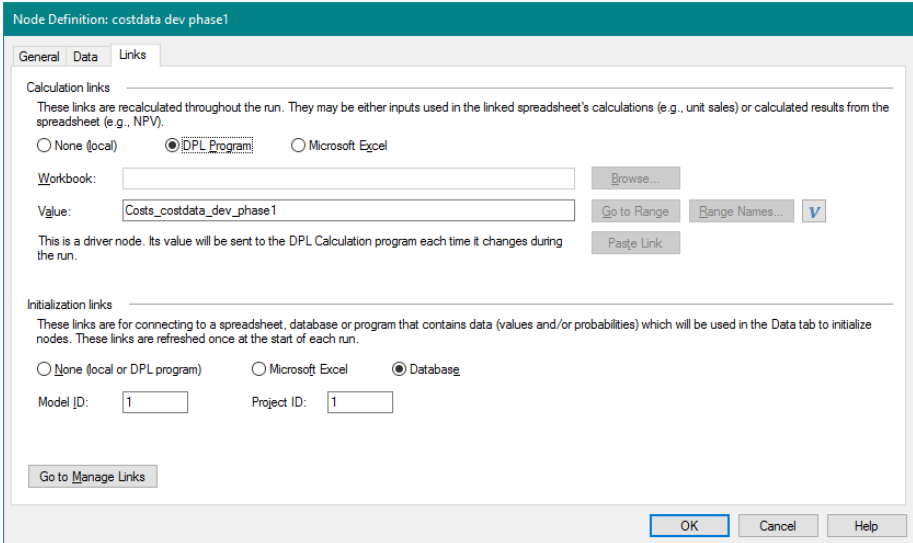
**Figure 9-7. Data Tab for costdata dev phase 1 Value Node**

The expression for this 1 x 18 array node is:

`=[Project_Tbl.NodeID]=costdata_dev_phase1[18]`

This syntax tells you that the link is to a database, that the data item is in table Project\_Tbl, that the Node ID (data item) is costdata\_dev\_phase1, and that it is an 18-column row array. More information about database linking syntax can be found in Section 17.6 of the *DPL User Guide*.

- ⇒ Click the Links tab. See Figure 9-8.



**Figure 9-8. Links Tab for costdata dev phase 1 Value Node**

This tab tells you that the node is both initialization-linked to the database, and calculation-linked to the DPL Program. In the *Initialization Links* section, you can see that the node will obtain its data from the records corresponding to Model ID 1, Project ID 1 of the database.

The model is not yet set up to run a Portfolio Analysis (you will take steps to set it up in the following subsections). It is, however, set up to run a Decision Analysis on Project 1, because all the initialization-linked nodes are linked to Model ID 1, Project ID 1. Once you have defined the portfolio, the nodes in the model will continue to be linked to the project specified the Model ID/Project ID in the node definition, but these links will be overridden with links to other projects using the Model IDs/Project IDs specified in the Portfolio Group and Portfolio Element definitions to identify the additional records. This is analogous to a model with spreadsheet links in a spreadsheet-linked portfolio. The model remains linked to a spreadsheet specified in the node definition, but the link is overridden by Portfolio Element definitions.

⇒ Click OK to close the Node Definition dialog.

#### 9.4.1 Defining a Portfolio Group

- ⇒ Select the Portfolio item in the Workspace Manger.
- ⇒ Click Portfolio | Definitions | Group | Add. The Add Portfolio Group dialog appears.

- ⇒ Name the Portfolio Group "DB Linked Portfolio".
- ⇒ In the Model drop-down list, select Template1 for Model.
- ⇒ Within the *Initialization Links* section, enter "1" within the Model ID box.
- ⇒ Leave the Edit Portfolio Group dialog open for the next subsection.

#### 9.4.2 Using a Database Field for Project Names

When you have project data stored in a database, you may also store a project's name in the database and tell DPL to use a database field for each project's name.

- ⇒ Within the *Initialization Links* section, check the box labeled Use database field for project names.
- ⇒ In the Table/query drop-down list, select Name\_Tbl.
- ⇒ In the Field drop-down list, select ProjectName. The dialog should now look like Figure 9-9.

**Add Portfolio Group** [X]

Title:

Model:

Project Categorization

Initialization Links

None  DPL Program  Microsoft Excel  Database

Model ID:

Use value node data for project names Table/query

Use database field for project names Field

Numeric export table:

String export table:

Calculation Links

None  DPL Program  Microsoft Excel

Excel links in one workbook

**Figure 9-9. Completed Add Portfolio Group dialog**

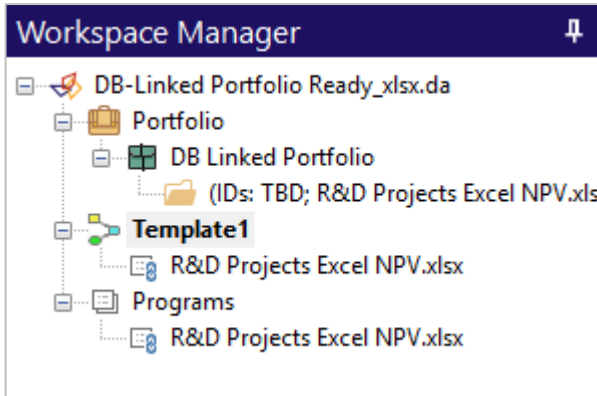
When storing project names in a database field and using that field to supply names to DPL Portfolio, you have some flexibility as to the design of the table that contains the field storing the project name. The table can be a table structured with a Node ID field as described in Section 17.3 of the *DPL User Guide*. Tables with this structure have Model ID and/or Project ID fields, fields to describe the dimensions of the data and a Node ID field. Or alternatively, the table may be structured in a more typical format for database tables. It must have fields to uniquely identify the project data (e.g., Model ID and/or Project fields), a field to store the project name and



may have other fields. When you select the table that contains the project name field using the Table/query drop-down list in the Portfolio Group dialog, DPL examines the table structure to see whether the table is structured with a Node ID field or not. If it is, then the drop-down list beneath the Table/query drop-down is populated with the Node IDs in the table. If the table is not, then the list beneath the Table/query drop-down is populated with the field names in the table.

⇒ Click OK to close the dialog.

The Workspace Manager now shows a single element underneath the DB Linked Portfolio Group as shown in Figure 9-10. The name of the element currently displays the IDs for initialization links and the DPL Program for the calculation links. The IDs are currently "TBD". You will specify them in the next section.



**Figure 9-10. Workspace Manager with New Group and Element**

**9.4.3 Defining Portfolio Element(s)**

When your portfolio is initialization-linked to a database, you have flexibility as to how you define portfolio Element(s) to map to project(s). Recall that in some portfolio designs, each element corresponds to a single project. In other portfolios, you might have a set of Elements in which each Element represents more than one project. All the projects within an Element must have the same calculation link, but each project can be initialization-linked to a different database record, i.e. a different Project ID.

In this example there are six projects with ID's numbered one through six. Each project uses the same DPL program for calculation links. Therefore, you could set up this portfolio with six similar Elements (one for each project), or with one Element indicating that the Element represents

projects one through six. In fact, you could even set it up in other ways, e.g., as two Elements, one representing projects one through three, and the other representing projects four through six (you may wish to do this to facilitate project categorization).

You will use the simplest method: one Element containing six projects.

- ⇒ Double-click the item for the newly created Element within the Workspace Manager. The Edit Portfolio Element dialog appears as in Figure 9-11.

**Figure 9-11. Edit Portfolio Element dialog**

- ⇒ In the *Element Name* edit box, give it the name "Element 1".
- ⇒ In the *Project ID(s)* edit box, type "1-6" (no quotes).

You can use commas to indicate additional projects with non-consecutive project ID's. For example, you could have typed "1-3, 7, 9-12" (no quotes). DPL ignores any IDs after a double slash ("//"). To temporarily exclude projects from the portfolio run, put their IDs after a double-slash (e.g., "1-3, 7, // 9-12" excludes projects with IDs 9-12 from the portfolio).

Instead of specifying project IDs directly in the *Project ID(s)* edit box, you may specify a text file containing the project IDs. If you specify a text file, it must have an extension of .CSV or .TXT and contain the full path to the file. Project IDs within the file may be on multiple lines and each line can

contain multiple IDs as above (e.g., "1-3, 7, 9-12" – once again without quotes). You may also use double slashes within the file. Double slashes work on a line by line basis in the file and only exclude any remaining IDs on that line.

Lastly, you may also specify the set of project IDs represented by the Element using an SQL query. To do this, check *Project IDs determined by SQL query* and specify the SQL statement in the *Project IDs* edit box. Alternatively, you may put the SQL statement in a text file. If you use a text file, it must have a .SQL extension and you must specify the full path and name of the file in the edit box. For an example of an Element defined using an SQL query, see the file DB-Linked Portfolio SQL Element.da in the Examples folder underneath the DPL installation directory.

⇒ Click OK to close the dialog.

You are ready to run a Portfolio Analysis, which you will do to make sure your database linking is correct and the analysis works. Refer to Chapter 5 of this manual for explanations of the Portfolio Analysis options and outputs.

#### 9.4.4 Running the Portfolio

⇒ Save your Workspace under a name of your choosing.

It is always a good idea to compile the models in your portfolio before you run a Portfolio Analysis because DPL reports errors interactively when you compile. This allows you to correct any errors more easily. In a Portfolio Analysis run, DPL reports errors to the Session Log for a project, aborts the analysis of that project and continues with the next project in the portfolio.

If you have a database-linked portfolio set up (as you do now) and you compile a model or run a Decision Analysis, DPL will compile/run the model using the model ID/project ID combination that is specified in the node definitions. You can see which record the model is linked to within the Manage Links dialog. The exception to this is when the Workspace contains previously extracted database data. See Section 9.6 for more information on extracting database data.

⇒ Click Home | Run | Compile.

If the model fails to compile, DPL will give you an error message and open the node with the error.

⇒ Click Home | Run | Clear Mem to clear the compile from memory.

⇒ Click Portfolio | Run | Analyze (Now).

DPL runs the database-linked Portfolio Analysis immediately with the current options. The Portfolio Analysis output options are set to generate a Results Report, Risk/Reward Chart, and Portfolio Time Series Percentiles in this Workspace. These outputs are shown below in Figure 9-12, Figure 9-13, and Figure 9-14.

	0	1	2	3	4	5	6	7	8	9	10
0	Name	NPV	Develop...	Develop...	FCF_18	FCF_19	FCF_20	FCF_21	FCF_22	FCF_23	FCF_24
1	Zoro Pr...	964.3	310.6	21%	0.0	0.0	139.5	279.1	418.6	558.1	558.1
2	Anti-Me...	674.3	494.5	11%	0.0	86.1	172.2	258.3	344.4	430.5	430.5
3	Nucleus ...	1706.6	177.8	26%	0.0	0.0	180.5	361.0	541.5	722.0	902.5
4	Xerio Lin...	1383.9	99.8	16%	0.0	98.5	197.0	295.5	394.0	492.5	591.0
5	TB8 Agg...	1750.0	143.1	20%	0.0	0.0	0.0	253.1	506.2	759.4	1012.5
6	Hep F Ra...	1366.7	128.3	21%	0.0	0.0	130.9	261.7	392.6	523.5	654.4
7	Portfolio	7845.8	1354.1		0.0	184.6	820.1	1708.7	2597.4	3486.0	4149.0

Figure 9-12. Portfolio Results Report

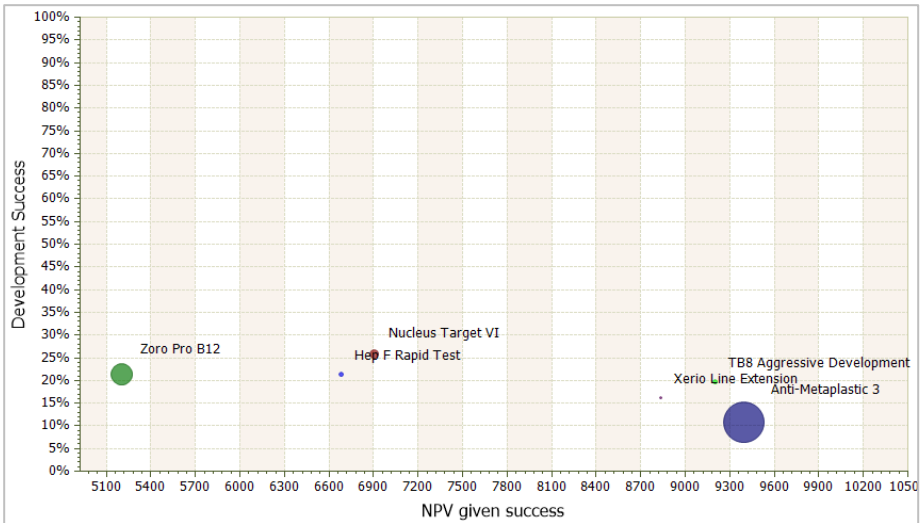
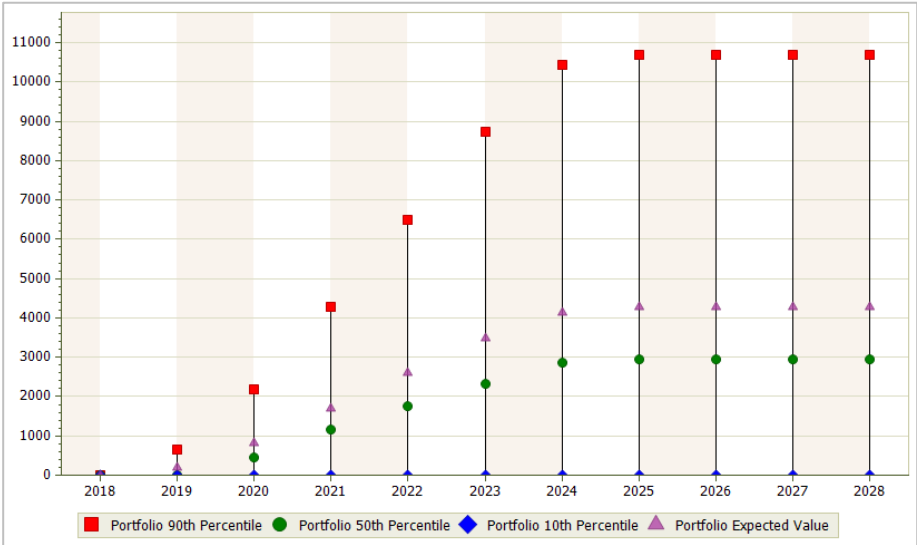


Figure 9-13. Risk/Reward Chart



**Figure 9-14. Portfolio Percentiles Chart**

⇒ Activate the Time Series Percentiles chart.

A quick glance at the outputs tells you that the project Anti-Metaplastic 3 has the largest potential value, largest development cost, and smallest probability of success. None of the six projects has a probability of success exceeding 26%. Accordingly, the uncertainty in the portfolio's post-launch cash flow is substantial; the 10th percentile is zero in 2025, while the 90th percentile is over 10,000.

⇒ Activate the Risk/Reward chart.

Notice the numbering of the Y-axis and the corresponding look and spacing of the bubbles in the Risk/Reward bubble chart (Figure 9-13). You can change both the X and Y-axis via the Chart | Format | Axis group to make the chart more ascetically pleasing. You will do so now.

⇒ Select the X-Axis (the numbers will turn magenta) and notice how the Chart | Format | Axis group becomes enabled, showing the axis Min and Max range.

⇒ Un-check the Auto checkbox. The Axis edit boxes will become enabled.

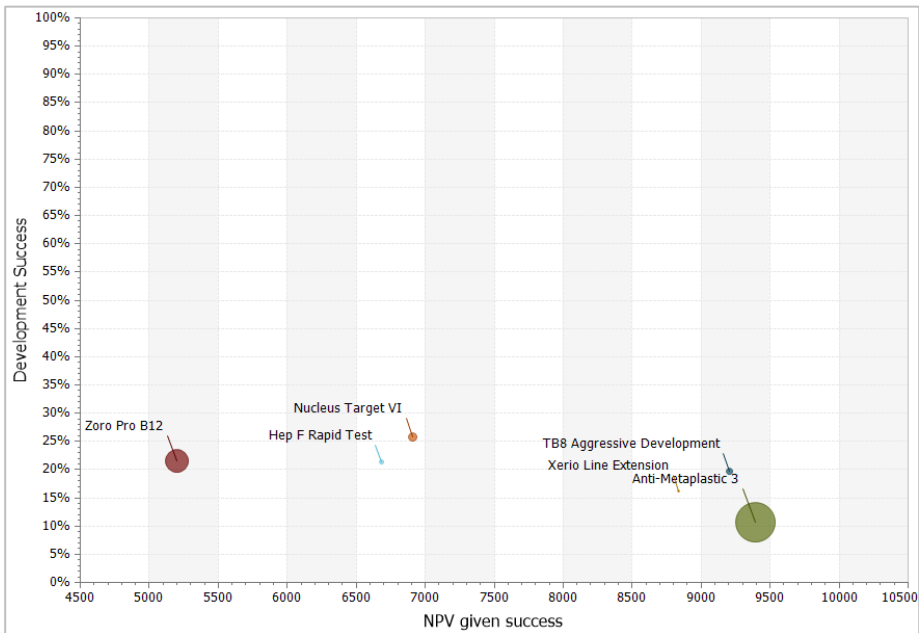
⇒ Change the X-axis Min to 4500, the Max to 10500, and the Major to 500.

You may find that the data labels displayed within the chart are overlapping. You can control if and how these labels are displayed via the

commands within the Chart | Series | Labels group. If you prefer, you can opt to turn off labels and have the data label information displayed within a Legend box instead (Chart | Format | Legend | Show) as done previously in Section 5.5. In the steps below you maintain the data labels but modify their location.

- ⇒ Select the text for one of the data labels in the chart. All of the data labels will turn magenta indicating selection.
- ⇒ Within the Chart | Series | Labels group enter "110" for the Data Label Angle and "15" for the Distance.
- ⇒ Check the box labeled Show Line to have a line drawn from the data label to its corresponding bubble.

Figure 9-15 displays the bubble chart with the formatting above applied.



**Figure 9-15. Risk/Reward Chart with Formatting**

- ⇒ Save your Workspace again before completing the final two sections of this chapter.

## 9.5 Exporting Portfolio Results

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As with other types of portfolios, you can export or save your Portfolio Analysis and Data Report results to .CSV files, Excel, or other applications (see Chapter 5 of this manual). In addition with a database-linked portfolio, you may also export your results back to the database that stores the project input data.

DPL provides the capability to export to a portfolio table for results that are common across the entire portfolio and to Group-specific export tables.

The portfolio table is structured like a standard portfolio table with fields or columns for each data item. E.g., you might have a table with an "EXPECTED\_NPV" field in it. The primary intent of the portfolio table is for the export of scalar values such as the expected values of attributes.

The Group-specific tables are structured using the Node ID structure with fields describing the dimensionality of the data as described in Section 17.3 of the *DPL User Guide*. Each Group can have two Group-specific tables: one for numeric results and one for qualitative or string data. The Group-specific tables are convenient for exporting non-scalar results.

### 9.5.1 Database Design for Exporting

In order to export results to database table(s), you must have read and write privileges for the table(s) within the database. The table(s) must contain the fields as indicated in Table 9-1.

Field	Purpose	Type	Default Name
Record ID	Unique identifier for the record. Required.	Integer	RecordID
Model ID	Identifies which model the record belongs to. Optional.	Integer	ModelID
Project ID	Identifies which project the record belongs to. Required.	Integer	ProjectID
Run Date	Identifies the date and time of the run. Required.	Date	RunDate

**Table 9-1: Table Structure for Analysis Results Exporting**

In addition to the fields above, the portfolio table must contain one field for each value that you wish to export. E.g., if you wished to export the expected values of the objective function, development costs and success attributes, then you would need three numeric fields in addition to those listed in Table 9-1. These three fields might be called NPV, DevCosts and Success, respectively.

As mentioned in Table 9-1, DPL needs to know the name of the RecordID field and how to supply values for the Record ID field. For more information on this, see Section 9.5.2.

### 9.5.2 Database Specifications for Exporting

The sample database delivered with DPL Portfolio has a portfolio export table already created within it. In order to set up your Workspace for exporting, you need to modify your Database Specifications one more time.

- ⇒ Click Data | Database | Set Up.
- ⇒ On the right-hand side of the dialog within the *Data Export* section, look at the tables listed in the *Portfolio export table* drop down list.
- ⇒ Select Results for the Export Table.



Note: if the Export Tables drop down list is empty, you may click Get Tables in order to populate the list. For databases without schema, this list is automatically populated. For databases with schema, you need to click Get Tables button after changing the schema in order to obtain the list of tables.

⇒ Beneath the drop-down, check the Append rows to table for each run box.

Note that if you elected not to append rows to the table for each run, the analysis results would be over-written each time you export.

In order to populate the Record ID field, DPL needs to know how to provide the value for it. This field uniquely identifies each record in the table. Some databases such as SQL Server provide an identity field type which will supply the next integer in sequence as the field value when a record is appended to the table (Microsoft Access refers to this as an auto-increment field). Oracle uses a structure called a sequence to provide similar functionality. The example database delivered with DPL Portfolio is a Microsoft Access database and the RecordID field within the results table is an auto-increment field. When you checked Append rows to table for each run, Auto-increment was selected by default and you do not need to do anything further.

As mentioned above Oracle uses a sequence to provide sequential values for a field intended to uniquely identify a record. If the database you are linked to is an Oracle database, you need to select the Oracle sequence radio button for Record ID field value provided by and then specify the name of the sequence in the edit box below the radio button. Your database administrator should be able to provide you with the sequence name.

If your portfolio analysis database and system is designed such that revision ID's are at the project level rather than data element (i.e., Node ID) level, you should indicate this to DPL. A system that has revision ID's at the project level is one in which each time a project's data is edited an entire new set of records storing all of the project's data with a new revision ID is created. I.e., new records are created even for data elements that did not change during the edit. This implementation may be appropriate if you have an application in which a user "checks out" a project to edit it in some data entry template and then the project is "checked in". At the point of check in, a new revision ID is assigned to the dataset being checked in and the entire dataset is stored in new records even if some data was not changed while the project was checked out.

A system in which revision ID's are not at the project level is one in which new records are created only for data elements that changed during the edit. In the latter type of system, the latest revision ID might vary on a Node ID by Node ID basis.

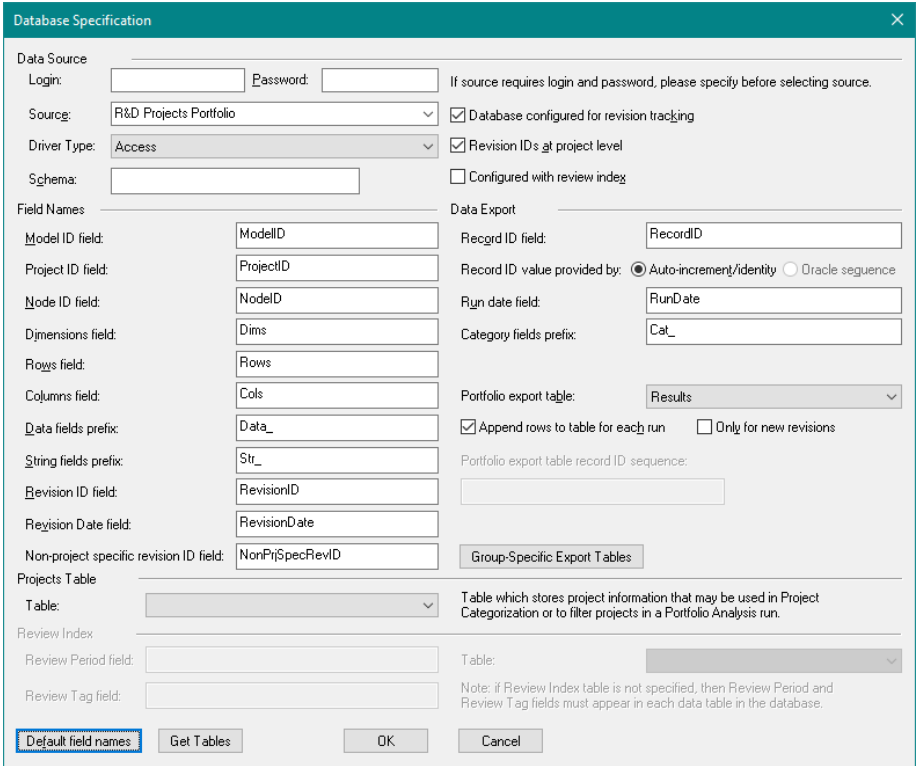
To indicate that revision ID's are at the project level, do the following in the Database Specification dialog.

- ⇒ On the right-hand side of the *Data Source* section, check the Revision IDs at project level box.

This will activate the Non-project specific revision ID field. You will provide default field names for this and the data export fields that are now active.

- ⇒ Click Default field names to fill in RunDate for the Run Date field, RecordID for the Record ID field, and NonPrjSpecRevID for the non-project specific revision ID field.

The Data Specification dialog should look like Figure 9-16.



**Figure 9-16. Database Specification dialog Settings for Exporting Results with Project Level Revision IDs**

⇒ Click OK to close the dialog.

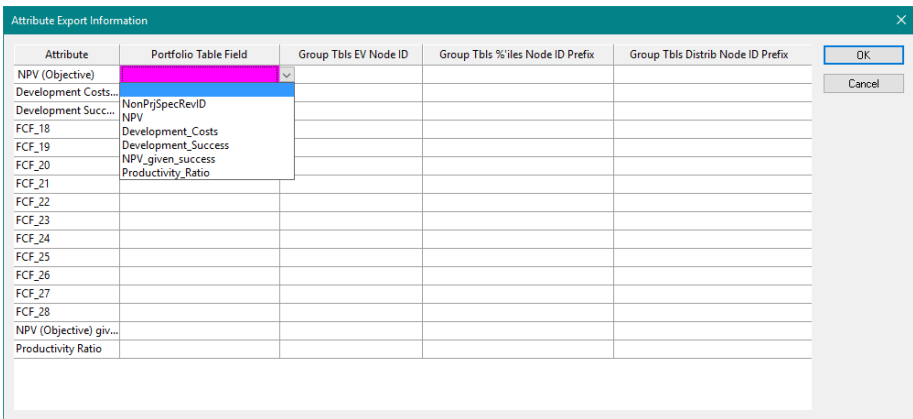
With Revision IDs at project level specified, DPL can identify the revision of the dataset for a project with a pair of numbers: the RevisionID (i.e., for project-specific data) and the NonPrjSpecRevID (i.e., for non-project specific data such as global drivers, see Section 11.1). This information is then written to the results table when exporting results so that the results can be tied to a specific project revision.

Also with Revision IDs at the project level specified, DPL can more efficiently extract data in systems in which data is stored in multiple tables when getting the latest revision. DPL will find the correct revision ID once and then use that in subsequent queries.

### 9.5.3 Portfolio Attributes and Export Fields

The second step to set up your Workspace to export results to the portfolio table involves telling DPL which results to export and to which fields to export them. The expected value of any of the Portfolio Attributes can be exported to the portfolio table as long as a field for the attribute has been created in the table. This attribute/field assignment is done via the Attribute Export Information dialog.

- ⇒ Open the Portfolio Attributes dialog (Portfolio | Definition | Attributes) and click the Export Information button. This will launch a blank Attribute Export Information dialog that looks similar to Figure 9-17.



**Figure 9-17. Attribute Export Information dialog with Portfolio Table Field List Drop-down Displayed**

The Portfolio Table Field drop-down list is populated with the fields available within the specified portfolio export table. You will now assign the appropriate export field for a subset of the attributes. You'll find that the fields in the export table are named the same as or very similar to the attributes. Note that fields have not been set up for the free cash flow attributes in the Results table so you will skip these attributes, leaving their fields in the dialog blank.

- ⇒ Select the first cell within the Portfolio Table Field column. It will become active and a drop-down list arrow will appear.
- ⇒ Drop-down the list and select NPV from it. You have told DPL to export the expected value results for the attribute NPV to the field within the Results table called NPV.

- ⇒ Select the appropriate field for each of the application attributes. When finished your dialog should match Figure 9-18.



**Figure 9-18. Completed Attribute Export Information dialog**

- ⇒ Click OK to close all dialogs.

**9.5.4 Exporting Results when Running a Portfolio Analysis**

You are ready to run another Portfolio Analysis, this time exporting results to the portfolio table. Since you are running the analysis only for export, you do not need to request outputs again.

- ⇒ Click Portfolio | Run | Analyze (Options). Note that within the *Tabular results* section the Export data to database checkbox is now enabled.
- ⇒ Check the Export data to database box.
- ⇒ Un-check the other output options, including Results Report. The dialog should look like Figure 9-19.

**Portfolio Analysis Options**

**Project selection**

All projects  
 Subset   
 Filter

**Project data**

Defaults   
 Use previously extracted

**Portfolio roll-up run settings**

Defaults   
 Custom

**Tabular results**

Results Report  Display project IDs  Export data to database

**Distributions**

Portfolio Risk Profile Chart  Project Risk Profile Data  
NPV  NPV and All attributes   
No Risk Profile Charts/Datasets selected

**Project comparison**

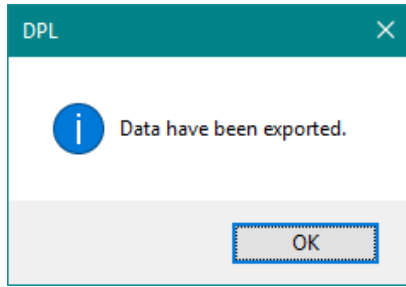
Risk/Reward Bubble Chart  Portfolio Tornado  
 Project Value Range Chart  Expected and Potential Value Chart  
 Productivity Ratio Chart  Initial Decision Alternatives Productivity Chart

**Time series**

Portfolio Percentiles Chart  Project Percentiles Charts  
From: FCF\_18  To: FCF\_28   
Initial time period: 2018

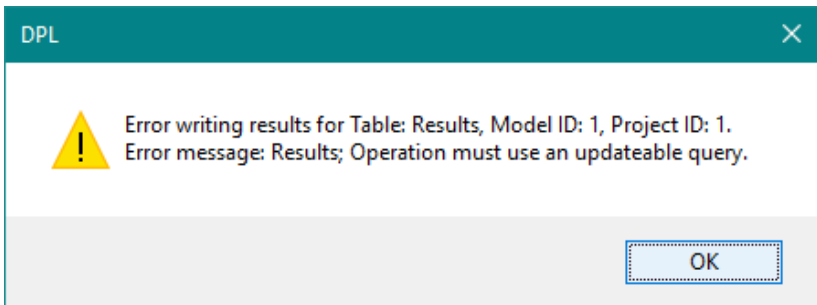
**Figure 9-19. Portfolio Analysis Options dialog for Exporting**

⇒ Click Run Now to run the analysis and export results to the database. Once complete, you should see the DPL message shown in Figure 9-20.



**Figure 9-20. Confirmation Message for Exporting Results**

Note: When attempting to export data in this example using a desktop database such as Microsoft Access, keep in mind that the database must reside in a directory for which you have read and write privileges. By default the example database provided with your DPL Portfolio license is installed within your Program Files directory where you may not have these privileges. Consequently, for the purposes of this tutorial you may need to move the example database to a directory in which you have write privileges (for example, C:\Users\\Documents). In the case that you don't have the write privileges you will receive the following message when you attempt to export data:



**Figure 9-21. Error for Data Export to Database that isn't Updateable**

Note if you need to move the database file, you will also have to re-configure the ODBC Datasource that you set up in Section 9.1 so that it points to the new location of the database.

- ⇒ Click OK.
- ⇒ Save your Workspace.

If you have Microsoft Access or another database program that allows you to examine .mdb tables, you may examine the Results table in the R&D Projects Portfolio database now. However, if you saw the confirmation

message in Figure 9-20, you can be confident that you have successfully exported results.

The next section in this chapter shows you the options for extracting data from the database and using extracted data in analyses and reports.

## 9.6 Extracting Data

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The example portfolio database you are using in this chapter is obviously quite small. There are only six projects, and there is not a large amount of project data. However, in a real portfolio analysis, you could have dozens to hundreds of projects and numerous data items for each project. Also, you might be linking to a corporate database on a remote server. In these situations, you might find that it takes a while to run your analyses if you access the linked database each time.

DPL provides a way for you to "extract" the data from the database and store it locally in your Workspace. This creates a local copy of all the necessary data from the database so that you can run the analysis from your laptop or desktop using only the information contained in your Workspace. In order to keep your analyses up to date, you will need to re-extract data from the database periodically or lock down the database to prevent changes. The latter alternative may be appropriate at a point in your portfolio review process when all project data should have been submitted and you are entering an analysis phase.

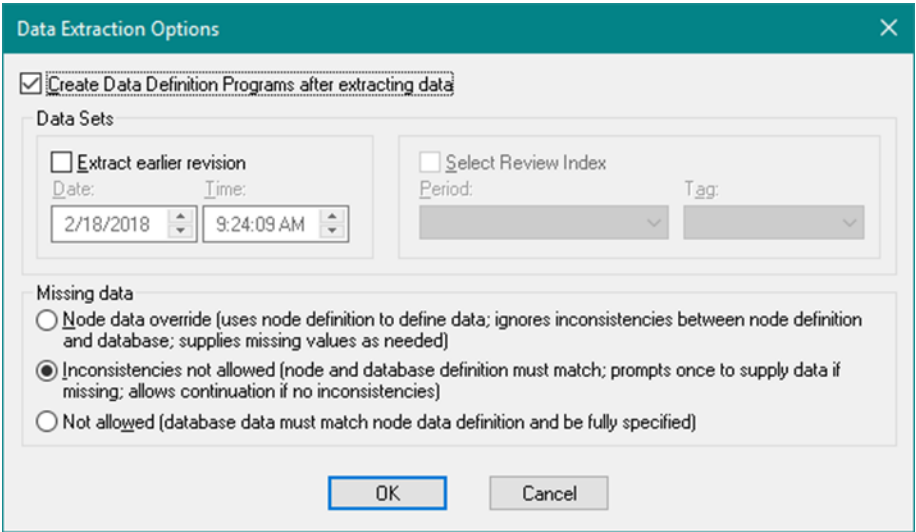
When the data is extracted from the database, it is stored in your DPL Workspace in the form of Data Definition Programs. See Chapter 11 if you would like more information about Data Definition Programs (initialization-linked DPL Programs). You do not need to understand the details of how the Data Definition Programs are set up in order to complete the following tutorial.

### 9.6.1 Extracting External Data via a Portfolio Analysis

- ⇒ Click Portfolio | Run | Analyze (Options).
- ⇒ Within the *Tabular results* section check Results Report. Un-check Export data to database and all other outputs.
- ⇒ Within the *Project data* section, click the Settings button. The Data Extraction Options dialog appears as in Figure 9-22.



- ⇒ Check the checkbox at the top labeled Create Data Definition Programs after extracting data.



**Figure 9-22. Data Extraction Options dialog**

- ⇒ Within the *Data sets* section, leave the Extract earlier revision checkbox un-checked.
- ⇒ In the *Missing data* section, the Inconsistencies not allowed option should be selected. If not, select it.

Note that until now, the Create Data Definition Programs checkbox was not checked, so in all of your previous Portfolio Analysis runs, DPL extracted data each time you ran and did not create Data Definition Programs for subsequent use.

You have just set up the options so that you will use the most recent revision. You could instead choose to extract an earlier revision of the data using the options in this dialog. See Section 9.7 for more information on using revisions.

In the Missing data section, the three options require different levels of consistency between the node definitions in your model and the database dimension information. These options also determine how missing data is handled.

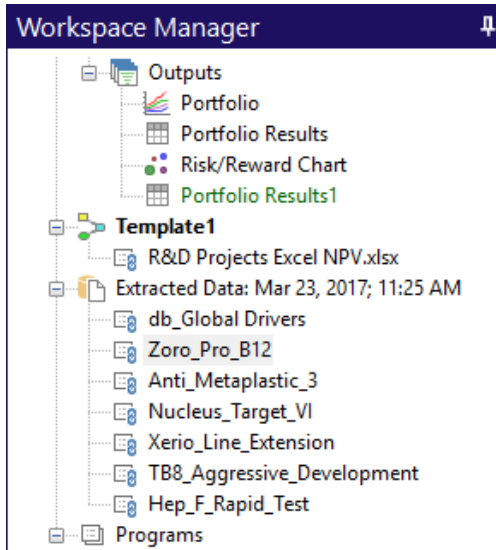
The *Node data override* is the least restrictive option of the three. If you select this option, DPL will ignore inconsistencies in data dimensions, will fill in zeros where there are missing values and will use the information

contained in the node definition to dimension the data. E.g., if a node has been specified to be a two-dimensional array with two rows and three columns, this is what will be created regardless of whether the dimensions in the database match the node definition information. A message is written to the Session Log if there are inconsistencies and/or missing data. This setting may be appropriate early in the design of the system when the database design may not necessarily match the information contained in the node definitions in the Influence Diagram.

The *Inconsistencies not allowed* setting is more restrictive in regards to node definitions vs. database definitions. The dimension information in the node definition and in the database must match. Missing data may be supplied as needed. DPL will prompt you once to verify that you want missing data to be set to zeroes. If you say no, the extraction stops. If you say yes, the extraction continues with zeroes supplied for any additional missing data. This setting is the default and is appropriate when the database design and Influence Diagram design are complete but when not all data will have been entered in the database.

The *Not allowed* setting is the most restrictive in terms of requiring the dimension information specified in the node definition and in the database to match and for there to be no missing data. If a mismatch is found or data is missing, DPL issues an error message and stops extracting. This setting may be appropriate to use when you believe all data should have been entered into the database (though depending on the design of your system, missing data may still be acceptable and this setting may not be appropriate).

- ⇒ Click OK to close the dialog.
- ⇒ Click Run Now in the Portfolio Analysis Options dialog to run the analysis and extract data.



**Figure 9-23. Workspace Manager with 7 Extracted Data Definition Programs Listed**

DPL not only builds the portfolio and runs the analysis but it also creates seven Data Definition Programs in your Workspace. An item for each program is listed under a new Extracted Data heading within the Workspace Manager (Figure 9-23), which also includes the date and time of the data extraction. The first program listed is for Global Drivers, which are discussed in Chapter 11 of this manual. The other six programs contain data extracted for the six projects in the R&D Projects Portfolio database for storage and use in your Workspace.

⇒ Double-click any of the six project Data Definition Programs in Workspace Manager to view it.

You should see a list of arrays and values in DPL code. Each value corresponds to a scalar value node in the template model, while each array corresponds to a 1-dimensional or 2-dimensional value node. There are 22 values and arrays because there are 22 initialization-linked nodes in the model.

At this point, you can re-run analyses to generate additional outputs using this extracted data.

⇒ Save your Workspace.

⇒ Select Portfolio | Run | Analyze (Options) again.

- ⇒ In the *Project data* section at the top of the dialog, select the Use previously extracted radio button (note that it is now enabled since extracted data exists in the Workspace).
- ⇒ Un-check Results Report under Tabular results.
- ⇒ Check the Initial Decision Alternatives Productivity Chart (an output you have not previously produced from this database). The dialog should look like Figure 9-24.

The screenshot shows the 'Portfolio Analysis Options' dialog box with the following settings:

- Project selection:**  All projects,  Subset,  Filter.
- Project data:**  Defaults,  Use previously extracted.
- Portfolio roll-up run settings:**  Defaults,  Custom.
- Tabular results:**  Results Report,  Display project IDs,  Export data to database.
- Distributions:**  Portfolio Risk Profile Chart (NPV),  Project Risk Profile Data (NPV and All attributes). No Risk Profile Charts/Datasets selected.
- Project comparison:**  Risk/Reward Bubble Chart,  Project Value Range Chart,  Productivity Ratio Chart,  Portfolio Tornado,  Expected and Potential Value Chart,  Initial Decision Alternatives Productivity Chart.
- Time series:**  Portfolio Percentiles Chart,  Project Percentiles Charts. From: FCF\_18, To: FCF\_28, Initial time period: 2018.

Buttons: Run Now, Cancel.

**Figure 9-24. Portfolio Analysis Options Using Previously Extracted Data**

- ⇒ Click Run Now.

DPL uses the data contained in the Programs in your Workspace rather than accessing the central database. Since the database is local and small,

there is not a noticeable difference in run time. However, for larger, remote databases, there may be.

### 9.6.2 Current Outputs Relative to Extracted Data in a Workspace

Once you have extracted data in a Workspace, DPL will determine whether the outputs in the Workspace are current relative to the extracted data. Look at the Workspace Manager item for the Portfolio Results<sup>1</sup> and Initial Decision Alternatives Ratio chart that you created from the extracted data in the last section. The text for both items should be shaded green, indicating that the output is current relative to the extracted data in the Workspace. Note that the items for the outputs that you produced in Section 9.4.4 (Portfolio Percentiles chart, Results Report, and Risk/Reward chart) are shown in default black within the Workspace Manager. That is because these outputs were produced before you extracted data. DPL is indicating that they are not current when compared to the extracted data within the Workspace.

Once you have extracted data, you can update all of your outputs using Data | Update | All Reports / Charts. See Section 5.13 for more information on this.

### 9.6.3 Extracting External Data via a Data Report



When you run a Data Report (see Chapter 8), you can also choose to extract and store data. The Data Extraction Options dialog is the same.

⇒ Click Portfolio | Run | Report (Options).

In the *Database data* section at the bottom right of the dialog the Use previously extracted option is enabled since extracted data exists in the Workspace. It is now selected because the last run you did used previously extracted data.

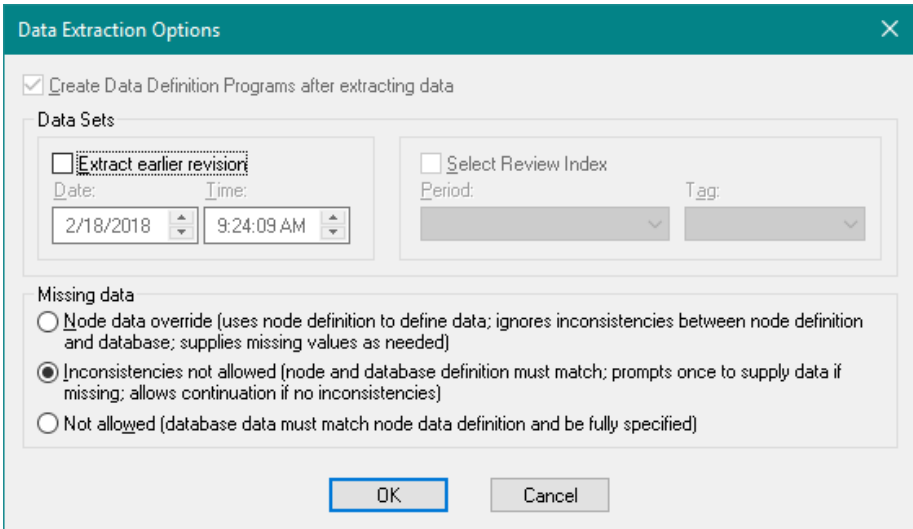
⇒ Click Cancel to close the Data Report Options dialog (you do not need to run a Data Report).

### 9.6.4 Extracting External Data Explicitly

You can also extract data and store it in the form of Data Definition Programs explicitly from the ribbon via the commands within the Portfolio | Project Data group. Similar to the commands within the Portfolio | Run group, the Extract Data split button has options for extracting. You can choose to extract data for all projects () or a subset of projects by ID () using the current settings specified within the Data Extraction Options

dialog. Or, you can opt to specify settings within the Data Extraction Options dialog and then extract all or by ID (🔧). You'll do the latter.

⇒ Drop-down the Portfolio | Project Data | Extract split button and select the Specify Settings and Extract.... The Data Extraction Options dialog now looks like Figure 9-25.



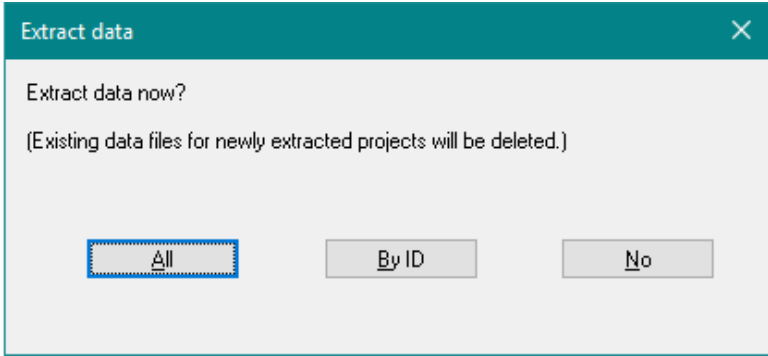
**Figure 9-25. Data Extraction Options for Explicit Extraction**

Note that the Create data files option is checked and grayed out. This is because the only thing you are doing is extracting the data into Data Definition Programs; it wouldn't make sense not to create them.

As before, you can choose to extract an earlier revision (see Section 9.7) and change the Missing data settings.

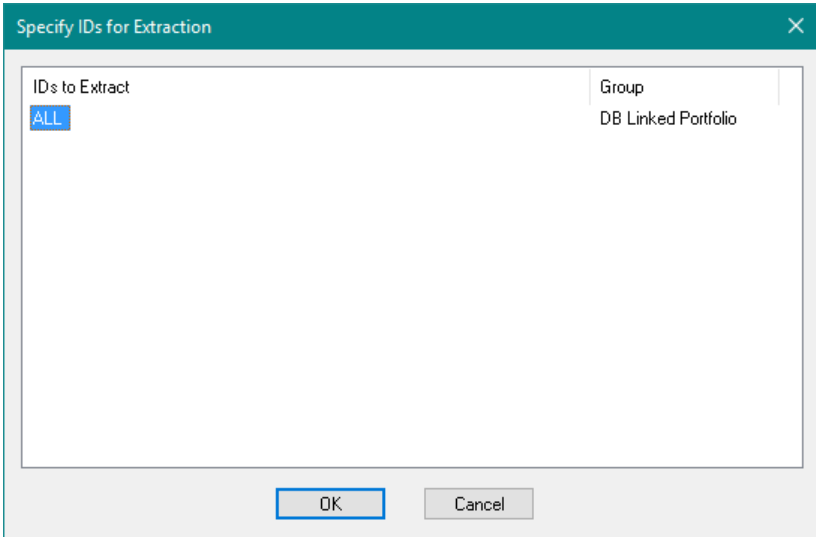
⇒ Click Cancel.

Note when you extract data directly from the ribbon, after clicking OK in the Data Extraction Options dialog you will be prompted as to whether you want to extract data for all projects or select a subset of projects by ID. See Figure 9-26. The extract by ID option is discussed in more detail below.



**Figure 9-26. Extract All or By ID Prompt**

If you know that only a subset of projects have changed, you may extract data for a subset of projects in the portfolio rather than the whole set using their project IDs to identify them. When you extract by ID, the Specify IDs for Extraction dialog comes up. See Figure 9-27.



**Figure 9-27. Specify IDs for Extraction Dialog**

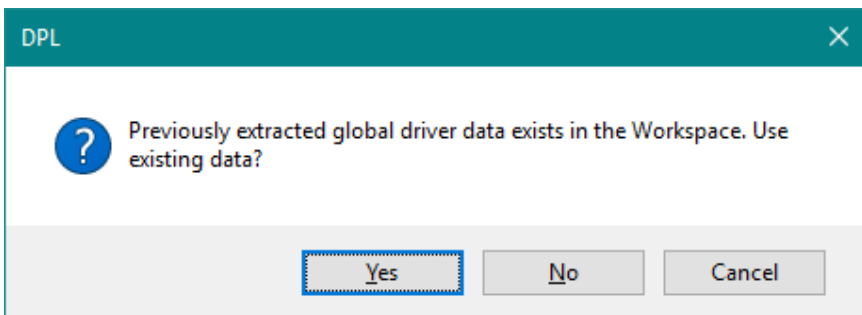
Project IDs need to be specified by Portfolio Group. In the example portfolio, there is only one Group. If you leave ALL as the IDs for a group, all projects for that Group will be extracted. If you set the IDs to be blank for a Group, then no projects will be extracted for that Group. Otherwise specify which IDs to extract for each Group in the same way you specify IDs for Portfolio Elements (e.g, "1", "1-3", or "1, 3-4", etc. see Section 9.4.3).

Note that the default action for the Extract split buttons changes based on the last type of extraction you did, e.g., if you extracted all, the next time you click the split button (without dropping it down), DPL will extract all again.

### 9.6.5 Running a Decision Analysis using Extracted Data

Now that you have extracted the data for all the projects in your portfolio into your Workspace, running a Decision Analysis on a single project is a slightly different process. You might want to run a Decision Analysis and/or a sensitivity analysis on a single project to gain more information on the project via the single-project output charts available from the Home | Run and Home | Sensitivity groups. You will run a Decision Analysis now.

- ⇒ Activate the Tempate1 model.
- ⇒ In the Home | Run group, check Risk Profile, Initial Decision Alternatives, Policy Summary™ and Expected Value of Perfect Information/Control.
- ⇒ Make sure Policy Tree™ and Endpoints are **not** checked.
- ⇒ Click Home | Run | Decision Analysis. DPL prompts you with a question about Global Drivers. See Figure 9-28.

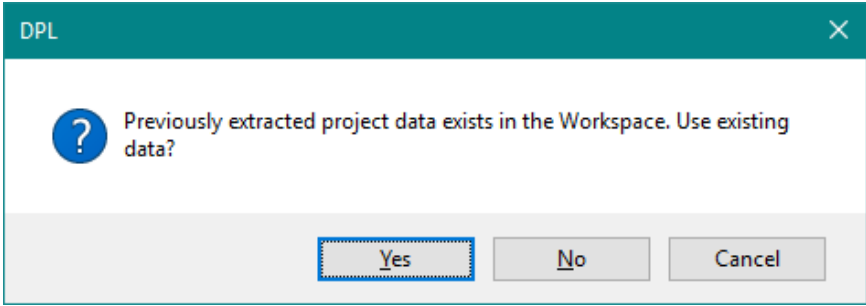


**Figure 9-28. Database Data for Global Drivers Prompt**

DPL is asking whether you want to use the data that already exists for the Global Drivers. Global drivers are covered in Chapter 11.

- ⇒ Click Yes. (Clicking no would cause DPL to extract data again for the Global Drivers.) DPL prompts about extracted project data as shown in Figure 9-29.

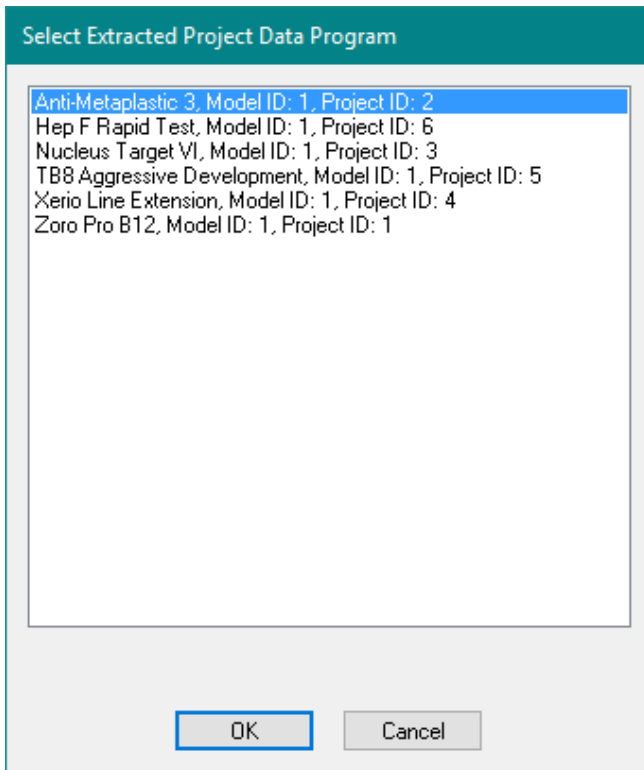




**Figure 9-29. Previously Extracted Data Prompt**

⇒ Click Yes to use the existing data. (Once again, clicking No would cause DPL to re-extract data.)

DPL then asks you to select which Extracted Project Data Program you would like to use for the Decision Analysis. See Figure 9-30.



**Figure 9-30. Select Extracted Project Data dialog**

⇒ Select Zoro Pro B12, Model ID: 1, Project ID: 1.

⇒ Click OK.

DPL produces the requested outputs for the single project.

⇒ Examine the outputs if you like.

Note: If you click Home | Run | Decision Analysis again at this point, DPL still has the Zoro Pro B12 project compiled in memory. Instead of prompting you to run a different project, DPL will assume you want to run the same one. To run a Decision Analysis on a different project, you first need to clear memory.

⇒ Select Home | Run | Clear Mem or press F9.

⇒ Click OK to the prompt.

If you now run a Decision Analysis, DPL will again prompt you to choose which project to analyze.

With extracted data in your Workspace you can easily run a Decision Analysis or any sensitivity analysis on any project in your portfolio. Without extracted data in your Workspace, you would need to edit the model ID's and/or project ID's specified in the node definitions via the Manage Links dialog in order to change which project was run.

### 9.6.6 Deleting/Overwriting Extracted Data Definition Programs

If you choose to extract data again (either via a Portfolio Analysis, Data Report or explicitly via the ribbon) in a Workspace that already has extracted data in it, DPL will overwrite the existing Data Definition Programs with the newly created ones. When you do this, DPL first displays a message saying Existing extracted files will be deleted. Note: if you are extracting by ID from the ribbon, DPL will only overwrite the Data Definition Programs for those projects that you re-extract.

You may also decide you do not want to keep all the extracted data (Data Definition Programs) in the Workspace. DPL provides a way to explicitly delete all extracted data at once.

⇒ Click Portfolio | Project Data | Delete.

⇒ DPL prompts you to be sure you want to delete the files. Click Yes.

DPL deletes the Data Definition Programs from the Workspace.

⇒ Save your Workspace for future reference.

For your reference, an example file named DB-Linked Portfolio Done.da that is the end result of the tutorial completed in this chapter has been provided within the Examples folder of your DPL installation directory.

## 9.7 Using Previous Revisions and/or Review Indices

---

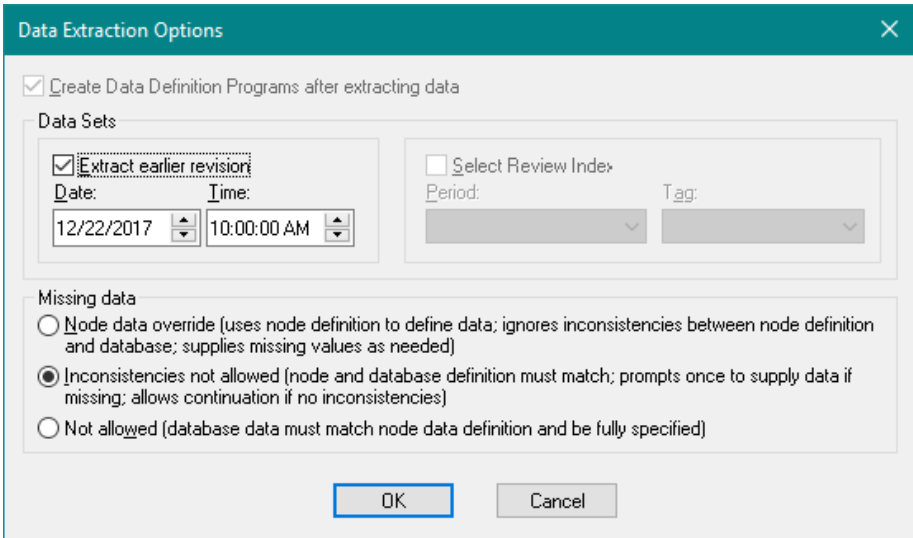
If the database that stores the data supporting your portfolio review process is configured for revision tracking and/or with a review index, then DPL allows you to conduct analyses or do reporting on specific revisions and/or for a specific review index. This section discusses using previous revisions and/or review indices.

### 9.7.1 Using Previous Revisions

In a database configured for revision tracking, multiple revisions of the data are stored in the database. These revisions are identified by a Revision ID (an increasing integer such that for a given data item, the larger the integer, the more recent the revision) and a Revision Date. For a given Model ID and/or Project ID and Node ID combination, the record with the maximum Revision ID is the most recent revision.

The maximum Revision ID within a table may vary by Model ID and/or Project ID and Node ID combination. For example, in the sample database delivered with DPL, in the table `Project_Tbl` there are two sets of records: one set with a Node ID of `probs_phase_1` to store the probabilities for Phase 1 Success, and another set with a Node ID of `probs_phase_2` to store the probabilities for Phase 2 Success. The maximum Revision ID for records where Model ID is equal to 1 and Project ID is equal to 1 and Node ID is equal to "probs\_phase\_1" may be different from the maximum Revision ID for records where Model ID is equal to 1 and Project ID is equal to 1 and Node ID is equal to "probs\_phase\_2". This allows revisions to be tracked on a per Node ID basis. Note however that if you specify that revision IDs are at the project level (see Section 9.5.2) then revision IDs may not vary at the Node ID level.

With the query settings as shown within the previous section in Figure 9-22, DPL extracts the most recent revision for each data item. To extract an earlier revision, check the Extract earlier revision checkbox within the *Data Sets* section of the Data Extraction Options dialog and specify the date and time that the revision must come before. See Figure 9-31.



**Figure 9-31. Extracting an Earlier Revision within the Data Extraction Options dialog**

With the settings as shown in the dialog in Figure 9-31, DPL will extract the last revision of each data item that occurs at or before December 22nd, 2017 at 10:00:00 AM. If for a given Node ID no such revision exists (i.e., all revisions occurred after December 22nd, 2017 at 10:00:00 AM), then DPL will supply zeroes as missing data for that data item (assuming you do not have Not allowed selected in the Missing data section of the dialog; if you do have Not allowed selected, then DPL stops extracting).

### 9.7.2 Setting up the Workspace for Review Indices

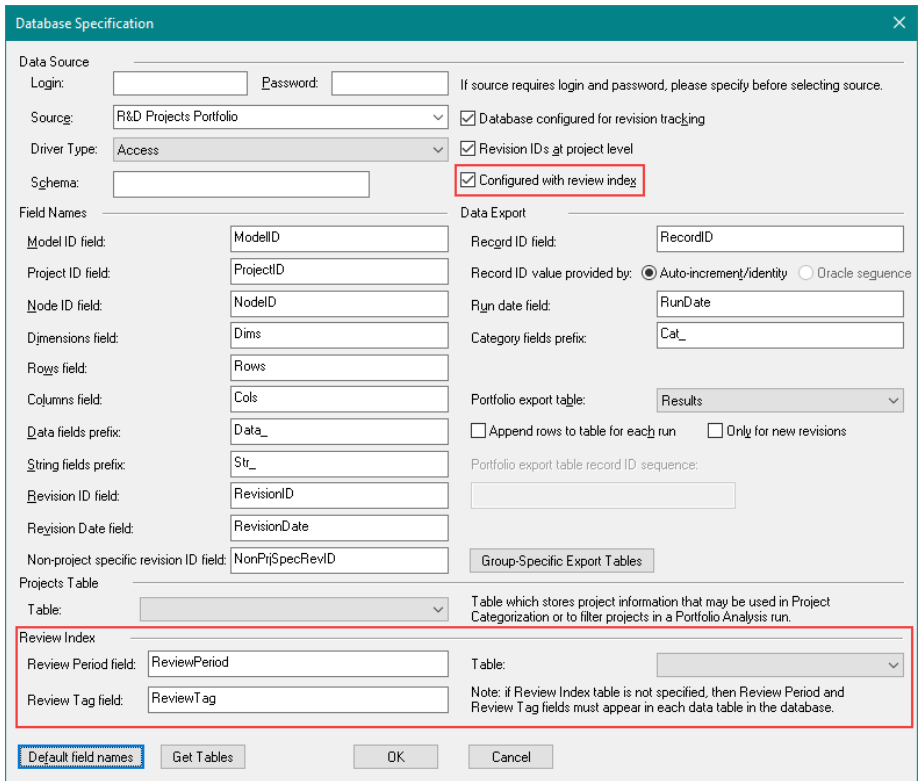
A review index comprises of two unique identifiers: a review tag and a review period. If the database that stores the data supporting your portfolio review is configured for a review index then DPL allows you to select a specific dataset to analyze using a review tag and review period combination.

The review tag can be used to identify a dataset by the purpose for which it was used, such as "Senior Management Review", "Annual Portfolio Submission", or "Quarter End Review". While the review period identifies a specific time period for the dataset, such as a quarter, month or year (e.g., 1Q 2018, 1/2018 or 2018). An example of a review index might be "Quarter End Review, 1Q 2018". If you were to extract using that review index, you are telling DPL that you'd like the dataset that was submitted as a quarter end review for the first quarter of 2018.

Note: the database must be configured with revision tracking in order for it to be able to be configured with a review index.

The default names for the review tag and review period fields are: ReviewTag and ReviewPeriod, respectively. These fields must be integer fields. To tell DPL that your database is configured with a review index, you need to use the Database Specifications dialog (Data | Database | Set Up). See Figure 9-32.

⇒ Select Data | Database | Set Up.



**Figure 9-32. Database Specifications Dialog for Review Index**

⇒ Within the *Data Source* section check the Configured with review index box to indicate the database has a review index. The Review Period and Review Tag fields are now available.

Within the *Review Index* section near the bottom of the dialog, you must specify field names for review period and review tag by using the Default field names button or specifying your own.

⇒ Click the Default field names button to supply default field names for the Review Period and Review Tag fields.

A database can be configured with a review index in one of two ways:

- 1) a separate review index table containing fields for model id (optional), project id, revision id, non-project specific revision ID (if needed), review period and review tag, or by
- 2) each database table containing fields for review period and review tag.

You may only specify a review index table if you have indicated that revision ID's are at the project level. If you have and you have a separate review index table, use the Table drop down list to specify the name of the review index table.

A separate review index table provides the mapping between projects (using model ID and/or project ID), revisions (using revision ID and if needed non-project specific revision ID) and review indices (using review period and review tag). If you configure your database with a review index table, then this table is used to find the correct revision ID (and if needed non-project specific revision ID) for a given project and review index. This revision ID/non-project specific revision ID is subsequently used to select the data from the remaining database tables when extracting data using a review index.

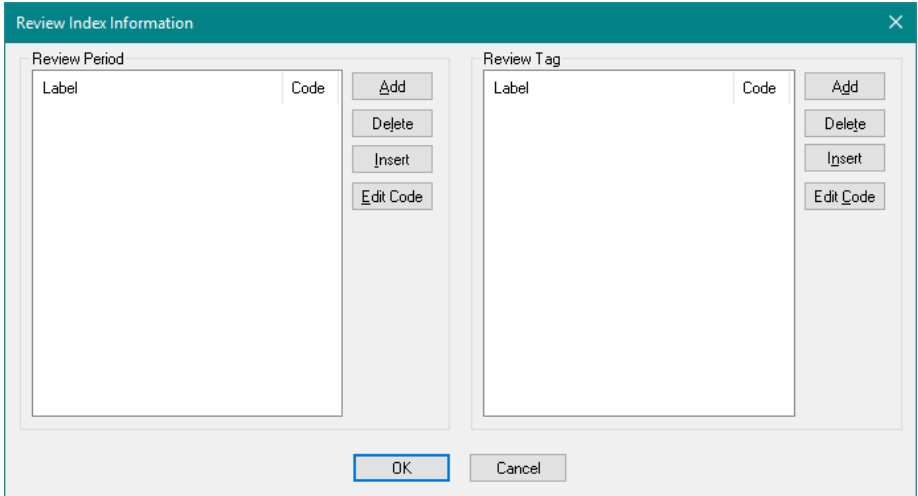
In the review index table implementation, revision ID's cannot vary by Node ID. Revision ID's may only vary by project.

If you choose not to have a separate review index table and/or revision IDs are not at the project level, then revision ID's may still vary by node ID.

Note: for the purposes of this example, the example database file delivered with your license has a review index configured both of the ways identified above (i.e., a separate table named Rev\_Index\_Tbl and ReviewPeriod and ReviewTag fields in each table). If you wish, you may experiment with both approaches.

Once you have told DPL that the database is configured for a Review Index, you need to provide further information about what the specific review periods and review tags are in the database and which integer codes are used for each. To do so:

- ⇒ Click OK to close the Database Specification dialog.
- ⇒ Click Portfolio | Project Data | Review Index. The Review Index Information dialog appears as in Figure 9-33.



**Figure 9-33. Review Index Information dialog**

⇒ Within the Review Period section of the dialog, click the Add button. A label of Period 1 with a code of 1 automatically appears ready for editing.

⇒ Edit the Period 1 label to be "1Q 2018" (without quotes).

This indicates that any data revision that is identified with a review period of 1 is 1Q 2018 data.

⇒ Repeat the above process to create a review period called "2Q 2018" with code 2.

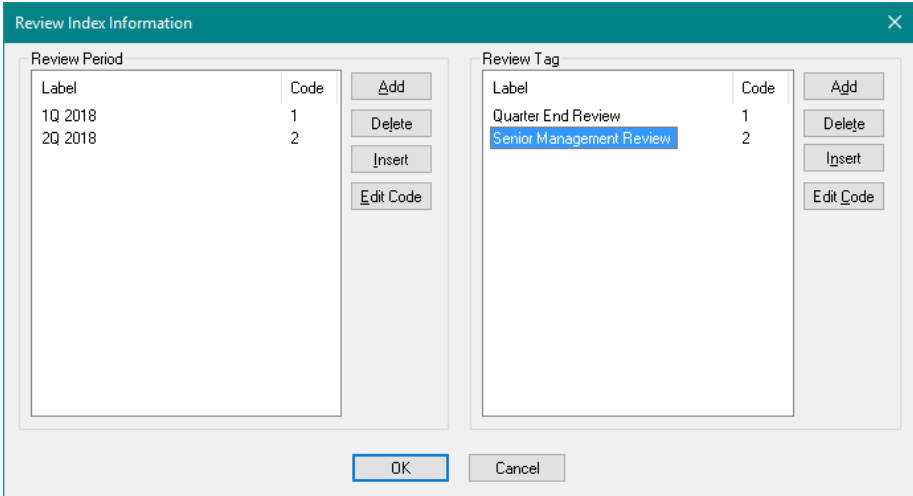
⇒ Click the Add button within the Review Tag section. A label of Tag 1 with a code of 1 automatically appears for editing.

⇒ Edit the Tag 1 label to be "Quarter End Review" (without quotes).

You have indicated that any data revision that is identified with a review tag of 1 is data that was submitted for a Quarter End Review.

⇒ Repeat the above process to create a review tag called "Senior Management Review" with code 2.

The Review Index Information dialog should now look like Figure 9-34.



**Figure 9-34. Review Index Information dialog with Information Specified**

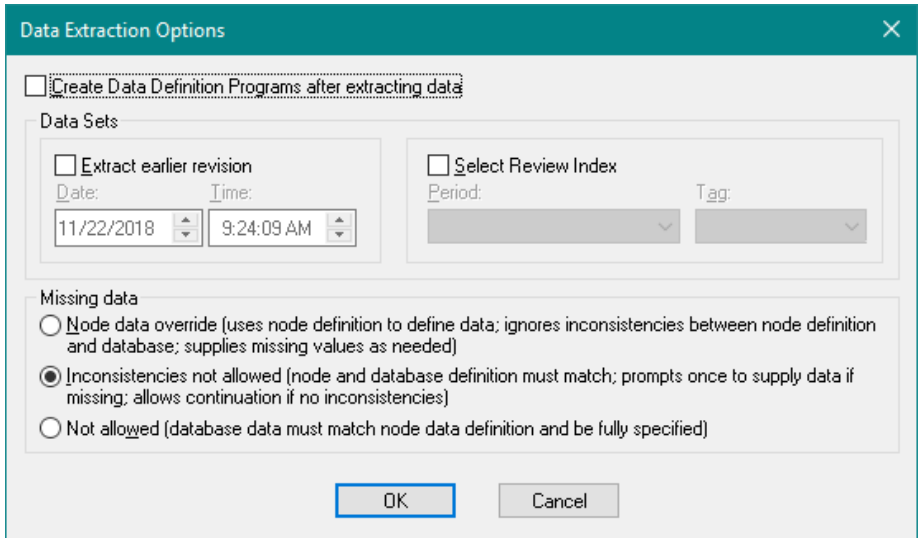
⇒ Click OK to close the dialog.

### 9.7.3 Extracting Data using Review Indices

With a database that has a review index, you may have DPL extract the latest revision of a specific review index or a previous revision from a specific review index.

The Select Review Index checkbox within the *Data Sets* section of the Data Extraction Options dialog is enabled now that you've told DPL that the database is configured for a review index. If neither checkbox in the Revisions section of the dialog is checked (as in Figure 9-35), DPL will extract the latest revision of the data regardless of whether it was part of any review index or not for each project.





**Figure 9-35. Data Extraction Options dialog with Review Index Enabled**

With just the Extract earlier revision checkbox checked, DPL will extract the last revision before the specified revision date and time for each project regardless of whether that revision is part of any review index. As mentioned above if no such revision exists, DPL will supply missing data as indicated by the settings in the Missing data section of the dialog. See Figure 9-31 at the beginning of this section (Note: the Select Review Index checkbox would also be enabled).

With just the Select Review Index checkbox checked, DPL will extract the latest revision for the specified review index combination. If no such review index exists for a given project, DPL will supply missing data as indicated by the settings in the Missing data section of the dialog. See Figure 9-36 below.

**Data Extraction Options**

Create Data Definition Programs after extracting data

**Data Sets**

Extract earlier revision

Date: 11/22/2018 Time: 9:24:09 AM

Select Review Index

Period: 1Q 2018 Tag: Quarter End Review

**Missing data**

Node data override (uses node definition to define data; ignores inconsistencies between node definition and database; supplies missing values as needed)

Inconsistencies not allowed (node and database definition must match; prompts once to supply data if missing; allows continuation if no inconsistencies)

Not allowed (database data must match node data definition and be fully specified)

OK Cancel

**Figure 9-36. Extracting the Latest Revision of a Specific Review Index**

With **both** checkboxes checked in the Revisions section, DPL will extract the last revision before the specified revision date and time for the specified review index combination. If no such revision exists for the specified review index for a given project, DPL will supply missing data as indicated by the settings in the Missing data section of the dialog.

Using the example review index above of "Quarter End Review, 1Q 2018", assume that the final submission date for this was March 22, 2018. Also assume that a draft of the submission was produced on March 15, 2018. To extract the dataset used for the draft submission, you would set the controls in the Data Extraction Options dialog as shown in Figure 9-37. DPL will extract the dataset with the latest revision that occurred at or before March 15, 2018 and was used for the "Quarter End Review, 1Q 2018" Review Index.

**Data Extraction Options**

Create Data Definition Programs after extracting data

**Data Sets**

<input checked="" type="checkbox"/> Extract earlier revision	<input checked="" type="checkbox"/> Select Review Index
Date: 3/15/2018	Time: 11:59:59 PM
Period: 1Q 2018	Tag: Quarter End Review

**Missing data**

Node data override (uses node definition to define data; ignores inconsistencies between node definition and database; supplies missing values as needed)

Inconsistencies not allowed (node and database definition must match; prompts once to supply data if missing; allows continuation if no inconsistencies)

Not allowed (database data must match node data definition and be fully specified)

OK Cancel

**Figure 9-37. Extracting an Earlier Revision for a Specific Review Index**

## 10. Program-Linked Portfolios

This chapter contains a tutorial on how to set up a DPL Program-Linked Portfolio. It uses an example of an existing stand-alone DPL model that is spreadsheet-linked, and shows how to convert this into a program-linked model that can then be used as a template model in a program-linked portfolio to analyze a set of R&D projects.

Converting the spreadsheet-linked model to a program-linked model is covered in Sections 10.1 through 10.3. Sections 10.4 through 10.6 discuss how to use a value node for project names, how to create additional Data Definitions Programs, and how to define Portfolio Groups and Elements for program-linked Portfolios.

Of course, it is not necessary to start with a spreadsheet-linked example in order to create a program-linked model. A program-linked model can be set up directly. If you are proficient with DPL code and with using DPL Programs, the information in Sections 10.1 through 10.3 may be of less interest.

While it may be easiest to follow the tutorial with the example files provided, you may also complete the tutorial using files of your own that you wish to modify and set up for a Portfolio Analysis. The text of the tutorial assumes you are using the provided example files.

### 10.1 Initialization Links

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The example DPL Workspace for the start of this tutorial is the DPL Workspace as completed through Chapter 3 of this manual. If you completed that tutorial and saved that file, you may use that. Alternatively, the file you need is delivered as one of the examples with DPL Portfolio.

- ⇒ Start DPL Portfolio.
- ⇒ Select File | Open Workspace.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select Excel-Linked Portfolio Prepared.da and click Open. (Or browse to your saved file from the end of Chapter 3 and open it.)

⇒ Save the Workspace under a new name.

DPL opens the Workspace, which contains one model called Drug Development. This model is a typical yet simple drug development example with a funding level decision upfront. The decision is followed by phase I, II and III technical uncertainties which are then followed by a regulatory uncertainty. Lastly, there are some commercial uncertainties. The tree is asymmetric: failure at any of the technical uncertainties or regulatory uncertainty is a terminal outcome.

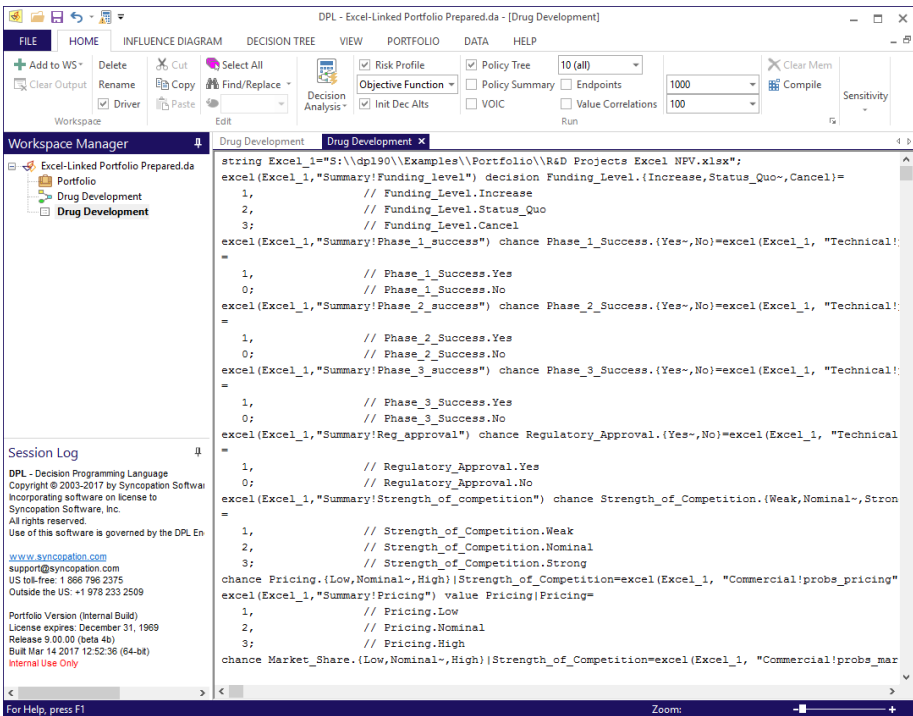
The model in the Workspace has already been set up to be part of a DPL Portfolio. In other words the Portfolio Attributes have been defined, the Portfolio Model indicator has been set, the model has been set up to track development costs and the get/pay expressions within the tree have been modified to use the Portfolio Attributes. For more information on how to set up a stand-alone model for use in a DPL Portfolio, see Chapter 3.

This section will show you one way to set up DPL Program initialization-links by converting a spreadsheet-linked model. Briefly, the process is:

- Convert the model to a program.
- Delete the sequence section.
- Modify the data definitions section to have values and arrays that will be used to initialize nodes in the Influence Diagram.
- Link the program to the model.
- Use the data definitions in the program to initialize probabilities and other data for nodes in the Influence Diagram.

You will follow this process now.

⇒ Click Home | Workspace | Add to WS and select Program from Model from the list. DPL creates a program from the Influence Diagram/Decision Tree model as shown in Figure 10-1.



**Figure 10-1. Program Created from Drug Development Model**

When you create a DPL Program from a DPL Model, DPL sets the Driver Program indicator for the program since the program can be run in the same way that a DPL Model can. However, you are going to modify the program so that it only contains data definitions and does not have a sequence section. Programs without sequence sections cannot be Driver Programs. You will first remove this indicator.

- ⇒ With the new program active, look at the Home | Workspace group. Note that Driver box is checked.
- ⇒ Un-check the Driver checkbox. Note that DPL moves the program to a new section of the Workspace Manager called Unreferenced programs.

The DPL Program is unreferenced because you have just told DPL it is not a Driver Program (i.e., that it cannot be run) and it is currently not linked to any DPL Model.

DPL Programs contain two sections: a Data Definition section which is equivalent to the Influence Diagram, and a sequence section which is equivalent to the Decision Tree. You do not need the sequence section of the DPL Program, so you will delete it now.

- ⇒ Page down in the program until you find a line beginning with the reserved word "sequence".
- ⇒ Select from the beginning of that line to end of the program. See Figure 10-2.

```

excel(Excel_1,"DCF!Dev_Costs_Ph_1") value Dev_Costs_Ph_1;
excel(Excel_1,"DCF!Dev_Costs_Ph_2") value Dev_Costs_Ph_2;
excel(Excel_1,"DCF!Dev_Costs_Ph_3") value Dev_Costs_Ph_3;
excel(Excel_1,"DCF!Dev_Costs_Reg") value Dev_Costs_Reg;

sequence( attributes = 3, objective = $1 ):

decide
  to Funding_Level.(Increase,Status_Quo) and get PV_Phase_1,Dev_Costs_Ph_1,0 then gamble
    on Phase_1_Success.Yes and get PV_Phase_2,Dev_Costs_Ph_2,0 then gamble
      on Phase_2_Success.Yes and get PV_Phase_3,Dev_Costs_Ph_3,0 then gamble
        on Phase_3_Success.Yes and get PV_Reg,Dev_Costs_Reg,0 then gamble
          on Regulatory_Approval.Yes and get PV_Launch,Dev_Costs_Launch,1 then
            a: gamble on Strength_of_Competition then
              gamble on Pricing then
                gamble on Market_Share then
                  gamble on Market_Size and get PV_On_Market,0,0
                    on Regulatory_Approval.No
                      on Phase_3_Success.No
                        on Phase_2_Success.No
                          on Phase_1_Success.No
                            to Funding_Level.Cancel

```

**Figure 10-2: DPL Pogram with Sequence Section Selected**

- ⇒ Press the Delete key to delete the selected text.

You now have a program that only contains data definitions. You will modify this further so it can be linked to the Influence Diagram.

- ⇒ Scroll to the top of the DPL Program.
- ⇒ Delete the entire first line of the program that begins with the reserved word "string".
- ⇒ Delete the next four lines that define the decision called Funding\_Level.

You have just deleted a string value that DPL uses when linking to Excel, and the DPL code which is the equivalent of the decision node called Funding Level in the Influence Diagram. You will not need either of these. For more information on DPL code and DPL Programs, see Chapter 15 of the *DPL User Guide*.

Look at the next four lines of code in the DPL Program (now the first four lines). These lines of code are the equivalent of the chance node Phase 1 Success. The excel phrase before the reserved word "chance" is the calculation link between DPL and Excel. The excel phrase after the equal sign on the first line of code is the initialization link. You will now modify much of this to create a value which will be used to initialize the probabilities of the chance node Phase 1 Success in the Influence Diagram.

- ⇒ Select from the beginning of the first line through the exclamation point after the word "Technical".
- ⇒ Type "value " in place of the selected text (without quotes).
- ⇒ Select from the first double-quote to the end of the line.
- ⇒ Type " = 0.77;" in place of the selected text (without quotes).
- ⇒ Delete the next three lines of code. Your program should now look like Figure 10-3.

```

value prob_phase_1 = 0.77;
excel(Excel_1,"Summary!Phase_2_success") chance Phase_2_Success.{Yes~,No}=excel(Excel_1, "T
=
1,          // Phase_2_Success.Yes
0;         // Phase_2_Success.No
excel(Excel_1,"Summary!Phase_3_success") chance Phase_3_Success.{Yes~,No}=excel(Excel_1, "T
=
1,          // Phase_3_Success.Yes
0;         // Phase_3_Success.No
excel(Excel_1,"Summary!Reg_approval") chance Regulatory_Approval.{Yes~,No}=excel(Excel_1, "
=
1,          // Regulatory_Approval.Yes
0;         // Regulatory_Approval.No
excel(Excel_1,"Summary!Strength_of_competition") chance Strength_of_Competition.{Weak,Nomin
=
1,          // Strength_of_Competition.Weak
2,          // Strength_of_Competition.Nominal
3;         // Strength_of_Competition.Strong
chance Pricing.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!probs
excel(Excel_1,"Summary!Pricing") value Pricing|Pricing=
1,          // Pricing.Low
2,          // Pricing.Nominal
3;         // Pricing.High
chance Market_Share.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!
excel(Excel_1,"Summary!Market_share") value Market_Share|Market_Share=
1,          // Market_Share.Low

```

**Figure 10-3. Program with New Value Defined**

You have just defined a value called `prob_phase_1`. It is initialized to be 0.77.



- ⇒ Repeat the above process to turn the code for the chance events called Phase\_2\_success, Phase\_3\_success and Regulatory\_approval into definitions of three values with data of 0.55, 0.65 and 0.90 respectively. Your program should now look like Figure 10-4.

```

value prob_phase_1 = 0.77;
value prob_phase_2 = 0.55;
value prob_phase_3 = 0.65;
value prob_reg_approval = 0.90;
excel(Excel_1,"Summary!Strength_of_competition") chance Strength_of_Competition.{Weak,Nomin
=
  1,          // Strength_of_Competition.Weak
  2,          // Strength_of_Competition.Nominal
  3;         // Strength_of_Competition.Strong
chance Pricing.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!prob
excel(Excel_1,"Summary!Pricing") value Pricing|Pricing=
  1,          // Pricing.Low
  2,          // Pricing.Nominal
  3;         // Pricing.High
chance Market_Share.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!
excel(Excel_1,"Summary!Market_share") value Market_Share|Market_Share=
  1,          // Market_Share.Low
  2,          // Market_Share.Nominal
  3;         // Market_Share.High
excel(Excel_1,"Summary!Market_size") chance Market_Size.{Low,Nominal~,High}=excel(Excel_1,
=
  1,          // Market_Size.Low
  2,          // Market_Size.Nominal
  3;         // Market_Size.High
excel(Excel_1,"DCF!PV_Phase_1") value PV_Phase_1;
excel(Excel_1,"DCF!PV_Phase_2") value PV_Phase_2;

```

**Figure 10-4. Program with Four New Values Defined**

In the Influence Diagram, the three chance nodes for the technical uncertainties and the regulatory approval chance node are all two-state chance nodes. Only a single value is needed to initialize the probabilities for each chance node (the probability of success in this case). The probability of failure is 1 – the probability of success.

You are about to modify the DPL code for a chance node that has three states. To do this, you will create an array to hold the three values.

- ⇒ Select from the beginning of the next line of code (for Strength of Competition) through the exclamation point after the word "Commercial".
- ⇒ Type "array " in place of the selected text.
- ⇒ Select from the first double-quote to the end of the line.
- ⇒ Type " = {0.20, 0.55, 0.25};" in place of the selected text.

- ⇒ Delete the next four lines of code. Your program should now look like Figure 10-5.

```

value prob_phase_1 = 0.77;
value prob_phase_2 = 0.55;
value prob_phase_3 = 0.65;
value prob_reg_approval = 0.90;
array probs_strength_of_competition = {0.20, 0.55, 0.25};
chance Pricing.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!probs
excel(Excel_1,"Summary!Pricing") value Pricing|Pricing=
  1,          // Pricing.Low
  2,          // Pricing.Nominal
  3;         // Pricing.High
chance Market_Share.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!
excel(Excel_1,"Summary!Market_share") value Market_Share|Market_Share=
  1,          // Market_Share.Low
  2,          // Market_Share.Nominal
  3;         // Market_Share.High
excel(Excel_1,"Summary!Market_size") chance Market_Size.{Low,Nominal~,High}=excel(Excel_1,
=
  1,          // Market_Size.Low
  2,          // Market_Size.Nominal
  3;         // Market_Size.High
excel(Excel_1,"DCF!FV_Phase_1") value FV_Phase_1;
excel(Excel_1,"DCF!FV_Phase_2") value FV_Phase_2;
excel(Excel_1,"DCF!FV_Phase_3") value FV_Phase_3;
excel(Excel_1,"DCF!FV_Registration") value FV_Reg;
excel(Excel_1,"DCF!FV_Launch") value FV_Launch;
excel(Excel_1,"DCF!FV_post_launch") value FV_On_Market;

```

**Figure 10-5. Program with New Array Defined**

You will repeat this procedure for the lines of code that define the chance event Market Size which are several lines further down in the program.

- ⇒ Scan down the code to find the line that starts "excel(Excel\_1,"Summary!Market\_size)".
- ⇒ Select from the beginning of this line of code through the exclamation point after the word "Commercial".
- ⇒ Type "array " in place of the selected text.
- ⇒ Select from the first double-quote to the end of the line.
- ⇒ Type " = {0.30, 0.40, 0.30};" in place of the selected text.
- ⇒ You do not need any of the values that follow this new array that you just defined. Delete the remaining lines of code. Your program should now look like Figure 10-6.

```

value prob_phase_1 = 0.77;
value prob_phase_2 = 0.55;
value prob_phase_3 = 0.65;
value prob_reg_approval = 0.90;
array probs_strength_of_competition = {0.20, 0.55, 0.25};
chance Pricing.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!probs
excel(Excel_1,"Summary!Pricing") value Pricing|Pricing=
    1,          // Pricing.Low
    2,          // Pricing.Nominal
    3;         // Pricing.High
chance Market_Share.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!
excel(Excel_1,"Summary!Market_share") value Market_Share|Market_Share=
    1,          // Market_Share.Low
    2,          // Market_Share.Nominal
    3;         // Market_Share.High
array probs_market_size = {0.30, 0.40, 0.30};
|

```

**Figure 10-6. Program with Market Size Probability Array Defined**

There are two remaining chance nodes in the Influence Diagram to be dealt with: Pricing and Market Share. Both of these chance nodes have probabilities that are conditioned by the chance node Strength of Competition. You can see this in the Influence Diagram because there is an influence arc with a green arrowhead from Strength of Competition to both nodes. The code in the program that is the equivalent of these two nodes also reflects the conditioning. To modify this code, you will create two two-dimensional arrays for the probabilities to initialize the chance nodes. The arrays you created above were one-dimensional.

- ⇒ Find the line that starts "chance Pricing.{Low,Nominal~,High}".
- ⇒ Select from the beginning of this line of code through the exclamation point after the word "Commercial".
- ⇒ Type "array " in place of the selected text.
- ⇒ Select from the first double-quote to the end of the line.
- ⇒ Type " = {0.05, 0.45, 0.50; 0.30, 0.40, 0.30; 0.50, 0.45, 0.05};" in place of the selected text.
- ⇒ Delete the next four lines of code. Your program should now look like Figure 10-7.

```

value prob_phase_1 = 0.77;
value prob_phase_2 = 0.55;
value prob_phase_3 = 0.65;
value prob_reg_approval = 0.90;
array probs_strength_of_competition = {0.20, 0.55, 0.25};
array probs_pricing = {0.05, 0.45, 0.50;
0.30, 0.40, 0.30;
0.50, 0.45, 0.05};
chance Market_Share.{Low,Nominal~,High}|Strength_of_Competition=excel(Excel_1, "Commercial!
excel(Excel_1,"Summary!Market_share") value Market_Share|Market_Share=
    1,          // Market_Share.Low
    2,          // Market_Share.Nominal
    3;          // Market_Share.High
array probs_market_size = {0.30, 0.40, 0.30};

```

**Figure 10-7. Program with Pricing Probability Array Defined**

- ⇒ Repeat the above process for the `Market_share` code; the line starts "`chance Market_Share.{Low,Nominal~,High}`".
- ⇒ Select from the beginning of this line of code through the exclamation point after the word "`Commercial`".
- ⇒ Type "`array` " in place of the selected text.
- ⇒ Select from the first double-quote to the end of the line.
- ⇒ Type "`= {0.10, 0.40, 0.50; 0.30, 0.40, 0.30; 0.40, 0.40, 0.20};`" in place of the selected text.
- ⇒ Delete the next four lines of code. Your program should now look like Figure 10-8.

```

value prob_phase_1 = 0.77;
value prob_phase_2 = 0.55;
value prob_phase_3 = 0.65;
value prob_reg_approval = 0.90;
array probs_strength_of_competition = {0.20, 0.55, 0.25};
array probs_pricing = {0.05, 0.45, 0.50;
0.30, 0.40, 0.30;
0.50, 0.45, 0.05};
array probs_market_share = {0.10, 0.40, 0.50;
0.30, 0.40, 0.30;
0.40, 0.40, 0.20};
array probs_market_size = {0.30, 0.40, 0.30};

```

**Figure 10-8. Program with All Probability Initializers Defined**

You may find it helpful to add comments to your code. You can place single-line comments after two double slashes on a line. Figure 10-9 shows the program with added comments.

```

value prob_phase_1 = 0.77; // probability of success
value prob_phase_2 = 0.55; // probability of success
value prob_phase_3 = 0.65; // probability of success
value prob_reg_approval = 0.90; // probability of approval
array probs_strength_of_competition = {0.20, 0.55, 0.25}; // probability of weak, nominal, strong
//probability of low, nominal, high
array probs_pricing = {0.05, 0.45, 0.50; //given strength of comp is weak
0.30, 0.40, 0.30; //given strength of comp is nominal
0.50, 0.45, 0.05}; //given strength of comp is strong
//probability of low, nominal, high
array probs_market_share = {0.10, 0.40, 0.50; //given strength of comp is weak
0.30, 0.40, 0.30; //given strength of comp is nominal
0.40, 0.40, 0.20}; //given strength of comp is strong
array probs_market_size = {0.30, 0.40, 0.30}; //probability of low, nominal, high

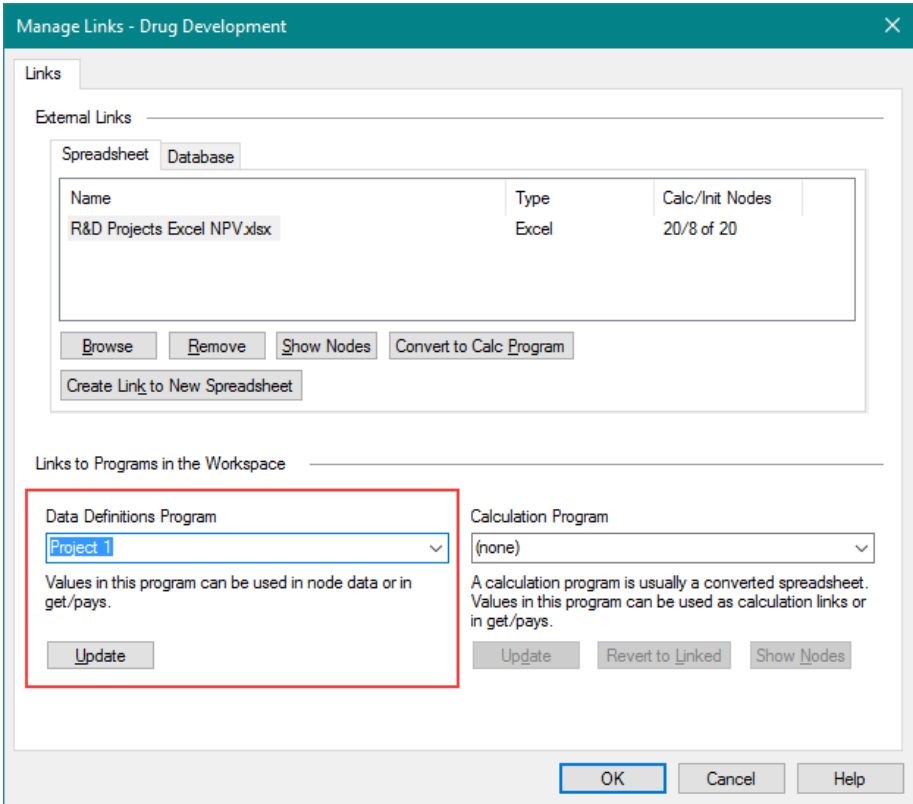
```

**Figure 10-9. Program with Added Comments**

The program is now ready to be used to initialize the probabilities of the chance nodes in the Influence Diagram. First you will rename the program something appropriate and then link the program to the model.

- ⇒ Select the item for the program within the Workspace Manager, press F2 and rename the program to be "Project 1".
- ⇒ Activate the Drug Development model.

- ⇒ Click Influence Diagram | Links | Manage.
- ⇒ Select Project 1 within the drop-down list under the Data Definitions Program. The Manage Links dialog should now look like Figure 10-10.

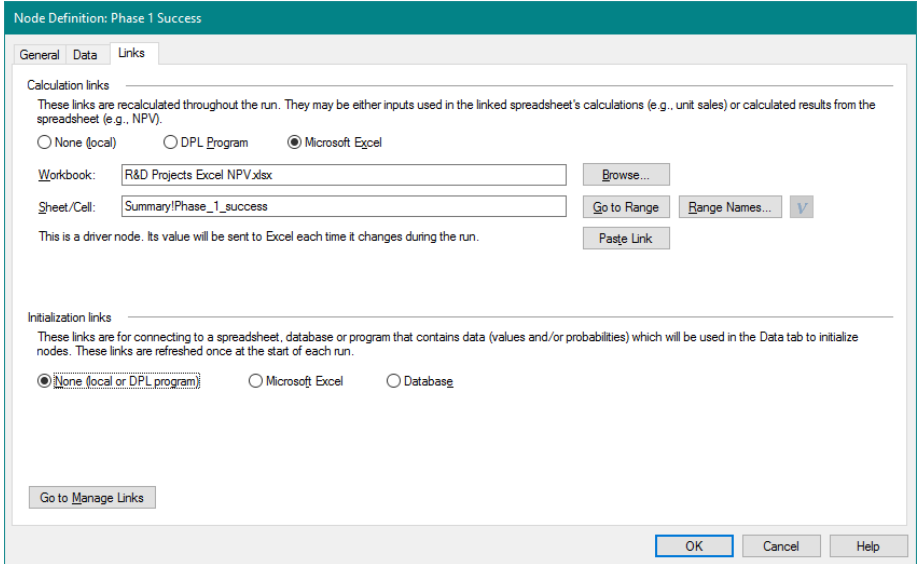


**Figure 10-10. Manage Links dialog with Program Selected**

- ⇒ Click OK to close the Manage Links dialog.
- ⇒ Double-click on the node Phase 1 Success in the Influence Diagram.

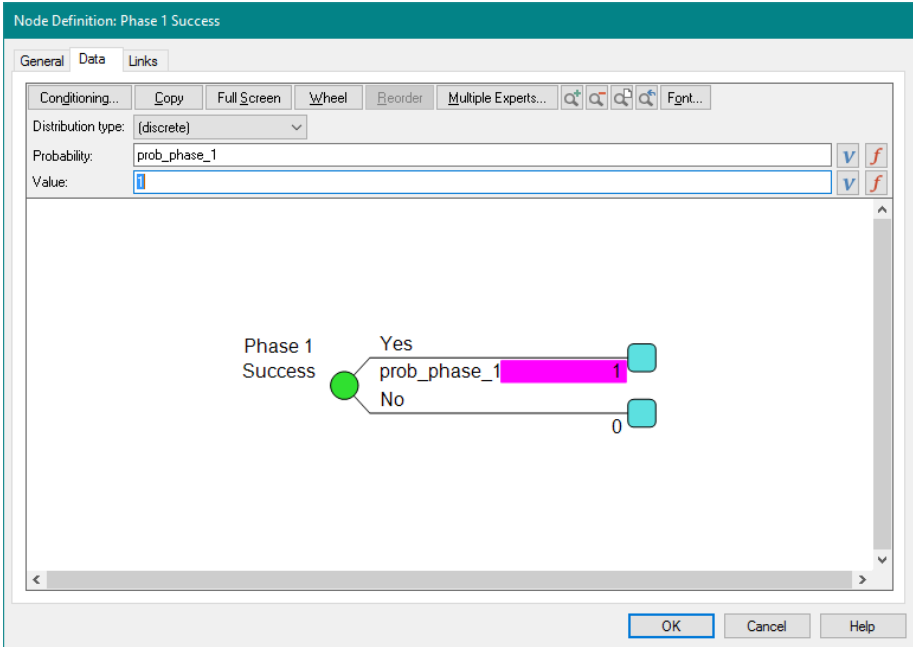
On the Data tab of the Node Definition dialog, you can see that the probabilities of this node are initialized by an Excel initialization link (the syntax is =Sheet\_name!range\_name).

- ⇒ Switch to the Links tab.
- ⇒ In the Initialization links section, select the radio button for None (local or DPL program). The Links tab of the Node Definition dialog should look like Figure 10-11.



**Figure 10-11. Links Tab for Phase 1 Success Node**

- ⇒ Switch back to the Data tab.
- ⇒ In the Probability edit box, delete everything from the equal sign to the exclamation point inclusive.
- ⇒ Press Enter. You have now told DPL that the probability for this chance node is initialized by prob\_phase\_1. Since the model is linked to the DPL Program you just created, DPL will be able to find the value in that program. The Data tab of the Node Definition dialog should look like Figure 10-12.



**Figure 10-12. Data Tab for Phase 1 Success Node**

- ⇒ Click OK to close the Node Definition Dialog.
- ⇒ Repeat the above process for the Phase 2 Success, Phase 3 Success and Regulatory Approval chance nodes.

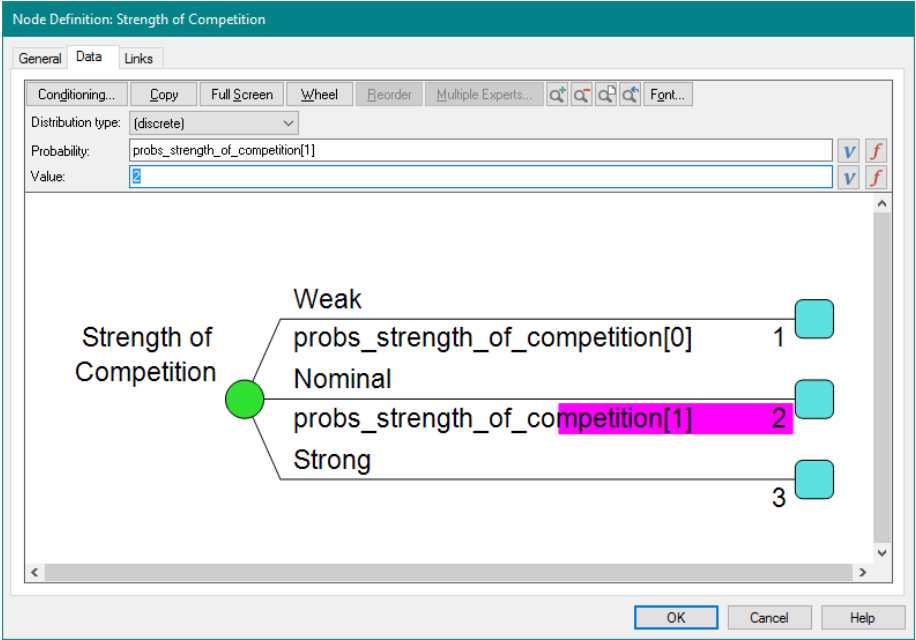
The three technical uncertainties and the regulatory uncertainty are now initialized with the data from the DPL Program.

You will now set up the Strength of Competition and Market Size nodes to be initialized by the data in the DPL Program.

- ⇒ Double-click on the node Strength of Competition.
- ⇒ Switch to the Links tab.
- ⇒ In the *Initialization links* section, select the radio button for None (local or DPL program).
- ⇒ Switch back to the Data tab.
- ⇒ In the Probability edit box for the Weak branch, make the data read "probs\_strength\_of\_competition[0]" (without the quotes).
- ⇒ Arrow down twice so the Nominal branch probability field is selected.
- ⇒ Type "probs\_strength\_of\_competition[1]" for the data.



- ⇒ Press Enter.
- ⇒ Right mouse click in the Data Entry tree window and select Lengthen Branch. The dialog should look like Figure 10-13.



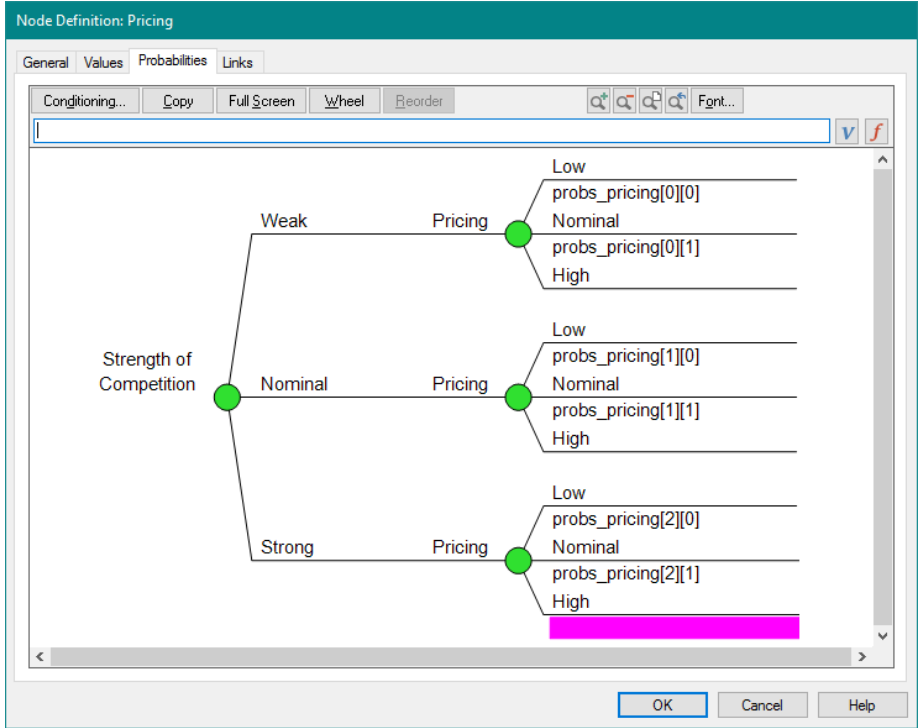
**Figure 10-13. Data Tab for Strength of Competition Node**

- ⇒ Click OK to close the Node Definition dialog.
- ⇒ Repeat the above process for Market Size using probs\_market\_size[0] and probs\_market\_size[1] for the initializing data.

Note: although you entered all three probabilities into the arrays in the DPL Program for both Strength of Competition and Market Size, you only initialized the first two states of each node and left the probability of the last state blank. You must do this in DPL when you are initializing probabilities with non-constant initializers (i.e., anything but a number). In this case you are initializing the probabilities with elements of an array, so you must leave the last probability blank. You must leave the last state blank so that DPL can assign a probability to the last state of one minus the sum of the probabilities of all the other states. This ensures the probabilities sum to one.

You will now initialize the probabilities of the two conditioned chance nodes in the model.

- ⇒ Double-click on the node Pricing.
- ⇒ Switch to the Links tab.
- ⇒ In the *Initialization links* section, select the radio button for None (local or DPL program).
- ⇒ Switch to the Probabilities tab.
- ⇒ In the edit box for the Strength of Competition = Weak and Pricing = Low branch (i.e., the first branch), make the data read "probs\_pricing[0][0]".
- ⇒ Arrow down **once** so the Strength of Competition = Weak and Pricing = Nominal branch (i.e., the second branch) is selected.
- ⇒ Type "probs\_pricing[0][1]" for the data.
- ⇒ Arrow down **twice** so the Strength of Competition = Nominal and Pricing = Low branch (i.e., the fourth branch) is selected.
- ⇒ Type "probs\_pricing[1][0]" for the data.
- ⇒ Arrow down **once** so the Strength of Competition = Nominal and Pricing = Nominal branch (i.e., the fifth branch) is selected.
- ⇒ Type "probs\_pricing[1][1]" for the data.
- ⇒ Arrow down **twice** so the Strength of Competition = Strong and Pricing = Low branch (i.e., the seventh branch) is selected.
- ⇒ Type "probs\_pricing[2][0]" for the data.
- ⇒ Arrow down **once** so the Strength of Competition = Strong and Pricing = Nominal branch (i.e., the eighth branch) is selected.
- ⇒ Type "probs\_pricing[2][1]" for the data.
- ⇒ Press Enter. The dialog should look like Figure 10-14.



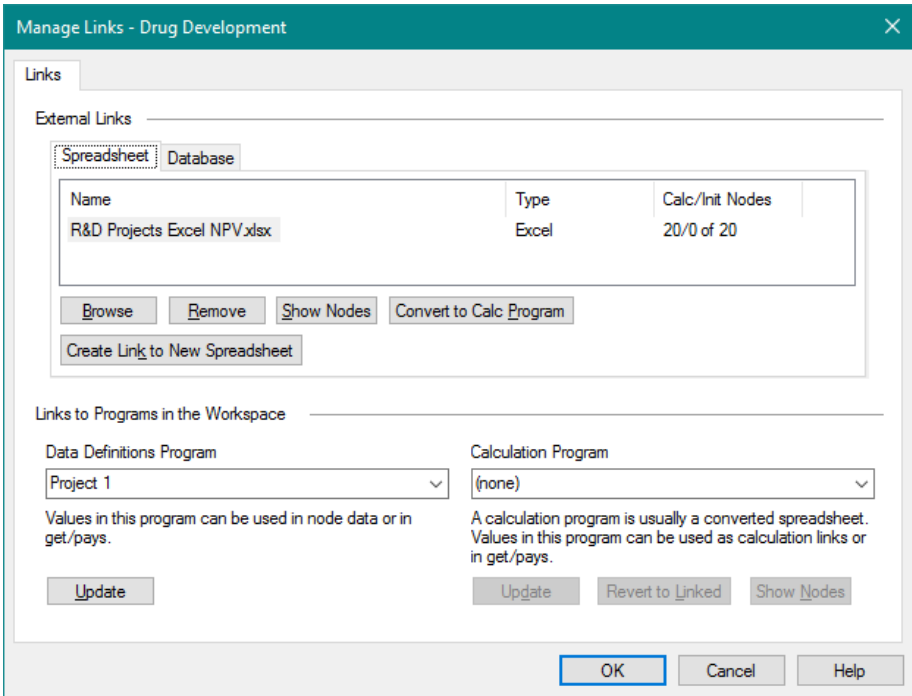
**Figure 10-14. Data Tab for Pricing Node**

- ⇒ Click OK to close the Node Definition dialog.
- ⇒ Repeat the above process for Market Share using `probs_market_share` for the initializing data with the same pattern of indexing as before, e.g., `[0][0]`, `[0][1]`, etc.

Note: for each state of the conditioning event, the probabilities for Pricing and Market Share must sum to one. Since you are initializing the probabilities with a non-constant initializer for Pricing and Market Share, the last probability for each set of probabilities must be left blank. Therefore, you left three probabilities blank (i.e., the last in each set) for each node.

The probabilities in the model are now all initialized by the data in the DPL Program. In fact, you have removed all initialization links to the Excel spreadsheet. You will now confirm this is the case.

- ⇒ Click Influence Diagram | Links | Manage. The dialog should indicate that there are no initialization links to the spreadsheet and 20 Calculation links. See Figure 10-15.



**Figure 10-15. Manage Links with Excel Initialization Links Removed**

⇒ Click Close to close the Manage Links dialog.

Note that the values for the various chance nodes and the one decision node in the Influence Diagram are all flags (1, 2, 3 or 0, 1). In the example, these flags will not vary on a project by project basis and hence do not need to be initialized by data from the Data Definitions Program. This may not always be the case. For example, you might set up the Market Size chance node so that it sends actual market size data to the spreadsheet for calculation rather than a flag. If this were the case, you would probably set up an array initializer for this data in the Data Definitions Program and initialize the values for the Market Size chance node in a similar way to which you initialized probabilities.

Note also that when initializing values for a chance node or decision node, you must specify values for all states (you do not leave the last state blank as you do with probabilities).

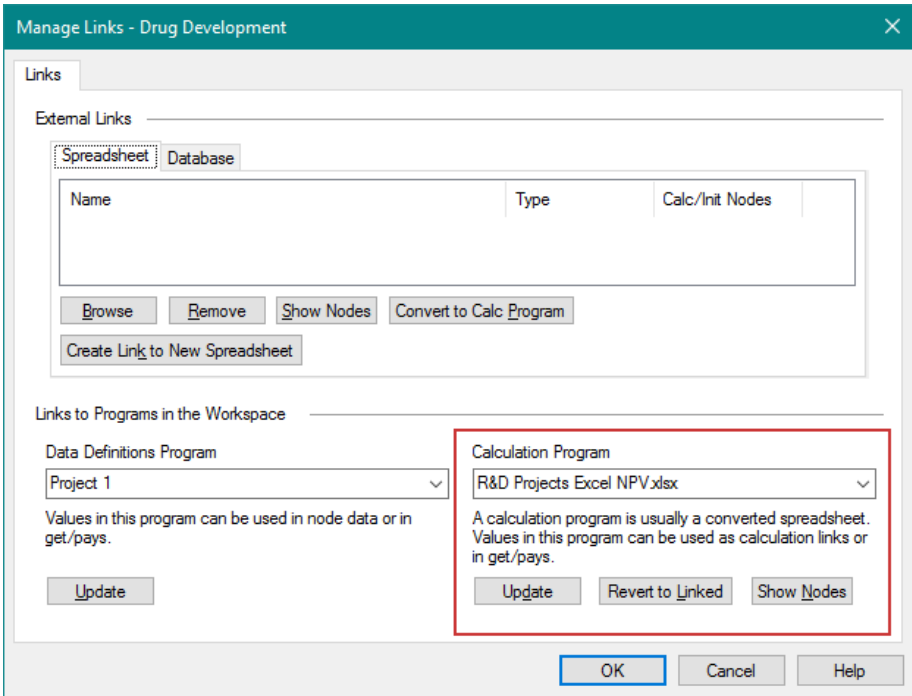
The next step to set up the model to be program-linked is to deal with the calculation links to the Excel spreadsheet. This will be covered in the next section.

## 10.2 Calculation Links

---

The Drug Development model as it currently stands has initialization links to a DPL Program and calculation links to an Excel spreadsheet. The quickest way to establish calculation links to a DPL Program in this situation is to convert the Excel spreadsheet to a program. You will do this now.

- ⇒ Click Influence Diagram | Links | Manage.
- ⇒ In the *External Links* section of the dialog, click on the Convert to Calc Program button.
- ⇒ In the Convert Spreadsheet to Program dialog, click on the Options button.
- ⇒ In the Conversion Options dialog, make sure "Always prefix names with sheet names" is selected.
- ⇒ Click OK to close the Conversion Options dialog.
- ⇒ Click OK to close the Convert Spreadsheet to Program dialog.
- ⇒ DPL converts the spreadsheet and selects it as the DPL Calculation Program as shown within the bottom right of the dialog. See Figure 10-16.



**Figure 10-16. Manage Links dialog After Spreadsheet Conversion**

- ⇒ Click OK.
  - ⇒ Double-click on the Phase 1 Success node and switch to the Links tab.
- DPL has converted the Excel calculation link to a DPL Program link. If you take a look at the Data tab you'll find that the probabilities are still initialized by the DPL Program you created earlier for the data definitions.
- ⇒ Click Cancel to close the Node Definition dialog.

There are several further modifications that need to be made to the converted spreadsheet Calculation Program. For example, the spreadsheet contains the entire set of probability data previously used to initialize the probabilities in the model that are now unnecessary. You will remove this data and make additional modifications. The goal is to have a DPL Calculation Program that contains no data and has only calculations in it. The converted spreadsheet (as it stands currently) has both data and calculations.

- ⇒ Double-click the R&D Projects Excel NPV.xlsx item within the Workspace Manager to activate the Calculation Program.

- ⇒ Scan down to find the line where the value `Technical_prob_phase_1` is defined.
- ⇒ Delete that line and the following four lines.

As you modify the Calculation Program, it is a good idea to check that you have not inadvertently deleted anything that you should not have. The easiest way to do this is to compile the model. You will do this now.

- ⇒ Click the Compile button within the Home | Run group. If you correctly deleted the rows above and nothing further, the item for the Drug Development model in the Workspace Manager will display the compiled indicator, double chevrons ("»»...««") around the model name, the Drug Development model will become active in the Model Window, and you should get no errors.
- ⇒ Note: if you do get an error, click the Undo button until the text you deleted has been restored and try again.
- ⇒ Double-click the R&D Projects Excel NPV.xlsx item in the Workspace Manager to activate it again.
- ⇒ Scan down to find the line where the array `Commercial_probs_market_share` is defined.
- ⇒ Delete that line and the following six lines.
- ⇒ Again, click Home | Run | Compile to confirm the model compiles.
- ⇒ Double-click the R&D Projects Excel NPV.xlsx item in the Workspace Manager and scan down to find the line where the array `Commercial_probs_pricing` is defined.
- ⇒ Delete that line and the following six lines.
- ⇒ Click Home | Run | Compile to confirm the model compiles.

You have now removed all the probability data (and some summations of probabilities from the template's error checking) from the Calculation Program. You will now clean up a few more items that are not needed.

- ⇒ Double-click the R&D Projects Excel NPV.xlsx item in the Workspace Manager to activate it again.
- ⇒ Scan toward the beginning of the program. There are several lines that define values `Summary_D13`, `Summary_D15`, `Summary_D16`, `Summary_D17`, `Summary_D18`, `Summary_D20`, `Summary_D21`, `Summary_D22`, `Summary_D23`.
- ⇒ Delete each of these lines, leaving the lines in between each value definition.

⇒ Click Home | Run | Compile to confirm the model compiles.

There are several other pieces of data still in the Calculation Program. These data items are part of the input data for the specific project for which the spreadsheet was designed to calculate NPV. These items should now reside in the Data Definitions Program you created earlier. In the next section you will modify the Data Definitions program, Influence Diagram and Calculation Program to move the input data to its proper location.

## 10.3 Creating Nodes to "Pass Through" Data

---

The R&D Projects Excel NPV.xlsx spreadsheet calculates NPV for a single R&D project in a pharmaceutical development pipeline. As such, there are a number of data items in the now converted DPL Calculation Program that will need to be overridden by data in the Data Definitions Program. To do this, you will create data items in the Data Definition Program for each of these pieces of data and then create a value node in the Influence Diagram to "pass through" the data to the Calculation Program.

⇒ Double-click the R&D Projects Excel NPV.xlsx item in the Workspace Manager to activate it again.

⇒ Scan through the program to find the arrays

`Commercial_strength_of_comp_table`, `Commercial_peak_sales_table`,  
`Commercial_YTP_table` and `Commercial_pricing_table`.

If you'd like to familiarize yourself with how these arrays are used, you may wish to open the Excel spreadsheet in Excel and examine it.

These four arrays all contain data that you may or may not want to change on a project-by-project basis. If you want them to change on a project-by-project basis, they each need to be overridden with data that comes from the Data Definitions Program. In this example, you will create initialization data items for all of them in the Data Definitions Program.

There are two values (`Calcs_Peak_sales` and `Calcs_Years_to_peak`) defined intertwined with the four arrays to be moved to the Data Definitions Program. You will move these values now to facilitate creating initialization arrays in the Data Definitions Program.

⇒ Select the line that defines `Calcs_Peak_sales` and cut it (Ctrl+X).

⇒ Paste it above the line that defines `Calcs_Adjusted_peak_sales`.



- ⇒ Similarly, move the line that defines `Calcs_Years_to_peak` to above where you just moved `Calcs_Peak_sales`.
- ⇒ Select the lines of code that define the four arrays:  
`Commercial_strength_of_comp_table`, `Commercial_peak_sales_table`,  
`Commercial_YTP_table` and `Commercial_pricing_table`.
- ⇒ Copy the selected text.
- ⇒ Double-click the Project 1 item in the Workspace manager to activate the Data Definitions Program.
- ⇒ Put your cursor at the end of the program.
- ⇒ Press Ctrl+V to paste the copied text.

To complete the process of passing data from the Data Definitions Program to the Calculation Program, you are going to rename these arrays within the Data Definition Program.

- ⇒ For each of the four arrays you just copied to the Data Definitions Program, delete the "Commercial\_" from the beginning of its name in the Data Definitions Program.
- ⇒ Leave the names unchanged in the Calculation Program.

You should now have four arrays called `strength_of_comp_table`, `peak_sales_table`, `YTP_table` and `pricing_table` in the Data Definitions Program (Figure 10-17. Project 1 Program with Four Arrays Added), and four arrays called `Commercial_strength_of_comp_table`, `Commercial_peak_sales_table`, `Commercial_YTP_table` and `Commercial_pricing_table` in the Calculation Program.

```

value prob_phase_1 = 0.77;
value prob_phase_2 = 0.55;
value prob_phase_3 = 0.65;
value prob_reg_approval = 0.90;
array probs_strength_of_competition = {0.20, 0.55, 0.25};
array probs_pricing = {0.05, 0.45, 0.50;
                      0.30, 0.40, 0.30;
                      0.50, 0.45, 0.05};
array probs_market_share = {0.10, 0.40, 0.50;
                            0.30, 0.40, 0.30;
                            0.40, 0.40, 0.20};
array probs_market_size = {0.30, 0.40, 0.30};
array strength_of_comp_table = { -0.2,0,0.4};
array peak_sales_table = {
  450,500,650;
  990,1100,1430;
  1300,1450,1880};
array YTP_table = {
  5;
  7;
  20};
array pricing_table = {
  0.65;
  1;
  1.25};

```

**Figure 10-17. Project 1 Program with Four Arrays Added**

You will now employ this same process to copy 10 additional input variables as listed within Table 10-1 below from the Calculation Program to the Data Definition Program. The grey cells in the table indicate the values that have already been added to the program in the steps above.

<b>Calculation Program value/array to override</b>	<b>Name in Data Definitions Program</b>
Commercial_peak_sales_table	peak_sales_table
Commercial_pricing_table	pricing_table
Commercial_strength_of_comp_table	strength_of_comp_table
Commercial_YTP_table	YTP_table
Costs_costdata_cogs	costdata_cogs
Costs_costdata_dev_phase1	costdata_dev_phase1
Costs_costdata_dev_phase2	costdata_dev_phase2
Costs_costdata_dev_phase3	costdata_dev_phase3
Costs_costdata_dev_reg	costdata_dev_reg
Costs_costdata_launch	costdata_launch
Costs_costdata_ongoing	costdata_ongoing
Costs_funding_mult_table	funding_mult_table
Summary_launch_year	launch_year
Summary_patent_expiry	patent_expiry

**Table 10-1. Input Data to be Copied and Modified within Data Definition Program**

Once complete, your Data Definition Program should look similar to Figure 10-18. Note that the order of the values within the program can vary from the figure.

```

value prob_phase_1 = 0.77;
value prob_phase_2 = 0.55;
value prob_phase_3 = 0.65;
value prob_reg_approval = 0.90;
array probs_strength_of_competition = {0.20, 0.55, 0.25};
array probs_pricing = {0.05, 0.45, 0.50;
                      0.30, 0.40, 0.30;
                      0.50, 0.45, 0.05};
array probs_market_share = {0.10, 0.40, 0.50;
                            0.30, 0.40, 0.30;
                            0.40, 0.40, 0.20};
array probs_market_size = {0.30, 0.40, 0.30};
array strength_of_comp_table = {-0.2,0,0.4};
array peak_sales_table = {
  450,500,650;
  990,1100,1430;
  1300,1450,1880};
array YTP_table = {
  5;
  7;
  20};
array pricing_table = {
  0.65;
  1;
  1.25};
array costdata_dev_phase1 = {20,10,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0};
array costdata_dev_phase2 = {0,33,54,62,0,0,0,0,0,0,0,0,0,0,0,0,0,0};
array costdata_dev_phase3 = {0,0,0,120,174,131,0,0,0,0,0,0,0,0,0,0,0,0};
array costdata_dev_reg = {0,0,0,0,0,35,0,0,0,0,0,0,0,0,0,0,0,0};
array costdata_launch = {0,0,0,0,135,185,0,0,0,0,0,0,0,0,0,0,0,0};
value costdata_ongoing = 0.26;
value costdata_cogs = 0.12;
array funding_mult_table = {
  1.3;
  1;
  0};
value launch_year = 2024;
value patent_expiry = 2034;

```

**Figure 10-18. Project 1 Data Definition Program with Overrides Complete**

You will now create several value nodes to pass this data from the Data Definitions Program to the Calculation Program using the Create DPL Program Calculation-Linked nodes command.

- ⇒ Double-click the Drug Development item in the Workspace Manager to activate the Drug Development model.
- ⇒ Click Influence Diagram | Node | Linked Node | DPL Program Calculation-Linked. This will launch the Add Value from DPL Program dialog as shown in Figure 10-19.



**Figure 10-19. Add Value form DPL Program Dialog**

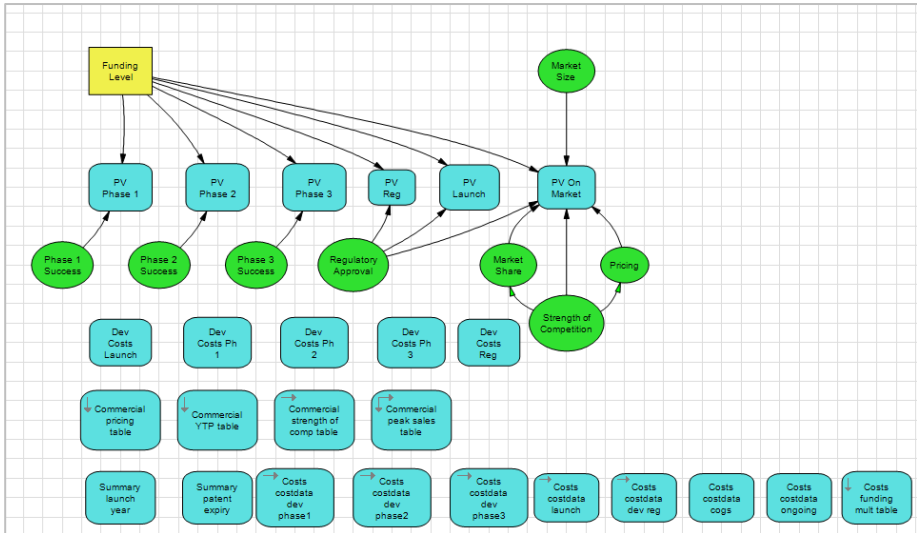
Notice that the values names match those within the Calculation Program (i.e., they are start with Costs\_, etc.), as the nodes are being created from this program. Note that the checkbox labeled Add as metric values is unchecked, which is what you want. The calculation-linked nodes you create are driver nodes (inputs to the model) and will pass data to the Calculation Program. As you will see below, you will initialize the data for each node with the inputs added to the Data Definition Program.

- ⇒ Within the Add Values from DPL Program dialog, select all 14 values/array included within the Calculation Program value/array to override column listed in Table 10-1. Note that the values listed in the table are in the order they are listed within the Add Value dialog.
- ⇒ Click OK.

The 14 values are added as Value nodes to the right of the model within the Influence Diagram.

- ⇒ Zoom Full in order to view all of the new nodes.


⇒ Move and organize the nodes as you'd like within the Influence Diagram. See Figure 10-20.



**Figure 10-20. Influence Diagram with 14 DPL Program Calculation-Linked Value Nodes Added**


⇒ Double-click on the Commercial pricing table value node to view its data.

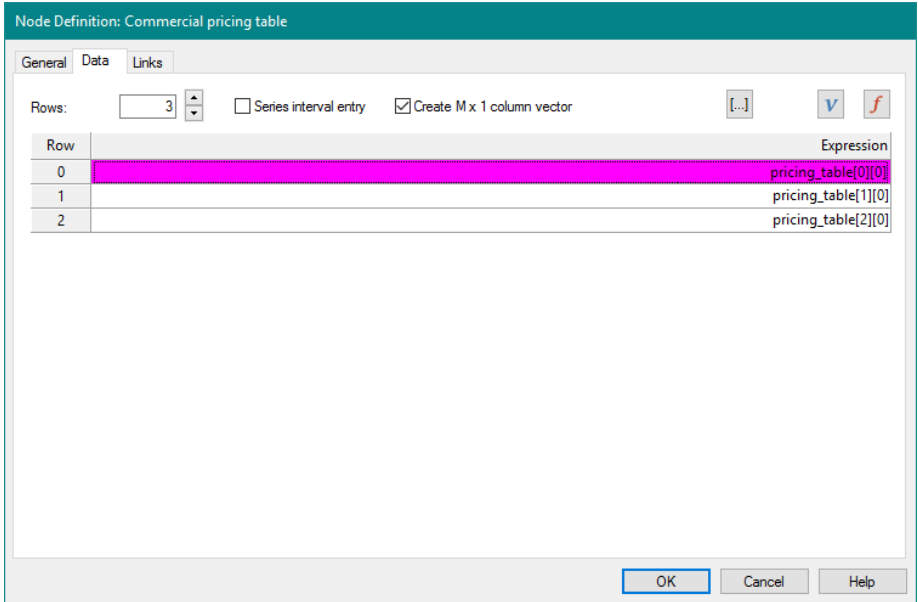
On the Links tab, you'll find that the node is calculation-linked to the value "Commercial\_pricing\_table" of the R&D Projects Excel NPV.xlsx calculation program. On the Data tab, notice that DPL has correctly defined the dimensions of the array – a 3x1 column vector. Lastly, the data from the Calculation Program has been supplied for each value row. You are now going to replace this data with values from the Data Definitions program for this and all of the "pass through" nodes in the model.

⇒ On the Data tab, with the first row selected click the variable button (  ).

⇒ Within the Select Variable list, scroll down and select pricing\_table.

⇒ Click OK.

⇒ Click the fill down button (  ) to fill in the remaining data. Click Yes within the prompt to confirm you'd like to overwrite the existing data. The Data tab should look like Figure 10-21.



**Figure 10-21. Data Tab for Commercial pricing table Pass-Through Value Node**

- ⇒ Click OK to close the Node Definition dialog.
- ⇒ Repeat the process above for the rest of the "pass through" nodes in the model using the names in the second column of Table 10-1 to initialize each "pass through" node with Data Definition Program data.

You have now created fourteen value nodes that are initialized by data in the Data Definitions Program. These nodes will pass that data through to the Calculation Program and override the values for those arrays/values in the Calculation Program.

Note that the example file called Program-Linked Portfolio Ready.da delivered with DPL Portfolio is the result of this completed tutorial and has been provided for your reference.

You should rename your model to indicate that it is now set up as a template to analyze projects in the R&D portfolio.

- ⇒ In the Workspace Manager, rename the model currently called Drug Development to be "Drug Dev Template".
- ⇒ Save your work.

## 10.4 Creating a Value Node for Project Names

---

You are nearly ready to define your portfolio. You will make one more modification to the Data Definitions Program and Influence Diagram so that you will be able to use an Influence Diagram node to name the projects in your portfolio.

You will first define a string value in the Data Definitions Program which will be used to initialize the value node you will create subsequently.

⇒ Double-click the Project 1 item in the Workspace Manager to activate the Data Definitions Program.

⇒ At the top of the program, type the line:

```
string Project_Name = "Project 1";
```

You will now create a value node which will be used as the project name source.


⇒ Activate the model and add a new value node to the model via Influence Diagram | Node | Add icon.

⇒ Click in an empty part of the Influence Diagram.

⇒ Name the new node "Name" on the General Tab.

⇒ Check String checkbox.

⇒ Switch to the Data tab.

⇒ Click the variable button ()

⇒ Select Project\_Name in the Select Variable dialog and click OK.

⇒ Click OK to close the Node Definition Dialog.

## 10.5 Creating Additional Data Definitions Programs

---

The Drug Dev Template model is now set up so that all project specific data is found in the Data Definitions Program called Project 1. This data is used in the Influence Diagram and Decision Tree which then passes data through to the Calculation Program, which calculates NPV and Development Costs for the project.



In this example, you make the assumption that multiple projects can be analyzed using the same Calculation Program. Therefore, in order to use the Drug Dev Template model to analyze a different project, all that you need to do is create new Data Definitions Program(s) for the additional project(s) to be analyzed.

You will create a new program now to define a new project.

- ⇒ Right mouse click in the Workspace Manager to view the context menu.
- ⇒ Select Add to Workspace | Program.
- ⇒ Rename the new program to be "Project 2".
- ⇒ Double-click the Project 1 item in the Workspace Manager to activate the original Data Definitions Program.
- ⇒ Place your cursor at the very beginning (top, left) of the program.
- ⇒ Hold down Ctrl and Shift and press End to select the entire program.
- ⇒ Press Ctrl+C to copy the selected text to the clipboard
- ⇒ Double-click the Project 2 item in the Workspace Manager to activate the new, blank Data Definitions Program.
- ⇒ Press Ctrl+V to paste the copied text.
- ⇒ Edit the string `Project_Name` within the first line to be "Project 2".
- ⇒ Change `prob_phase_1` to be 0.65.
- ⇒ Change `prob_phase_2` to be 0.48.
- ⇒ Change `prob_reg_approval` to be 0.92.
- ⇒ Change `peak_sales_table` to be:  
500, 550, 700;  
1020, 1150, 1470;  
1310, 1485, 2100

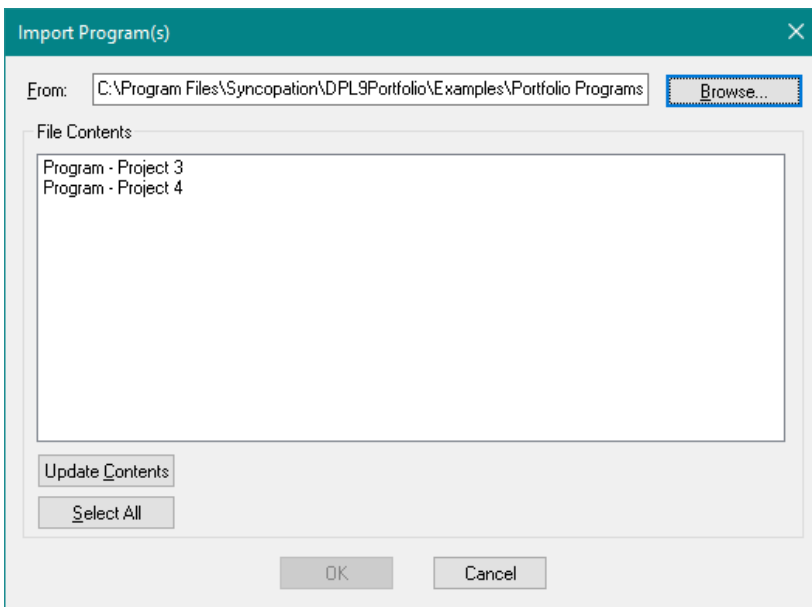
You have now created a second project with (slightly) different input data.

DPL also allows you to import programs from other Workspaces. This would allow you to create a Workspace with a shell Data Definitions Program with all the data declarations in it but no data. This file could then be saved under new names and the resulting files distributed to the people in your organization, such as project leaders, who are responsible for providing data input to your portfolio review process. Once you have the files back, you can import the data definitions program from each one to

combine them into a single DPL Workspace in which you will create the DPL Portfolio.

You will import two Data Definitions Programs now for two additional projects.

- ⇒ Click Home | Workspace | Add to WS and select Imported Program from the list.
- ⇒ Click the Browse... button in the Import Program (s) dialog.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select Portfolio Programs.da and click Open. The Import dialog should look like Figure 10-22. The Workspace contains two Programs named Project 3 and Project 4.



**Figure 10-22. Import Dialog with Portfolio Programs.da**

- ⇒ Select both programs within the File Contents list box.
- ⇒ Click OK.

DPL imports the two programs into the Workspace. You should now have 3 unreferenced programs listed in your Workspace Manager. Your model is now set up so that you can create a portfolio of projects that are initialized

by the data definition programs contained in the Workspace. You'll define your Portfolio Group and Elements now.

- ⇒ Select the item for the Portfolio within the Workspace Manager and select Portfolio | Definition | Group | Add.
- ⇒ Name the group "Drug Dev Group" and select the Drug Dev Template for the Model.

DPL will correctly set both the Initialization and Calculation links to DPL Program.

- ⇒ Within the Initialization Links section, check the box labeled Use value node data for project names.
- ⇒ Select Name within the Value Node drop-down. Your Edit Portfolio Group dialog should look like Figure 10-23.

**Add Portfolio Group** [X]

Title:

Model:

Project Categorization

Initialization Links

None  DPL Program  Microsoft Excel  Database

Model ID:

Use value node data for project names Value Node:

Use database field for project names Field:

Numeric export table:

String export table:

Calculation Links

None  DPL Program  Microsoft Excel

Excel links in one workbook

**Figure 10-23. Add Portfolio Group Dialog for Program-Linked Drug Development Model**

⇒ Click OK to close the dialog.

DPL has created the first element of the group for you. As indicated by the default element name, it's linked to the Project 1 and R&D Projects Excel NPV.xlsx programs.

⇒ Double-click the item for this element to edit it and name it "Element 1". Click OK to close the dialog.

⇒ Select the Drug Dev Group and click Portfolio | Definition | Element | Add. The Add Portfolio Element dialog comes up.

- ⇒ Name the Element: "Element 2".
- ⇒ Select Project 2 for the Initialization Links program.
- ⇒ Select R&D Projects Excel NPV.xlsx for the Calculation Links Program.
- ⇒ Click OK.
- ⇒ Repeat the above process to create two more Elements called Element 3 and Element 4 with Project 3 and Project 4 as the Initialization Links programs, respectively and R&D Projects Excel NPV.xlsx as the Calculation Links program for both.
- ⇒ Save your work.

Your Program-linked Portfolio is now ready for analysis.

## 10.6 Generating Data Definitions Programs from Excel

---

As discussed previously, it is possible to distribute DPL Workspace files to colleagues in your organization in order to collect input data on projects in the portfolio and then combine these together into a single Workspace to do the Portfolio Analysis. However, given the syntax requirements of and likely lack of familiarity with DPL code, it is not an ideal data input mechanism.

To get around these limitations, DPL provides a feature that allows you to generate Data Definitions Programs from Excel files. This allows you to distribute the Excel files for data input and then process the Excel files from one central location such as a network directory once the data entry has been completed. This approach has a number of advantages. Most project managers and analysts are familiar with Excel. The spreadsheets can be designed to include error checking.

This section demonstrates how to set up a DPL Portfolio to use external Excel files to generate the Data Definitions Programs.

- ⇒ Either continue with the Workspace file from the previous section or you can use the Program-Linked Portfolio Done.da example file provided with your license.
- ⇒ To use the example file start DPL and choose File | Open.

- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select Program-Linked Portfolio Done.da and click Open.
- ⇒ Save the file under a new name.

Several example Excel files that correspond to the Data Definitions Programs currently in the Workspace have been delivered with DPL Portfolio. You will briefly examine one of them.

- ⇒ If necessary, start Excel otherwise switch to it.
- ⇒ Select File | Open.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select R&D Projects Excel Data 1.xlsx and click Open.

This spreadsheet has four sheets which contain all of the inputs that are found in the Data Definitions Programs you created in Sections 10.1 through 10.5. Explore the colored cells in the spreadsheet. As you are doing this, look at the Name Box to the left of the Formula Bar in Excel. Note that the cells are named using the same names as the values and arrays in the Data Definitions Programs.

In order to create an Excel data entry template to match a Data Definitions Program, you must have a named range in Excel for every value, array or string in the program. In addition, the dimensions of the range must match the dimensions of the data in the program. E.g., if you have a value called input1 in the program, then you need a single-cell named range called input1 in Excel. If you have a 1 by 10 array in the program called input2, then you need a named range with 1 row and 10 columns in Excel called input2.

You will now set up the DPL Portfolio in your Workspace to use external Excel files to generate Data Definitions Programs.

- ⇒ Expand the Drug Dev Group in the Workspace Manager in order to display all of the Elements.
- ⇒ Delete Element 2, Element 3 and Element 4 by selecting them and hitting the Delete key.
- ⇒ Edit Element 1.
- ⇒ Rename it to be "All" (without quotes).

- ⇒ Within the *Initialization Links* section, check the Generate program(s) from external Excel workbook file(s). Note with this checkbox checked, you no longer have the option to select a program in the Workspace; instead, you may browse for the path that contains the Excel files.
- ⇒ Click Browse.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncoption\DPL9Portfolio\Examples.
- ⇒ Select R&D Projects Excel Data 1.xlsx and click Open.
- ⇒ In the Path edit box, edit the Path to read:  
R&D Projects Excel Data\*.xlsx (i.e., replace the " 1" at the end of the file name with "\*").

The "\*" is a wild card character which tells Windows to find all Excel .xlsx files in that folder that start with "R&D Projects Excel Data".

- ⇒ Click OK to close the dialog.

Note that in the Workspace Manager, DPL has moved the programs Project 2, Project 3 and Project 4 to the Unreferenced programs section. This is because they are not linked to the model Drug Dev Template, nor are they used in the Portfolio. Project 1 remains linked to the model. You may delete the programs Project 2, Project 3 and Project 4 from the Workspace.

You are now ready to run the portfolio. Refer to Chapter 5 of this manual for information on running and analyzing portfolios. Note: the data in the Excel input files R&D Projects Excel Data 1.xlsx, R&D Projects Excel Data 2.xlsx, etc. are not the same as the data in the programs Project 1, Project 2, etc. Therefore, the results for the portfolio in this section will not be the same as the results for the portfolio you created in 10.5. However, the results should be the same as you saw in earlier chapters on Excel-linked portfolios that used the same four input data files, e.g., Chapters 5 through 8 (but not Chapter 9, which uses a different set of input data stored in a database).

If you run the portfolio at this point, you will see that DPL creates Data Definitions Programs for each of the four input data files. Each time you run a portfolio that is set up this way, DPL will over-write the programs it created previously. Also, if you look at the four Data Definitions Programs you will see that they contain a lot more data than you saw in the programs that were manually created or imported earlier in this chapter. Most of this "extra" data is string labels or other values that exist in the spreadsheet but are not actually used in the model.

⇒ Save your Workspace if you like.

The end result of the Workspace in this section is also provided in your Examples folder in case you need it for future reference. It is called Program-Linked External Done.da.



# 11. Handling Dependencies in a Portfolio

The example Portfolios you have seen throughout this manual have all made the same assumption of "independence" of projects within the portfolio. That is, the results for each project in the portfolio do not depend on the success or failure of any other project in the portfolio or whether any other project in the portfolio is funded or not. For example, there is an uncertainty for each project in the example portfolio that it succeeds in Phase I (as captured by the Phase I success chance node). The probability that any given project in the portfolio succeeds or not in Phase I does not depend upon whether any other project succeeds in Phase I. In all the examples thus far, DPL Portfolio has relied upon the independence assumption to analyze each project independently of any other project and then combine the project results to generate overall portfolio results.

In more complex environments, you may or may not be able to assume "independence" of projects. A few of the typical situations that exhibit project "dependence" (i.e. lack of independence) are:

- There may be one or more highly uncertain "global variables" (such as interest rates or other financial variables) that are important factors in project valuation, but have the same value for all projects, rather than being independently determined for each project.
- There may be one or more subsets of projects in the portfolio that are mutually exclusive; e.g., only one of Project A, B, or C can be funded and included in the portfolio.
- There may be other interactions or interdependencies between projects that require more complex modeling. For example, there may be several sequential projects in development, each of which depends on the success of the previous project(s): Project A is attempted first, and if it succeeds, Project B is attempted, but if B fails, Project C is attempted as a last resort.

DPL Portfolio can handle the first situation, global variables or global drivers, through its Global Drivers capability. Analysis of the impact of the Global Drivers can be done using the Global Tornado Chart. The steps for setting up global drivers are simple, and are provided in a brief tutorial in Section 11.1 below.

DPL Portfolio can also handle the situation of mutually exclusive projects within subsets of the portfolio via the definition of Portfolio Elements. The process for setting up a portfolio this way is described in Section 11.2.

Complex interactions or interdependencies between two or more projects are not easily generalized; there is no single correct way to handle them. However, you can handle any type of interdependence between projects by developing an Influence Diagram/Decision Tree model that captures the interdependence.

In some situations where there are interdependencies, it may be useful to combine together separate project models in a single model so as to explicitly model their interdependencies. DPL provides a capability to get you started building a "combined-project" model. This capability will be briefly illustrated in Section 11.3.

If you have complex project interdependencies, it may require significant expertise in both modeling and in the use of DPL to develop models to handle these interdependencies that can then be included in the portfolio.

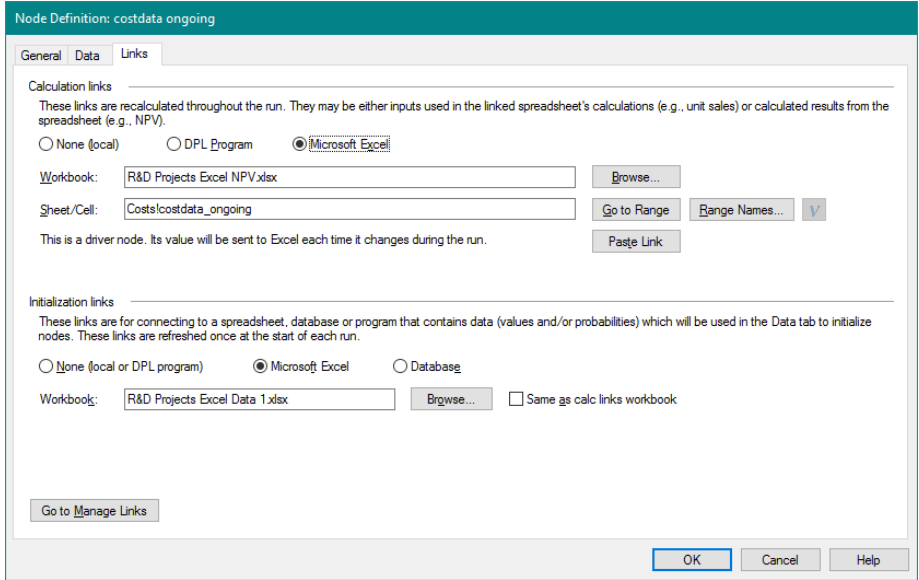
## 11.1 Global Drivers and the Global Driver Tornado Chart

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The tutorial in this section uses the Workspace you saved at the end of Section 4.5 of this manual. This Workspace has initialization and calculation links to Excel and is fully set up to run a Portfolio Analysis.

### 11.1.1 Setting up Global Drivers

- ⇒ If necessary, start DPL.
- ⇒ Open either the Workspace you saved at the end of Section 4.5, or open the one provided for you: Excel-Linked Portfolio Done.da (in the Examples folder underneath where you installed DPL).
- ⇒ Double-click the value node called costdata ongoing to edit it.
- ⇒ Click on the Links tab. See Figure 11-1.

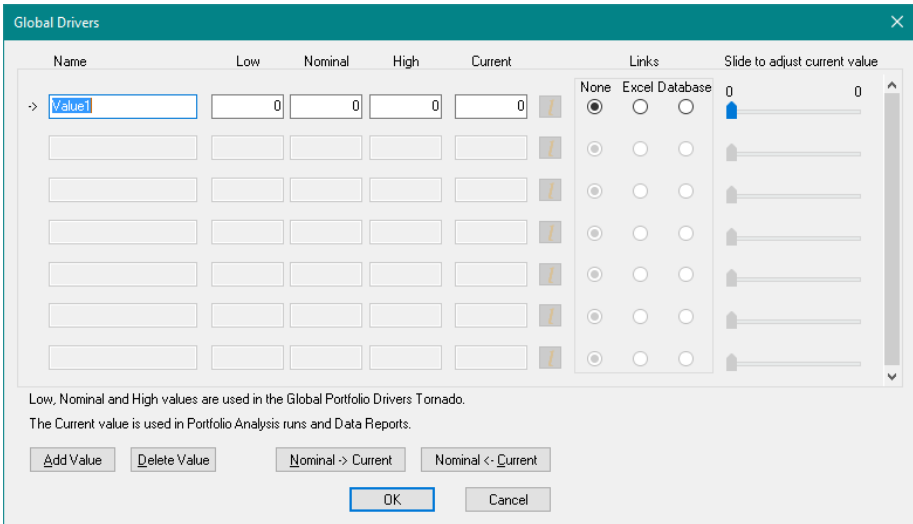


**Figure 11-1. Costdata Ongoing Node: Links Tab**

This node, which represents the ongoing marketing expenditures as a percentage of sales, varies across projects; it is initialized by the project data workbooks (e.g., R&D Projects Excel Data 1.xlsx). It is also calculation-linked to the Excel cash flow spreadsheet: R&D Projects Excel NPV.xlsx.

You will change this node so that it is initialized by a Global Driver, i.e. it is initialized with the same value for all projects. In addition, it can be varied simultaneously across all projects to create a Global Driver Tornado Chart.

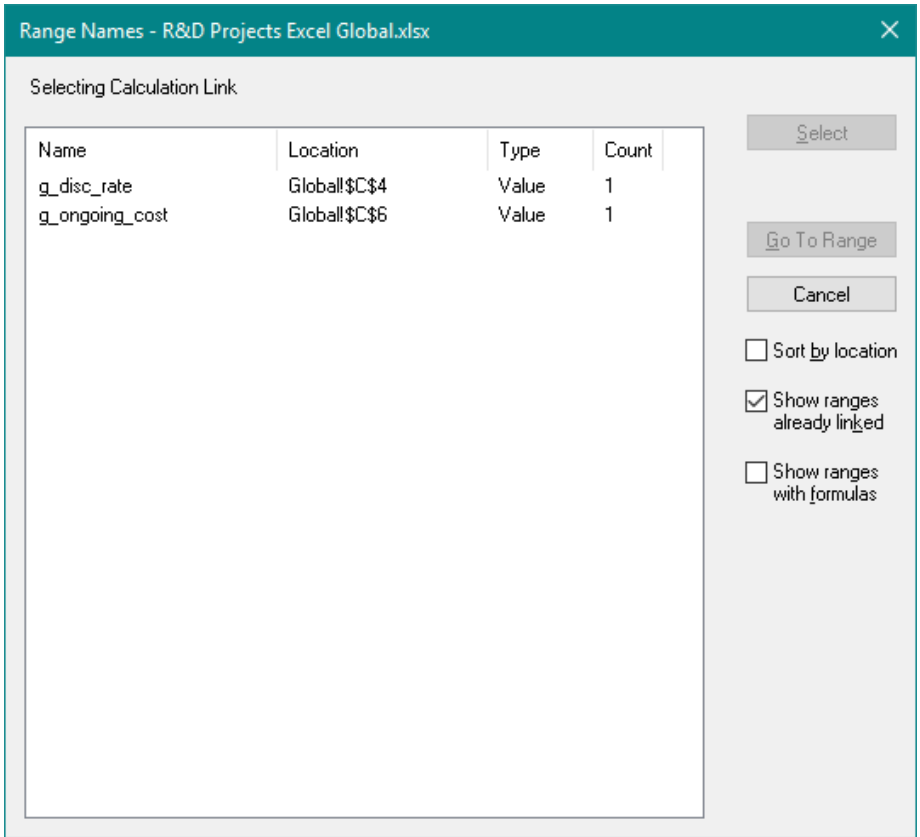
- ⇒ Click Cancel to close the Node Definition dialog.
- ⇒ Click Portfolio | Global Drivers | Edit. The Global Drivers dialog comes up. See Figure 11-2.



**Figure 11-2. Global Drivers dialog**

Currently there are no Global Drivers defined. There is a placeholder for a new Global Driver called Value1. The controls on the left of the dialog allow you to name a Global Driver and supply data for low, nominal, high and current settings. The controls in the middle of the dialog within the *Links* section allow you to define Excel or Database Initialization Links for the Current value of the Global Driver. You will now create a Global Driver for ongoing cost.

- ⇒ Name the first value to be "Global Ongoing Costs" instead of "Value1" (no quotes).
- ⇒ In the Links section, select the radio button for Excel (instead of None). The Select Spreadsheet dialog appears.
- ⇒ Browse to find the spreadsheet called R&D Projects Excel Global.xlsx. It should be in the Examples folder under where you installed DPL.
- ⇒ Click Open to select the file.
- ⇒ Click OK. The Range Names dialog appears as in Figure 11-3.




**Figure 11-3. Range Names dialog for Global Spreadsheet**

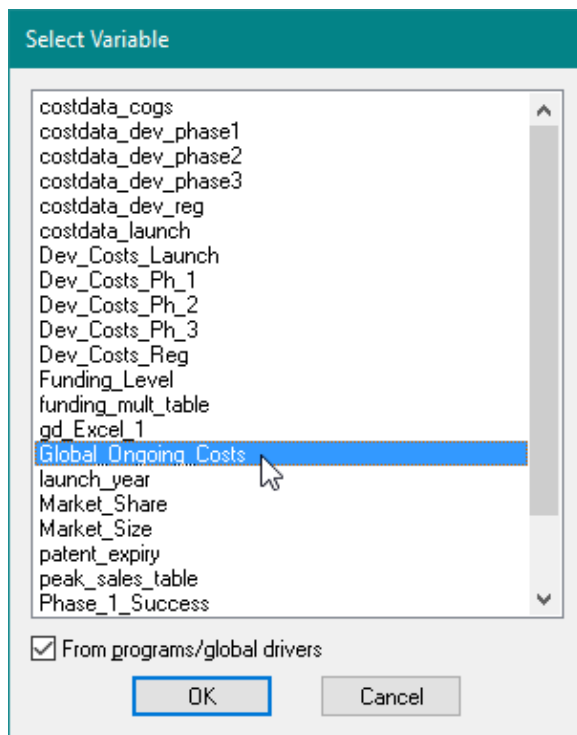
- ⇒ Select g\_ongoing\_cost from the list. Note that there are only two values in the list.
- ⇒ Click Select.

The Global Drivers dialog now shows a spreadsheet initialization link in the Current edit box. You have set up a Global Driver for ongoing marketing cost and it is initialized for all projects by the named range in the Global spreadsheet.

The Low, Nominal, and High cells are all set to zero. These are used to run a Global Drivers Tornado. Leave them alone for now.

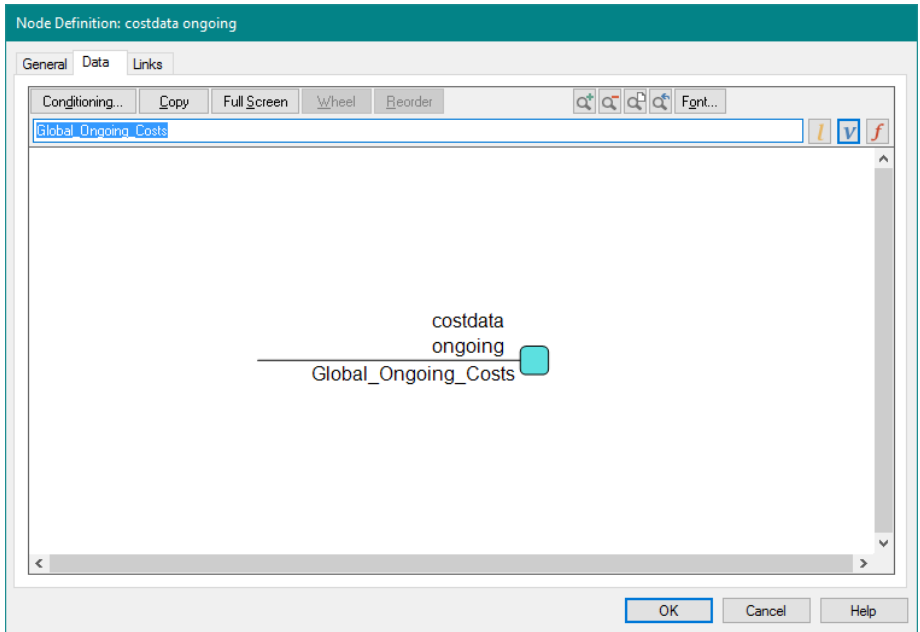
- ⇒ Click OK to close the Global Drivers dialog.
- ⇒ Edit the value node costdata ongoing again.
- ⇒ In the Data tab, click the Variable (  ) button.

The Select Variable dialog appears as in Figure 11-4.



**Figure 11-4. Select Variable dialog**

- ⇒ The option From programs/global drivers near the bottom of the dialog should be checked; if not, check it.
- ⇒ In the Select Variable dialog, select Global\_Ongoing\_Costs.
- ⇒ Click OK.
- ⇒ Press Enter. The Node Definition dialog now looks like Figure 11-5.



**Figure 11-5. Data tab for costdata ongoing Node**

Note that the Global Driver you just defined, Global Ongoing Costs, showed up as a variable in the Select Variable dialog. It is not explicitly defined as a value node in your Influence Diagram, but because it is defined as a Global Driver, it is available as a variable and can be used to initialize the costdata ongoing value node.

⇒ Switch to the Links tab.

The Initialization Links are still set up to be the project data file, i.e., R&D Projects Excel Data 1.xlsx. However, you now want the variable to be initialized by the Global Driver. The Global Driver itself is linked to Excel but from the perspective of initializing the costdata ongoing value node Global Costs Ongoing is a local variable.

⇒ Click None (local or DPL program) for Initialization Links.

⇒ Click OK.

Note that you did not have to change the calculation links. The node is already correctly calculation-linked. You have completed the set up for your first Global Driver.

⇒ Save your portfolio Workspace under a new name.

Next you will define another Global Driver. This time, the new Global Driver is also new to your Workspace; it is a parameter that was previously set in the calculation-linked cash flow spreadsheet. Therefore in addition to creating a Global Driver, you will need to create a value node to pass the Global Driver to the calculation spreadsheet.

- ⇒ Select Portfolio | Global Drivers | Edit again.
- ⇒ Click the Add Value button near the bottom of the dialog.

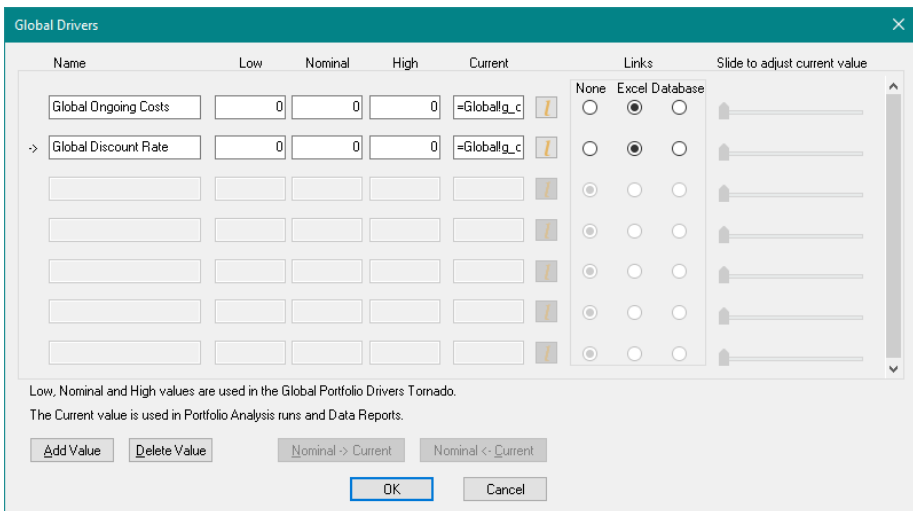
The dialog provides you with another row of controls to define another Global Driver.

- ⇒ Name the new Global Driver "Global Discount Rate" (no quotes).
- ⇒ Select Excel within the *Links* section.

The Range Names dialog should appear again. You can only link to one Global Drivers spreadsheet at a time, so DPL assumes you want to link to the R&D Projects Excel Global.xlsx spreadsheet again.

- ⇒ Select `g_disc_rate` and click Select.

The Global Drivers dialog now looks like Figure 11-6.




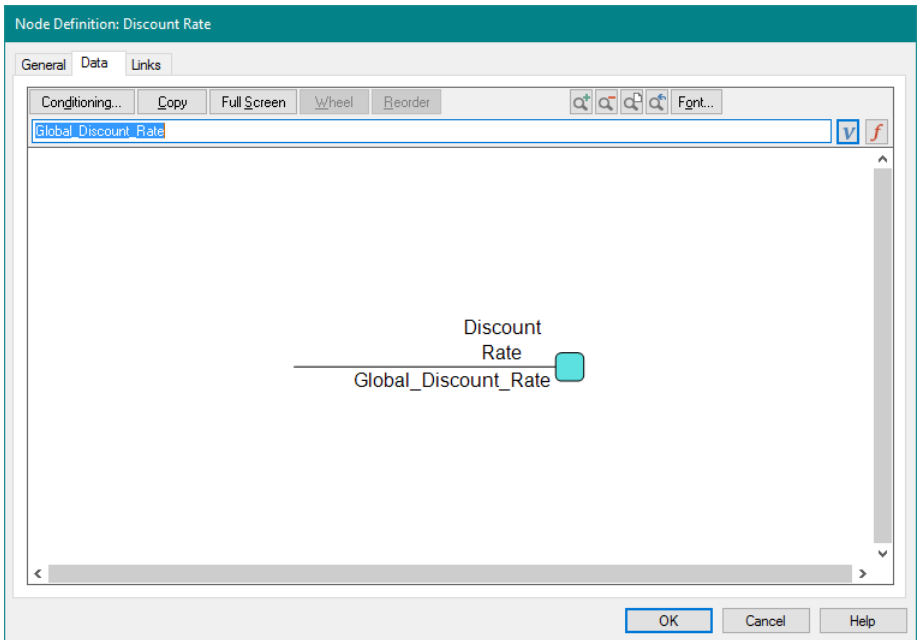
**Figure 11-6. Global Drivers Dialog with Two Global Drivers**

- ⇒ Click OK to close the dialog.

Now you will add a value node that uses the new Global Discount Rate parameter.

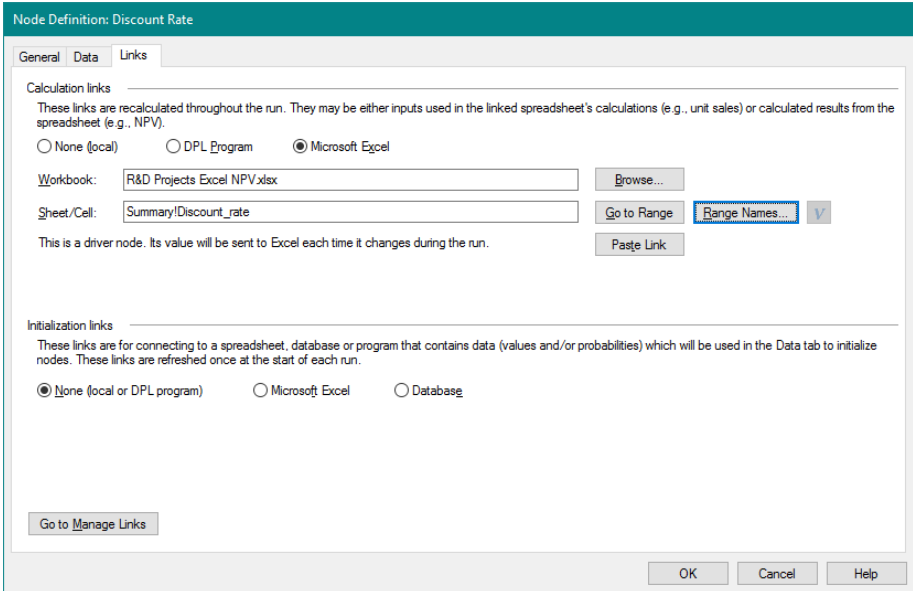


- ⇒ Click Influence Diagram | Node | Add and place the new value node in your Influence Diagram.
- ⇒ In the General tab, name the node "Discount Rate".
- ⇒ In the Data tab, click the Variable (  ) button. The Select Variable dialog appears.
- ⇒ Select Global\_Discount\_Rate from the dialog.
- ⇒ Click OK.
- ⇒ Press Enter. The Data tab looks like Figure 11-7.



**Figure 11-7. Data tab for Discount Rate Node**

- ⇒ Click on the Links tab.
- ⇒ Select Microsoft Excel for the calculation links.
- ⇒ The linked workbook should be R&D Projects Excel NPV.xlsx. If not, browse to select it.
- ⇒ Click the Range Names... button and select Discount\_rate. Click Select.
- ⇒ Leave the Initialization Links set to None (local or DPL program). The Node Definition Links tab should look like Figure 11-8.



**Figure 11-8. Links tab for Discount Rate Node**

⇒ Click OK.

The Current settings of the two Global Drivers are now fully specified. If you run a Portfolio Analysis at this point, the ongoing marketing cost and the discount rate will be set to the same values for all projects, and will be initialized from the R&D Projects Excel Global.xlsx spreadsheet. Because the values in that spreadsheet are different from the values you were using previously (you were using four different values for ongoing marketing cost, and one value for the discount rate), the results will be different from the results you obtained in the Chapter 5 tutorial.

⇒ If you wish, run a Portfolio Analysis and examine the results.

For your reference, an example file named Excel-Linked Portfolio Global Drivers Done.da that is the end result of the tutorial completed in this section has been provided within the Examples folder of your DPL installation directory. You can now set up and run a Global Driver Tornado Chart.

### 11.1.2 Creating a Global Driver Tornado Chart

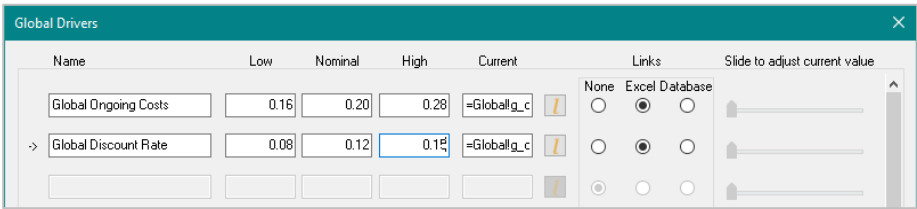
You are now able to set up and run a Global Driver Tornado Chart.

⇒ Select Portfolio | Global Drivers | Edit again.

The Current values for the two global drivers are displayed as links. They are 0.22 (22%) and 0.10 (10%), as you may know if you examined the R&D Projects Excel Global.xlsx spreadsheet. These are the values used if you run a Portfolio Analysis or a Data Report. The Low, Nominal, and High values are used only for the Global Driver Tornado.

- ⇒ Edit the Low, Nominal, and High values for Global Ongoing Cost so that they are 0.16, 0.20, and 0.28, respectively.
- ⇒ Edit the Low, Nominal, and High values for Global Discount Rate so that they are 0.08, 0.12, and 0.15, respectively.

Note that the Current value (which is spreadsheet-linked) is not used in the Global Driver Tornado chart. The top of the dialog should look like Figure 11-9.



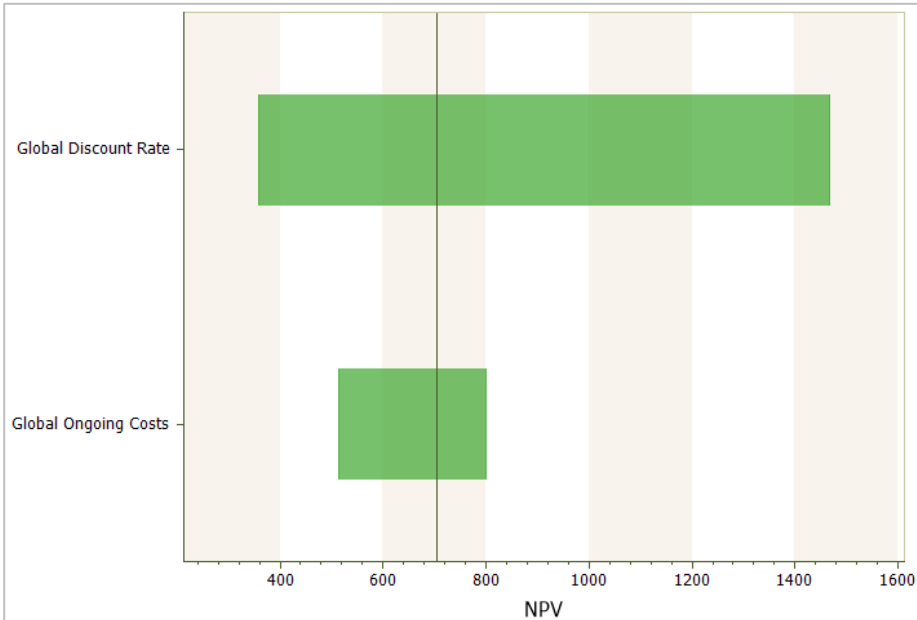
**Figure 11-9. Global Drivers dialog, Completed**

Before you close this dialog, there are a few other features to note.

- If your model is database-linked, you could set up your Global Drivers using database links. The database-linked example used in Chapter 9 of this manual contains these same two global parameters and they are linked to the database. If you like, examine the Global Drivers dialog and/or run a Global Drivers Tornado Chart in that example after you complete this chapter.
- Because your Global Drivers are currently Excel initialization-linked, you cannot use the Nominal -> Current and Nominal <- Current buttons at the bottom of the dialog. These buttons are available when the Links are set to None. In this case, you would type in numbers instead of links for the Current cell. The buttons let you copy the values back and forth between the Nominal and Current settings.
- When the Low, Nominal, High, and Current settings are all filled in and are all numbers (i.e. when the Current value is not a link), the slider bars to the right of each Global Driver are enabled and the Low and High values are displayed on each bar. The marker on the bar represents the Current setting and it can be moved left or right, which will adjust the Current value accordingly.

- The Add Value and Delete Value buttons let you add new values to the Global Drivers list, or delete values you have added.
- ⇒ Click OK to close the Global Drivers dialog.
- ⇒ Click Portfolio | Global Drivers | Sensitivity.

DPL runs the tornado as shown in Figure 11-10. This may take a minute or two.



**Figure 11-10. Global Driver Tornado Chart**

To create this chart, DPL ran a Portfolio Analysis five times: once with both Global Drivers set to Nominal, and then once each using the Low and High settings of each driver with the other driver set to its Nominal setting. The width of the bars in the chart is the change in expected value of the portfolio as each Global Driver is varied from its Low to High setting while holding all other Global Drivers at their Nominal setting. The chart shows that given the settings you used for Low, Nominal and High for each of the Global Drivers, varying the Global Discount Rate has greater impact on the overall portfolio value than varying the Global Ongoing Cost parameter.

Note that if you had several Global Drivers and a large portfolio, the tornado chart could take some time to run because DPL has to run a full Portfolio Analysis for each Low and High setting of each Global Driver, in addition to the base case analysis.

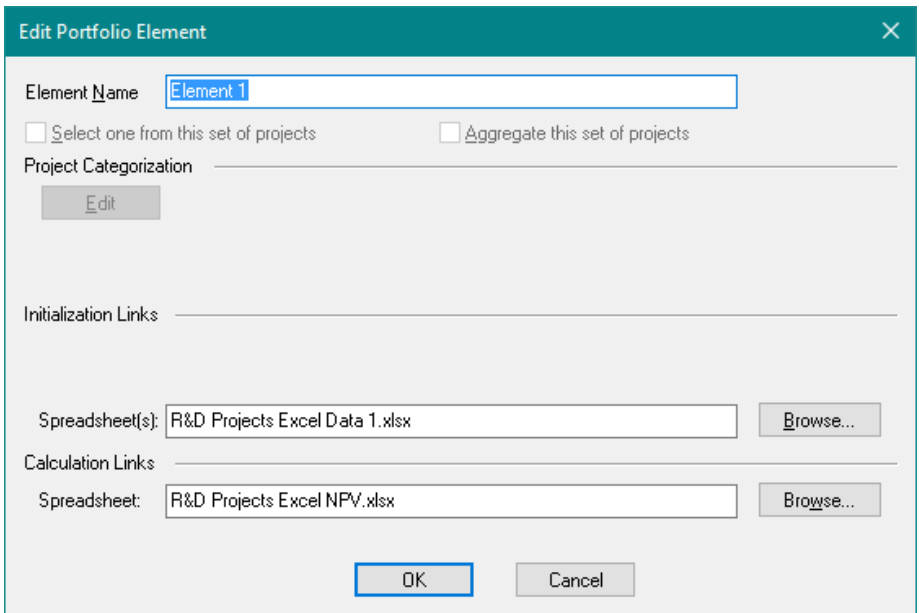
⇒ Save your portfolio Workspace.

You will continue with this Workspace in the next section.

## 11.2 Mutually Exclusive Projects

As mentioned earlier, DPL Portfolio has a feature to help you model the situation where your portfolio can include only one of a set of "mutually exclusive" projects. This feature is contained in the definition of a Portfolio Element. To use it, you must define one (or more) Elements that each represent two (or more) projects that are "mutually exclusive".

- ⇒ Within the Workspace Manager, expand the Drug Dev Group so that you can see the four Elements.
- ⇒ Double-click any of the Elements to edit it. See Figure 11-11.



**Figure 11-11. Edit Portfolio Element dialog for Element 1**

Note that under the Element Name at the top there is a checkbox; *Select one from this list of projects*, which is grayed out. This is how you tell DPL that the projects within this Element are mutually exclusive. When you check this checkbox, DPL will analyze each project represented by this

element and include only the project with the largest expected objective function value in the portfolio.

The checkbox is currently grayed out in the file you are working on because the Elements in this example each correspond to exactly one project, rather than multiple projects. Note that there are three ways in which you can have multiple projects represented by an Element. These are the situations in which you can use the "Select one from this set of projects" feature.

- 1) Spreadsheet initialization-linked using wildcards: you can tell DPL that an Element represents two or more projects by using wildcards in the Initialization Link name. An example of this is given in Section 4.6 of this manual.
- 2) Database initialization-linked: you can set up one or more Elements so that the initialization links are a list of two or more Project ID's, as is done in Chapter 9 of this manual.
- 3) DPL Program initialization-linked: if you have a set of Data Definitions Programs that you created using DPL's Generate programs from external .xlsx files feature, you can use wildcards in a similar manner to spreadsheet initialization links to tell DPL that an Element represents more than one project. See Section 10.6 of this manual for more information.

⇒ Click Cancel to close the dialog.

When DPL runs a Portfolio Analysis with Elements that use the *Select one from this list* feature, the portfolio results will contain one project for each of the Elements that have the feature checked. DPL selects the project with the highest expected objective function value to include in the portfolio results. The remaining projects represented by the Element that are not selected are completely excluded (i.e., the assumption is they are completely unfunded).

In a Data Report, data for all projects are summarized regardless of whether or not Select one from this list is checked for an Element.

⇒ Save and close your Workspace. In the final section of this chapter, you will be using a different example Workspace.

## 11.3 Combining Project Models to Explicitly Handle Dependencies

---

There is no single, generally applicable method for modeling complex interdependencies between projects in a portfolio. In some situations, the relatively simple techniques described in the two previous sections are not sufficient to adequately capture project dependencies. If you have complex project interdependencies in your portfolio, one way to handle them is to combine two or more projects within one decision model in your portfolio, and explicitly model the multiple projects together as one project. DPL provides a tool to help you get started doing this.

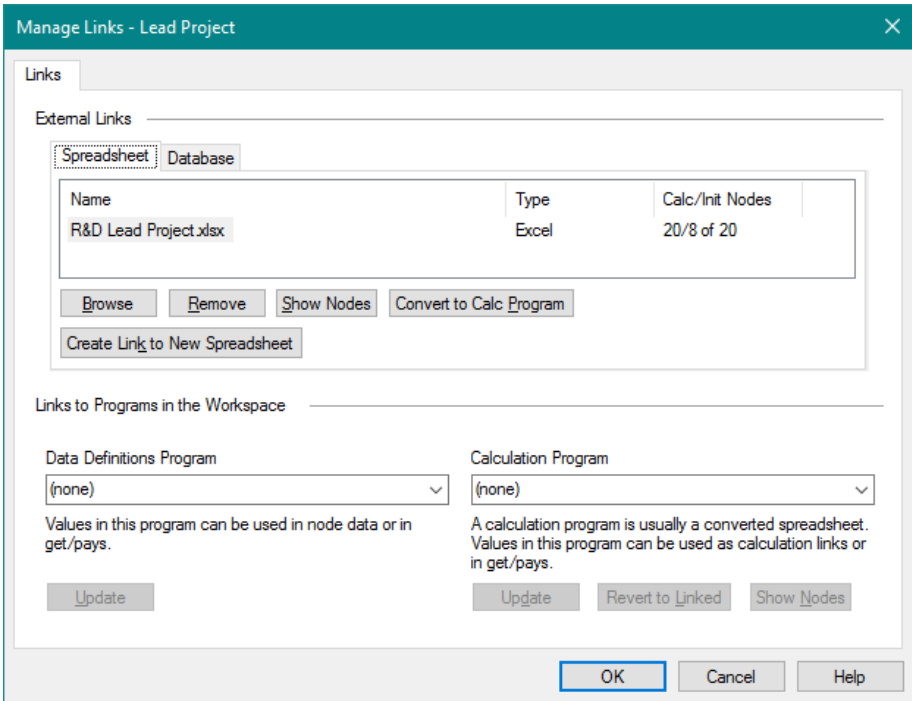
For the tutorial in this section, you will use two drug development models that have been set up in a similar way to the model you have used previously in the spreadsheet linked examples in this manual. Each model is initialization-linked and calculation-linked to a single spreadsheet (similar to the way a non-portfolio model is often spreadsheet linked). One of the models represents a "lead project" that will be launched in 2021 if it succeeds; the other represents a "follow-on" project which is an extension of the lead project. The follow-on project can only be attempted if the lead project is successful (launched), so these projects are not independent.

You will combine the two models into one overall model of the two projects, and then include the combined model in a larger Portfolio.

- ⇒ Start DPL Portfolio, if it's not already running.
- ⇒ Open the example Workspace called Lead Project.da (in the Examples folder underneath where you installed DPL).

This Workspace should look familiar except that the nodes have been renamed so that each name begins with "LP". You will see why in a minute.

- ⇒ Click Influence Diagram | Links | Manage. See Figure 11-12.



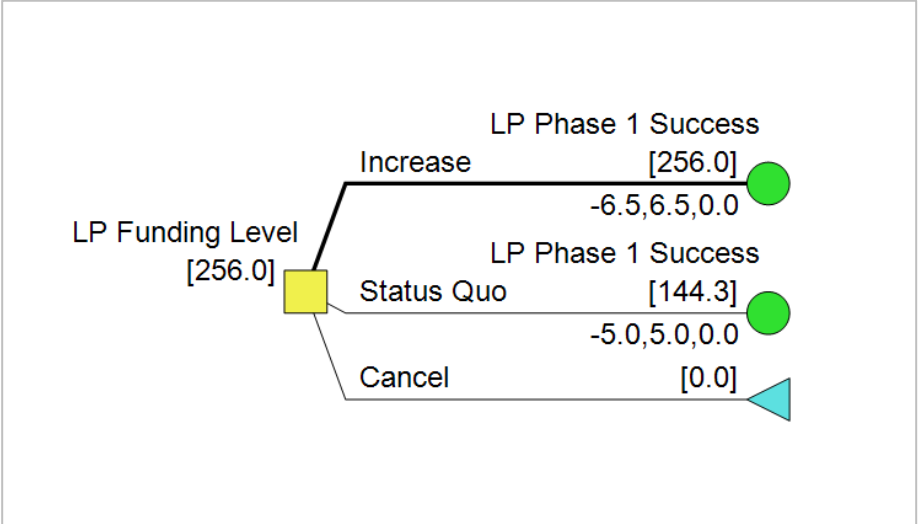
**Figure 11-12. Manage Links dialog for Lead Project Model**

The model is linked to the spreadsheet R&D Lead Project.xlsx. Note that the model is both initialization-linked and calculation-linked to this spreadsheet. All eight of the chance nodes are initialized with probabilities from the spreadsheet, and all of the nodes in the model are calculation-linked. There are no "pass-through" nodes because this model is set up for the evaluation of one project, rather than as a template model for a set of projects within a portfolio.

- ⇒ Click OK to close the dialog.
- ⇒ Within the Home | Run group check the Risk Profile and Policy Tree™ outputs. Ensure all other outputs are left un-checked.
- ⇒ Run a Decision Analysis (not a Portfolio Analysis) on the model.

The Policy Tree™ appears as in Figure 11-13.

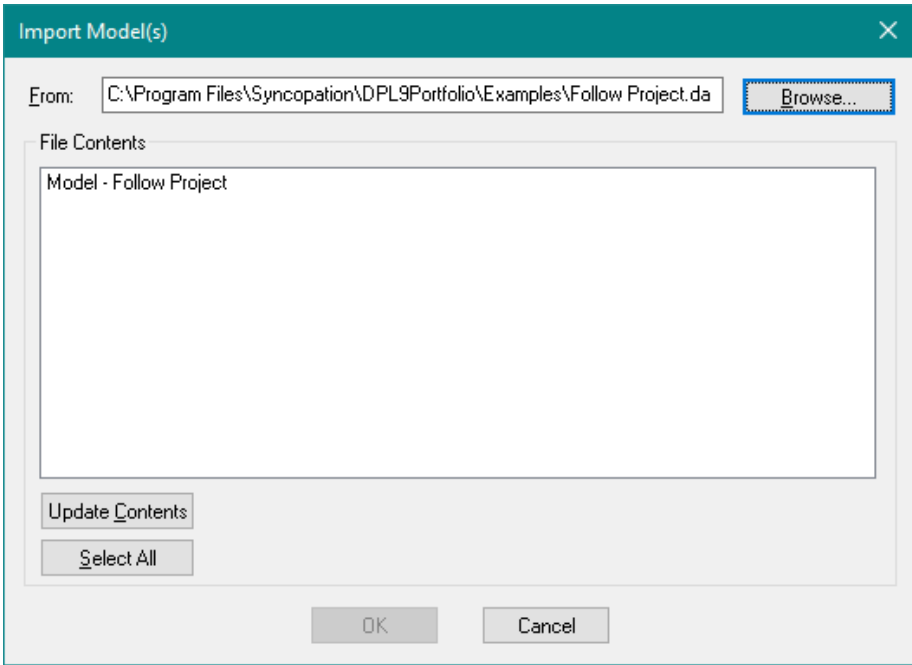




**Figure 11-13. Policy Tree™ for Lead Project**

The expected value of the project is 256. As you can see from the Risk Profile, this project is fairly risky; it has about a 70% chance of losing money, and about a 30% chance of losing quite a lot of money. However, this project "enables" the follow-on project.

- ⇒ Activate the Influence Diagram again (if you were examining the Policy Tree™ or Risk Profile).
- ⇒ Click Home | Workspace | Add to WS and select Imported Model... from the list.
- ⇒ Browse to select the file Follow Project.da. (in the Examples folder underneath where you installed DPL)
- ⇒ The File Contents list box should include "Model - Follow Project" as in Figure 11-14.



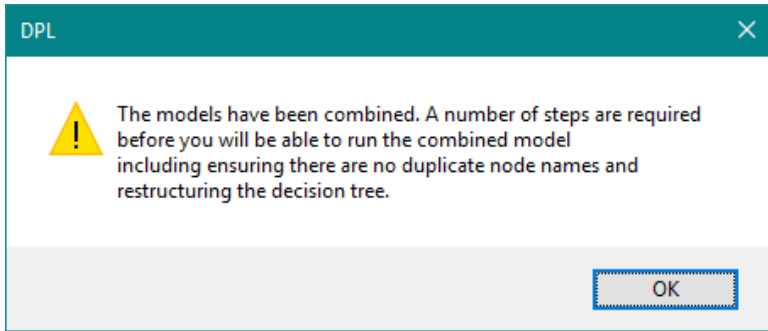
**Figure 11-14. Import Model dialog**

⇒ Select the Model - Follow Project and click OK.

DPL imports the Follow Project model into the Workspace. The Workspace now has two separate models that are set up the same way except for their node names (which are prefixed by LP or FP) and their links. The model for Follow Project is linked to another spreadsheet, R&D Follow Project.xlsx, for both its initialization and calculation links.

You will now combine these two models into one model.

- ⇒ Double-click on the Lead Project item in the Workspace Manager to activate the Lead Project model.
- ⇒ Click Home | Workspace | Add to WS.
- ⇒ Select Combined Model... from the list.
- ⇒ In the Select Model dialog, Follow Project should be selected.
- ⇒ Click OK. DPL displays a message as in Figure 11-15.



**Figure 11-15. Combine Models Prompt**

⇒ Click OK to the message.

The combined model is shown in Figure 11-16 and Figure 11-17. DPL has copied the Follow Project model into the Lead Project for both the Influence Diagram and Decision Tree panes. As noted in the warning message, the resulting combined model still needs some work before it will run. One of the things the warning message told you was that nodes may need to be renamed. This has already been taken care of for you in this example.

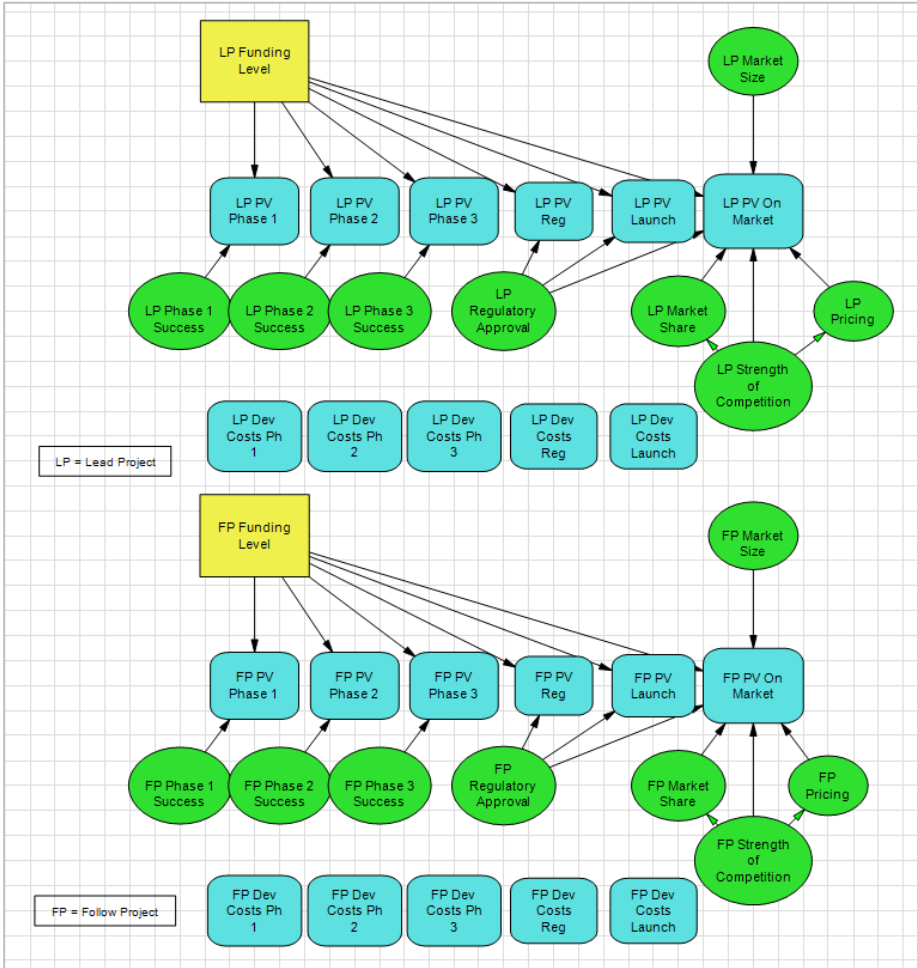


Figure 11-16. Influence Diagram After Combining Models



⇒ Select both the FP Funding Level decision node and the endpoint triangle for LP Market Size using Ctrl+Click.

⇒ Select Decision Tree | Instance | Subtree.

The decision tree now has three "perform subtrees". If the Lead Project is launched, all the uncertainties for the Lead Project are resolved, and then the decision is made about FP Funding Level for the Follow Project and the rest of the Follow Project subtree is performed.

You now have a decision tree with no detached subtrees as shown in Figure 11-18.

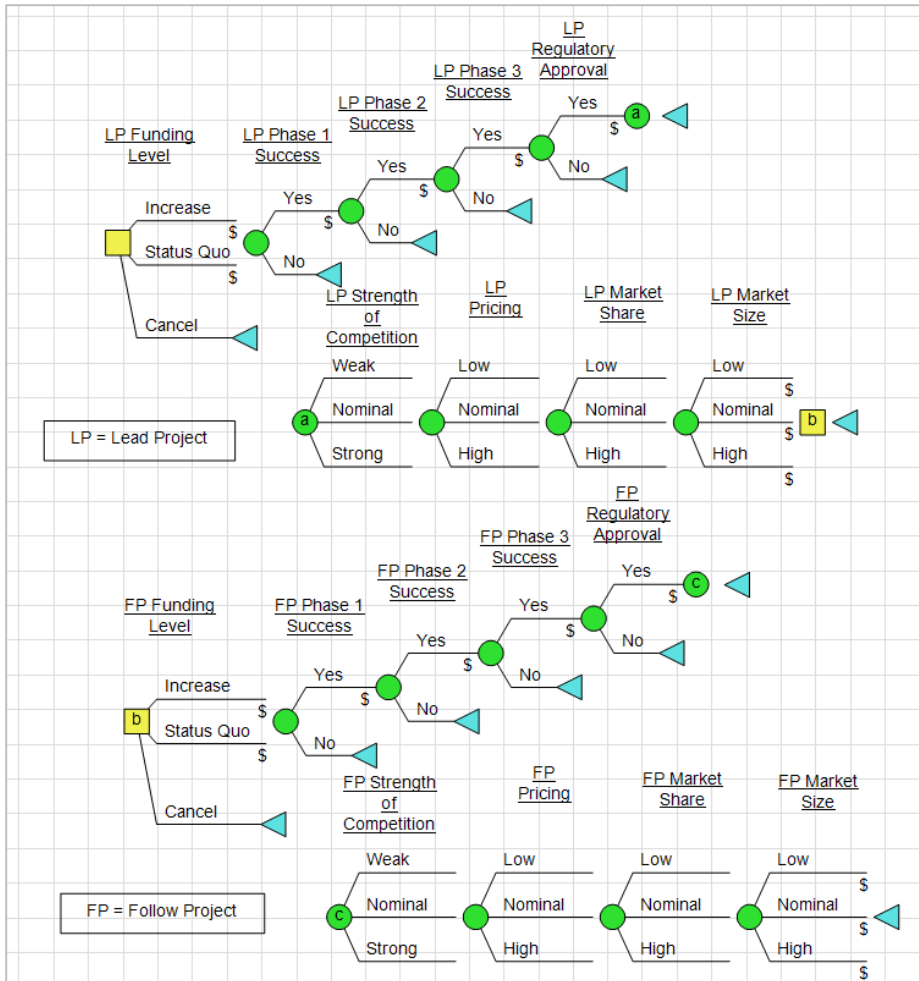


Figure 11-18. Fully Attached Decision Tree

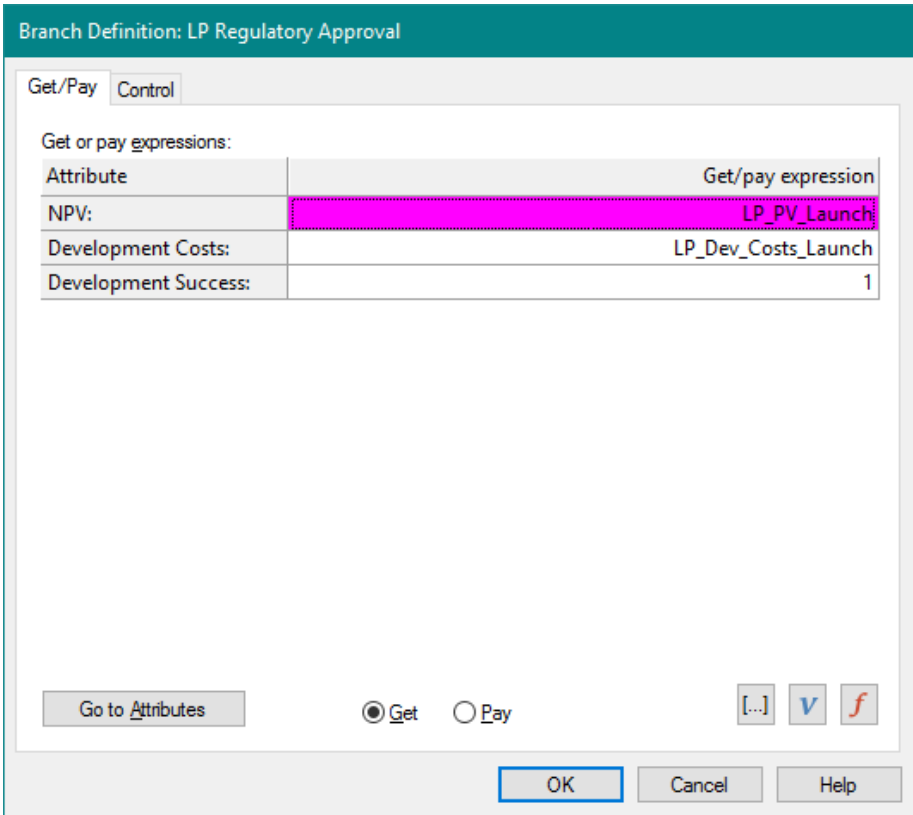
Note that this is not the only way you could build the combined decision tree. For example, you could make the initial FP Funding Level decision before resolving the marketplace uncertainties in the LP model. However, this would require a bit more effort because of the asymmetric nature of the tree. The tree is kept as simple as possible for purposes of illustration.

Also, if this were an actual model rather than an example, you might make changes to the Influence Diagram so that the model would take into account additional dependencies between the two projects. For example, the Strength of Competition uncertainty for the Follow Project might depend upon the Strength of Competition outcome for the Lead Project. Or the Pricing of the Follow Project could depend upon the Pricing and/or Market Share of the Lead Project. Obviously, modeling combined projects could result in a fairly complex Influence Diagram and/or Decision Tree, depending on your situation.

Finally, note that you have made no changes to the Influence Diagram or to the get/pay expressions. This model is set up with only the three required Portfolio Attributes. The get/pay expressions from each of the two projects are simply added to obtain the final attribute value for any particular path through the tree. Therefore, the NPV attribute will be the total NPV for both projects at any point on the tree, and the Development Cost will be the total Development Cost for both projects at any point.

There is one change that you need to make to the get/pay expressions before you can include this combined project in a larger portfolio. The Development Success attribute needs to be addressed.

- ⇒ Double-click the Yes branch of LP Regulatory Approval in the Lead Project section of the tree to open its Branch Definition dialog. See Figure 11-19.



**Figure 11-19. Branch Definition dialog for LP Regulatory Approval**

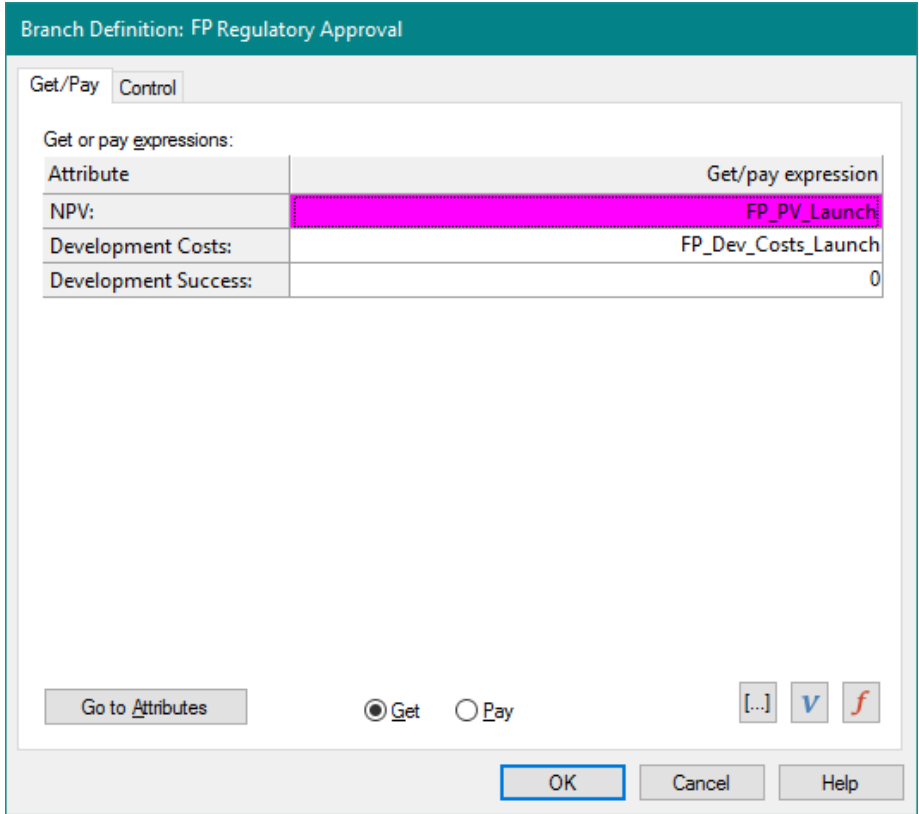
Note that the get/pay expression for the Development success attribute is set to 1. This is what you want because you are defining "success" for the combined project as "success of the lead project".

- ⇒ Click Cancel to close the dialog.
- ⇒ Double-click to open the Yes branch of the FP Regulatory Approval node in the Follow Project subtree.

Note that the get/pay expression is also 1 for Development success on this branch. Currently the success indicator is specified twice on some paths on the tree. This would result in the success attribute being 2 on those paths which is not allowed. Development success must be defined so that its sum, for any path on the tree, is either 0 or 1.

- ⇒ Edit the "1" in the get/pay expressions cell for Development success. Change it to 0 (zero). See Figure 11-20.





**Figure 11-20. Revised Get/Pay for FP Regulatory Approval**

⇒ Click OK.

This example highlights the fact that it is sometimes difficult to define "development success" in more complex analyses. In this situation, you could alternatively define "development success" to mean that both the Lead Project and the Follow Project succeed. Note that this would not change the expected NPV or the expected development cost results for the portfolio; however, it would change the probability of development success and the expected NPV given success.

- ⇒ Select the item for the combined model (named Lead Project Combined with Follow Project) in the Workspace Manager and rename it to be "Combined Project".
- ⇒ Run a Decision Analysis (not a Portfolio Analysis) on the Combined Project.
- ⇒ Examine the Policy Tree™ and Risk Profile.

The expected value of the Combined Project is about 495. The expected value, as well as the potential upside, have increased significantly compared with the Lead Project alone.

⇒ Save and close your Workspace. Leave DPL Portfolio open (use File | Close).

The last step in this tutorial is to open a separate Portfolio Workspace (the one you saved after Section 4.5 of this manual), and add the Combined Project model to your portfolio.

⇒ Either open the Workspace you saved at the end of Section 4.5, or the one that is provided for you: Excel-Linked Portfolio Done.da (in the Examples folder underneath where you installed DPL).

Recall that this Workspace contains a portfolio that is set up and ready to run. The portfolio has one Group with four Elements. Each Element is Excel-linked.

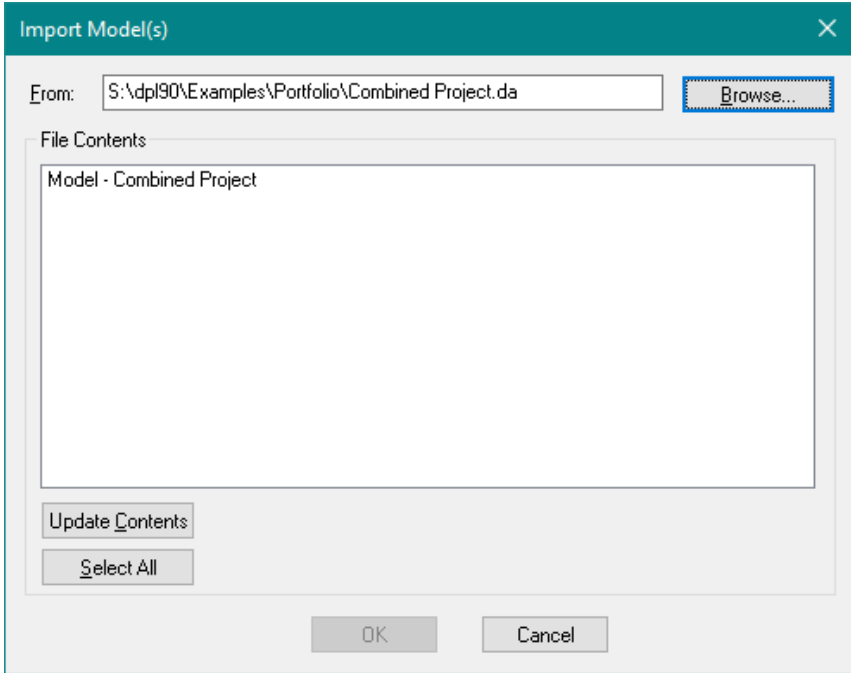
You will import the Combined Project model you just saved, and it will become its own Portfolio Group within this portfolio.

⇒ Save the Workspace under a new name.

⇒ Click Home | Workspace | Add to WS and select Imported Model... from the list. Browse to select the Combined Project model you just saved, or the one that has been provided, which is called Combined Project.da (in the Examples folder underneath where you installed DPL).

⇒ Click Open. The Import dialog appears.

⇒ Select Model - Combined Project from the dialog see Figure 11-21.



**Figure 11-21. Import Dialog with Combined Project Selected**

⇒ Click OK.

The Combined Project model appears in the Workspace. However, it is not yet part of the portfolio. In order to be included in the portfolio it has to be added to a Portfolio Group. Note: the Combine Project model already had the Portfolio Model indicator set on it and used the Portfolio Attributes (which are the same in the Combined Model.da file). If this were not the case, you would have to set the indicator and potentially modify get/pay expressions accordingly.

- ⇒ Select the Portfolio item in the Workspace Manager.
- ⇒ Click Portfolio | Definition | Group and select Add from the list. The Add Portfolio Group dialog appears.
- ⇒ Give the group the title "Lead/Follow Project".
- ⇒ For the Model, select Combined Project from the drop-down list.
- ⇒ Select None for Initialization Links.
- ⇒ Select None for Calculation Links. The dialog should now look like Figure 11-22.

**Add Portfolio Group** [X]

Title:

Model:

Project Categorization

Initialization Links

None  DPL Program  Microsoft Excel  Database

Model ID:

Use value node data for project names Source:

Use database field for project names Field:

Numeric export table:

String export table:

Calculation Links

None  DPL Program  Microsoft Excel

Excel links in one workbook

**Figure 11-22. Edit Portfolio Group dialog**

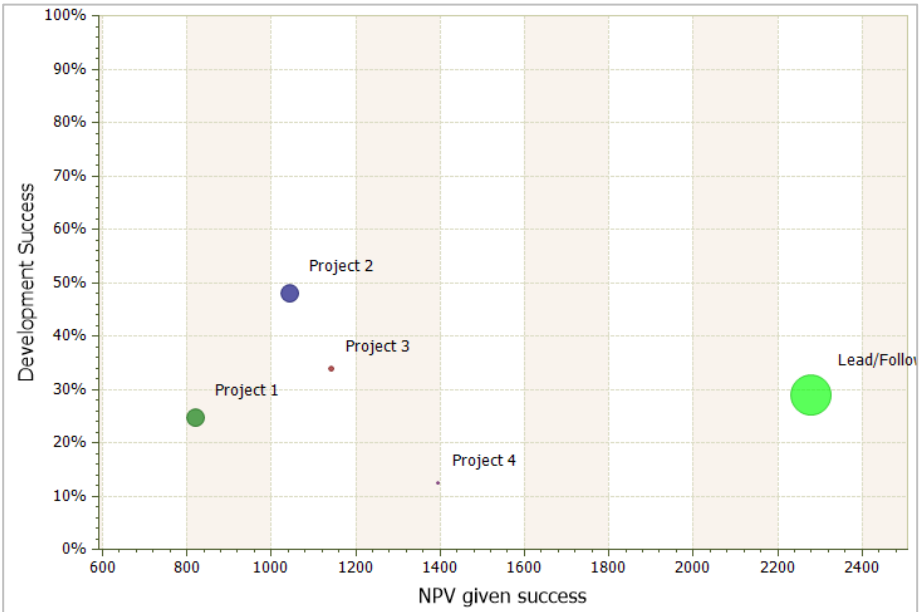
⇒ Click OK.

The Lead/Follow Project group now appears in the Workspace as a Portfolio Group.

Note that you have told DPL that both Initialization Links and Calculation Links were None. The Combined Project model is linked to two spreadsheets, R&D Lead Project.xlsx and R&D Follow Project.xlsx. However, these links will not be overridden. The Combined Project model is being included in the Portfolio to analyze the combination of the two projects as a single project. DPL does not need to override the links, so you set them to None. Also, since you are not overriding the links there is no need to create an Element for the Lead/Follow Portfolio Group.

- ⇒ Save your Workspace.
- ⇒ Click Portfolio | Run | Analyze (Options). Check Results Report, Risk/Reward Bubble Chart, Productivity Ratio Chart, and Expected and Potential Value Chart (and other outputs if you wish to see them).
- ⇒ Click Run Now.
- ⇒ Double-click on the Risk/Reward item to activate it.

The Risk/Reward chart is as shown in Figure 11-23.



**Figure 11-23. Risk/Reward Chart with Lead/Follow Project**

You can see from the chart that the Lead/Follow Project has the largest expected NPV given success in the portfolio. Also, the probability of development success is 29%; recall that this is defined as the probability of the Lead Project succeeding, but not necessarily the Follow Project. Also, the Expected NPV given success attribute in this case is the Expected NPV over all possible outcomes (including failure) for the Follow Project, assuming only that the Lead Project succeeds.

Note that the Risk/Reward chart would look different if you had defined the Development success attribute to require that both the Lead Project and Follow Projects succeed. The probability of development success would have been smaller, but the expected NPV given success would have been larger, as mentioned earlier.

⇒ Examine the other outputs if you wish.

Note in particular the Expected and Potential Value chart, which shows that the Combined Project has significant upside potential given that (at least) the Lead Project succeeds.

You have completed the tutorials for this chapter. Note that for your reference an example file named Excel-Linked Portfolio Combined Project Done.da that is the end result of the tutorials completed in sections 11.2 and 11.3 has been provided within the Examples folder of your DPL installation directory.

## 12. CSV Definition of Portfolio

For a portfolio with a large number of projects, maintaining the list of Groups and Elements can be a time consuming task in and of itself. DPL provides you with a feature for exporting and reimporting the portfolio definition as a CSV text file, so you can make edits using Excel or a text editor when doing so is more convenient than using DPL's interactive, dialog-based interface.

While it is possible to start a CSV portfolio definition from scratch, we recommend that users first define a small portfolio using DPL's interactive interface and save that as a CSV file, to serve as a starting point.

A CSV file defining a DPL portfolio has three types of rows, a PORTFOLIO row, one or more GROUP rows, and one or more ELEMENT rows. The order is significant: the PORTFOLIO row comes first, followed by the first GROUP row, then one or more ELEMENT rows for the Elements in that Group. After the Elements for the first Group, there may be a second GROUP row followed by one or more ELEMENT rows for that Group, and so forth.

The fields (columns) of the three types of rows are listed in Table 12-1, Table 12-2, and Table 12-3 for reference. In practice, you'll seldom need to consult these as the use of the fields in a saved CVS file are clear in context.

The portfolio row is first and it serves to identify the CSV file as the definition of a DPL portfolio.

1	String	"PORTFOLIO"
2	Integer	version (always 1 at this time)

**Table 12-1. Columns within PORTFOLIO Row of CSV Definition File**

The columns in the GROUP row correspond to controls in the Edit Portfolio Group dialog.

1	string	"GROUP"
2	string	group name
3	string	template model name
4	integer	init link type
5	integer	calc link type
6	integer	reserved (should be 0)
7-18	integer	categories (-1 if not set)
19	integer	model ID
20	integer	Project names from value node data
21	string	Project name source
22	string	Project name field
23	string	Numeric report table
24	string	String report table

**Table 12-2. Columns within GROUP Rows in CSV Definition File**



The columns in the ELEMENT row correspond to controls in the Edit Portfolio Element dialog.

1	string	"ELEMENT"
2	string	element name
3	string	project IDs
4	integer	Flags
5	string	init link path
6	string	calc link path
7-18	integer	categories (-1 if not set)

**Table 12-3. Columns within ELEMENT Rows in CSV Definition File**

## 12.1 Tutorial: CSV Definition of Portfolio

---

- ⇒ Start DPL Portfolio.
- ⇒ Select File | Open.
- ⇒ Navigate to the Examples folder underneath where you installed DPL Portfolio, usually  
C:\Program Files\Syncopation\DPL9Portfolio\Examples.
- ⇒ Select R&D Projects Definition.da and click Open.

Notice that the Portfolio in this Workspace includes a single group named Drug Dev Group and six elements (Projects 1-6) within that group. Take a moment to look at the Project Categories that have been defined.

- ⇒ Select Portfolio | Definition | Categories to view the Project Categorization dialog.

Therapeutic Area has been defined as a Category Type for the Portfolio. Within this Category Type, 4 categories have been defined. Lastly, note that the categories are specified at the group/element level.

- ⇒ Click Cancel to close the dialog without making any changes.

- ⇒ Double-click the item for the Drug Dev Group in the Workspace Manager to view the Edit Portfolio Group dialog (Figure 12-1).

The *Project Categorization* section tells you that the Therapeutic Area categories are defined by the elements. This will be reflected in the .CSV definition of the portfolio. Lastly, take note of the Initialization and Calculation Link settings.

**Edit Portfolio Group**

Title:

Model:

Project Categorization

Therapeutic Area: Defined by element(s)

Initialization Links

None  DPL Program  Microsoft Excel  Database

Model ID:

Use value node data for project names Source:

Use database field for project names Field:

Numeric export table:

String export table:

Calculation Links

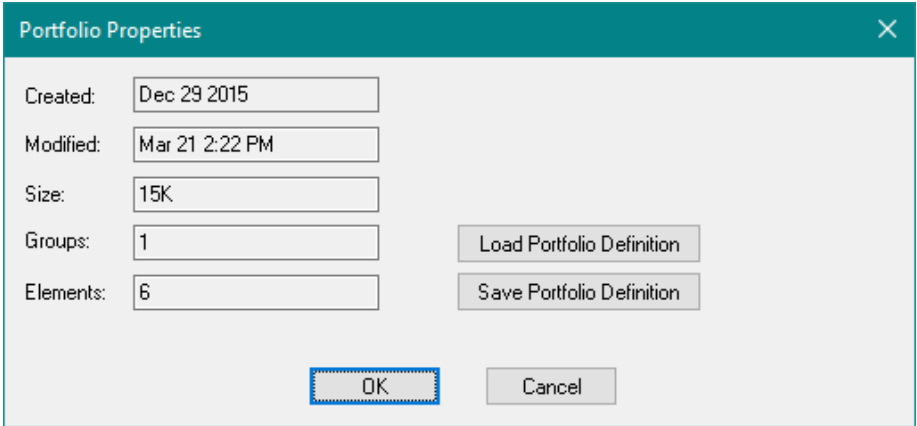
None  DPL Program  Microsoft Excel

Excel links in one workbook

**Figure 12-1. Edit Portfolio Group dialog**

- ⇒ Close the Edit Portfolio Group dialog without making any changes.

- ⇒ Right-click on the Portfolio item within the Workspace Manager and select Properties from the context menu list. The Portfolio Properties dialog will appear as in Figure 12-2.



**Figure 12-2. Portfolio Properties dialog**

- ⇒ Click the Save Portfolio Definition button.
- ⇒ Browse to choose the location where you wish to save the .CSV file.
- ⇒ Name the file to be "Portfolio Defn.CSV". Click Save.

It's OK to leave the dialog up in DPL as you proceed with the following steps in Excel.

- ⇒ Open the Portfolio Defn.CSV file you just saved in Excel. Note: you may need to set the file type to All Files in order to open the CSV file. See Figure 12-3.

	A	B	C	D	E	F	G	H	I	J
1	PORTFOLIO									
2	GROUP	Drug Dev Group	Drug Dev Temp	0	1	0	-1	-1	-1	
3	ELEMENT	Project 1		1	0 (none)	R&D_Project_1_NPV	0	-1	-1	
4	ELEMENT	Project 2		2	0 (none)	R&D_Project_2_NPV	0	-1	-1	
5	ELEMENT	Project 3		3	0 (none)	R&D_Project_3_NPV	1	-1	-1	
6	ELEMENT	Project 4		4	0 (none)	R&D_Project_4_NPV	2	-1	-1	
7	ELEMENT	Project 5		5	0 (none)	R&D_Project_5_NPV	3	-1	-1	
8	ELEMENT	Project 6		6	0 (none)	R&D_Project_6_NPV	3	-1	-1	
9										
10										
11										
12										
13										
14										
15										

**Figure 12-3. Portfolio Defn.csv file Opened in Excel**

The PORTFOLIO row is first. It doesn't include any information in terms of defining the portfolio, it only serves to identify the CSV file as the definition of a DPL portfolio.

Moving down to the GROUP row, you can see that it first identifies the group name (B2) and template model (B3). The model currently has only Calculation links set up which is why you see a "0" in the cell D2 for Init link type (none) and a "1" in cell E2 for the Calc link type (DPL Program). Cell G2 contains category information as defined within the Portfolio. Cell G2 and the remaining categorization cells contain a -1 (not set) because the categories are specified at the Portfolio Element level, not the Portfolio Group level.

Within the ELEMENT rows you can see each of the 6 projects listed (column B) along with their project IDs (column C). The Init and Calc link paths are identified within columns E and F. Similar to the GROUP row, column G contains information on project categories. Because the categories have been specified at the Portfolio Element level you see various integers defined. The "0" entered within column G for Project 1 refers to the first category defined for the Portfolio, which in this case is Oncology. Note that the integer that defines a particular category within the CSV definition does not match the category code assigned to the category within the Project Categorization dialog. Category codes must be

positive integers so they start at 1, whereas the CSV definition integers start at 0.

You're now going to make some slight modifications to the CSV file, save it, and re-import the modified file to the Portfolio. You'll then confirm that the appropriate changes have been made to the Workspace. More specifically you're going to remove a project, rename a project, and modify the category definitions.

- ⇒ Rename Project 1 to be Project 1A (e.g., click in cell B3 and edit).
- ⇒ Remove Project 5 (select the whole row, right click and select Delete from the context menu).

You'll now define the Oncology category at the Portfolio Group level rather than the Element level. To do so:

- ⇒ Edit cell G2 and replace the "-1" with "0". Now the Oncology category is set at the Portfolio Group level.
- ⇒ Edit cells G3 and G4, replacing the "0" with "-1". The Project Category specifications have been removed for these two Portfolio Elements. They will use the Group level setting.

Your Portfolio Definition should now look like Figure 12-4.

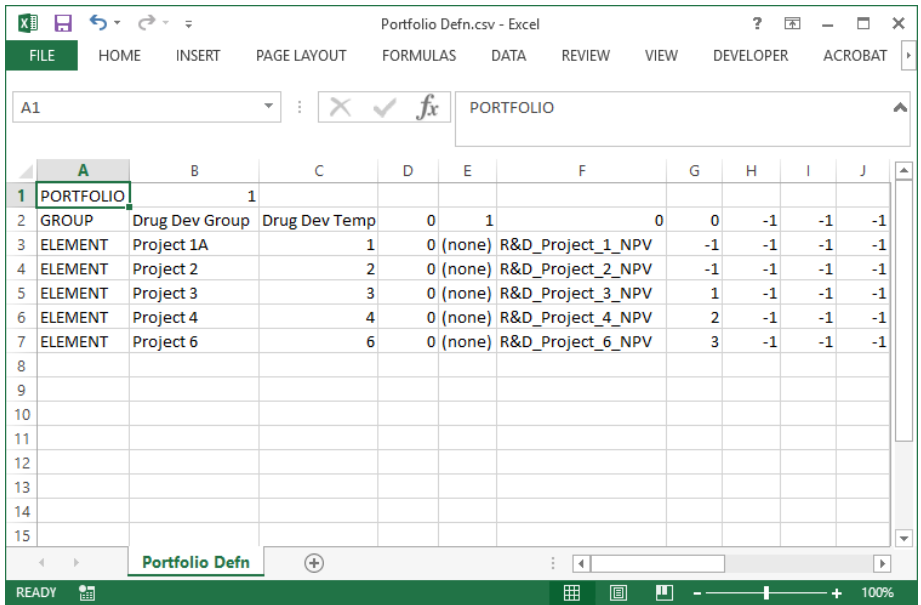


Figure 12-4. Portfolio Defn.csv file with Modifications

- ⇒ Save the CSV file as "Portfolio Defn Modified.CSV". You can ignore any prompt from Excel about saving in a CSV format.
- ⇒ Close Excel. If you don't close the .CSV file, DPL won't be able to import the modified definitions.
- ⇒ Return to DPL. From the Portfolio Properties dialog, click Load Portfolio Definition.

DPL will warn you that the existing portfolio definition will be replaced.

- ⇒ Click Yes to the prompt.
- ⇒ Browse for and select the Portfolio Defn Modified.CSV file you just saved and click Open. Click OK to close the Portfolio Properties dialog.

Inspect the Portfolio to ensure the appropriate changes have been made. You should note that:

- Project 1 has been renamed to be Project 1A within the Workspace
- Project 5 has been removed from the Workspace
- The Oncology category is now defined at the Portfolio Group level
- Project 1A and Project 2 now use the Group Setting for their Project Categorization

For your reference, an example file named R&D Projects Definition Modified.da that is the end result of the tutorial completed in this chapter has been provided within the Examples folder of your DPL installation directory.

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