UMT Consulting Group

Portfolio Analysis with Microsoft Project Server 2010

A Guide for the Business User

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Microsoft

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1. Foreword

Microsoft Project Server 2010 prominently features the Portfolio Analysis module, which is essentially the integration of key functionality from a previous stand-alone product: Microsoft Project Portfolio Server, acquired from UMT in 2006. With the Portfolio Analysis feature, Microsoft extends the reach of the tool further into demand management and portfolio analysis, i.e. much of the work that comes before the project actually begins.

Arguably the Portfolio Analysis module represents the first example of Project Server performing calculations on the server without similar functionality in the desktop client. Now I know the Project Server veterans will claim that this was the case with Microsoft Office Project Server 2007, which indeed was the first release to include a server-side calculation engine, enabling project plans to be updated without opening the client application. However, in Office Project Server 2007, the server essentially emulated the scheduling engine found in the client. With Project Server 2010, there is no corresponding functionality in the client, and that is a key distinction.

Immediately after the 2010 release, I began seeing questions appear on the newsgroups inquiring as to exactly how the calculations were performed within the Portfolio Analysis module. As I had taken a course on Quality Management a couple of years ago and learned about the Analytic Hierarchic Process (AHP), I put together a quick little blog post talking about pairwise analysis, and how it was implemented to calculate the driver prioritization heuristics within Project Server. After I completed that, I threw together a quick blog on the project prioritization mechanism. Then, perhaps having what some may describe as a surfeit of free time, I decided to throw those into a spreadsheet and model the optimization engine. From there, it was only a hop, skip and a jump to figuring out the efficient frontier calculations … and so on and so forth.

Six months and approximately two dozen blog posts later, I realized that I had developed quite a lot of material about specifically how portfolio analysis is performed in Project Server 2010. This paper represents the sum of those blog posts, assembled into a slightly more readable format with supplemental information to fill in key continuity gaps.

This document should be treated as an unofficial, non-technical user guide for the Portfolio Analysis module in Project Server 2010. This document is intended for the power user, and not the system administrator (with perhaps a couple of minor exceptions where noted.)

Disclaimer

This document was developed through extensive observational analysis of Microsoft Project Server 2010. I was not part of the development team, and do not have access to proprietary information regarding the internal calculation algorithms of the tool. Where possible, I have attempted to infer processes that are occurring within the tool itself based on observation and publicly available information. Any mistakes or inaccuracies are solely my responsibility and do not reflect upon Microsoft Project Server 2010 or the UMT Consulting Group.

Should you, the reader, recognize opportunities for improving this document, please feel free to contact me with any critiques, suggestions, or requests for clarifications.

Twitter: @alavinsky

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Readers are also encouraged to post questions to the online Microsoft forums so that other users may benefit from the community-based information exchange:

http://social.technet.microsoft.com/Forums/en-US/category/projectserver2010,projectprofessional2010.

Questions posted to the forums are answered by a wide range of volunteers from across the globe.

2. Executive Summary

This document is intended to function as a comprehensive user guide for the Portfolio Analysis module of Microsoft Project Server 2010. The intended audience for this document is a non-technical power user or PMO administrator charged with analyzing portfolios of projects within Project Server.

This document assumes that the reader has a basic understanding of the mechanics of working with resource loaded projects within Microsoft Project Professional 2010.

This document does not address the technical aspects of configuring Project Server to support Portfolio Analysis, i.e. any of the functionality typically found on the Server Settings page of Project Web App (with several minor exceptions as noted). This document does not address the implementation of workflow to support organizational demand management practices, including discussion of Project Detail Pages or Enterprise Project Types.

In other words, this document focuses primarily on the exciting new functionality that lies behind these three simple links on the PWA Quick Launch bar:

- Driver Library
- Driver Prioritization
- Portfolio Analyses

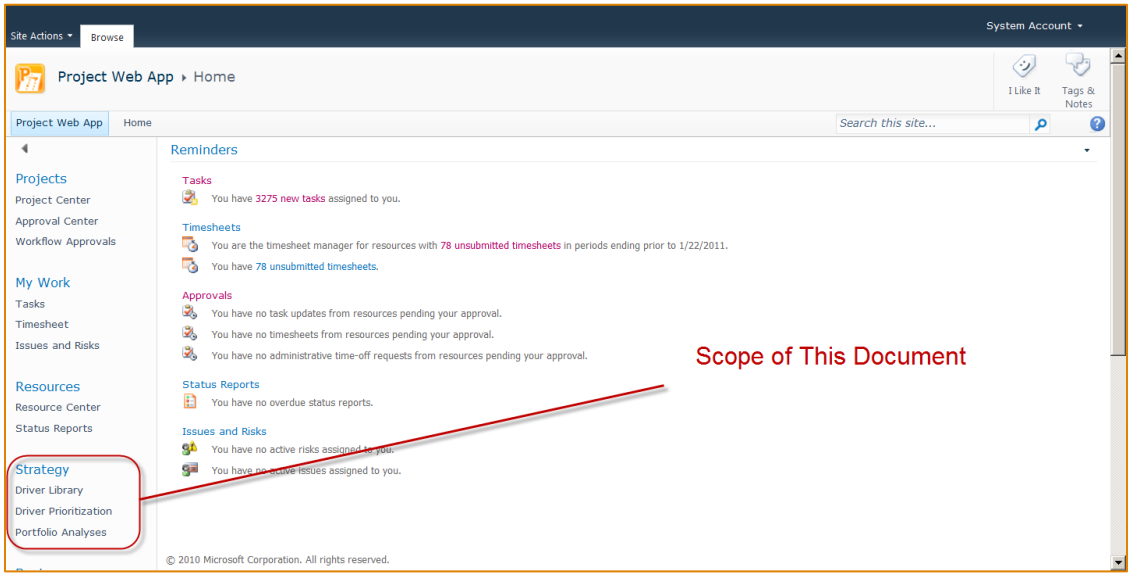


Figure 1: Document Scope

3. Process Overview

Portfolio analysis must be performed within the context of an organizational project selection and prioritization process.

Typically, this process appears in the literature in many guises, but at the end of the day, 90% of organizations that use this tool will likely follow a process as outlined below:

1) Create a proposed project schedule.
2) Populate the schedule with generic resources.
3) Submit the schedule for approval.
4) Review the project schedule against cost constraints.
5) Review the project schedule against resource constraints.
6) Perform what-if analysis on the project portfolio.
7) Select and commit to the desired portfolio of projects.
8) Replace the generic resources with specific named resources.
9) Modify the project schedule based on the actual execution schedule.
10) Execute, monitor and control.
11) Conduct post implementation and benefit realization review.

The Portfolio Analysis module typically is designed to manage steps 3-7 in the above process, whereas Project Server could arguably be said to include features that support steps 1-10, and could be extended to support step 11. For more discussion of best practices in managing demand management within an organization, refer to the Microsoft library for Project Server demand management articles:

http://technet.microsoft.com/en-us/projectserver/ff899331.aspx

Technical Overview

Portfolio Analysis within Project Server is treated as a separate technical module, with its own data tables within the Project Server databases. Each analysis is created as a separate data entity within the Project Server database. As a result, the same project may exist in multiple portfolio analyses simultaneously. This is important when reviewing some of the user questions that have already appeared in the newsgroups on the topic. For instance, one of the frequent questions observed has been “How do I report on the priority of each project within the analysis?” The priority will not appear in any of the project tables. Instead, the priority is flagged to each project on a scenario by scenario basis, and is stored in the analysis tables. One project may have multiple priorities, each one in a separate analysis.

This dynamic causes reporting against the analysis data to be challenging at times. On preliminary examination, much of the analysis data resides in the Reporting database, but some of the critical data such as project dependency data appears to be maintained only in the Publishing database. Reporting on Portfolio Analysis is a topic for another paper.

The user should treat the Portfolio Analysis module as a virtual sandbox to test various scenarios. Those scenarios, such as revised cost constraints, adjusted start dates, and the incremental addition of resources do not affect the actual project data stored in Project Server. Some organizations will opt to develop custom workflow to push those data points into project schedules, but in the absence of such workflow, none of those scenarios will actually affect the project schedules saved in Project Server.

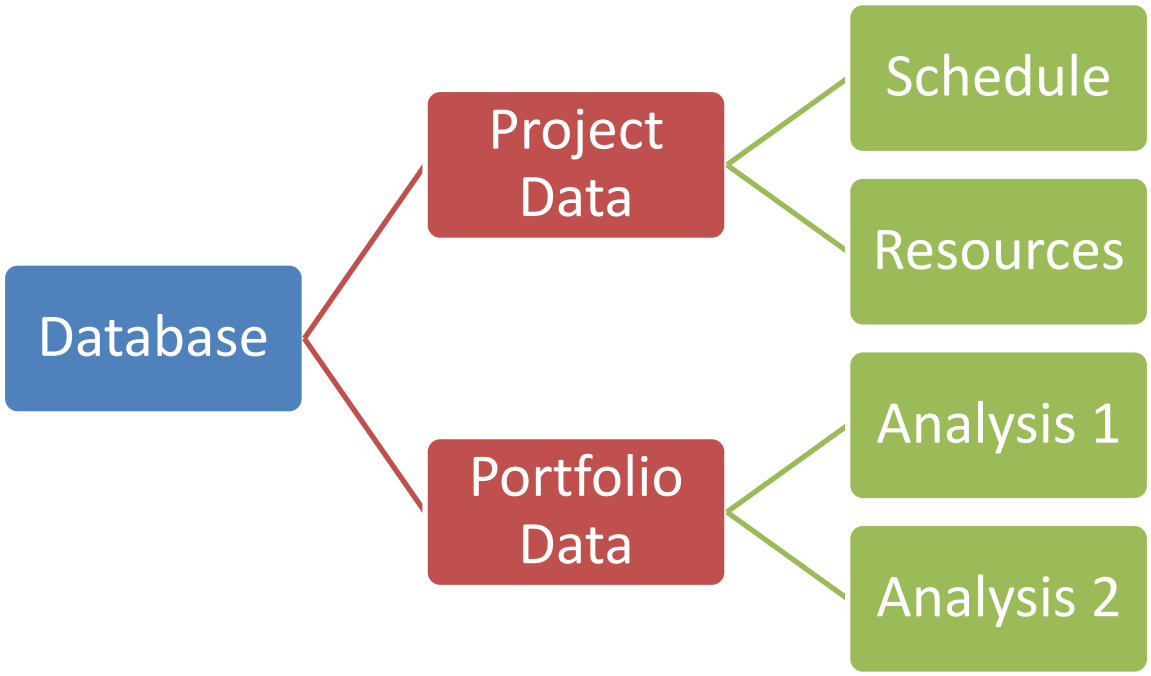


Figure 2: Project Server Data Schema

The one exception to this rule is that when the user clicks on the Commit button, up to six specific project level fields will be populated. These fields will not change the schedule in any way.

For more information on committing specific scenarios, refer to page 119 of this document.

Terminology Overview

A "project portfolio" is usually defined as a centralized collection of projects managed jointly to enhance advantages to the organization or to minimize risk. From a technical standpoint, within Project Server 2010, a portfolio of projects should be defined as a set of projects that share the same cost or resource constraints.

Users of Project Portfolio Server 2007 may get confused by the use of terminology within this document. To clarify, the Portfolio Analysis module is a component of Project Server 2010. Within the Portfolio Analysis module are two primary functions: Cost Analysis and Resource Analysis. These two functions roughly correlate to Microsoft Project Portfolio Server 2007 as follows:

2007 Terminology	2010 Terminology
Project Portfolio Server 2007	Portfolio Analysis Module
Portfolio Optimizer	Cost Analysis Function
Portfolio Planner	Resource Analysis Function (also referred to as Schedule Analysis)

Table 1: PPM Terminology Changes

The Resource Analysis scenarios are further detailed analyses of the scenarios defined in the Cost Analysis process. As a result, the Resource Analysis scenarios should be considered a subset of the Cost Analysis scenarios.

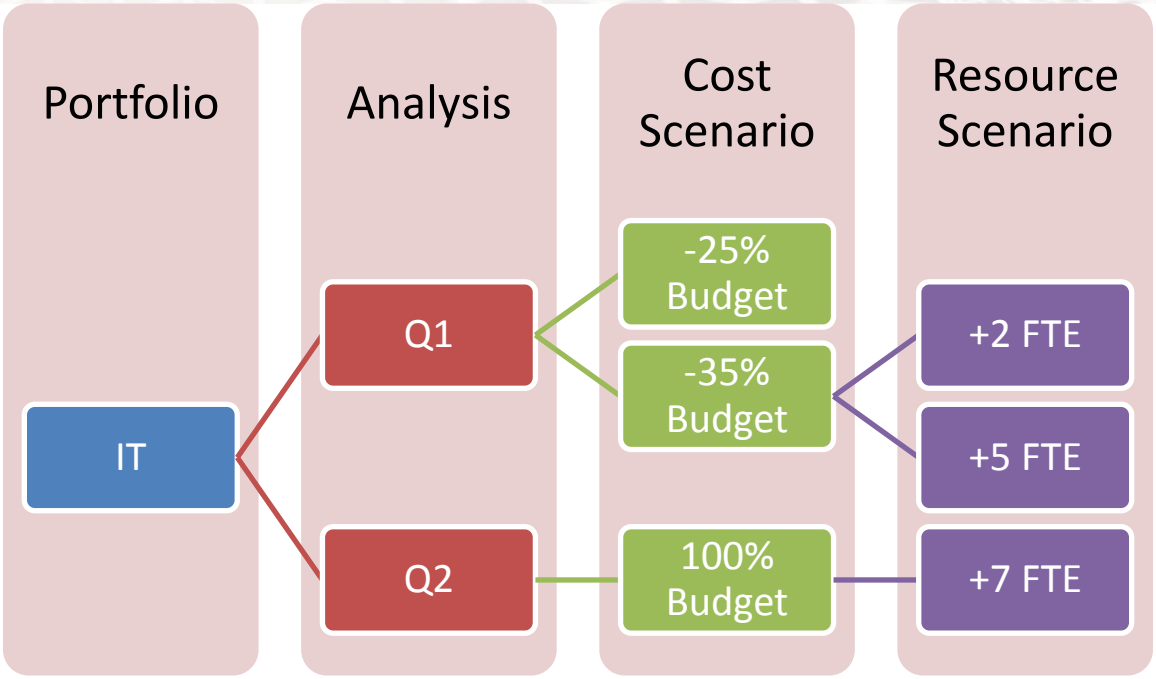


Figure 3: Terminology Overview

That hierarchy of terms is evident on the Portfolio Analysis page.

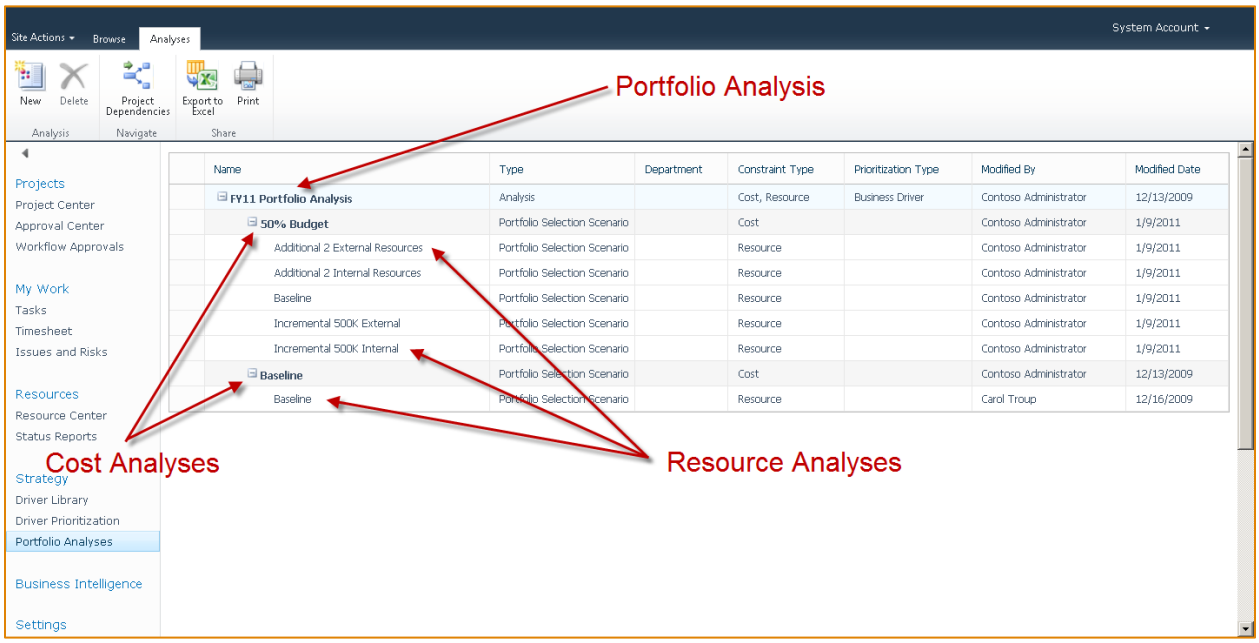


Figure 4: The Analysis Hierarchy

4. Preparing for Portfolio Analysis

There is a joke amongst EPM consultants. The joke goes something like this, "Implementing portfolio management in an organization is actually quite easy; it's just a three step process. First, you define all your projects. Second, you define all of your resources. Third, you figure out your entire decision making structure, and map it into a spreadsheet. See? It's a simple three step process."

Implementing and performing portfolio analysis is of course not that simple. That last step, of defining the organizational decision-making process and turning it into a documented set of heuristics is one of the toughest parts of the portfolio management adoption process. On the other hand, once resource or cost constraints are laid bare, and placed next to the wish list of possible projects, the organization will often quickly realize that these decision making factors must be defined.

Proper preparation for portfolio analysis ensures quality of output, but also ensures that the organization can perform analysis that fits specific needs. The following three steps must be performed to prepare for portfolio analysis:

- Define business drivers or other factors relevant to the project approval process.
- Define the demand profile, i.e. define the list of projects including resource level of effort estimates and/or cost estimates.
- Define the resource supply by populating and configuring the resource pool.

In Project Server 2010, the first step in preparing to analyze projects within the Portfolio Analysis module is to define and rank the specific business drivers that will be used to assess the strategic value of the project. Business drivers may either be defined within the system as addressed below, or defined outside of the system and then brought into the system as manual drivers as defined on page 29.

Defining Business Drivers

Business drivers are used to assess project strategic value and to assure that project selection supports the organizational strategy. The usage of business drivers and pairwise business driver prioritization yields a number of benefits to the organization:

- Business drivers enable stakeholders to systematically develop relative weights rather than arbitrarily assigning priorities to projects.
- Business driver use promotes critical discussions about consensus or the lack thereof for critical business objectives.

- The prioritization exercise takes into account both objective and subjective concerns regarding relative driver weights.
- The prioritization exercise builds consensus by exposing critical differences of opinion amongst the key stakeholders.
- Overlays qualitative assessments on quantitative decision making mechanisms.

Most organizations should define between 5 and 12 drivers for each portfolio. Any less than 5 drivers are typically inadequate to capture the complexities of the organization. Any more than 12 often become unwieldy in the prioritization session.

Navigate to the Business Driver Library to define the business drivers.

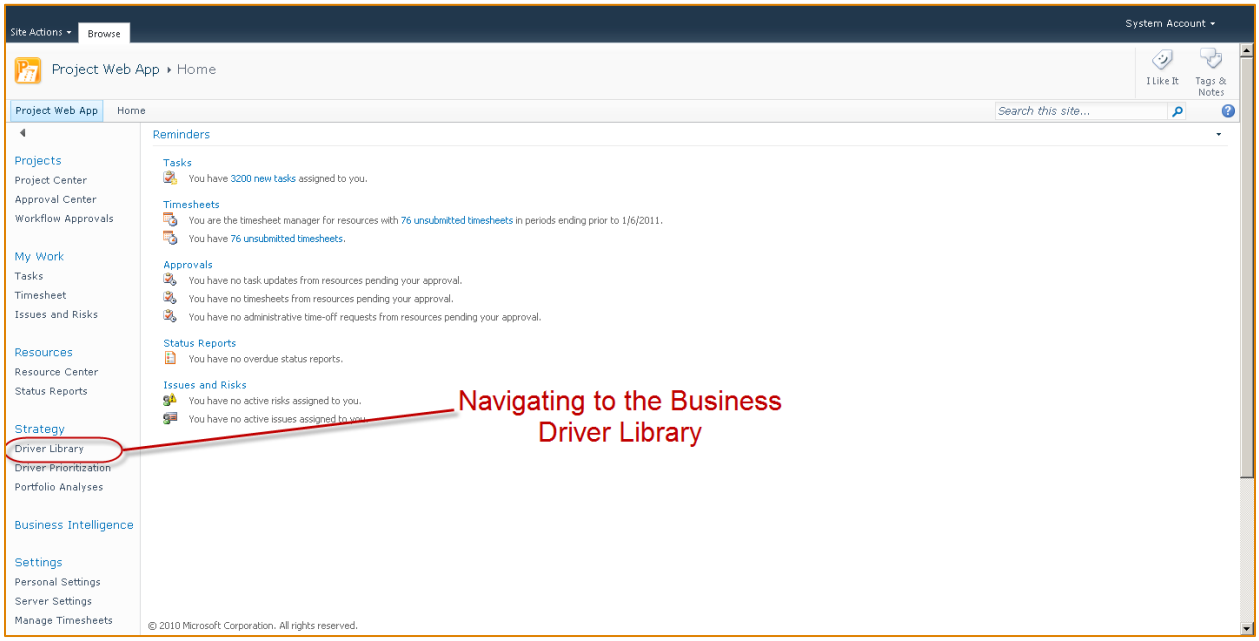


Figure 5: Navigating to the Business Driver Library

After navigating to the Driver Library, click the New button to create a new driver.

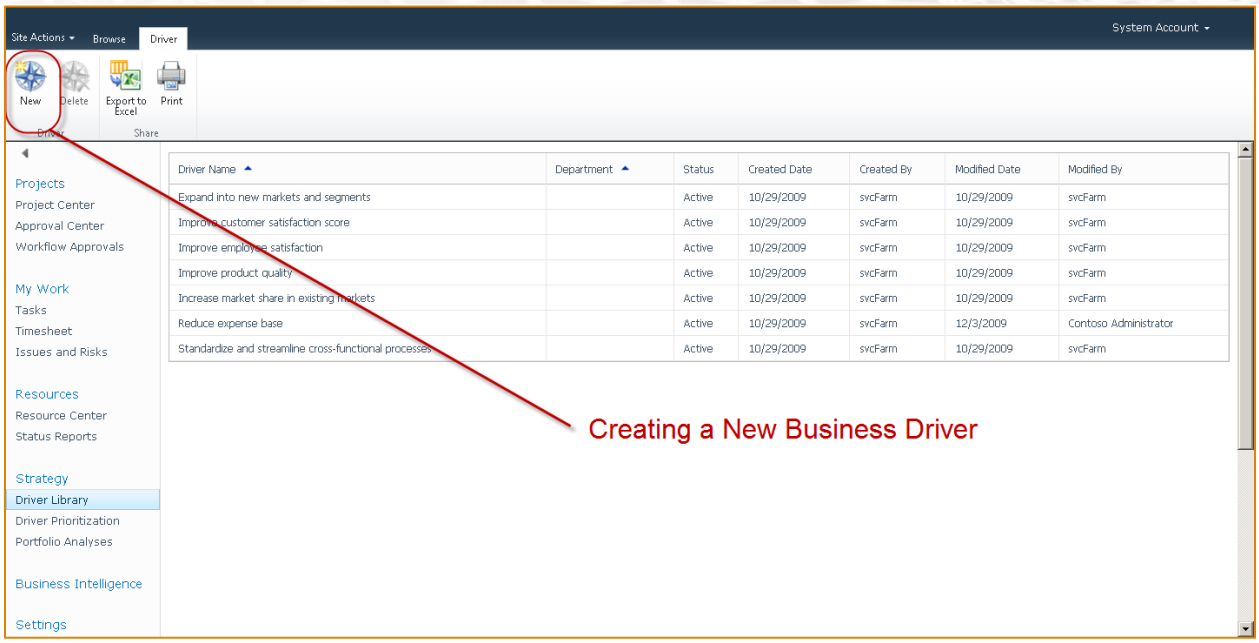


Figure 6: Creating a New Business Driver

Each driver should be associated with quantifiable impact statements. Both the driver and the specific impact statements should be specific and measurable. As a best practice, ensure that each of the drivers are roughly equivalent in scope, without some drivers being too broad and other drivers being too specific.

When identifying drivers, the organization may consider creating multiple analysis views based on the different driver sets if multiple stakeholders within the organization have radically different opinions regarding which drivers should be used for project prioritization. After each of the key stakeholders performs the project prioritization process, the results may be analyzed to identify similarities between the outcomes.

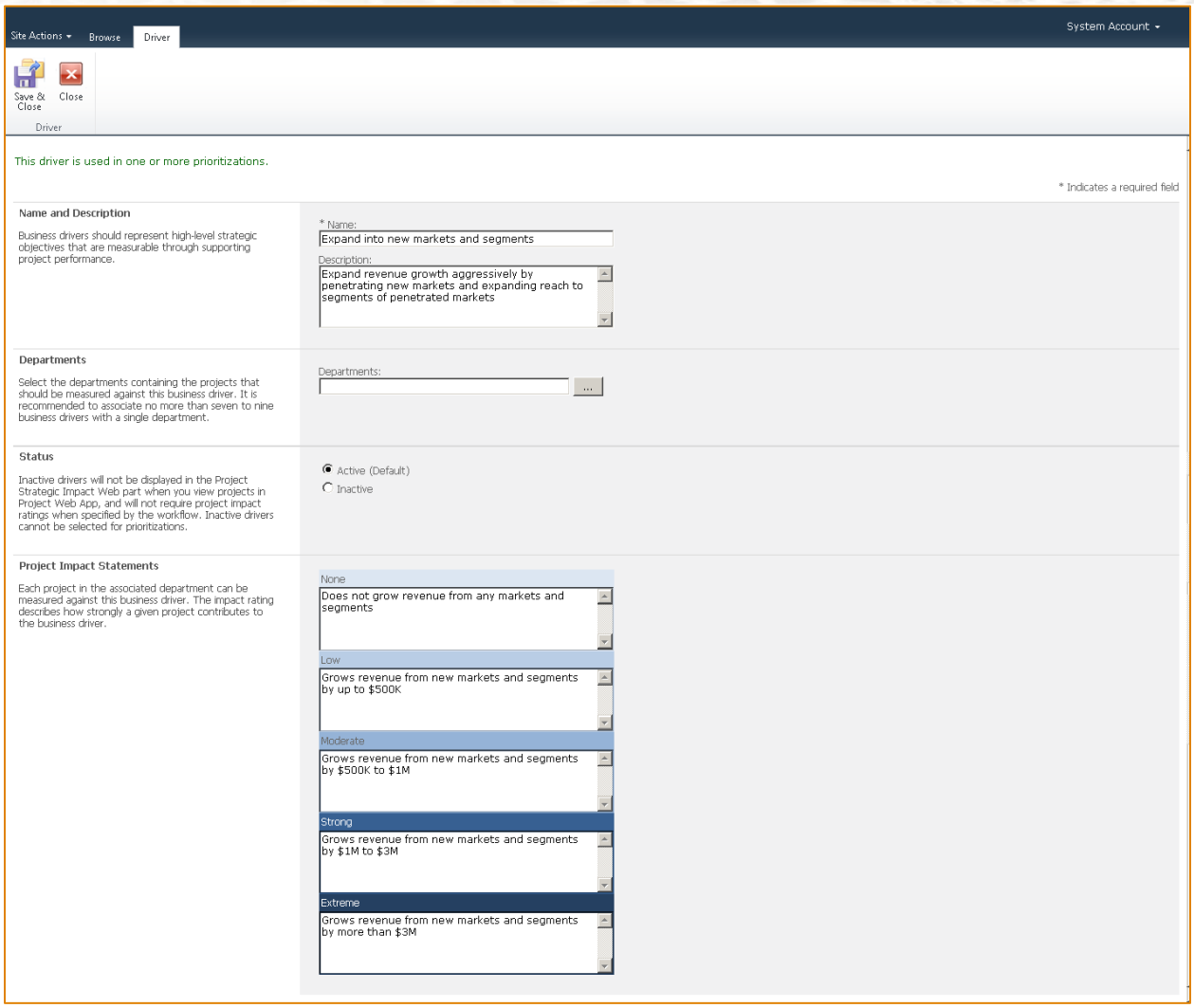


Figure 7: The New Driver Interface

After saving the driver, the user may review a list of all drivers within the system.

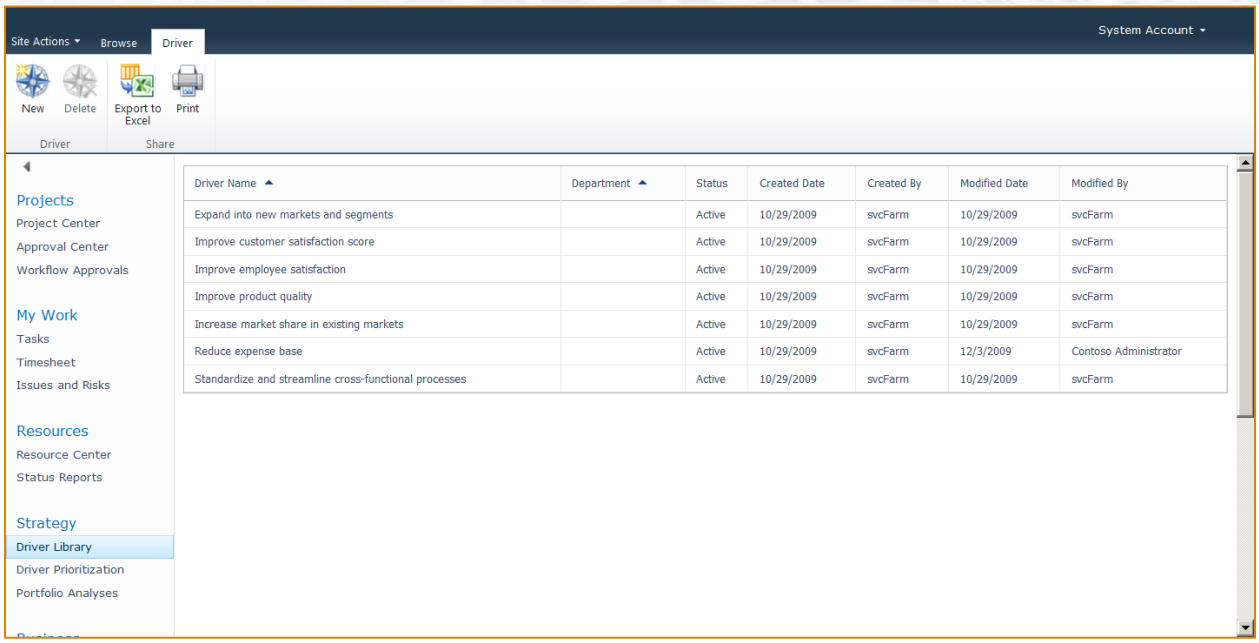


Figure 8: The Driver Library

Prioritizing the Business Drivers

After creating a list of relevant business drivers, several drivers may be combined into a set. To combine the drivers into a set, navigate to the Driver Prioritization interface.

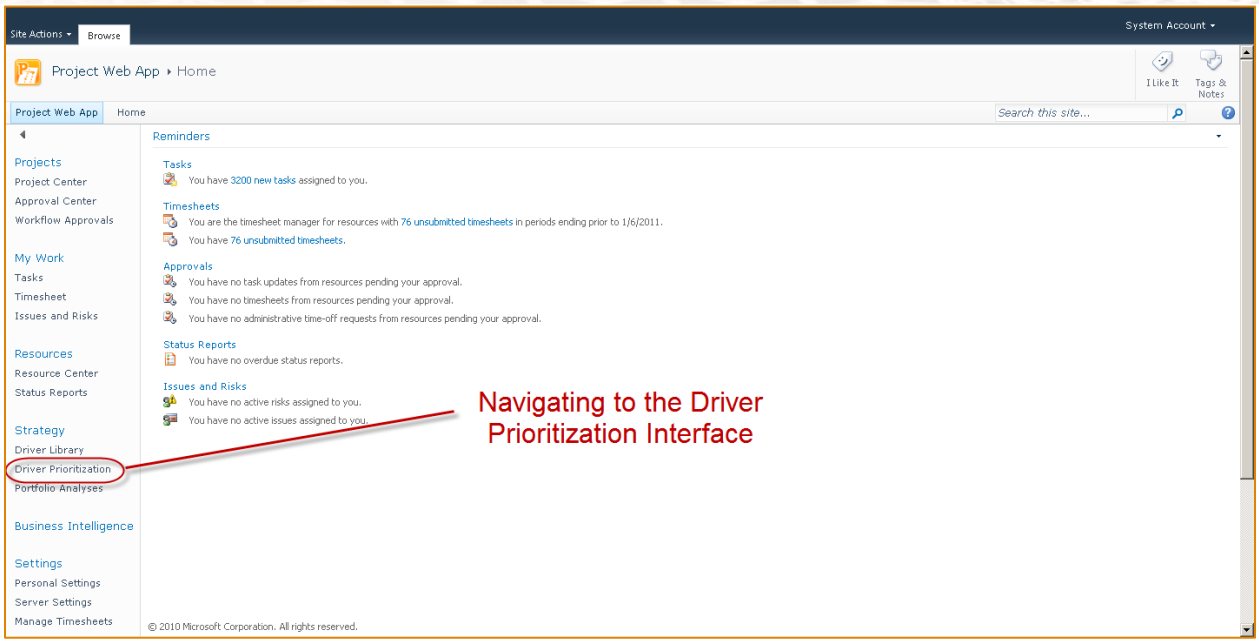


Figure 9: Navigating to the Driver Prioritization Interface

Click the New button to define a new driver set.

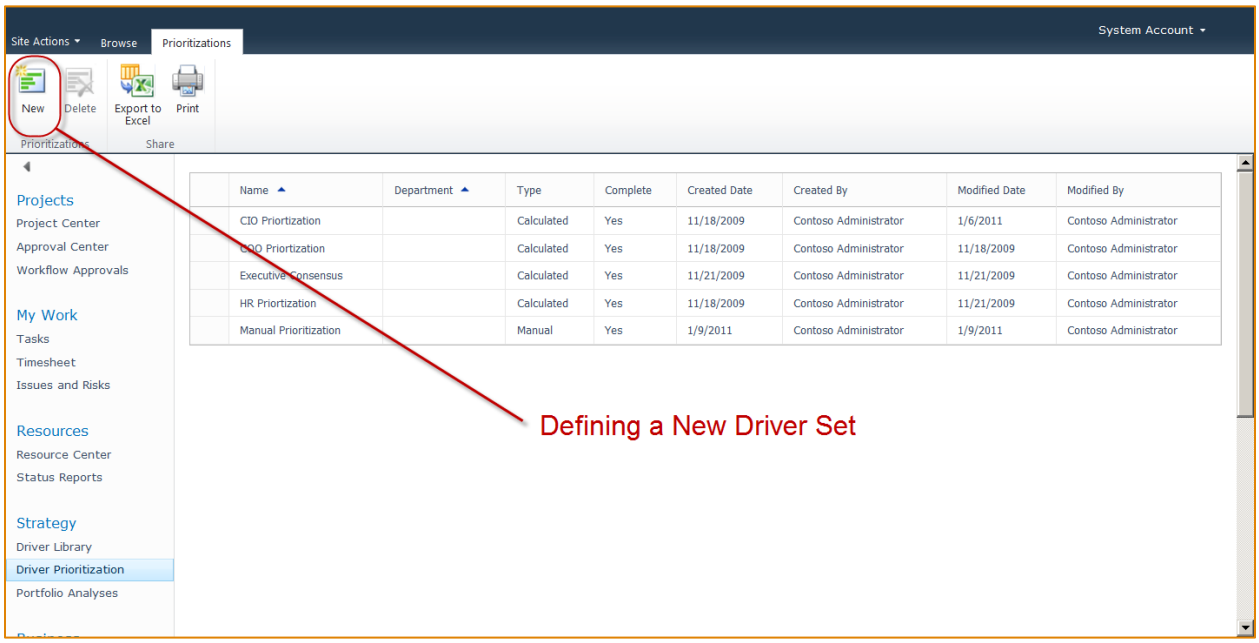


Figure 10: Defining Different Prioritization Sets

The following page allows the user to select the drivers to be included in the prioritization exercise.

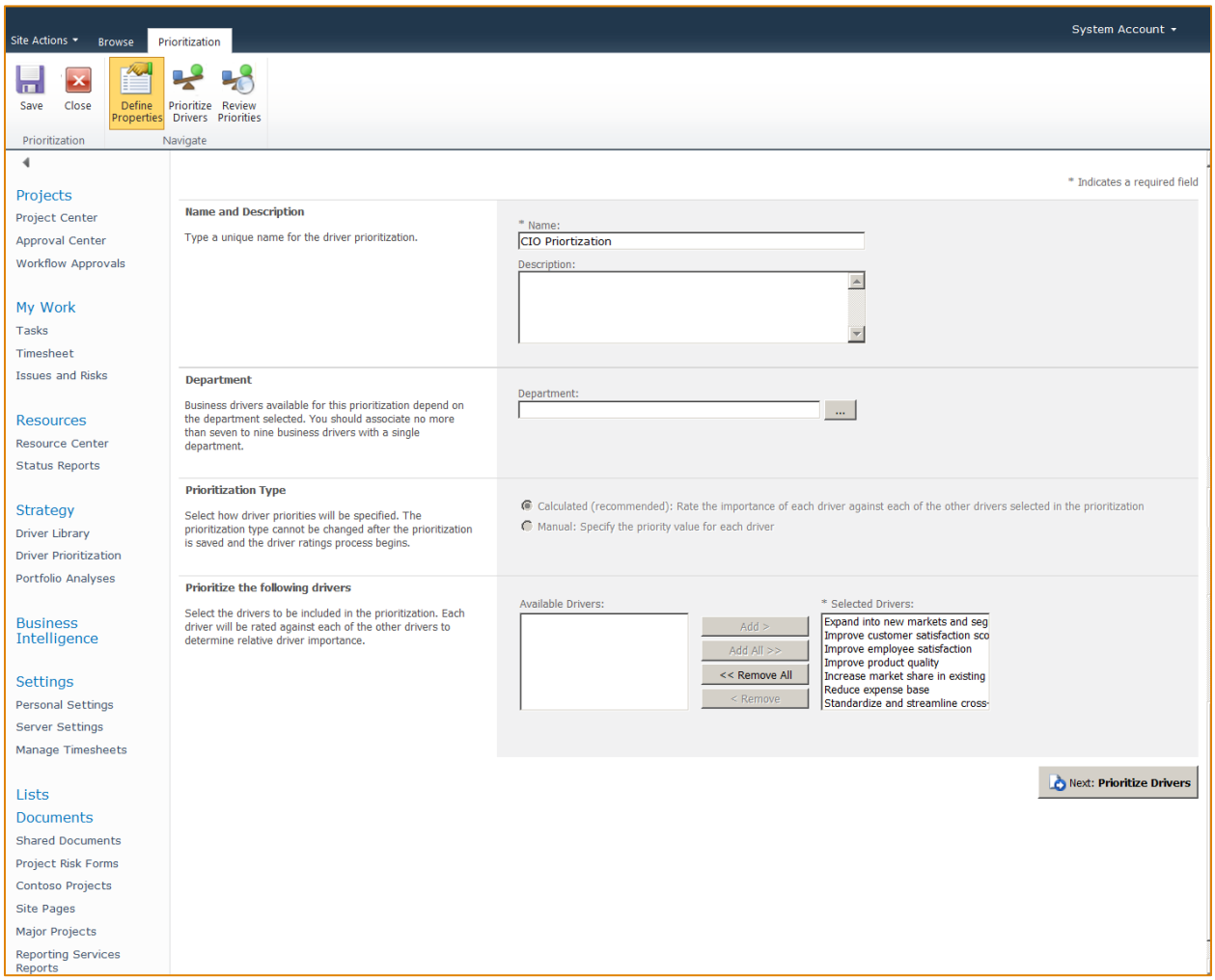


Figure 11: Defining the Driver Set Properties

After defining the driver set, the user should then facilitate a session with the key stakeholders to perform pairwise analysis on the driver set to identify relative priorities.

In pairwise analysis, the drivers are not assigned objective values, but are instead compared with other drivers to develop a relative ranking. Thus, the drivers must be compared to each other to develop a prioritization matrix. Typically, an organization would implement a driver prioritization for each portfolio of projects defined.

Project Server provides an interface to compare each driver with each of the other drivers.

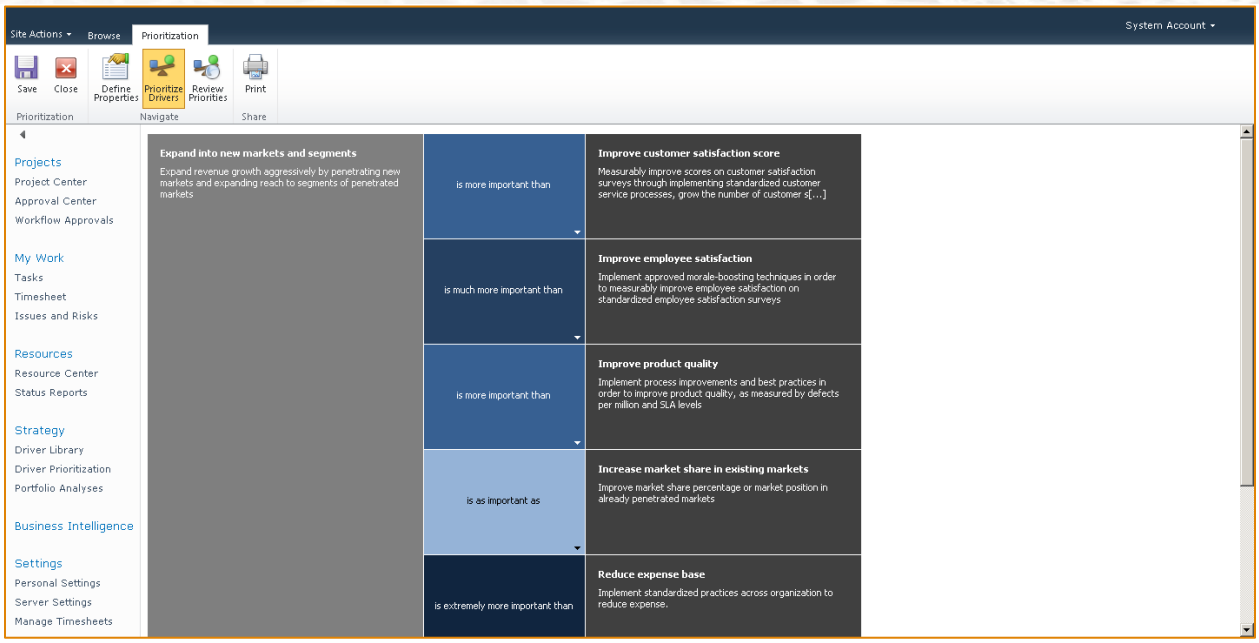


Figure 12: Comparing One Driver to Others

Project Server 2010 does not provide an accessible interface to display the overview of all of the drivers compared to all the other drivers, but if the data were depicted in a table, the driver prioritization would appear as in the following illustration.

`

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Increase Market Share	is as important as	is as important as	is more important than	is more important than	is more important than
Expand Into New Markets	is as important as	is as important as	is much more important than	is more important than	is more important than
Standardize Processes	is less important than	is much less important than	is as important as	is more important than	is extremely less important than
Improve Product Quality	is less important than	is less important than	is less important than	is as important as	is more important than
Improve CustSat	is less important than	is less important than	is extremely more important than	is less important than	is as important as

Figure 13: Simulated Driver Prioritization Matrix

The proper way to read this table would be to pick the driver on the left, insert the prioritization, and apply to the driver above. For instance, the following illustration depicts that “Standardize Processes” is more important than “Improve Product Quality.”

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Increase Market Share	is as important as	is as important as	is more important than	is more important than	is more important than
Expand Into New Markets	is as important as	is as important as	is much more important than	is more important than	is more important than
Standardize Processes	is less important than	is much less important than	is as important as	is more important than	is extremely less important than
Improve Product Quality	is less important than	is less important than	is less important than	is as important as	is more important than
Improve CustSat	is less important than	is less important than	is extremely more important than	is less important than	is as important as

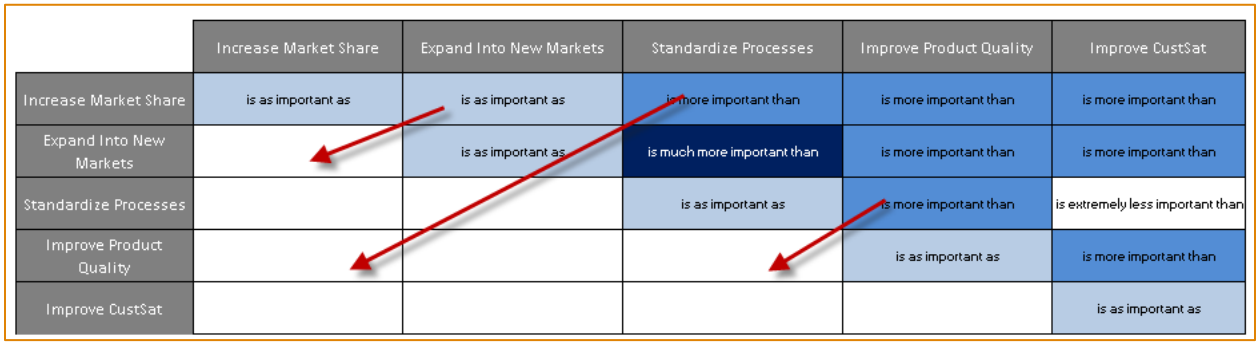
Figure 14: Reading the Driver Prioritization Matrix

Conversely, the opposite may also be extrapolated, i.e. “Improve Product Quality” is less important than “Standardize Processes.”

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Increase Market Share	is as important as	is as important as	is more important than	is more important than	is more important than
Expand Into New Markets	is as important as	is as important as	is much more important than	is more important than	is more important than
Standardize Processes	is less important than	is much less important than	is as important as	is more important than	is extremely less important than
Improve Product Quality	is less important than	is less important than	is less important than	is as important as	is more important than
Improve CustSat	is less important than	is less important than	is extremely more important than	is less important than	is as important as

Figure 15: Driver Prioritization Tautologies

The implication of that dynamic is that only half of the cells in the above table must be populated, as populating any of the cells in the top right half will populate the corresponding cells in the bottom left half.



	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Increase Market Share	is as important as	is as important as	is more important than	is more important than	is more important than
Expand Into New Markets		is as important as	is much more important than	is more important than	is more important than
Standardize Processes			is as important as	is more important than	is extremely less important than
Improve Product Quality				is as important as	is more important than
Improve CustSat					is as important as

Figure 16: Simplifying the Driver Prioritization Matrix

Subtracting the correlations between the driver on the left and the same driver on the top, the following cells remain to be populated.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Increase Market Share		is as important as	is more important than	is more important than	is more important than
Expand Into New Markets			is much more important than	is more important than	is more important than
Standardize Processes				is more important than	is extremely less important than
Improve Product Quality					is more important than
Improve CustSat					

Figure 17: Driver Prioritization Editable Values

The driver prioritization matrix as implemented in Project Server 2010 conceptually starts with the rightmost driver, and then progresses through to the left:

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Increase Market Share		is as important as	is more important than	is more important than	is more important than
Expand Into New Markets			is much more important than	is more important than	is more important than
Standardize Processes				is more important than	is extremely less important than
Improve Product Quality					is more important than
Improve CustSat					

Figure 18: Modeling the Driver Prioritization Interface

As a result of this natural progression in populating the cells, the first driver prioritization page will display all of the relevant drivers.

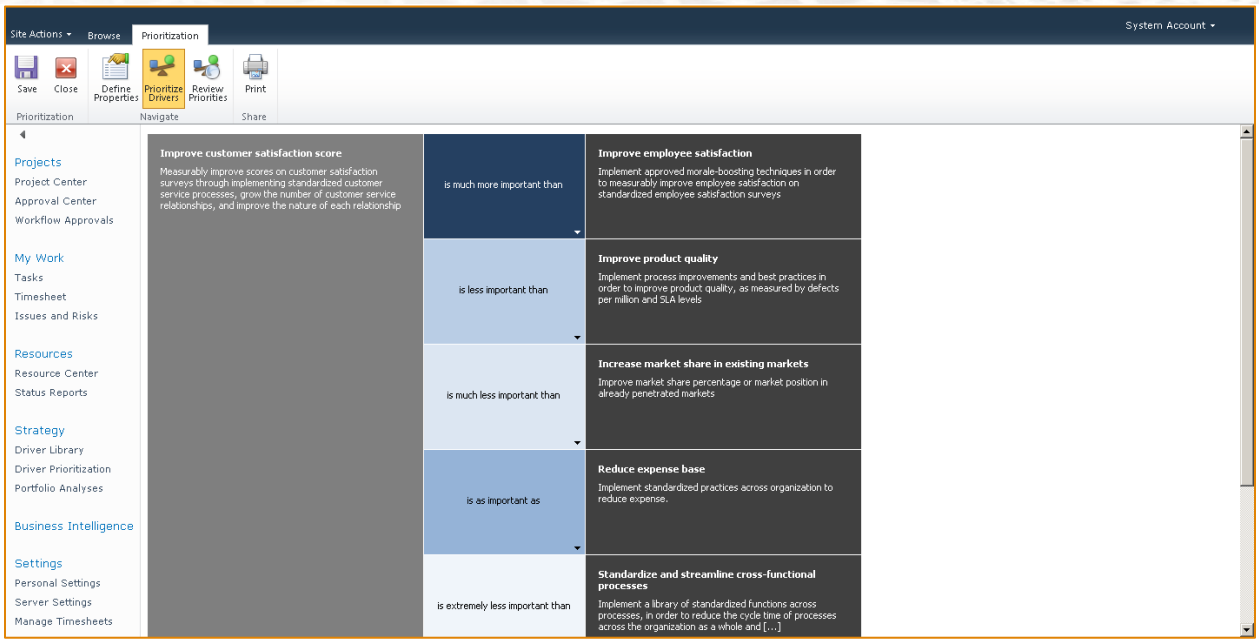


Figure 19: Initial Driver Prioritization Page

While subsequent driver prioritization pages will gradually contain less drivers:

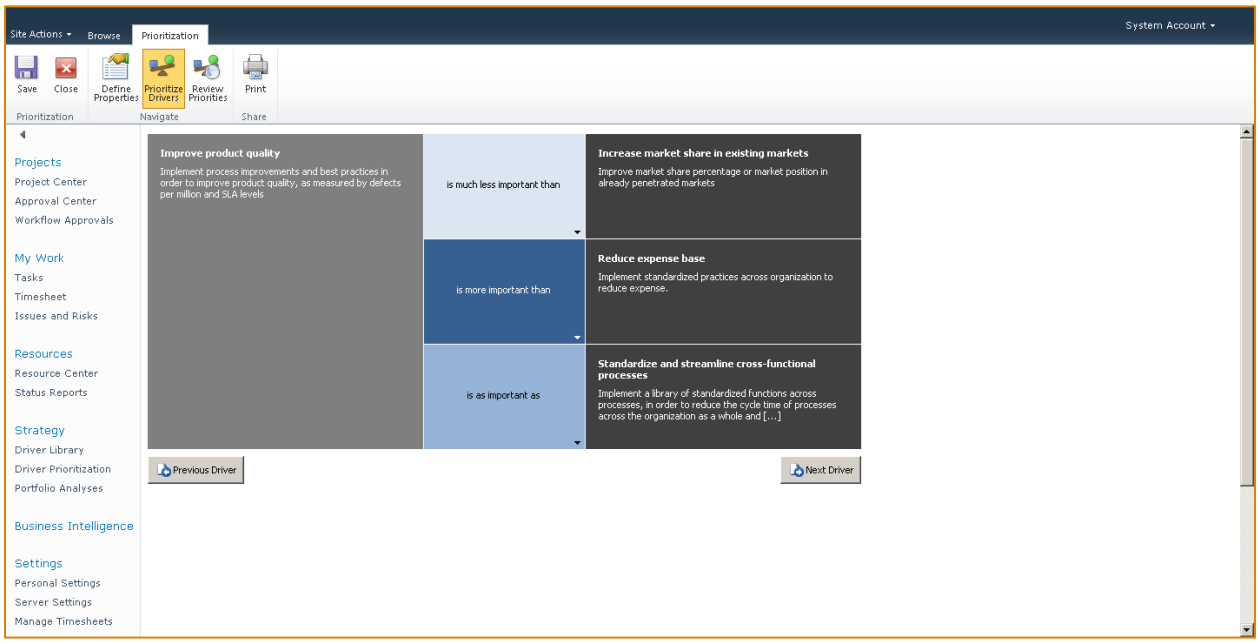


Figure 20: Penultimate Driver Prioritization Page

On the final page, only one driver needs to be compared.

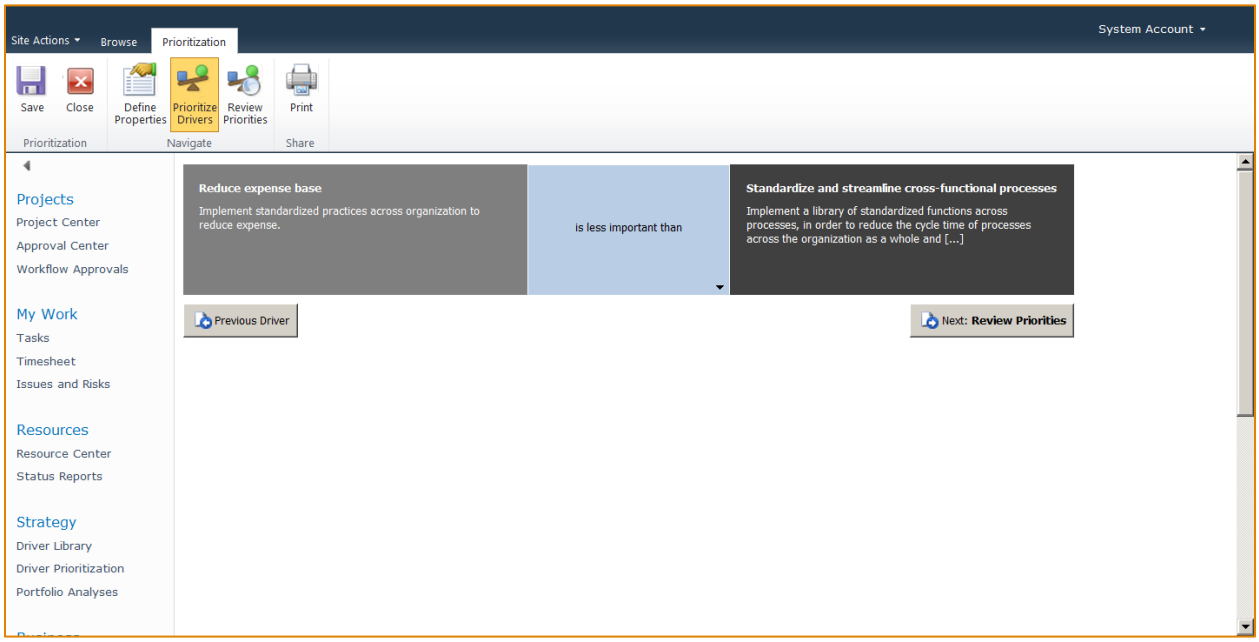


Figure 21: Final Driver Prioritization Page

Facilitating Driver Prioritization Workshops

When facilitating driver prioritization sessions, the following guidelines are recommended for facilitating the driver prioritization workshop:

- Start with the question: Is driver A more or less important than driver B?
- Follow with the question: Is it extremely, strongly or moderately more/less important?
- Perform the comparison row by row at the beginning, and consider using column by column towards the end. For experienced stakeholder groups, consider picking random selections of pairs for prioritization.
- Consider doing the prioritization exercise using manual tools such as sticky notes, or model the entire matrix in a spreadsheet before entering into the Project Server interface.
- Utilize voting cards. For each pair to be evaluated, ask the stakeholders to vote by holding up index cards with the appropriate prioritization selection. Alternately, use a modified Delphi technique.
- Discuss and document the rationale behind each pairwise comparison.

After completing the driver prioritization workshop, the results should be mapped into a mathematical calculation as described below.

The Prioritization Calculation

Behind the page, Project Server 2010 is applying specific calculations to each of the relative value statements to derive the overall driver value. Each of the seven possible comparisons is assigned a numerical value:

Value Assessment	Score
Is extremely more important than	9
Is much more important than	6
Is more important than	3
Is as important as	1
Is less important than	1/3 (.33)
Is much less important than	1/6 (.17)
Is extremely less important than	1/9 (.11)

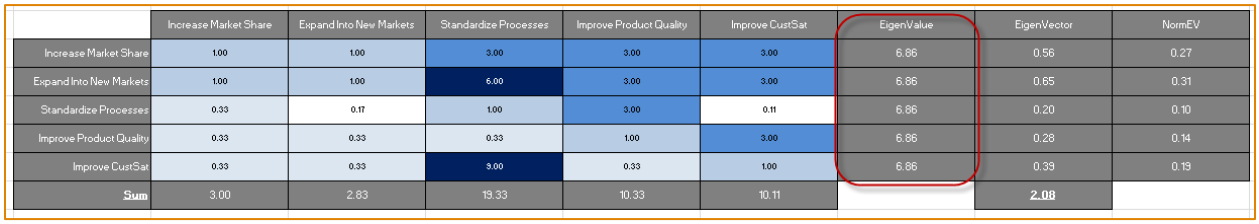
Table 2: Driver Prioritization Score Conversion

Translated, this means that Figure 13 appears as follows – with a numerical value swapped out for each of the seven relationship descriptions.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Increase Market Share	1.00	1.00	3.00	3.00	3.00
Expand Into New Markets	1.00	1.00	6.00	3.00	3.00
Standardize Processes	0.33	0.17	1.00	3.00	0.11
Improve Product Quality	0.33	0.33	0.33	1.00	3.00
Improve CustSat	0.33	0.33	9.00	0.33	1.00
Sum:	**3.00**	**2.83**	**19.33**	**10.33**	**10.11**

Figure 22: Converting Driver Prioritization Statements to Numerical Values

At this point, the system uses a statistical calculation method called *eigenvectors* to combine the scores and develop the weighted driver values. The calculation first defines the eigenvalues for each of the projects. (In the following calculations a free add-in called *Matrix 2.3* produced by the Foxes Team has been used to provide the relevant statistical functions within Microsoft Excel. As of this writing, the add-in was available for download here: http://digilander.libero.it/foxes/SoftwareDownload.htm.)



	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat	EigenValue	EigenVector	NormEV
Increase Market Share	1.00	1.00	3.00	3.00	3.00	6.86	0.56	0.27
Expand Into New Markets	1.00	1.00	6.00	3.00	3.00	6.86	0.65	0.31
Standardize Processes	0.33	0.17	1.00	3.00	0.11	6.86	0.20	0.10
Improve Product Quality	0.33	0.33	0.33	1.00	3.00	6.86	0.28	0.14
Improve CustSat	0.33	0.33	9.00	0.33	1.00	6.86	0.39	0.19
Sum	3.00	2.83	19.33	10.33	10.11		2.08	

Figure 23: Calculating Eigenvalues

Then, using the defined eigenvalues, the system calculates the eigenvector for each project.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat	EigenValue	EigenVector	NormEV
Increase Market Share	1.00	1.00	3.00	3.00	3.00	6.86	0.56	0.27
Expand Into New Markets	1.00	1.00	6.00	3.00	3.00	6.86	0.65	0.31
Standardize Processes	0.33	0.17	1.00	3.00	0.11	6.86	0.20	0.10
Improve Product Quality	0.33	0.33	0.33	1.00	3.00	6.86	0.28	0.14
Improve CustSat	0.33	0.33	9.00	0.33	1.00	6.86	0.39	0.19
Sum	3.00	2.83	19.33	10.33	10.11		2.08	

Figure 24: Calculating Eigenvectors

Finally, the system normalizes the eigenvectors by dividing by the sum of all of the eigenvectors for all projects. This results in the relative value for each driver.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat	EigenValue	EigenVector	NormEV
Increase Market Share	1.00	1.00	3.00	3.00	3.00	6.86	0.56	0.27
Expand Into New Markets	1.00	1.00	6.00	3.00	3.00	6.86	0.65	0.31
Standardize Processes	0.33	0.17	1.00	3.00	0.11	6.86	0.20	0.10
Improve Product Quality	0.33	0.33	0.33	1.00	3.00	6.86	0.28	0.14
Improve CustSat	0.33	0.33	9.00	0.33	1.00	6.86	0.39	0.19
Sum	3.00	2.83	19.33	10.33	10.11		2.08	

Figure 25: Normalizing Eigenvectors

Project Server 2010 displays the results on the following page. (Note that the numbers do not correspond exactly to the illustrations above as the simulated environment contains seven drivers while the illustrations have been simplified to five drivers.)

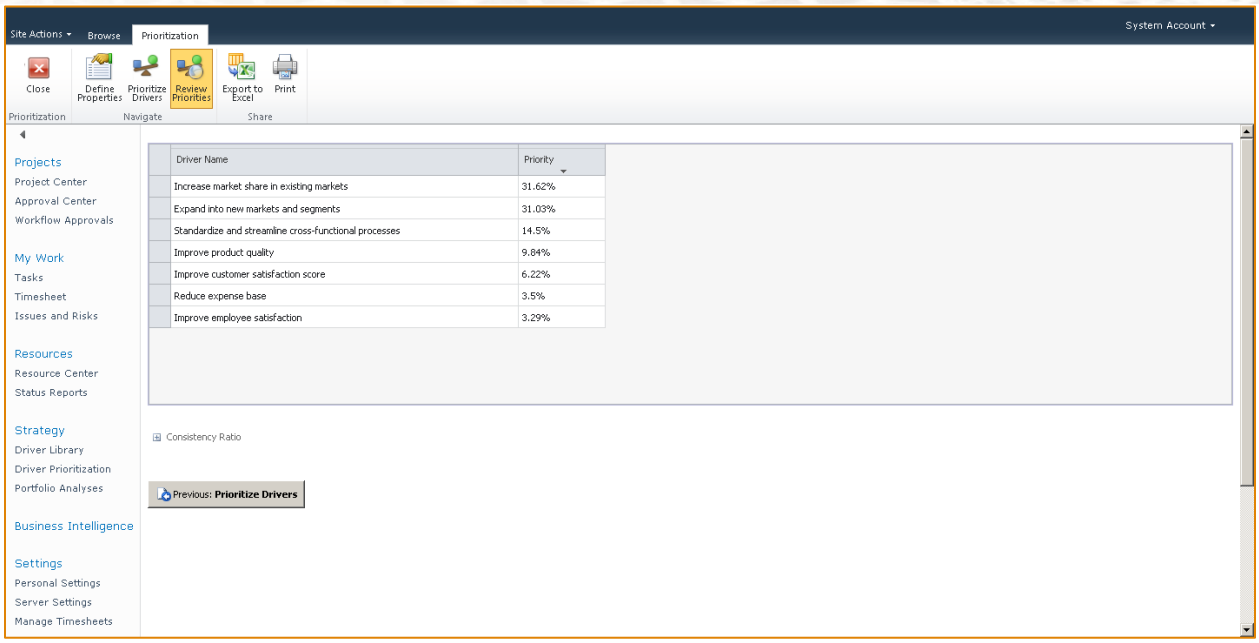


Figure 26: The Driver Priority Review page

Consistency Ratio

The Review Priorities page allows the user to assess the consistency ratio.

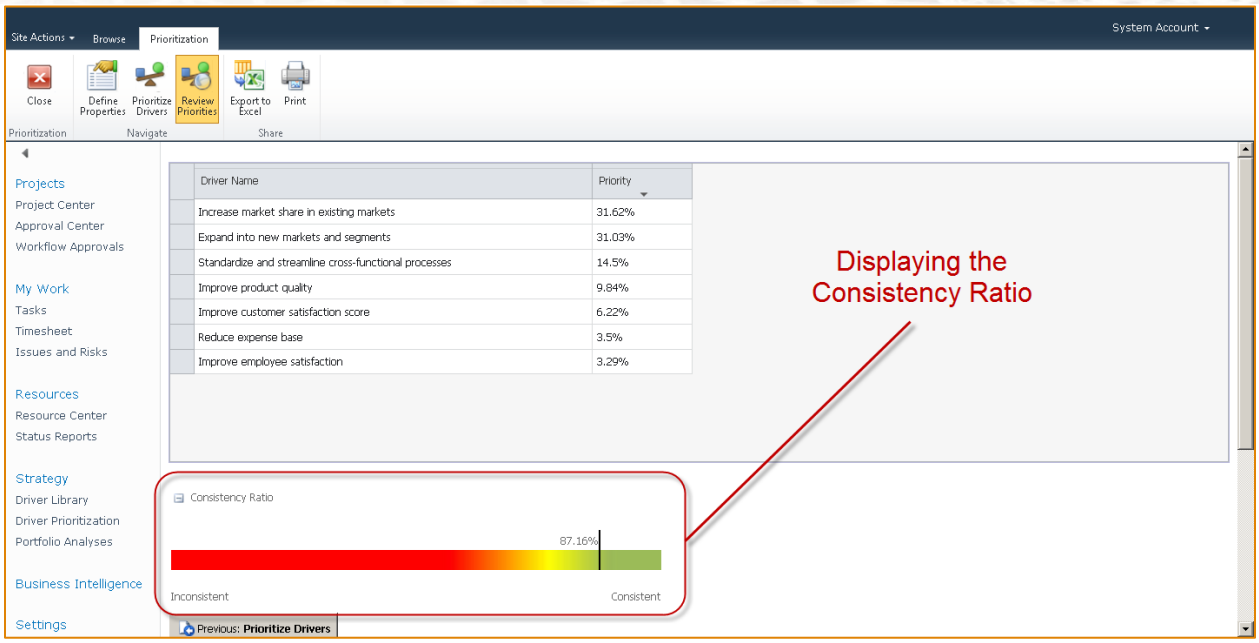


Figure 27: Displaying the Consistency Ratio

The consistency ratio measures how many logical conflicts exist in the driver prioritization.

For instance, three drivers are included in a hypothetical driver prioritization: Driver A, Driver B, and Driver C. The user may prioritize those drivers as follows:

- Driver A is as important as Driver B.
- Driver C is significantly more important than Driver B.
- Driver A is more important than Driver C.

Following the logic of the first two statements: if A=B, and C > B, then C should be greater than A. The user has set the prioritization as C < A, which violates the logical flow of the three statements, and results in a lower consistency ratio.

Having a consistency ratio lower than 100% is normal for most organizations and certainly constitutes an expected outcome of a human process. Any ratio above 80% should be considered generally acceptable. If the ratio is under 80%, the organization may consider reviewing the prioritization matrix to identify logical discrepancies.

Consistency issues are typically driven by a number of potential factors:

- Clerical or input error

- Lack of sufficient information
- Lack of participant focus during the prioritization process
- Real lack of consistency within the model
- A poorly defined model

If the consistency ratio is very low, the organization may consider revisiting the entire driver prioritization process.

Manually Prioritizing the Drivers

Some organizations may opt to manually prioritize the drivers without using the built-in pairwise analysis techniques. The manual option may be used if a third party tool or even a spreadsheet is used to develop driver priorities outside of Project Server.

To manually prioritize the drivers, select the appropriate option when creating the driver prioritization set.

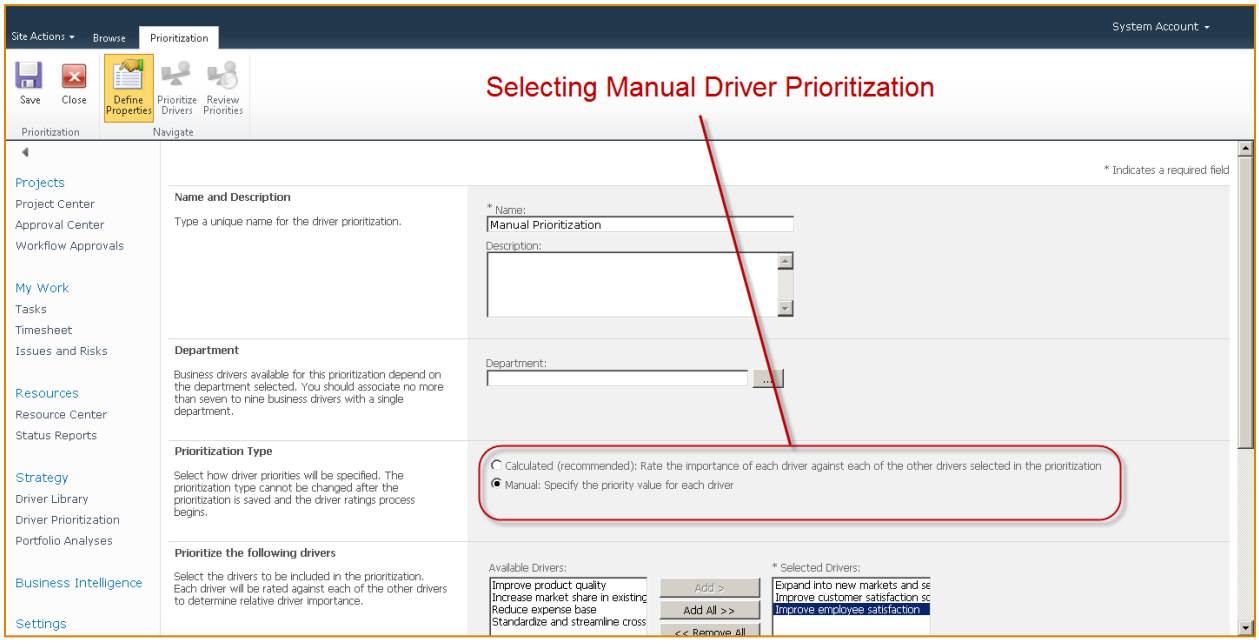


Figure 28: Creating a Manual Driver Prioritization Set

The next page allows the user to manually enter driver priorities:

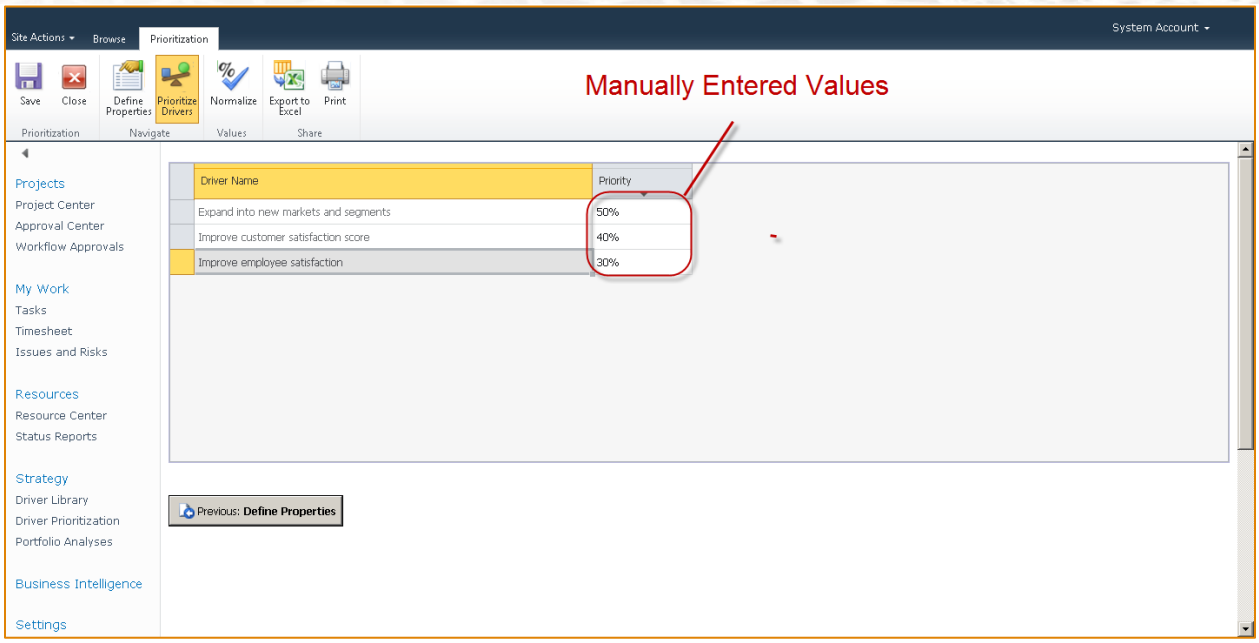


Figure 29: Manually Entering Driver Priorities

When you click the Save button, the manually entered values are normalized, that is, each of the values is divided by the sum of all values. In the above example, performing those calculations for the first driver results in 50 / (50 + 40 + 30) = 41.67%.

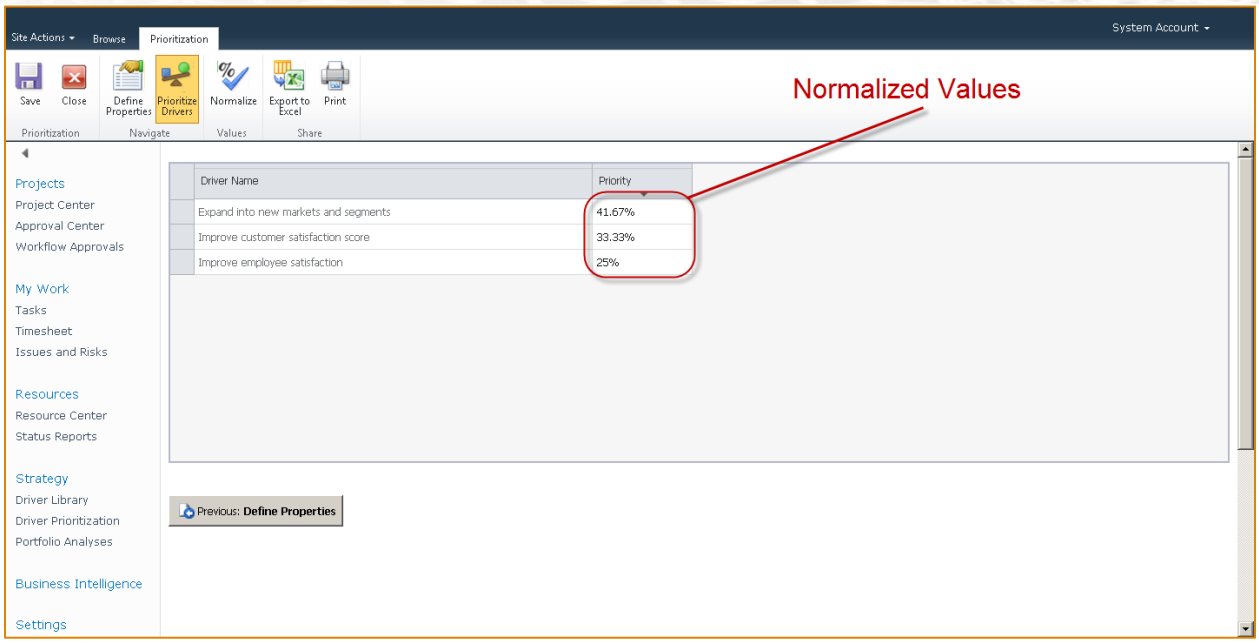


Figure 30: Normalized Values

The driver set is now treated within the system identically to a driver set that was developed using pairwise analysis.

Configuring the Resource Pool

The resource pool represents the supply of available resources within the organization. The system administrator must configure the resource pool to support the portfolio analysis process.

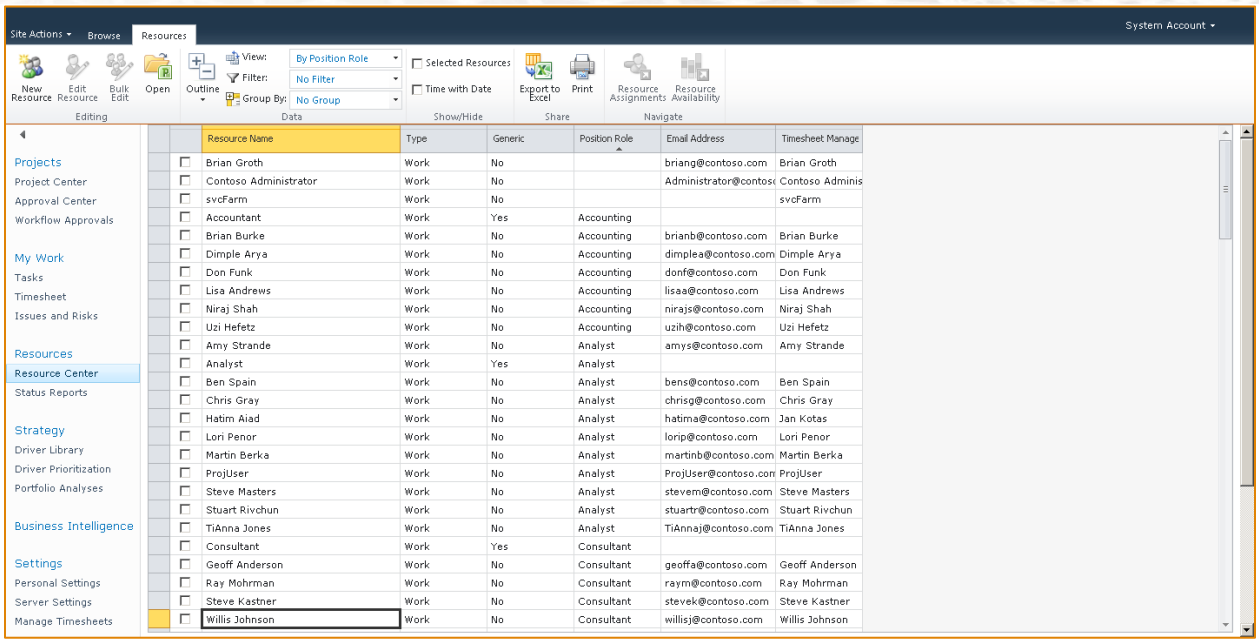


Figure 31: The Enterprise Resource Pool

Following are key resource settings for consideration when configuring the enterprise resource pool:

Configuration Item	Notes
Maximum Units	The total resource availability in the Resource Analysis component is calculated as the total of the resource availability within each of the defined time periods. The Maximum Units field determines the maximum availability for each resource that is included in that calculation.
Resource Calendars	Total availability is decremented by any exceptions to the resource calendars, such as holidays and vacation time. Typically holidays are relevant to organizational portfolio analysis, but vacations may not be as they are entered into the calendar with a relatively short planning window.
Role	Each resource should be assigned a specific role within Project Server. The Portfolio Analysis module uses this field to calculate the total role availability and the average cost for a resource in that specific role. This field must be created as an enterprise custom field and linked to a custom lookup table.
Standard Rates (and Cost Tables)	The system utilizes the Standard Rate field to approximate the incremental costs of adding resources to a given portfolio. Cost Tables A

Configuration Item	Notes
	through E may be used as the system allows the user to select the cost table to serve as a basis for calculations.

Table 3: Configuring the Resource Pool

When the initial analysis is created, the field that will be used for the role field is selected. Each analysis may be based on different role fields as needed.

The Standard Rate field defined when creating a new resource in the Resource Center corresponds to the entry in Cost Rate Table A. To edit the other cost rate tables when creating a new resource, the user must configure the resource within Microsoft Project Professional.

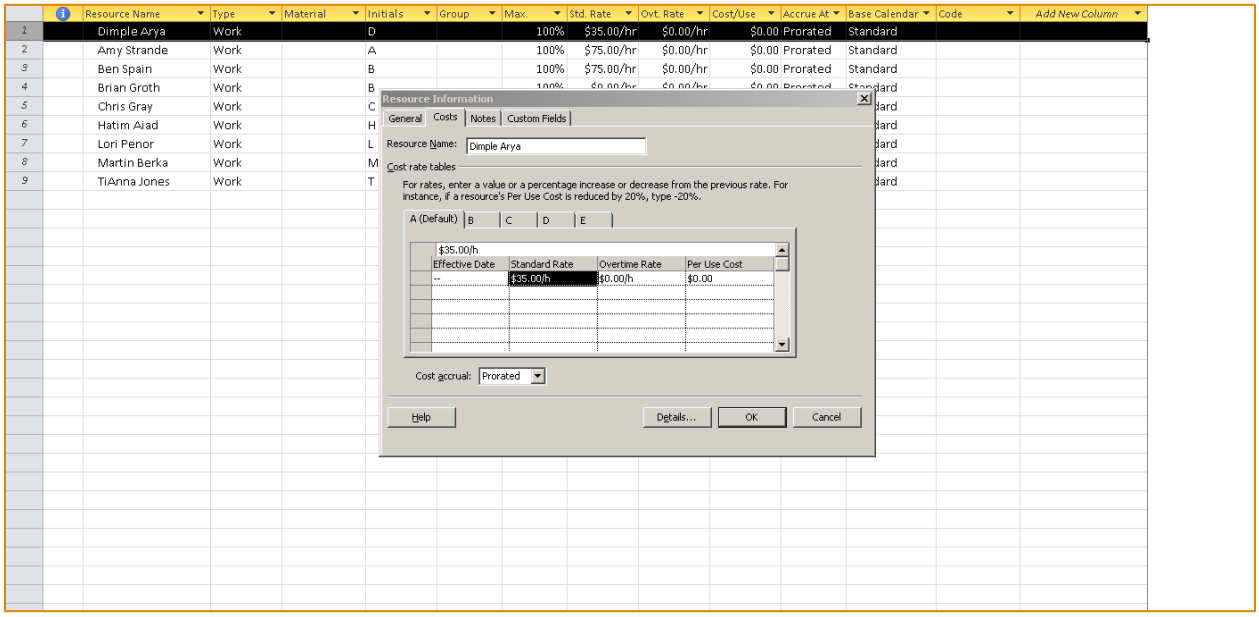


Figure 32: Configuring Resource Standard Cost

The calculated average cost for the resources mapped to a specific role is used in the Resource Analysis calculations. If the organization has resources sharing a role across multiple markets, the administrator should consider assigning the resources to different roles. For instance, a company with developers in the German and Chinese market, where the cost of the resources is significantly disparate, may define the roles by geography and then skill, that is, Germany.Developer and China.Developer (or Developer.Germany and Developer.China). This allows the system to treat those roles separately in all calculations.

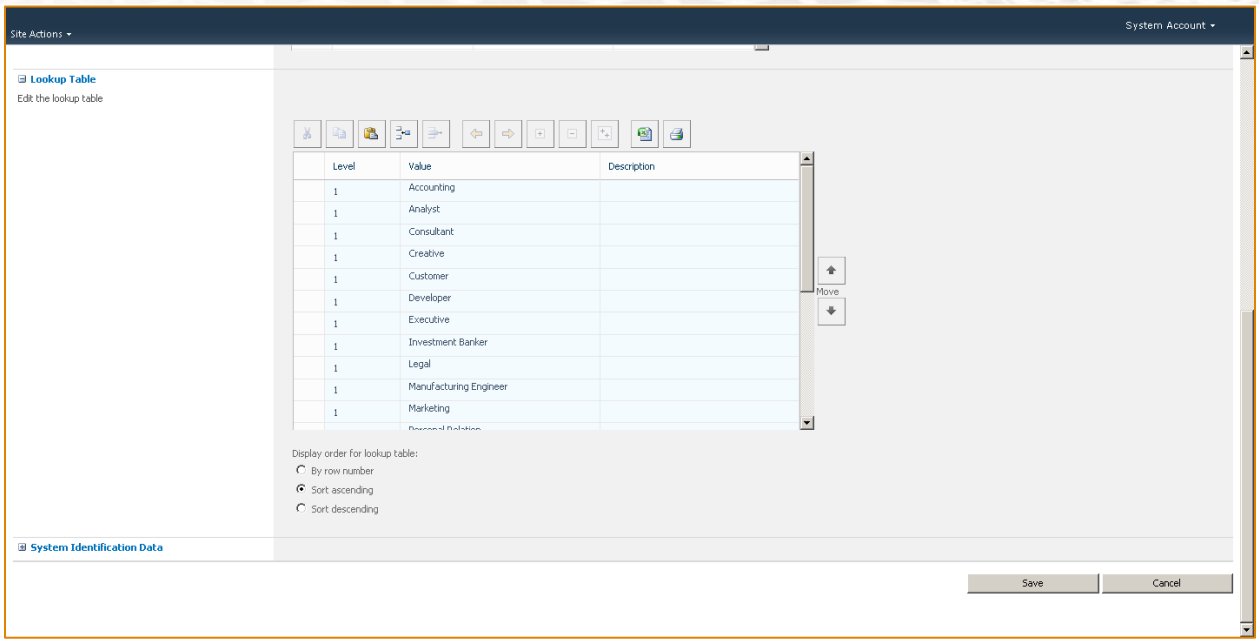


Figure 33: Defining the Role Lookup Table

Alternately, the user may consider filtering out other geographies when defining the analysis by implementing the Filter by RBS feature.

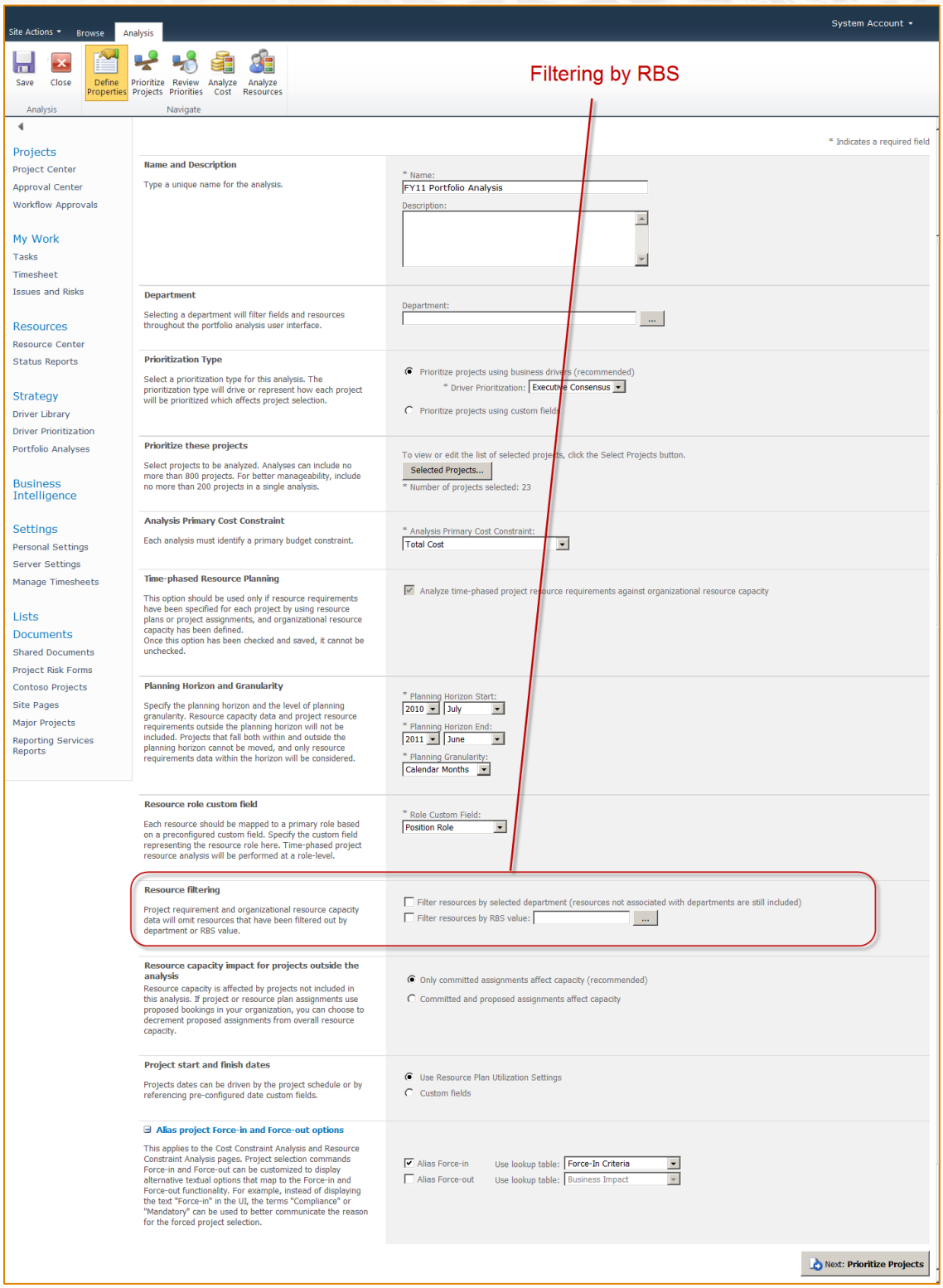


Figure 34: Portfolio Analysis: Filtering by RBS

Many organizations create at least one generic resource in the resource pool for each role defined in the role lookup table. These generic resources are then used as placeholders in projects awaiting analysis and approval.

Establishing the Demand Profile

After configuring the resource supply, the resource demand must also be defined. Project Server 2010 allows users to implement two separate methods for defining the resource demand profile:

Resource Demand Estimation Method	Description
Bottom Up	Project managers or schedulers assign resources to specific tasks, and then publish the schedule to Project Server.
Top Down	A project is created within Project Server. Instead of assigning resources to specific tasks, the project manager or scheduler creates a high level Resource Plan. The Resource Plan allows the project manager to "reserve" the resource for a defined period of time. This option is usually used early in the project planning cycle before specific tasks have been defined within the project schedule.

Table 4: Defining the Resource Demand Profile

For more information on working with Resource Plans in Microsoft Project Server 2010, refer to the online help documentation.

If you are using manually scheduled tasks, note that Microsoft Project 2010 requires that at least two of three specific fields be defined for each task before the resource demand is displayed in Project Server: Start, Finish, and Duration. If the user creates a new task, assigns a resource, and defines the duration, the work profile is not included in the calculations until a start date is defined.

Many organizations implement a process whereby projects are originally configured with all resources assigned using the Proposed booking type. This configuration may potentially affect the Resource Analysis module as Proposed work is not included by default. For more information on including Proposed assignments in the Portfolio Analysis, refer to page 40.

5. Defining the Portfolio

The second step in the portfolio analysis process is to combine the resource supply, resource demand profile and business decision factors into a single portfolio of projects. As the portfolio is defined, interrelationships between the projects are added, as are portfolio specific configuration items that define how the system calculates and analyzes constraints.

Users must define how all of the portfolio elements are combined when they create the initial cost analysis. Note that some of these settings may not be changed after the analysis is created.

Configuring the Analysis Settings

To create a new portfolio analysis, navigate to the appropriate link on the Quick Launch bar.

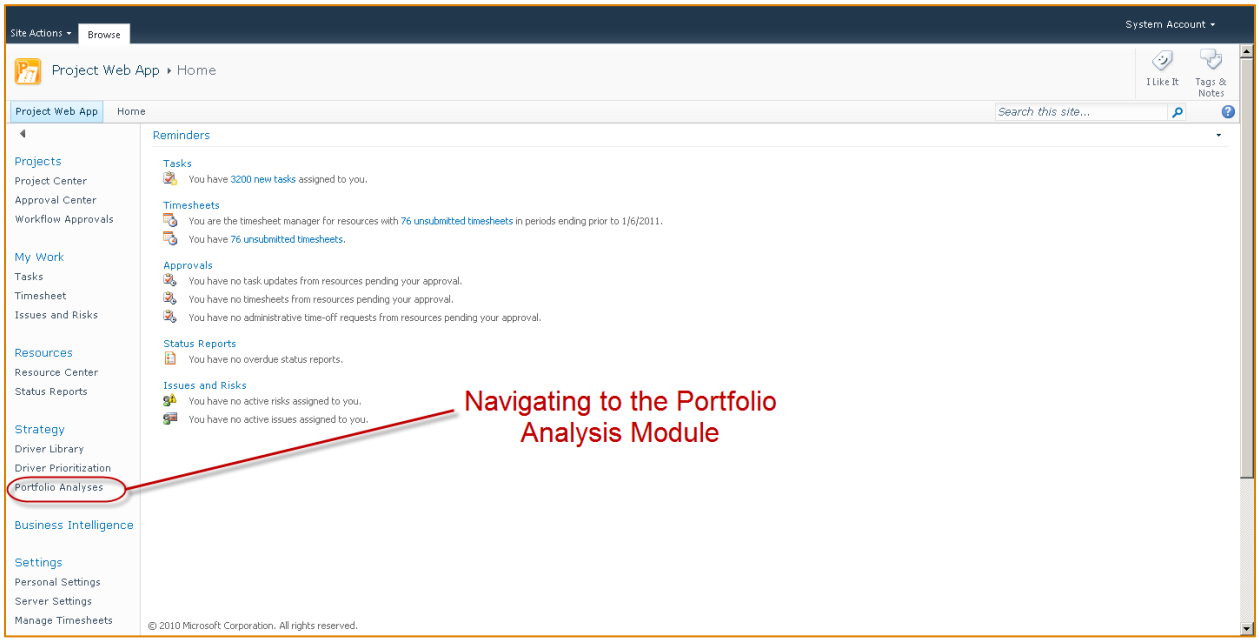


Figure 35: Navigating to the Portfolio Analysis Module

Select the option to create a new analysis.

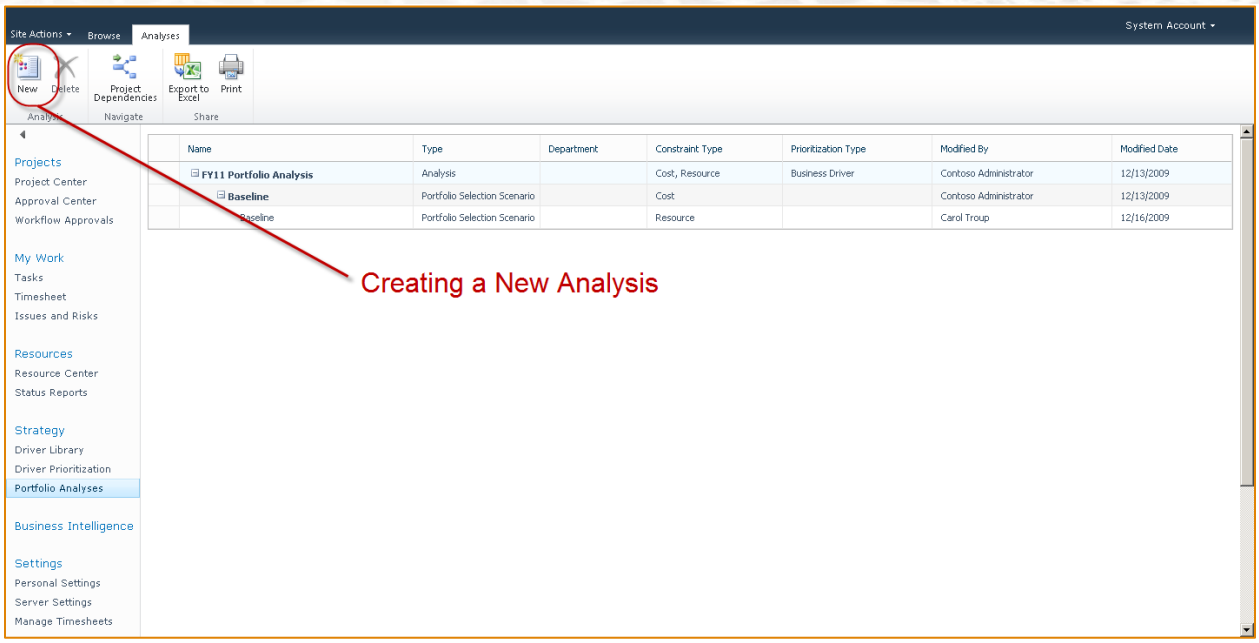


Figure 36: Creating a New Analysis

The Add/Modify Analysis page appears.

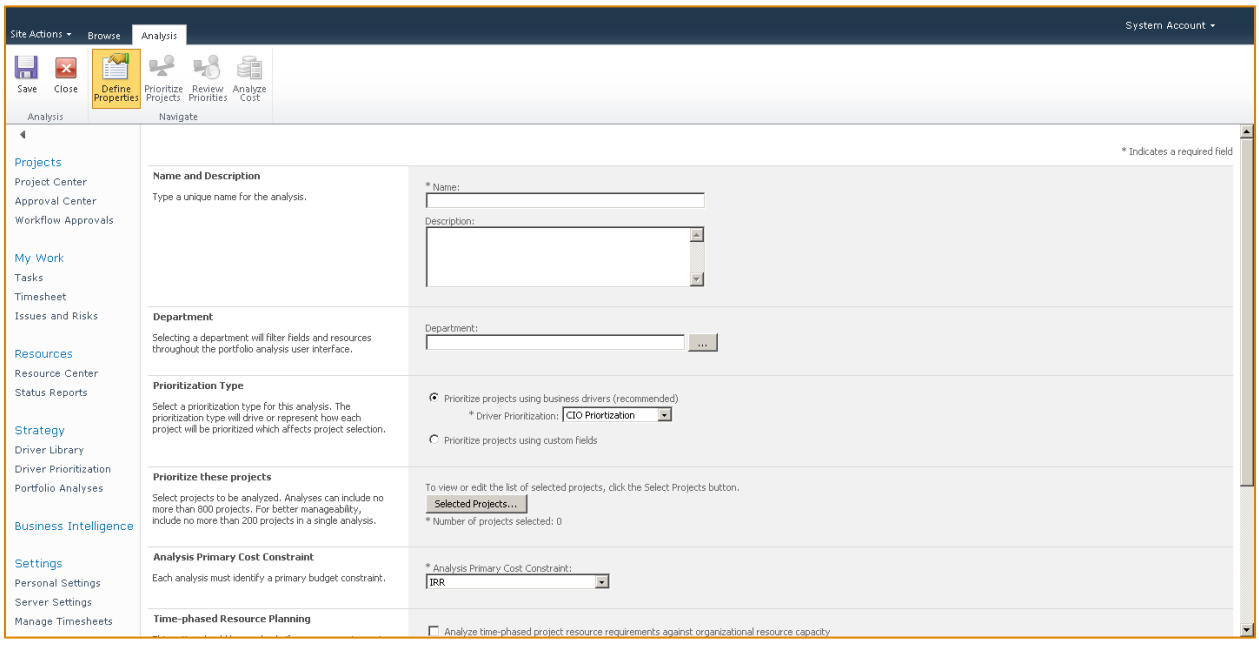


Figure 37: The Add/Modify Analysis Page

See below for information regarding the specific configurable fields:

Field	Description
Name	Define a descriptive name for the analysis. Use a standard naming convention like "FY11 Q1 IT Projects" or "IT Projects FY11 Q1."
Description	Provide a detailed description of the reasons for creating this analysis.
Department	Populating this field will filter on only those resources assigned to the specific department. Use this setting if the projects within the analysis are confined to only one department, and resources outside of the department should not be a consideration in the planning process.
Prioritization Type	Select to use either the built-in driver prioritization mechanism and choose the appropriate driver set for the portfolio. Alternately, use a manual project ranking system. See page 48 for more information on manual prioritization methods.
Project Selection	Select the projects to be included in this analysis. All projects sharing a specific cost constraint or resource pool should be selected as part of this option. **Projects not selected for the analysis will still have resource requirements decremented from the overall resource pool**. The project selection option is limited to a maximum of 800 projects at any one time.
Analysis Primary Cost Constraint	Identify the main budgetary constraint to be used in calculating efficient portfolios. This constraint may be the project cost as derived from bottom up planning, or if that level of detail is not yet available, budget cost, or a custom project level field. See page 77 for more discussion of using custom constraints within the optimization process. Note that screening factors such as IRR or minimum NPV generally should not be used as cost constraints, as the system will not automatically determine any projects with values over a specific parameter. For more information on implementing screening factors as custom constraints, refer to page 77.
Time Phased Resource Planning	Select this option to expose the Resource Analysis settings. Once this option has been selected and saved, it cannot be turned off within the specific analysis. Note that this item must be selected for the Resource Analysis to appear as an active button on the Portfolio Analysis ribbon. For more information on these specific settings, refer to the next section.

Field	Description
Alias Project Force In/Out Options	The user may link the Force In and Force Out settings to specific administrator-created lookup tables. For instance, Force-In can be linked to a lookup table with the options of "Compliance, Board-Mandated, or Critical." In the analysis, users may then select from any of those options to implement the Force In functionality. Force Out may be aliased as "Insufficient NPV" or "Does Not Meet IRR Requirements."

Table 5: Portfolio Analysis Settings (General)

Projects not selected as part of the analysis will continue to affect the analysis by decrementing resource requirements from the available resource supply. Leaving projects out of the analysis results in a phenomenon called the "phantom project." The resource supply appears to have a shortfall, but the actual source of the shortfall does not appear in any of the analysis views to assist in identifying any resource shortfalls.

Optionally, the organization may choose to not include in-progress, already-approved projects. These resources will be automatically removed from the available resource supply. Those in-progress projects may then be continuously assessed at routine stage gate reviews and not as part of the overall portfolio analysis.

The Resource Analysis Settings

Click the Time-phased Resource Planning option to expose the Resource Analysis configuration options.

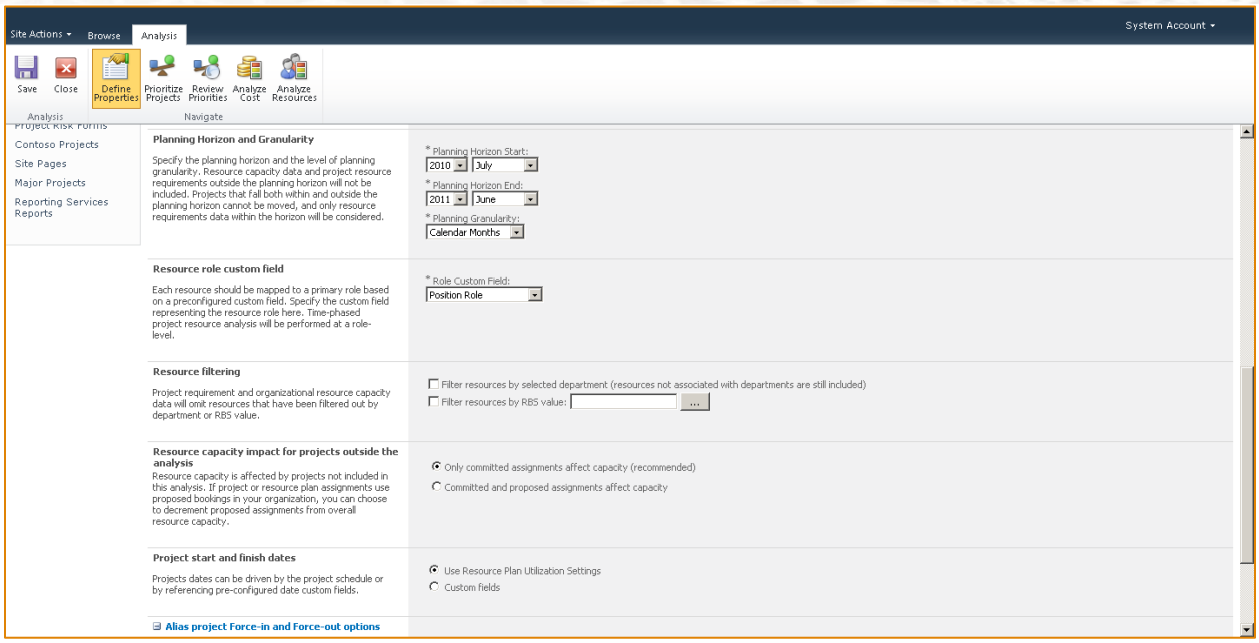


Figure 38: Portfolio Analysis Settings (Resource)

The following settings are revealed.

Field	Description
Planning Horizon	Defines the start and end dates for the analysis.
Granularity	Controls the time periods used in assessing work allocations for specific roles, that is, the total availability minus the total work for that specific time period. Granularity may significantly affect resource cost calculations in the Resource Analysis as resource gaps are calculated in terms of the time period selected.
Resource Role Custom Field	To use this functionality, each resource within the resource pool should be mapped to a primary role using a preconfigured custom field. Specify the custom field representing the resource role here.
Resource Filtering	Project requirement and organizational resource capacity data will omit resources that have been filtered out by department or RBS value. Consider using this feature to filter out external resources such as contracting firms that are responsible for managing their own resource capacity.

Field	Description
Resource Capacity Impact for Projects Outside of the Analysis	Determines whether to include projects with proposed bookings in the analysis. Note that regardless of whether the project is actually included in the specific analysis, the resource requirements may be decremented against the enterprise resource supply. By default, only committed assignments are decremented, but when this option is chosen, proposed bookings will be decremented as well.
Project Start and Finish Dates	Most organizations will likely default to using the start and finish dates configured in the project schedule. Those dates may be validated as part of the what-if analysis process performed in the Resource Analysis function. Some organizations may rely on other tools to assess the optimal start date, for instance an ERP system or a stochastic modeling tool. For those organizations, the proposed start date may be generated outside of Project Server and then input as a custom project level field.

Table 6: Portfolio Analysis Settings (Resources)

The resource role setting denotes a key difference between Resource Analysis on the Portfolio level and the Microsoft Project desktop leveling functionality. Resource leveling is used to modify a specific named resource's availability in the context of assignments across multiple projects. The Resource Analysis feature does not focus on the specific resource but rather manages resource availability in the aggregate, as defined by the custom resource role field. In other words, in Portfolio Analysis, it is not relevant who is doing the specific work, but instead how many people the organization has available to do the work.

Defining Project Dependencies

Project dependencies may be defined either before or after the creation of the specific analysis. Dependencies may then be optionally enforced by using the check box on the Analysis Options ribbon as part of the what-if analysis process. To navigate to the Project Dependencies page, first click the Portfolio Analyses option in the Quick Launch bar. After navigating to the overview of all analyses, click the option at the top to manage dependencies.

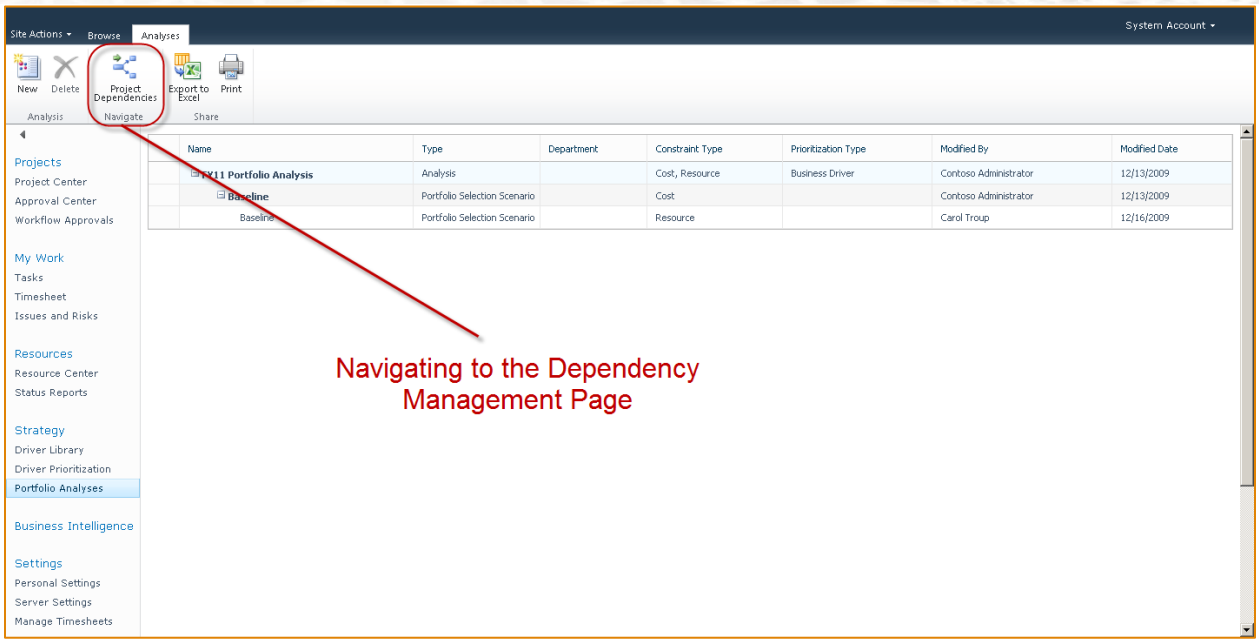


Figure 39: Navigating to the Dependency Management Page

Click the New button in the top left to create a new project dependency.

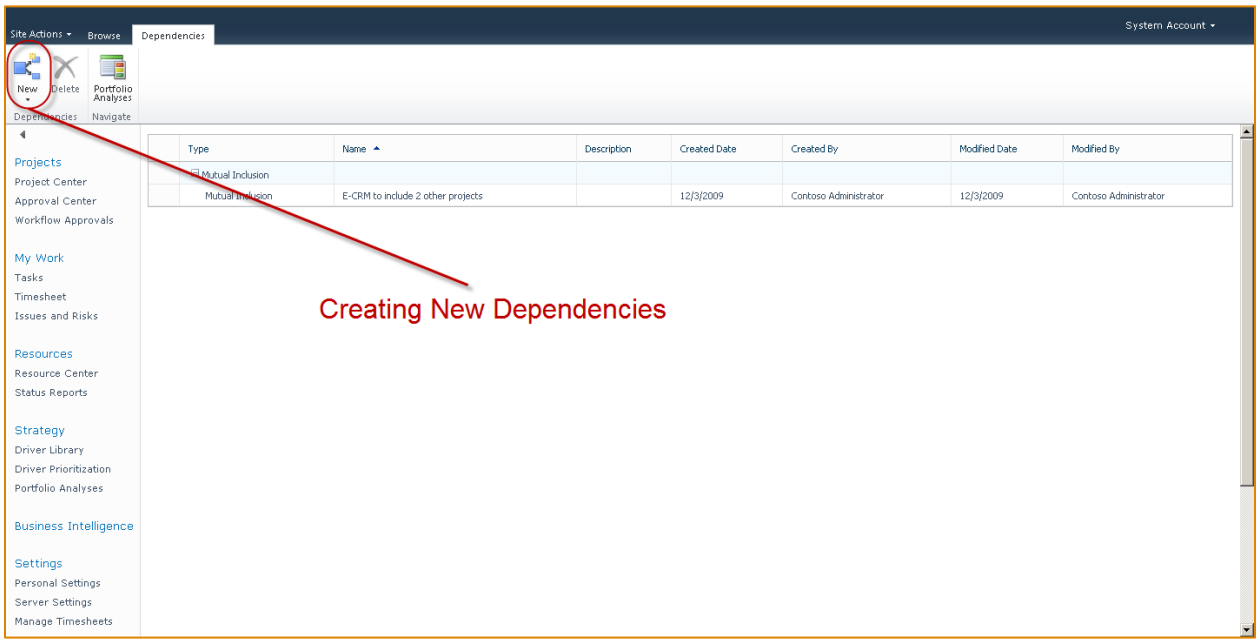


Figure 40: Creating a New Dependency

Dependencies imply relationships between specific projects within a given portfolio. Project Server 2010 allows the use of four distinct kinds of dependencies, split into two main categories: Project and Finish to Start.

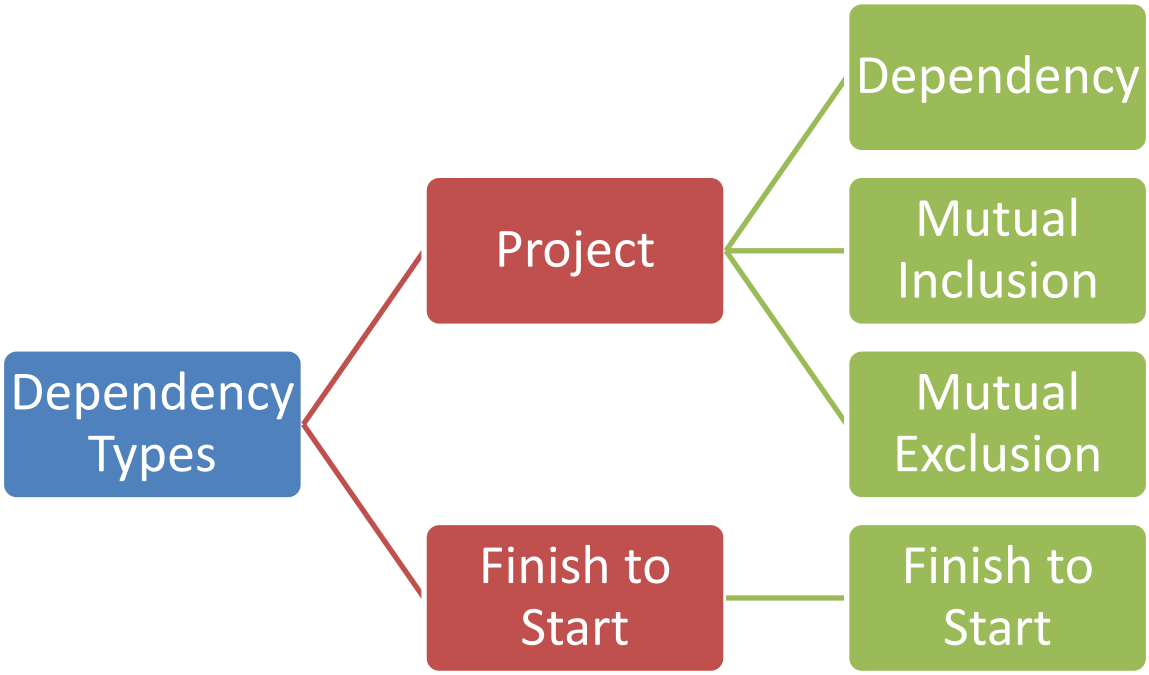


Figure 41: Dependency Classifications

Finish to Start dependencies may only be used in the Resource Analysis functionality, and are not relevant to the Cost Analysis function.

Type	Description
Dependency	The primary project will not be selected unless all of the dependent projects have been selected. No specific execution sequence is implied by this dependency, simply an all or nothing selection mechanism. This dependency also does not imply that the primary project will be selected if all of the dependent projects are selected – only that the primary project will not be selected if all of the dependent projects have not been.
Mutual Inclusion	Either all projects are included, or all projects are excluded. Users should consider using this dependency in the scenario of program management, where each of the projects must be implemented to garner the benefits of the

Type	Description
	program.
Mutual Exclusion	This dependency may be used for multiple competing projects. The portfolio analysis process will select the most viable project based on cost and resource constraints. Once the viable selection has been made, all other competing projects will be excluded. Organizations should consider using this if multiple competing avenues to achieve the same goal have been identified – but only one is required.
Finish to Start	With Finish to Start dependencies, the user selects a primary project that must complete prior to the start of successor projects. This dependency does not imply the successor projects will be selected, but only sets the sequence in which they may be selected. Organizations should consider using this dependency in conjunction with the Mutual Inclusion dependency to ensure that all projects in a given sequence are a) selected, and b) selected in the appropriate sequence.

Table 7: Dependency Types

Dependencies are not enforced by default. Refer to page 72 for enforcing dependencies within Cost Analysis and page 109 for enforcing dependencies within Resource Analysis.

See below for more information on the specific interfaces available for defining the different dependency types.

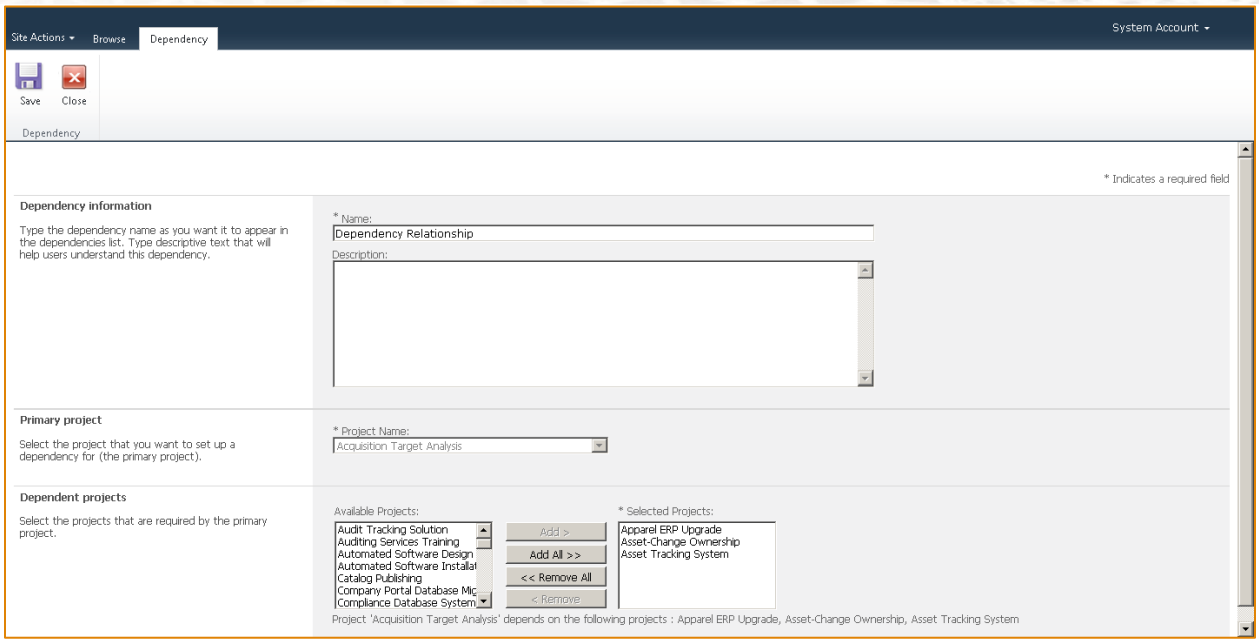


Figure 42: Dependency Relationship

In the example above, the three dependent projects must all be selected for the primary project to be selected.

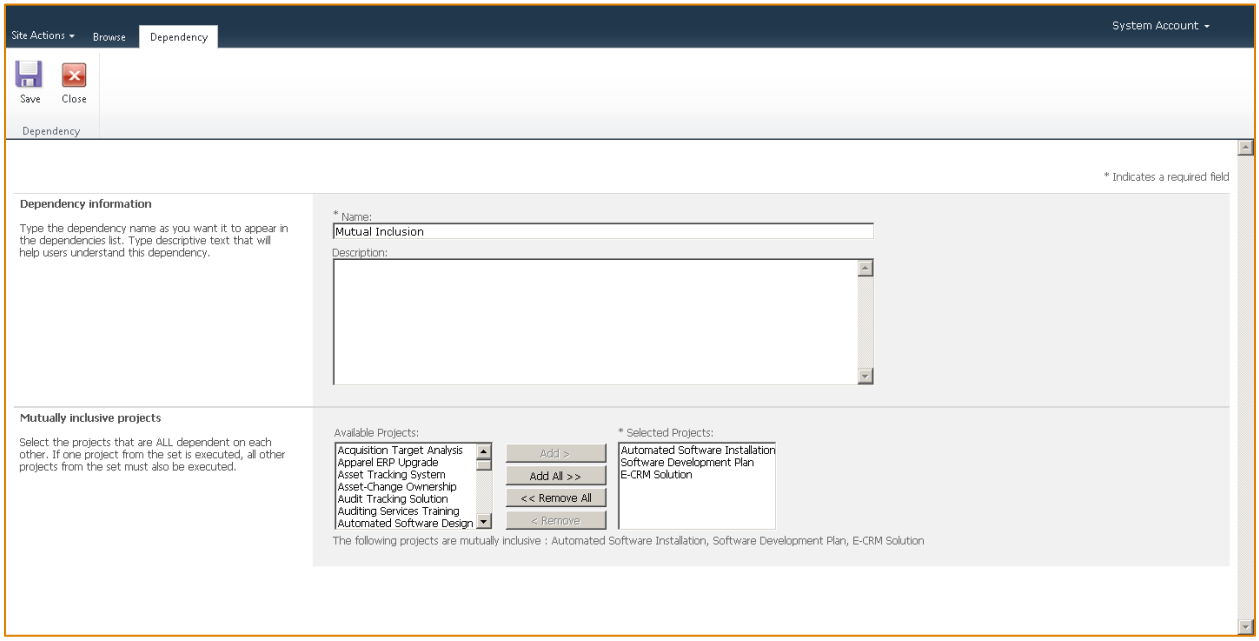


Figure 43: Mutually Inclusive Relationship

In the above example, all three mutually inclusive projects must be selected. If one of those projects is not selected, none of the projects are selected.

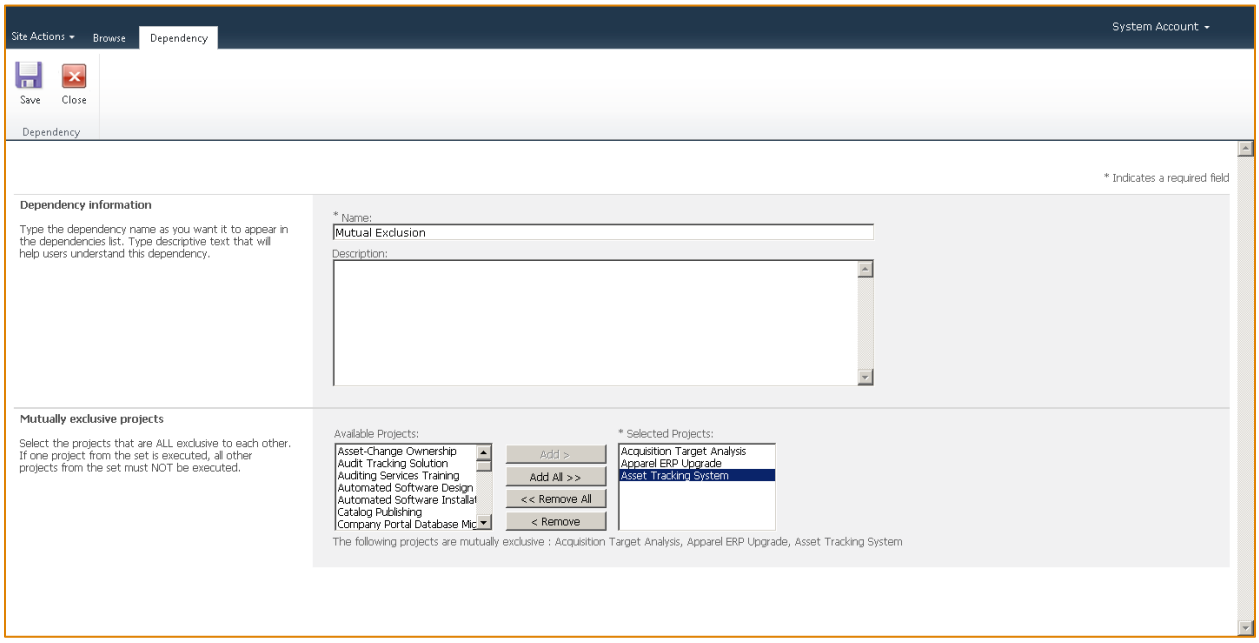


Figure 44: Mutually Exclusive Relationship

In the above example, selecting any one of the mutually exclusive projects will force the remaining selected projects out of the analysis.

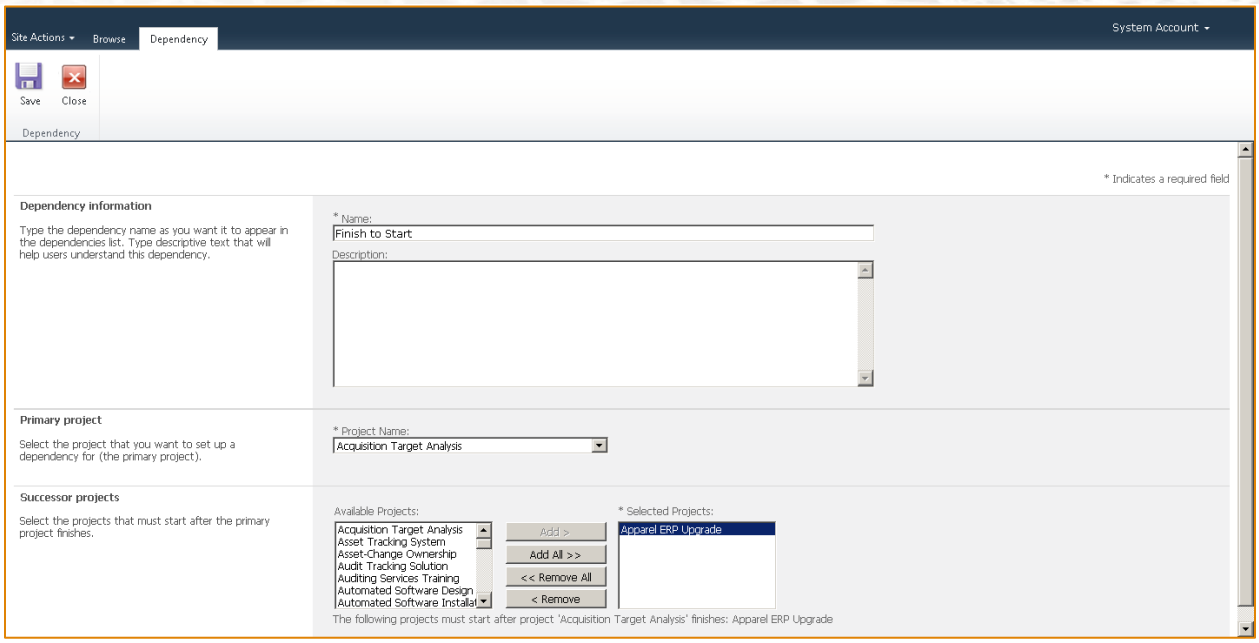


Figure 45: Finish to Start Relationship

In the above example, the successor project must start after the primary project has completed.

Project Prioritization

Once the analysis has been created with the specified projects, each of the projects should be mapped to a designated driver set.

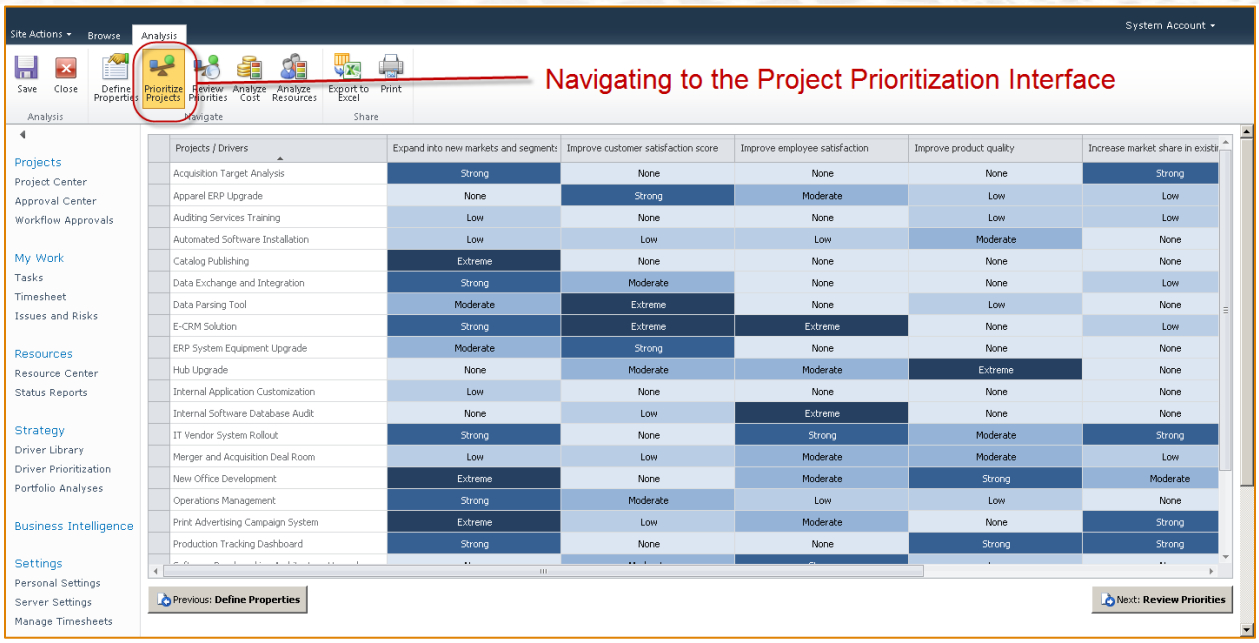


Figure 46: The Project Prioritization Interface

Users may select from six options to assess how well each project maps to the specific driver:

1. Extreme
2. Strong
3. Moderate
4. Low
5. None
6. No Rating

The Prioritization Calculation

Similar to the driver prioritization calculations discussed on page 25, each of these options translates into a numerical score:

Selection	Score
Extreme	9
Strong	6
Moderate	3

Selection	Score
Low	1
None	0
No Rating	0

Table 8: Project Prioritization Scores

To illustrate the calculations, a simplified version of the portfolio depicted in Figure 46 will be used with five projects and five drivers.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Acquisition Target Analysis	Strong	Strong	Extreme	None	None
Apparel ERP Upgrade	Low	None	None	Low	Strong
Auditing Services Training	Low	Low	Strong	Low	None
Automated Software Installation	None	Low	Moderate	Moderate	Low
Catalog Publishing	None	Extreme	Extreme	None	None

Figure 47: Simulated Project Prioritization Interface

Project Server 2010 translates the text to numerical values. (The following illustrations are simulated using a spreadsheet.)

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat
Acquisition Target Analysis	6	6	9	0	0
Apparel ERP Upgrade	1	0	0	1	6
Auditing Services Training	1	1	6	1	0
Automated Software	0	1	3	3	1
Catalog Publishing	0	9	9	0	0
Sum	8.00	17.00	27.00	5.00	7.00

Figure 48: Converting Project Prioritization to Numerical Values

Each cell is multiplied by the driver score from the driver prioritization exercise.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat	Sum	Score
Acquisition Target Analysis	1.70	1.01	2.18	0.00	0.00	4.89	35.81%
Apparel ERP Upgrade	0.28	0.00	0.00	0.08	1.34	1.71	12.51%
Auditing Services Training	0.28	0.17	1.45	0.08	0.00	1.99	14.57%
Automated Software Installation	0.00	0.17	0.73	0.25	0.22	1.37	10.03%
Catalog Publishing	0.00	1.51	2.18	0.00	0.00	3.69	27.07%
					Sum	13.64	100.00%

Figure 49: Weighted Project Prioritization

The row for each project is summed.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat	Sum	Score
Acquisition Target Analysis	1.70	1.01	2.18	0.00	0.00	4.89	35.81%
Apparel ERP Upgrade	0.28	0.00	0.00	0.08	1.34	1.71	12.51%
Auditing Services Training	0.28	0.17	1.45	0.08	0.00	1.99	14.57%
Automated Software Installation	0.00	0.17	0.73	0.25	0.22	1.37	10.03%
Catalog Publishing	0.00	1.51	2.18	0.00	0.00	3.69	27.07%
					Sum	13.64	100.00%

Figure 50: Calculating the Total Project Score

Then the score for each project is normalized by dividing by the sum for all projects to yield the strategic value as a percentage of the scores for all projects.

	Increase Market Share	Expand Into New Markets	Standardize Processes	Improve Product Quality	Improve CustSat	Sum	Score
Acquisition Target Analysis	1.70	1.01	2.18	0.00	0.00	4.89	35.81%
Apparel ERP Upgrade	0.28	0.00	0.00	0.08	1.34	1.71	12.[illegible]%
Auditing Services Training	0.28	0.17	1.45	0.08	0.00	[illegible]99	4.57%
Automated Software Installation	0.00	0.17	0.73	0.25	0.22	[illegible]37	10.03%
Catalog Publishing	0.00	1.51	2.18	0.00	0.00	[illegible]39	27.07%
					Sum	13.64	100.00%

4.89/13.64

Figure 51: Normalizing the Project Score

Project Server 2010 reports these rankings in the Review Priorities page.

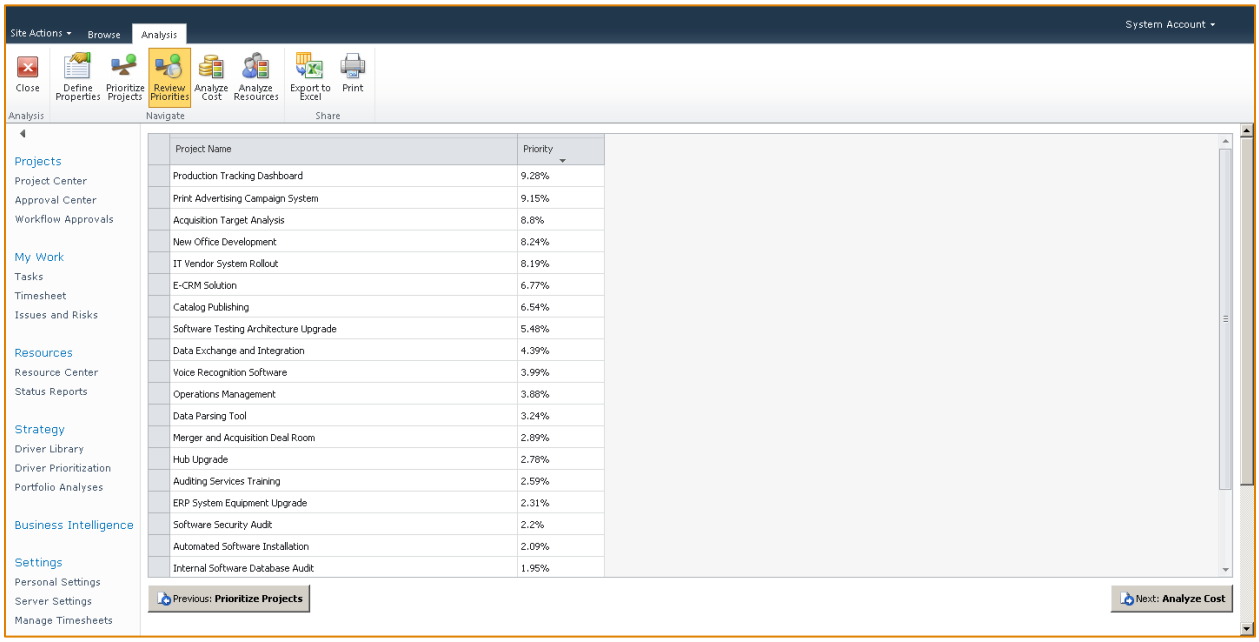


Figure 52: The Review Project Priorities Page

Using Custom Project Ranking Values

Prioritization may be performed manually for a number of reasons:

- To leverage an existing prioritization tool or process that already identifies project ranking.
- To simplify the prioritization process or even to shortcut the Cost Analysis module - For example, a hypothetical organization does not wish to assess priority for every project in the portfolio. The organization does wish however, to use the Resource Analysis features to identify resource pool shortfalls. The organization may then use a manual project prioritization field, and set the value for each project to "1." When creating an analysis, as the projects are already

prioritized equally, the Cost Analysis functionality may be skipped with a perfunctory scenario save, and all of the projects will be delivered into the Resource Analysis module for review.

Those prioritization values may be recorded in a project level custom field and then used in the prioritization process in lieu of prioritizing projects against a defined driver set.

To manually rank projects, the system administrator must first create a new custom project level field to record the value. In this case, a number field is used.

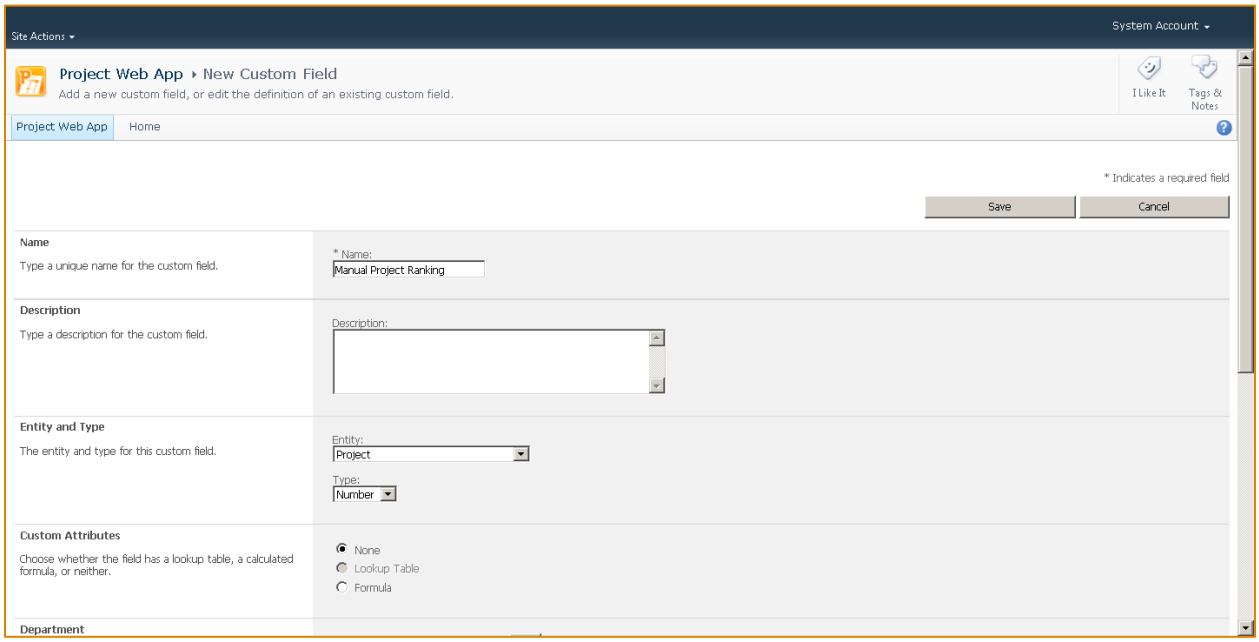


Figure 53: Creating a Manual Ranking Field

The field should be populated for each project, either using the Microsoft Project Professional interface or within the Project Detail Pages for the Enterprise Project Type.

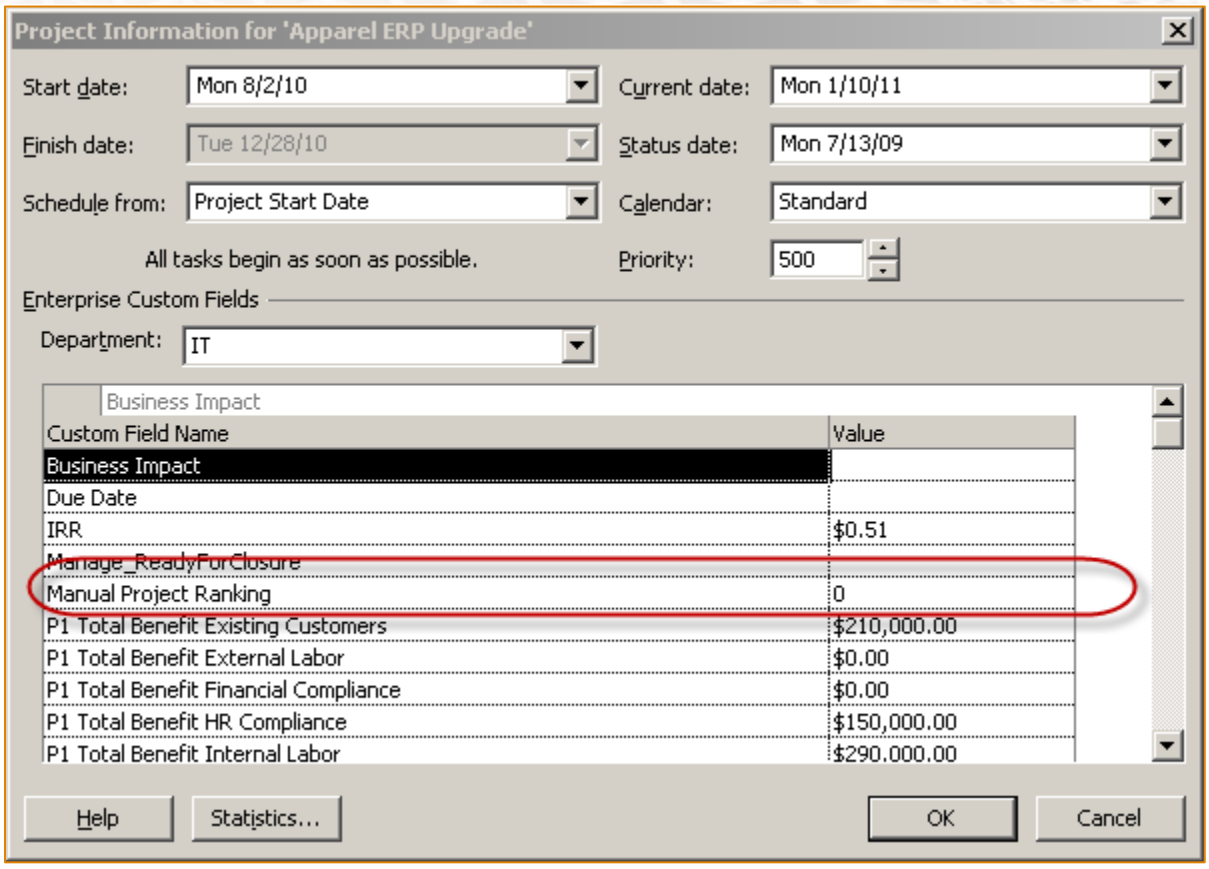


Figure 54: The Project Information Dialog Box

When creating the initial analysis, the user must select the option to prioritize using custom fields.

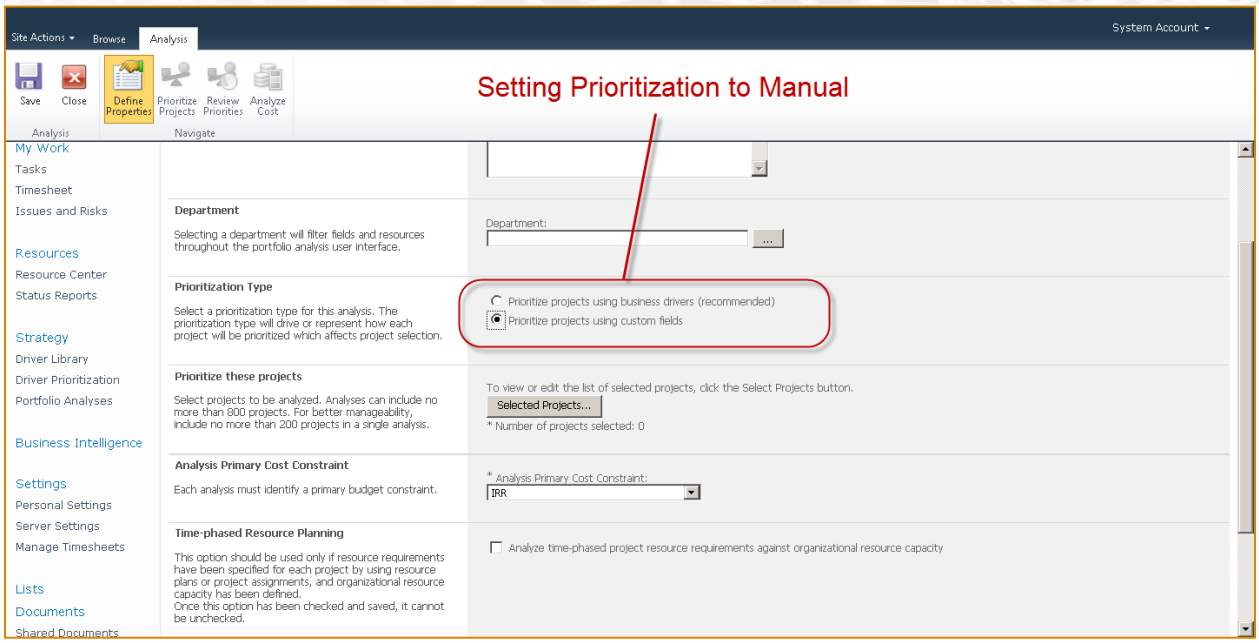


Figure 55: Setting Analysis Options

After creating the analysis, the next page requires the user to identify the field or fields to be used for the prioritization effort. Some organizations may opt to combine multiple custom fields to develop that ranking matrix. In those circumstances, the relative weighting for the fields may also be configured.

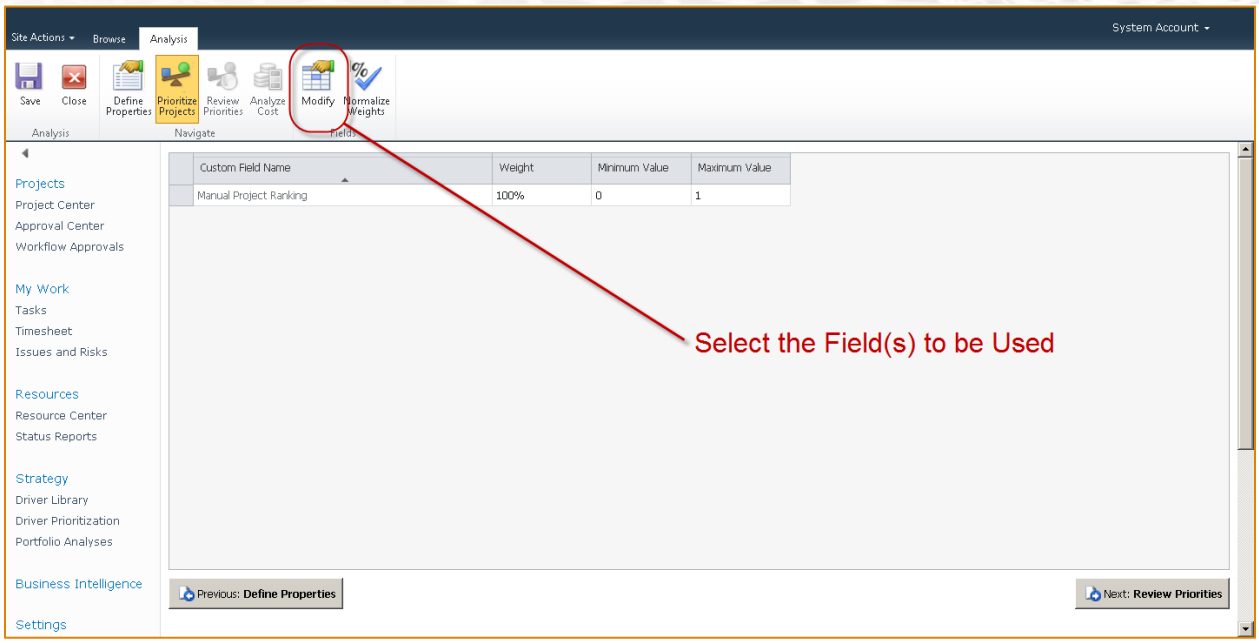


Figure 56: Selecting the Prioritization Fields

If using multiple custom fields, after setting the weights for each of the fields, the user should click the Normalize Weights button to normalize the relative weighting.

The projects may now be analyzed in the same fashion as projects prioritized against defined driver sets.

6. Performing Cost Analysis

After creating the initial analysis, the user is presented with a prioritized list of projects that may then be analyzed and optimized. The user performs this process within Project Server 2010 by manipulating specific factors: project dependencies, constraints, force in/out options, and a number of other potential calculations. The goal of this step is for the organization to determine the optimal portfolio within these constraints.

The initial calculation is automatically saved as the baseline scenario.

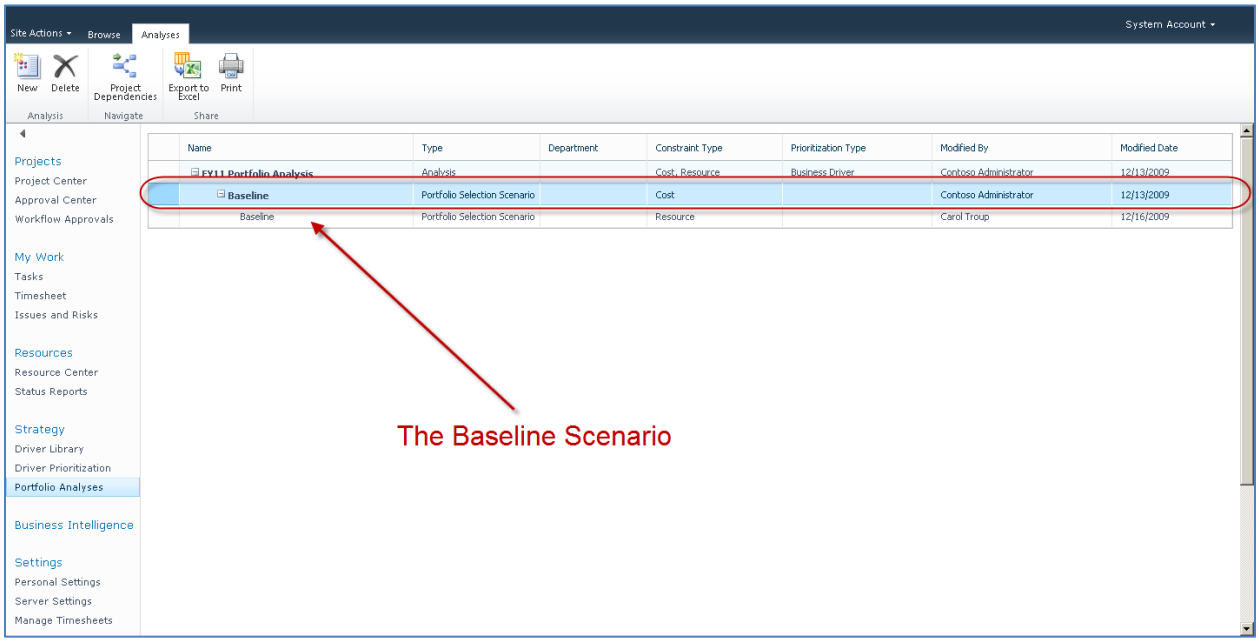


Figure 57: Navigating to the Baseline Scenario

The baseline scenario represents the unconstrained selection of every project within the portfolio. Users may perform what-if analysis on the scenario by changing the various options and recalculating the optimal solution within the new parameters.

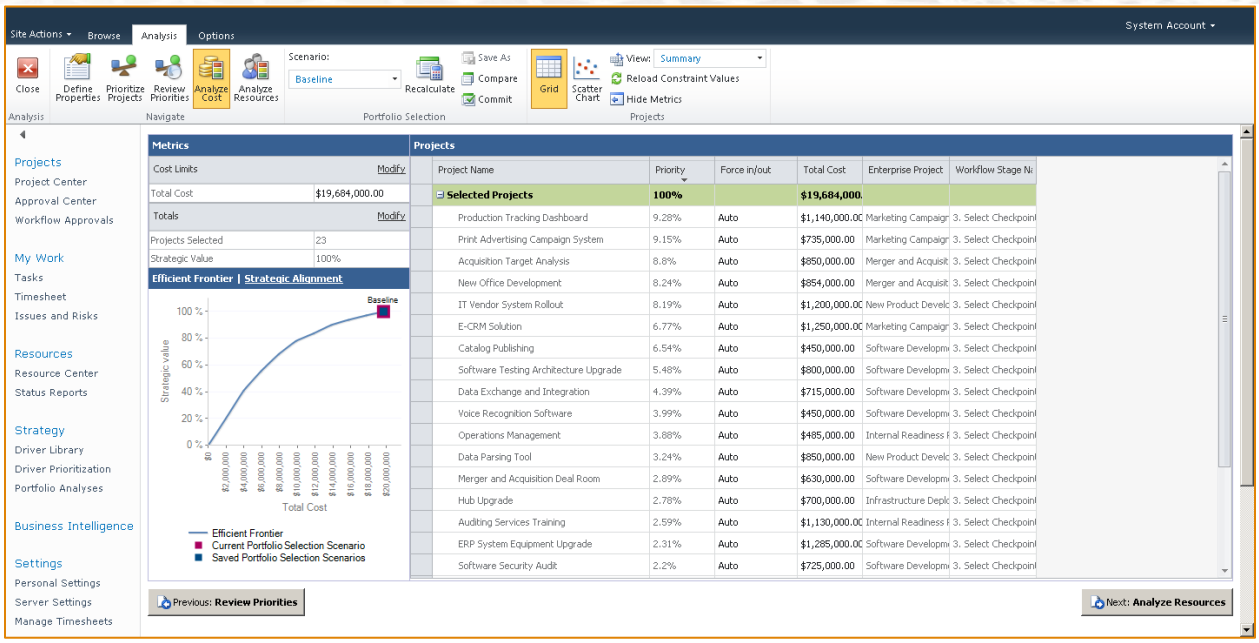


Figure 58: The Baseline Scenario

The data comprising the portfolio analysis is a snapshot of the project data taken upon creation of the baseline scenario. Similarly, no changes, with the exception of the commit functionality, will affect the project data. No changes to the project data will affect the analysis unless the user selects to reload the constraint values. **Caution must be taken when reloading constraint values as this action may invalidate any saved scenarios by changing the source data.**

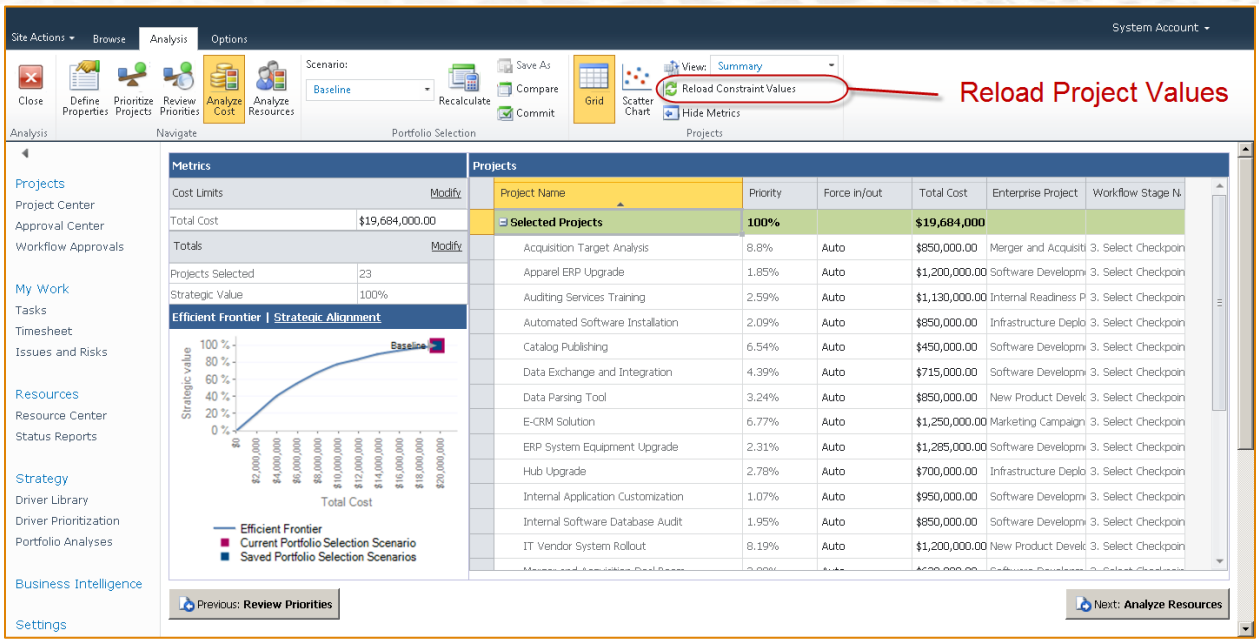


Figure 59: Reloading Project Values

The Optimization Calculation

To develop the baseline calculation scenario, Project Server 2010 performs a number of calculations that may not be readily apparent to the end user. For a more precise discussion of the actual algorithms used in the product, refer to this recorded presentation (http://www.microsoft.com/showcase/en/us/details/6ed064ea-b61a-4e3c-a703-eed6ba5f4b01) from the 2009 Project Conference.

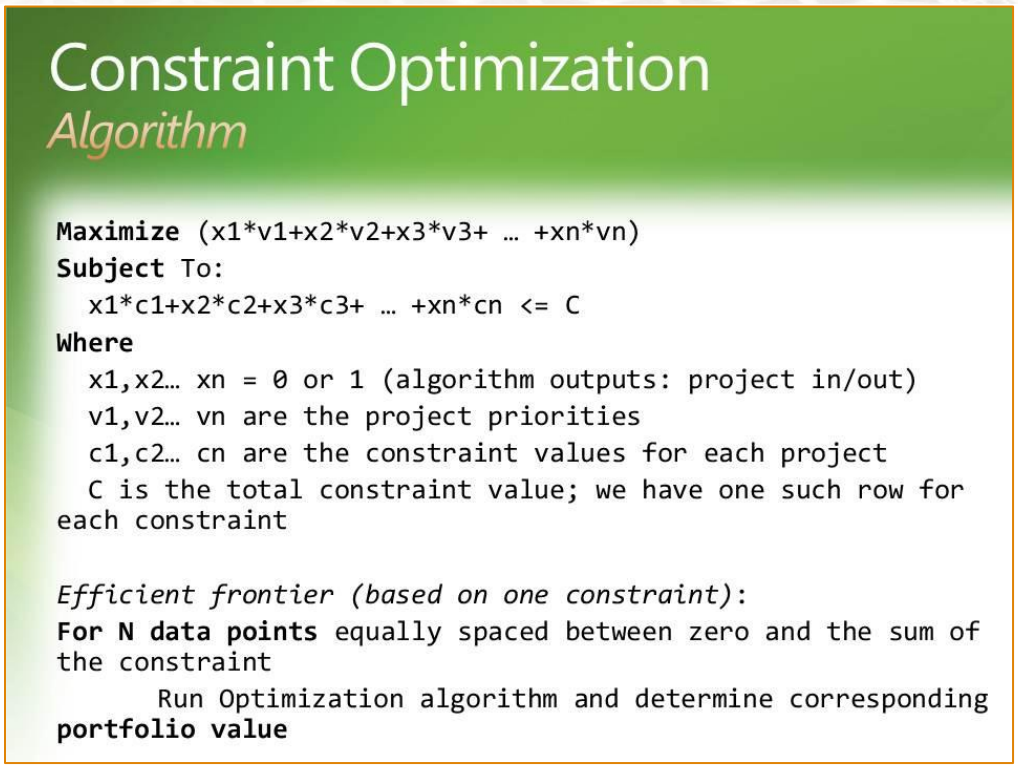


Figure 60: Humphrey/Olteanu Presentation from Project Conference 2009

The following illustrations present conceptually how those calculations are performed.

First, the system must define the total number of possible solutions. As each project has two potential states (Included, Not Included), the total number of solutions is represented by the equation n^2, where *n = the total number of projects in the analysis*.

For illustration purposes, this calculation yields a total of 32 potential solutions for a sample of 5 projects: 2^5 or 32 possible solutions.

Each of those solutions will be depicted as a string of Y's and N's, where YNNYN means the solution includes Projects 1 and 4, but not 2, 3 or 5, the solution set in total will then appear as follows:

NNNNN	NYNNN	YNNNN	YYNNN
NNNNY	NYNNY	YNNNY	YYNNY
NNNYN	NYNYN	YNNYN	YYNYN
NNNYY	NYNYY	YNNYY	YYNYY
NNYNN	NYYNN	YNYNN	YYYNN
NNYNY	NYYNY	YNYNY	YYYNY
NNYYN	NYYYN	YNYYN	YYYYN
NNYYY	NYYYY	YNYYY	YYYYY

Figure 61: Defining the Solution Set

Each of those solution sets may then be translated into cost figures using the cost estimate for each project. For example, the solution YNYYN (Column 3, Row 7) includes Projects 1, 3 and 4. The costs for those projects were estimated using either top down estimating in project-level fields or rolled up from bottom-up estimating methods.

Project	Score	Proposed Cost
Acquisition Target Analysis	36.09%	$850,000.00
Apparel ERP Upgrade	12.78%	$1,200,000.00
Auditing Services Training	10.75%	$1,130,000.00
Automated Software Installation	9.93%	$850,000.00
Catalog Publishing	30.45%	$450,000.00
Total Cost:		$ 4,480,000

Figure 62: Project Cost and Value

Referencing those costs, the system will calculate that the estimated cost for each of those projects is $850,000, $1,130,000, and $850,000, or a total estimated cost for the portfolio of Projects 1, 3, and 4 of $2,830,000. Each of those solutions may be represented by a total cost as in the following table:

$0	$1,200,000	$850,000	$2,050,000
$450,000	$1,650,000	$1,300,000	$2,500,000
$850,000	$2,050,000	$1,700,000	$2,900,000
$1,300,000	$2,500,000	$2,150,000	$3,350,000
$1,130,000	$2,330,000	$1,980,000	$3,180,000
$1,580,000	$2,780,000	$2,430,000	$3,630,000
$1,980,000	$3,180,000	$2,830,000	$4,030,000
$2,430,000	$3,630,000	$3,280,000	$4,480,000

Figure 63: Translating the Solution Set to Cost Values

The same approach is used to convert each solution into an aggregated strategic value score.

0.00%	12.78%	36.09%	48.86%
30.45%	43.23%	66.54%	79.32%
9.93%	22.70%	46.02%	58.79%
40.38%	53.16%	76.47%	89.25%
10.75%	23.53%	46.84%	59.62%
41.21%	53.98%	77.30%	90.07%
20.68%	33.46%	56.77%	69.55%
51.14%	63.91%	87.22%	100.00%

Figure 64: Translating the Solution Set to Strategic Values

Each solution may then be mapped to two data points:

NNNNN ($0, 0.00%)	NYNNN ($1200000, 12.78%)	YNNNN ($850000, 36.09%)	YYNNN ($2050000, 48.86%)
NNNNY ($450000, 30.45%)	NYNNY ($1650000, 43.23%)	YNNNY ($1300000, 66.54%)	YYNNY ($2500000, 79.32%)
NNNYN ($850000, 9.93%)	NYNYN ($2050000, 22.70%)	YNNYN ($1700000, 46.02%)	YYNYN ($2900000, 58.79%)
NNNYY ($1300000, 40.38%)	NYNYY ($2500000, 53.16%)	YNNYY ($2150000, 76.47%)	YYNYY ($3350000, 89.25%)
NNYNN ($1130000, 10.75%)	NYYNN ($2330000, 23.53%)	YNYNN ($1980000, 46.84%)	YYYNN ($3180000, 59.62%)
NNYNY ($1580000, 41.21%)	NYYNY ($2780000, 53.98%)	YNYNY ($2430000, 77.30%)	YYYNY ($3630000, 90.07%)
NNYYN ($1980000, 20.68%)	NYYYN ($3180000, 33.46%)	YNYYN ($2830000, 56.77%)	YYYYN ($4030000, 69.55%)
NNYYY ($2430000, 51.14%)	NYYYY ($3630000, 63.91%)	YNYYY ($3280000, 87.22%)	YYYYY ($4480000, 100.00%)

Figure 65: Identifying Solution Set X and Y Axes

To analyze which of these options is the optimal solution, the system will then identify the optimal strategic value within the cost constraint set by the user.

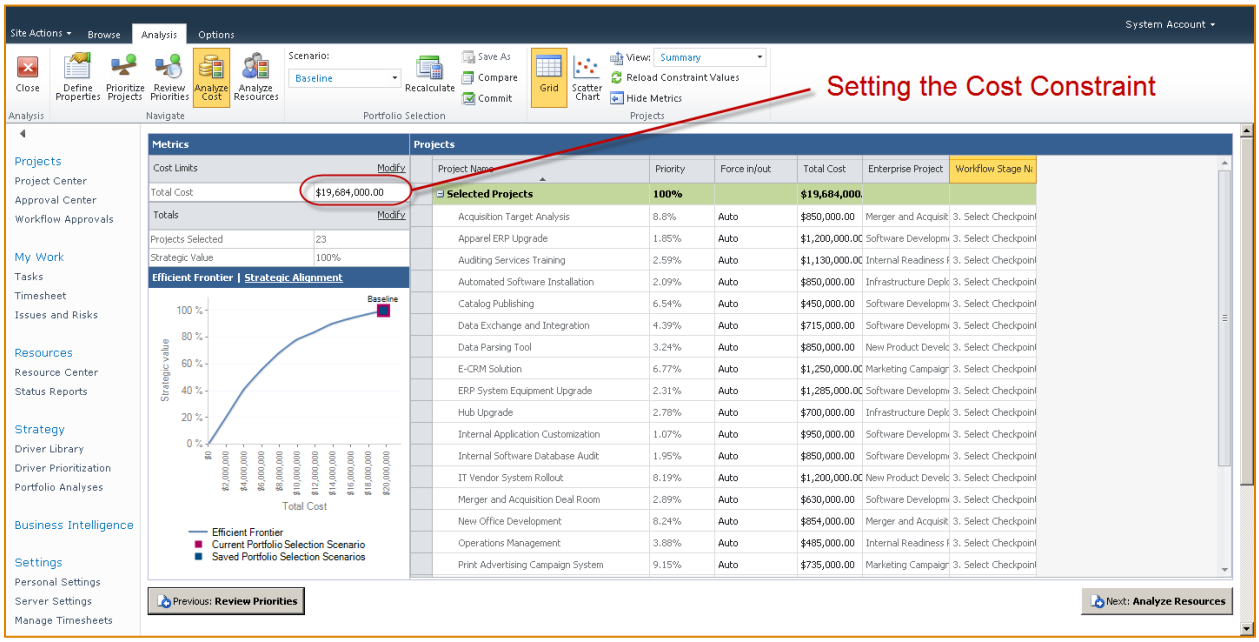


Figure 66: Setting the Portfolio Cost Constraint

In the following illustration, an arbitrary cost constraint of $3,000,000 has been set. The solutions outside of that cost constraint are highlighted in red.

$0	$1,200,000	$850,000	$2,050,000
$450,000	$1,650,000	$1,300,000	$2,500,000
$850,000	$2,050,000	$1,700,000	$2,900,000
$1,300,000	$2,500,000	$2,150,000	$3,350,000
$1,130,000	$2,330,000	$1,980,000	$3,180,000
$1,580,000	$2,780,000	$2,430,000	$3,630,000
$1,980,000	$3,180,000	$2,830,000	$4,030,000
$2,430,000	$3,630,000	$3,280,000	$4,480,000

Figure 67: Excluding Potential Solution Sets

The optimal cost constrained solution based on strategic value in this case would be the cell highlighted in green, or a strategic value of 79.32%.

0.00%	12.78%	36.09%	48.86%
30.45%	43.23%	66.54%	79.32%
9.93%	22.70%	46.02%	58.79%
40.38%	53.16%	76.47%	
10.75%	23.53%	46.84%	
41.21%	53.98%	77.30%	
20.68%		56.77%	
51.14%			

Figure 68: Identifying the Optimal Solution Set

The total portfolio cost would then be defined as $2,500,000, and would include projects 1, 2 and . Note that this solution is well under the cost constraint, which has been set at $3,000,000.

NNNNN ($0, 0.00%)	NYNNN ($1200000, 12.78%)	YNNNN ($850000, 36.09%)	YYNNN ($2050000, 48.86%)
NNNNY ($450000, 30.45%)	NYNNY ($1650000, 43.23%)	YNNNY ($1300000, 66.54%)	YYNNY ($2500000, 79.32%)
NNNYN ($850000, 9.93%)	NYNYN ($2050000, 22.70%)	YNNYN ($1700000, 46.02%)	YYNYN ($2900000, 58.79%)
NNNYY ($1300000, 40.38%)	NYNYY ($2500000, 53.16%)	YNNYY ($2150000, 76.47%)	YYNYY ($3350000, 89.25%)
NNYNN ($1130000, 10.75%)	NYYNN ($2330000, 33.53%)	YNYNN ($1980000, 46.84%)	YYYNN ($3180000, 59.62%)
NNYNY ($1580000, 41.21%)	NYYNY ($2780000, 53.98%)	YNYNY ($2430000, 77.30%)	YYYNY ($3630000, 90.07%)
NNYYN ($1980000, 20.68%)	NYYYN ($3180000, 33.46%)	YNYYN ($2830000, 56.77%)	YYYYN ($4030000, 69.55%)
NNYYY ($2430000, 51.14%)	NYYYY ($3630000, 63.91%)	YNYYY ($3280000, 87.22%)	YYYYY ($4480000, 100.00%)

Figure 69: Identifying the Optimal Solution Cost

Defining the Efficient Frontier

Project Server 2010 will calculate the efficient frontier for each portfolio of projects.

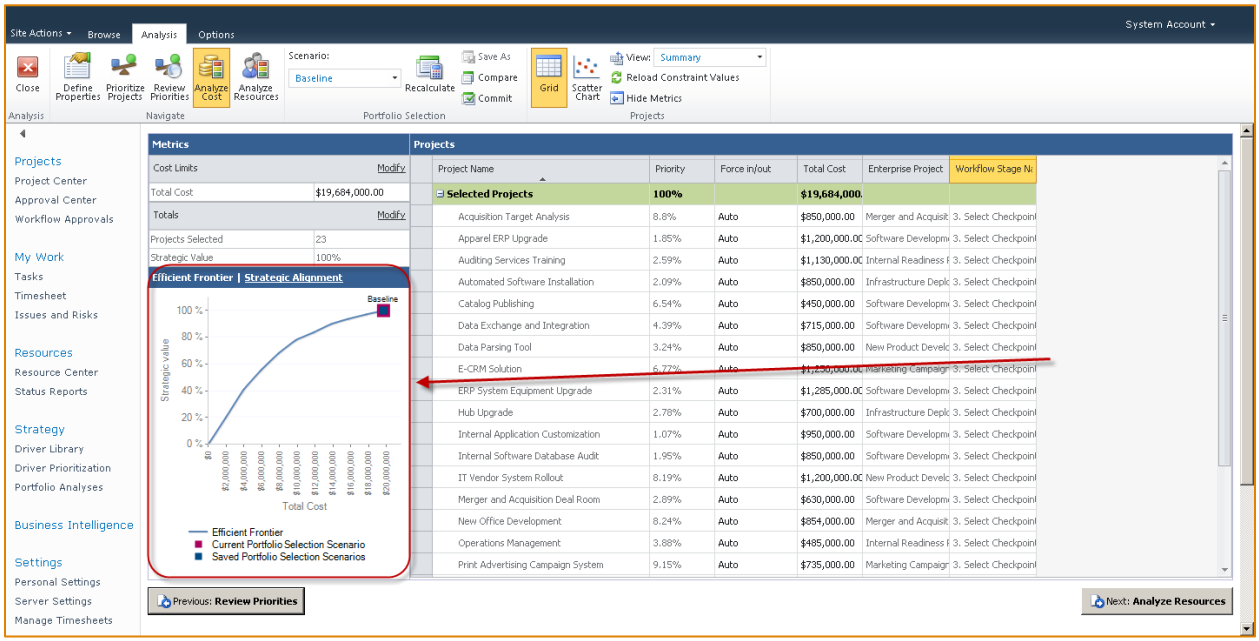


Figure 70: The Efficient Frontier

The efficient frontier is a well-documented concept in portfolio analysis. Again, the following illustrations present a conceptual model of how those calculations are performed.

For a more precise discussion of the actual algorithms incorporated into the tool, refer to this recorded presentation from the 2009 Project Conference, accessible at the following URL: http://www.microsoft.com/showcase/en/us/details/6ed064ea-b61a-4e3c-a703-eed6ba5f4b01.

The efficient frontier is calculated by first plotting each of the potential solution sets on a scatter chart.

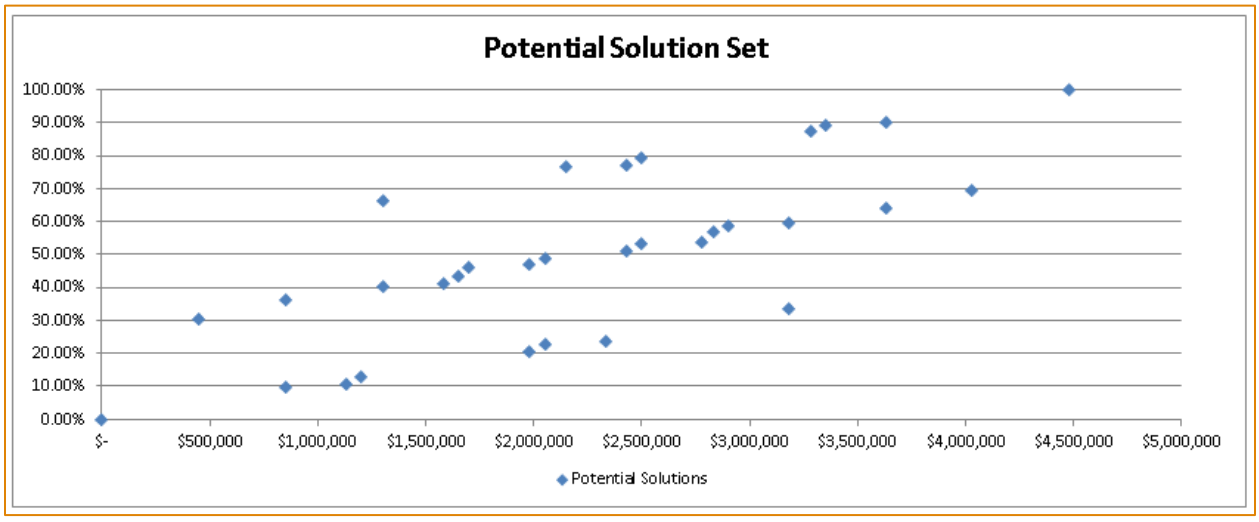


Figure 71: Plotting the Potential Solutions

The efficient frontier is the leftmost collection of solution sets that satisfies the requirement that any solution set on the efficient frontier represents the greatest strategic value for a specific price point. No other solution may provide a greater strategic value for the same price or less.

Plotting the efficient frontier on the above scatter chart yields the following:

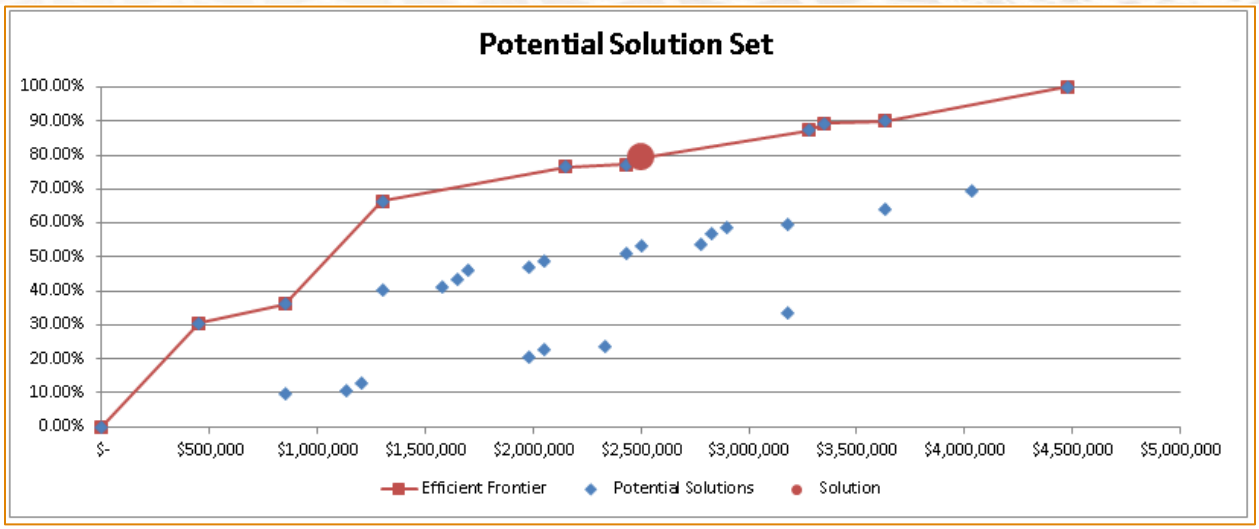


Figure 72: Plotting the Efficient Frontier

Calculating Strategic Alignment

Project Server 2010 calculates strategic alignment for each portfolio of projects.

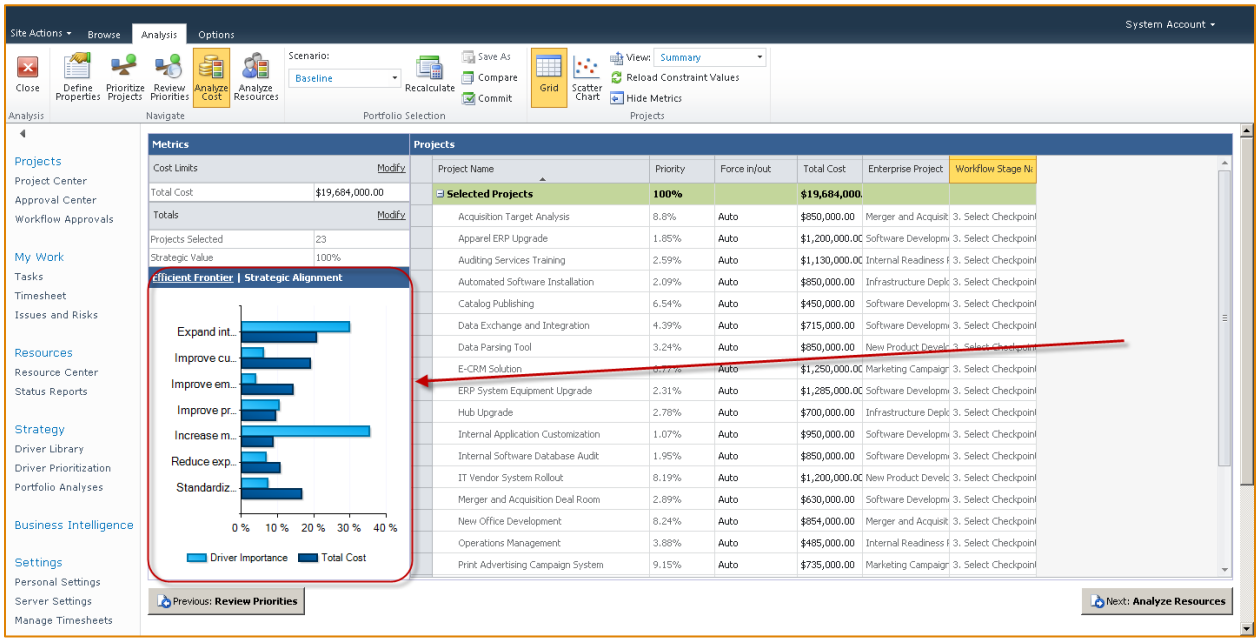


Figure 73: The Strategic Alignment Chart

To develop the strategic alignment chart, the system first calculates the scores for each project as rated against the specific drivers. (The following illustration is a result of the prioritization calculation discussed in more detail on page 51.)

Project	D1 Score	D2 Score	D3 Score	D4 Score	D5 Score
Acquisition Target Analysis	1.61	1.86	0.87	0.00	0.00
Apparel ERP Upgrade	0.27	0.00	0.00	0.14	1.13
Auditing Services Training	0.27	0.31	0.58	0.14	0.00
Automated Software Installation	0.00	0.31	0.29	0.41	0.19
Catalog Publishing	0.00	2.80	0.87	0.00	0.00
Sum:	2.15	5.28	2.61	0.68	1.32

Figure 74: Identifying the Weighted Project Scores per Driver

Each cell value is normalized by dividing by the sum of the column.

Project	D1 Score	D2 Score	D3 Score	D4 Score	D5 Score
Acquisition Target Analysis	1.61	1.86	0.87	0.00	0.00
Apparel ERP Upgrade	0.27	0.00	0.00	0.14	1.13
Auditing Services Training	0.27	0.31	0.58	0.14	0.00
Automated Software Installation	0.00	0.31	0.29	0.41	0.19
Catalog Publishing	0.00	2.80	0.87	0.00	0.00
Sum:	2.15	5.28	2.61	0.68	1.32

1.61 / 2.15

Figure 75: Normalizing the Project Scores per Driver

That calculation yields the approximate percentage of each project budget to be allocated against each driver.

Project	Norm D1 Score	Norm D2 Score	Norm D3 Score	Norm D4 Score	Norm D5 Score
Acquisition Target Analysis	0.37	0.43	0.20	0.00	0.00
Apparel ERP Upgrade	0.17	0.00	0.00	0.09	0.74
Auditing Services Training	0.21	0.24	0.45	0.10	0.00
Automated Software Installation	0.00	0.26	0.24	0.34	0.16
Catalog Publishing	0.00	0.76	0.24	0.00	0.00

Figure 76: Normalized Project Scores

The system then multiplies the overall cost of each project times the approximate percent of budget allocated to the driver. This yields a breakdown of how much of each project cost is allocated to specific drivers.

Project	Proposed Cost	Norm D1 Score	D1 Investment
Acquisition Target Analysis	$ 850,000	0.37	$ 314,969.28
Apparel ERP Upgrade	$ 1,200,000	0.17	$ 209,343.13
Auditing Services Training	$ 1,130,000	0.21	$ 234,175.04
Automated Software Installation	$ 850,000	0.00	$ -
Catalog Publishing	$ 450,000	0.00	$ -
			$ 758,487.45

$850,000 X .37

Figure 77: Calculating the Project/Driver Investment

The total cost allocated to each driver is then summed.

Project	D1 Investment	D2 Investment	D3 Investment	D4 Investment	D5 Investment
Acquisition Target Analysis	$ 314,969.28	$ 364,617.07	$ 170,413.65	$ -	$ -
Apparel ERP Upgrade	$ 209,343.13	$ -	$ -	$ 105,431.26	$ 885,225.61
Auditing Services Training	$ 234,175.04	$ 271,087.44	$ 506,800.20	$ 117,937.32	$ -
Automated Software Installation	$ -	$ 220,853.05	$ 206,443.30	$ 288,248.14	$ 134,455.51
Catalog Publishing	$ -	$ 343,096.41	$ 106,903.59	$ -	$ -
	$ 758,487.45	$ 1,199,653.96	$ 990,560.75	$ 511,616.72	$ 1,019,681.12

Figure 78: Calculating the Total Investment per Driver

Finally, the sum of investment for each driver is normalized against the total cost of the portfolio to determine the percent invested in each driver.

Driver	Score	Invested
1	36.09%	16.93%
2	12.78%	26.78%
3	10.75%	22.11%
4	9.93%	11.42%
5	30.45%	22.76%
Total:	100.00%	100.00%

Figure 79: Identifying the Total Investment per Driver

This value is then plotted on the Strategic Alignment chart.

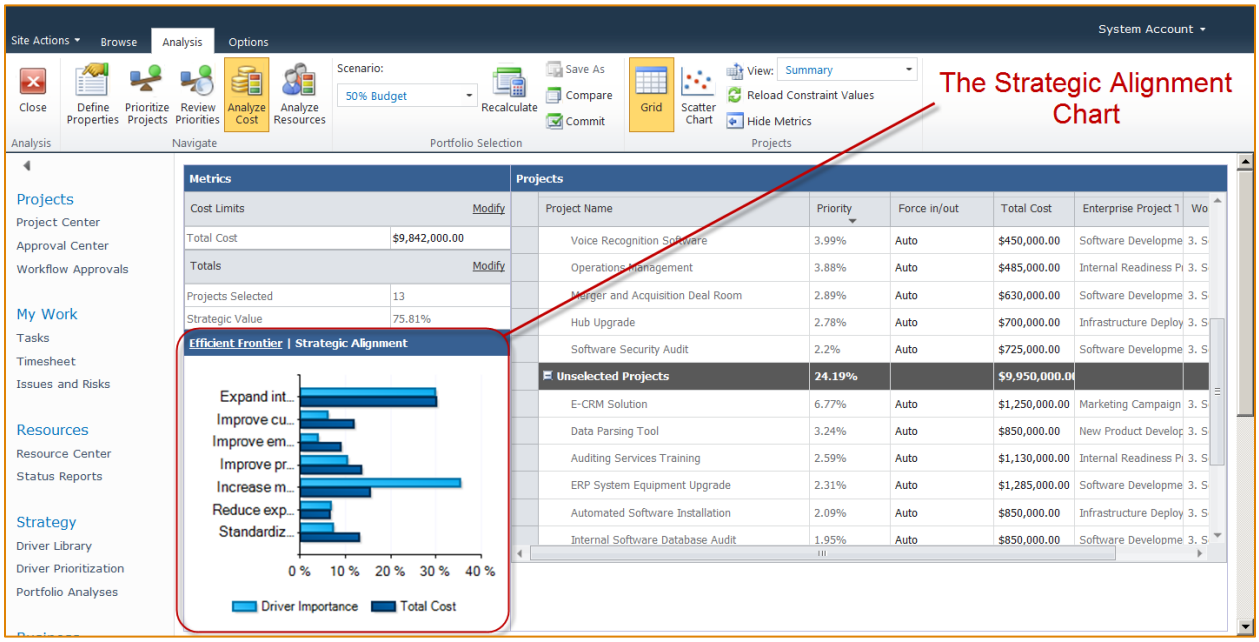


Figure 80: The Strategic Alignment Chart

Assessing the Scatter Chart

Each portfolio scenario is also plotted on a scatter chart.

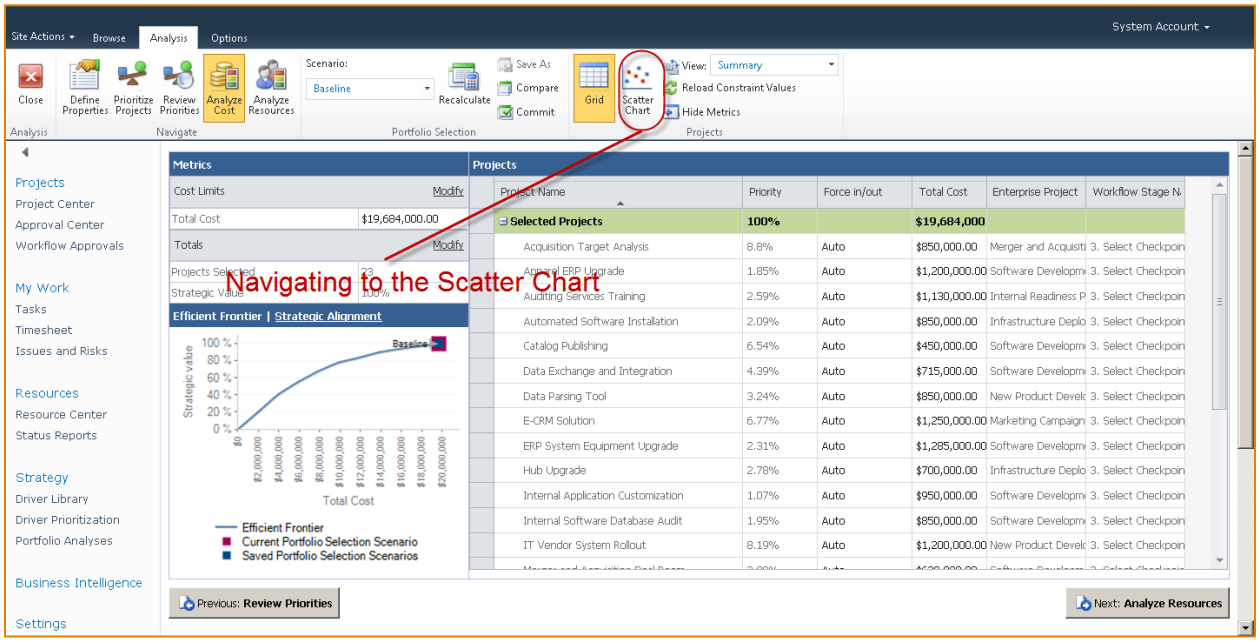


Figure 81: Navigating to the Scatter Chart

The scatter chart is not a bubble chart, although the terms are often used interchangeably. Each of the elements on the scatter chart do not change size based on a specific metric. Scatter charts display two variables: x and y. To develop a portfolio bubble chart, which uses a third variable (z), the user will have to develop custom report using Microsoft Excel or PerformancePoint.

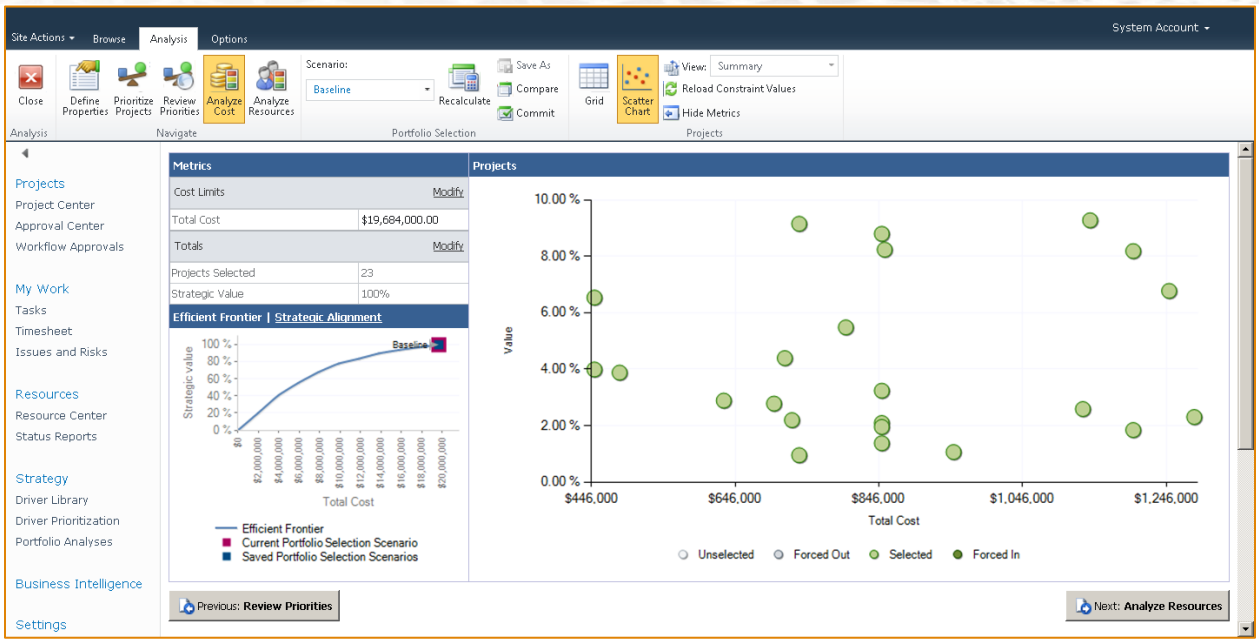


Figure 82: The Scatter Chart

Four different project types are graphically depicted on the scatter chart. See the table below for further definitions of those specific terms:

Term	Definition
Selected	The project has been selected in the scenario currently under analysis.
Unselected	The project has not been selected in the scenario currently under analysis.
Forced In	The project was forced into the scenario under review.
Forced Out	The project was forced out of the scenario under review.

Table 9: Scatter Chart Term Definitions

If a project is forced in, and the result is that another project is unselected, the latter project is considered “unselected” as opposed to “forced out” for display purposes.

Performing What-if Analysis

Once the baseline scenario has been established without cost constraints, the system allows the user to perform what-if analysis by controlling specific settings.

The settings that may be controlled include:

1) Cost (or Custom) Constraints
2) Project Dependencies
3) Force In/Out Status

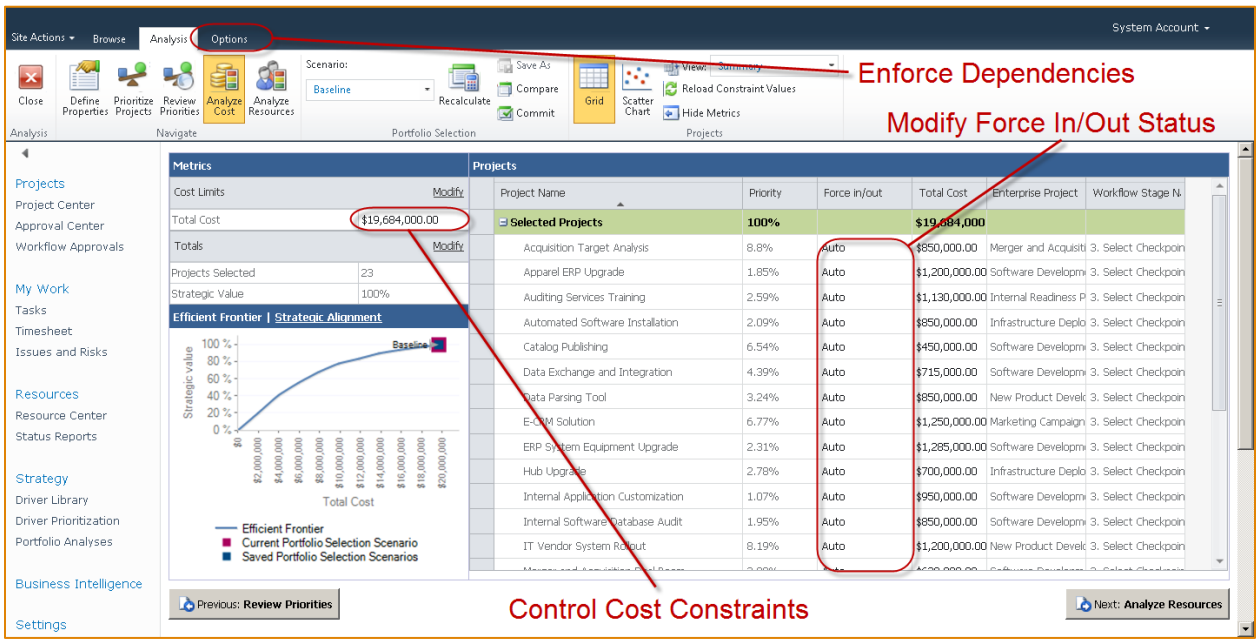


Figure 83: Controlling Scenario Parameters

After changing any of the available parameters, the user must click the Recalculate button on the Analysis ribbon to re-optimize the analysis.

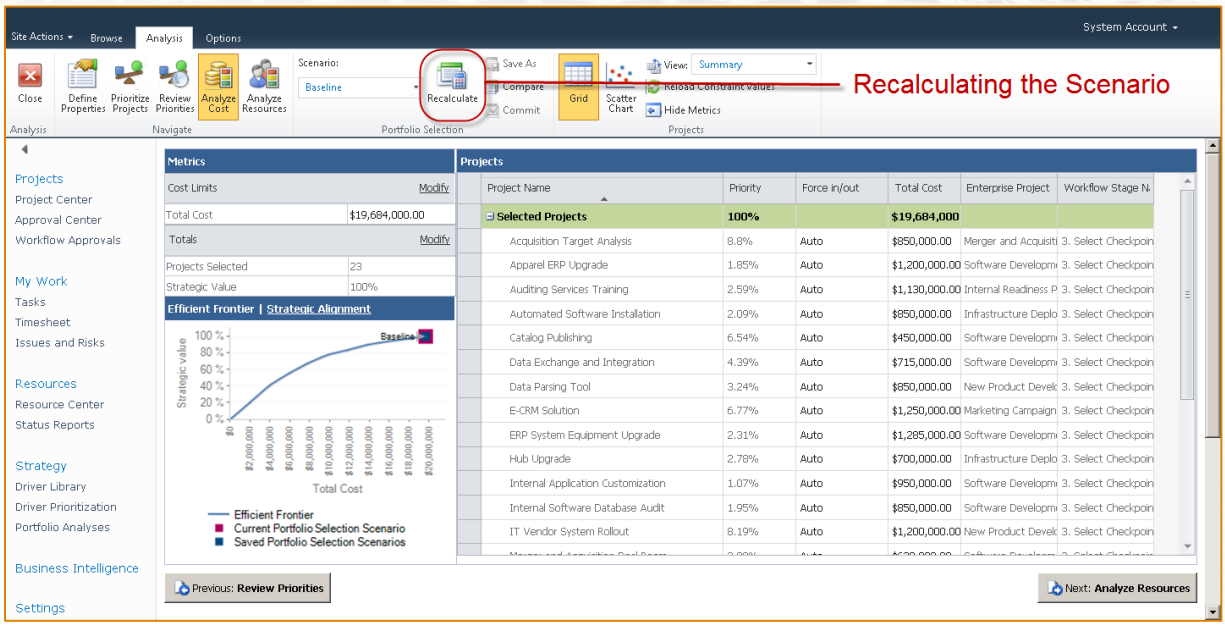


Figure 84: Recalculating the Scenario

The Total Cost constraint may be modified by adding other constraints such as pessimistic project costs, management reserve or other custom fields. This feature may also be used to assess project screening factors. For more information on how to perform these functions, see page 77.

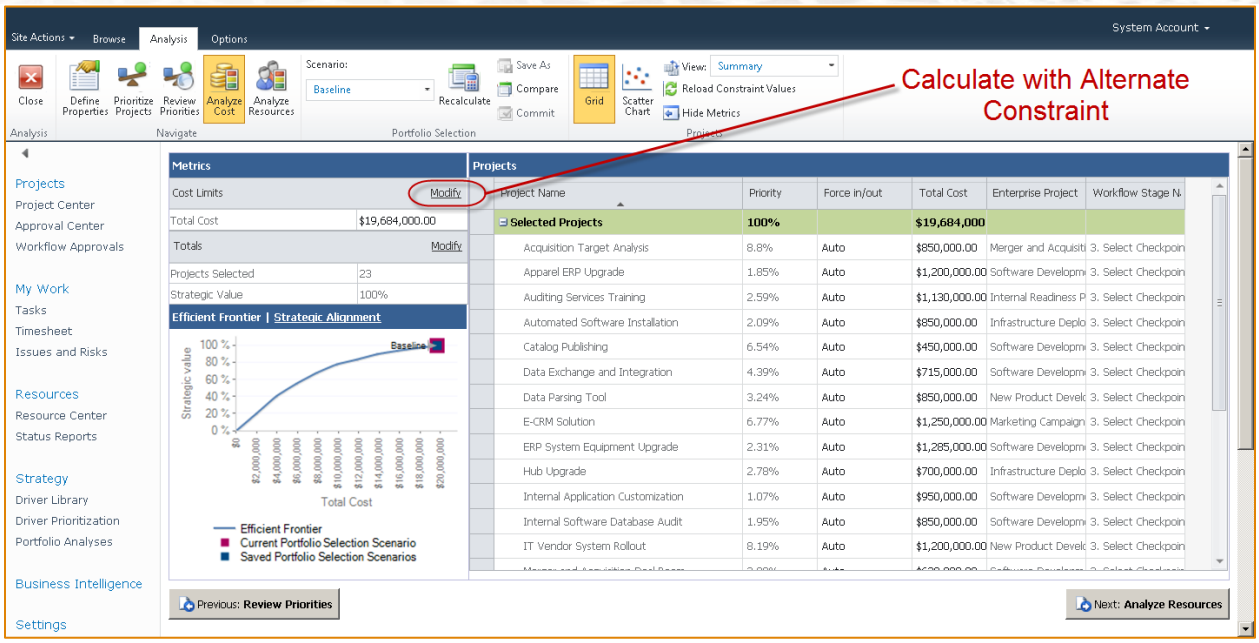


Figure 85: Calculating with Alternate Primary Constraints

Revising Cost Constraints

Project Server 2010 allows the user to set an overall cost constraint for the specific scenario.

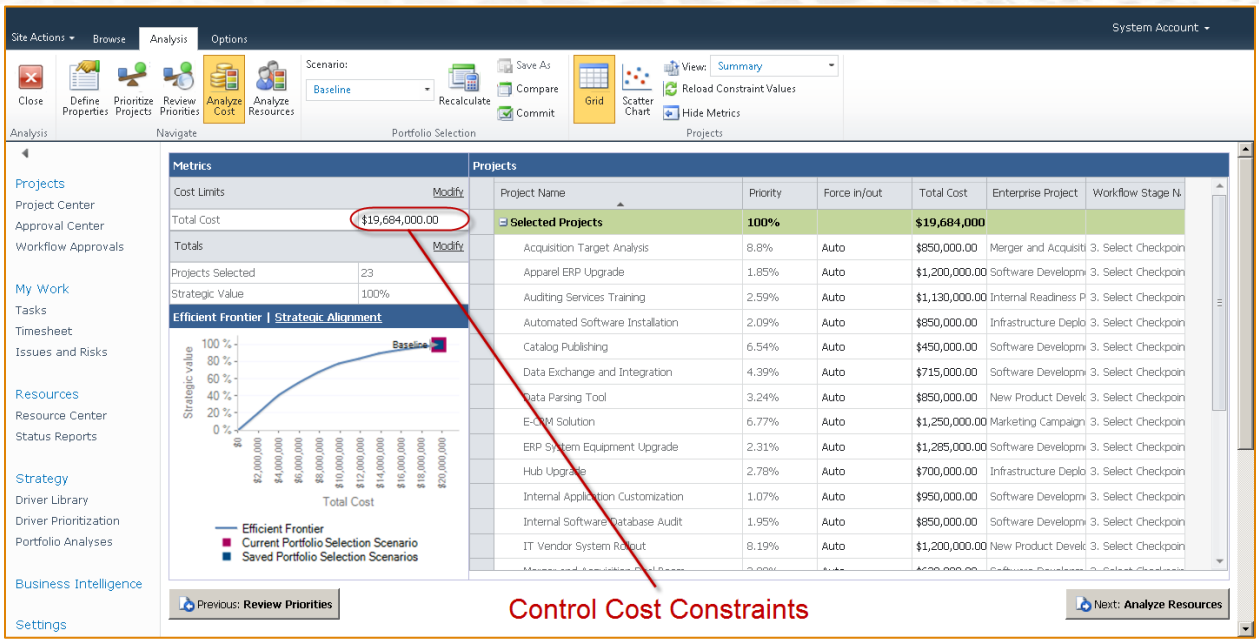


Figure 86: Controlling Cost Constraints

In the above example, the default cost constraint is set to the total cost of the entire portfolio, resulting in all projects being selected. When the cost constraint is cut in half, and the Recalculate option is selected, the results are as follow:

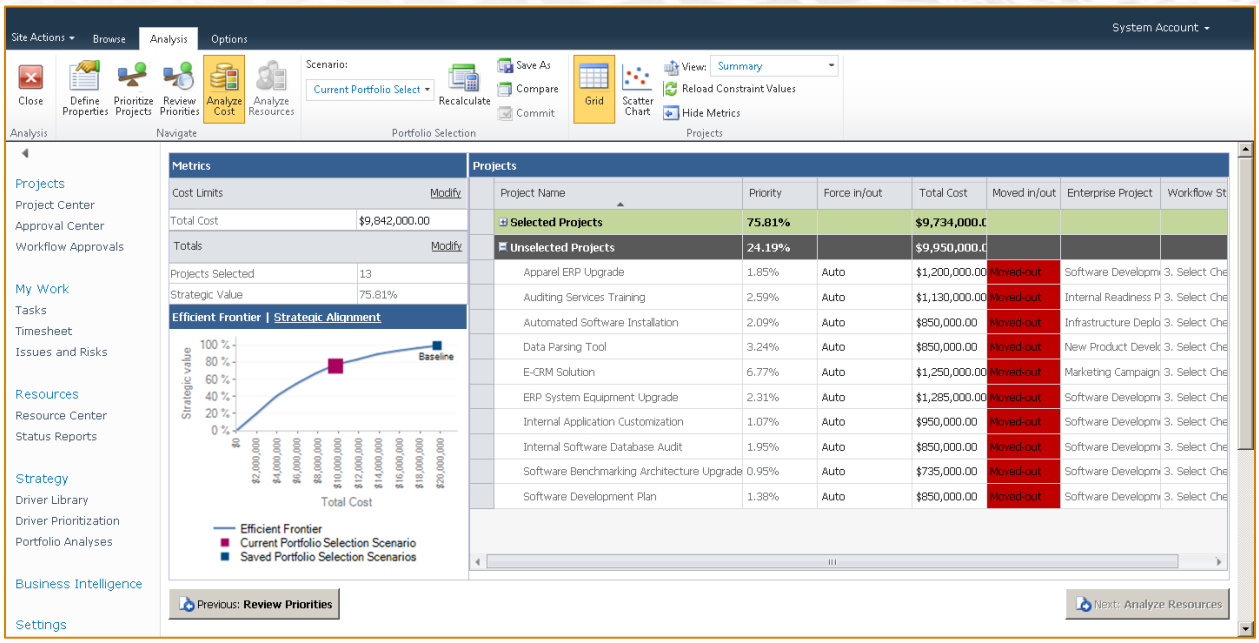


Figure 87: Cost Constrained Scenario

Revising Custom Constraints

Organizations may choose to use other constraints such as the sheer number of projects allowed through the pipeline at one time, or a maximum level of risk that may be considered acceptable. In this example, the additional P2 Total Cost is added as a constraint. The P2 Total Cost field represents a pessimistic estimate of the project cost, and may be used to assess how many projects may be selected without exceeding the defined management reserve.

To change the primary constraint, select the Modify option in the Metrics section of the analysis.

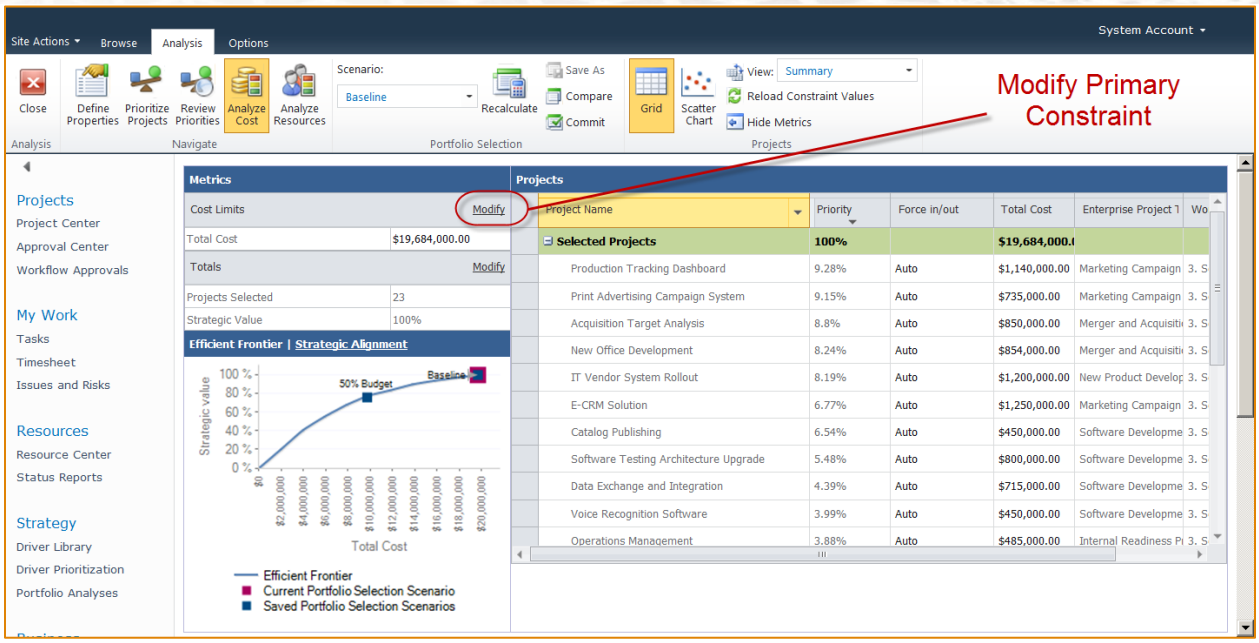


Figure 88: Modifying the Key Constraint

Select the new constraint from the list of available fields.

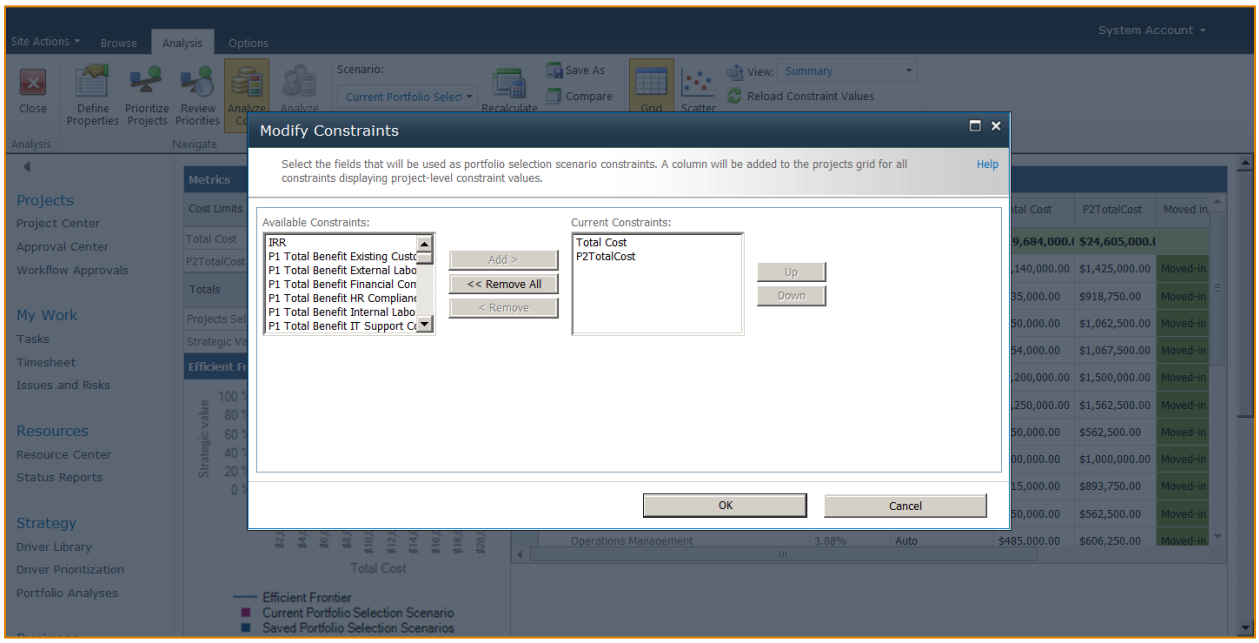


Figure 89: Adding the P2 Total Cost

Note that once the new constraint is added, the field appears in the main page.

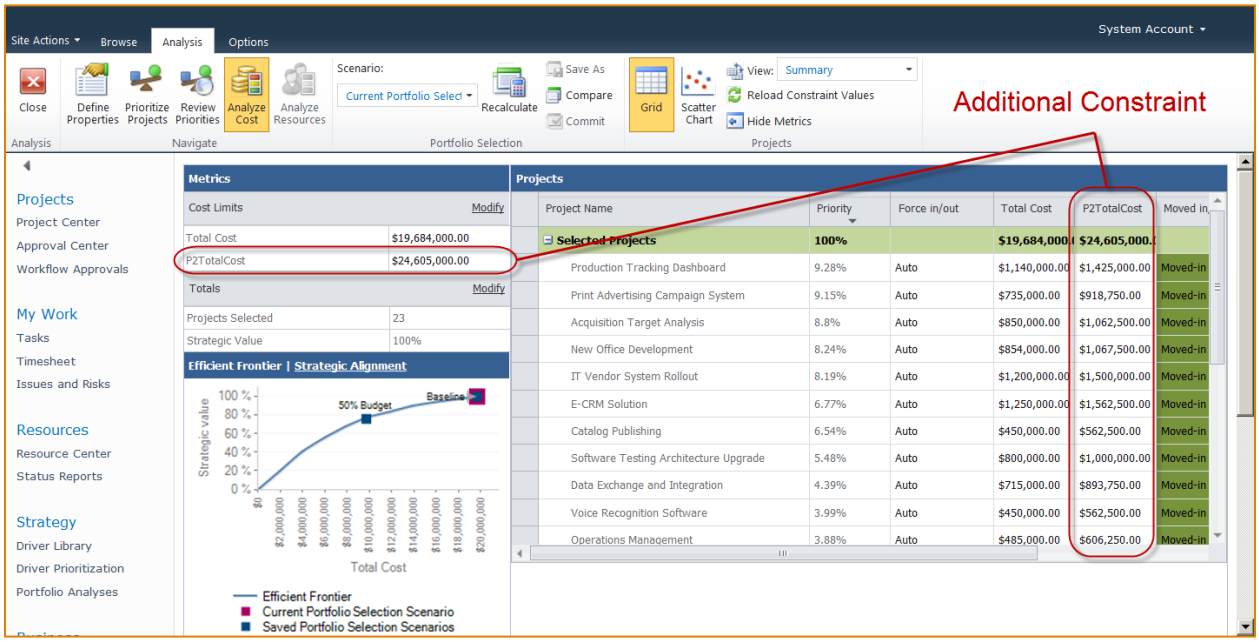


Figure 90: Adding a Second Constraint

The new field may be controlled in the same fashion as the primary constraint.

The same mechanism may be used to assist the user in defining a minimum threshold – or a barrier that must be met before the project is approved. In the below example, the Internal Rate of Return (IRR) has been added as a field. This is a number that is calculated externally to Microsoft Project.

In this case, the organization may have determined a minimum IRR or the hurdle rate to be 4%. Any project in the list under 4% may then be manually forced out of the analysis. Note that as of this writing, no automatic screening mechanism has been identified within Project Server 2010.

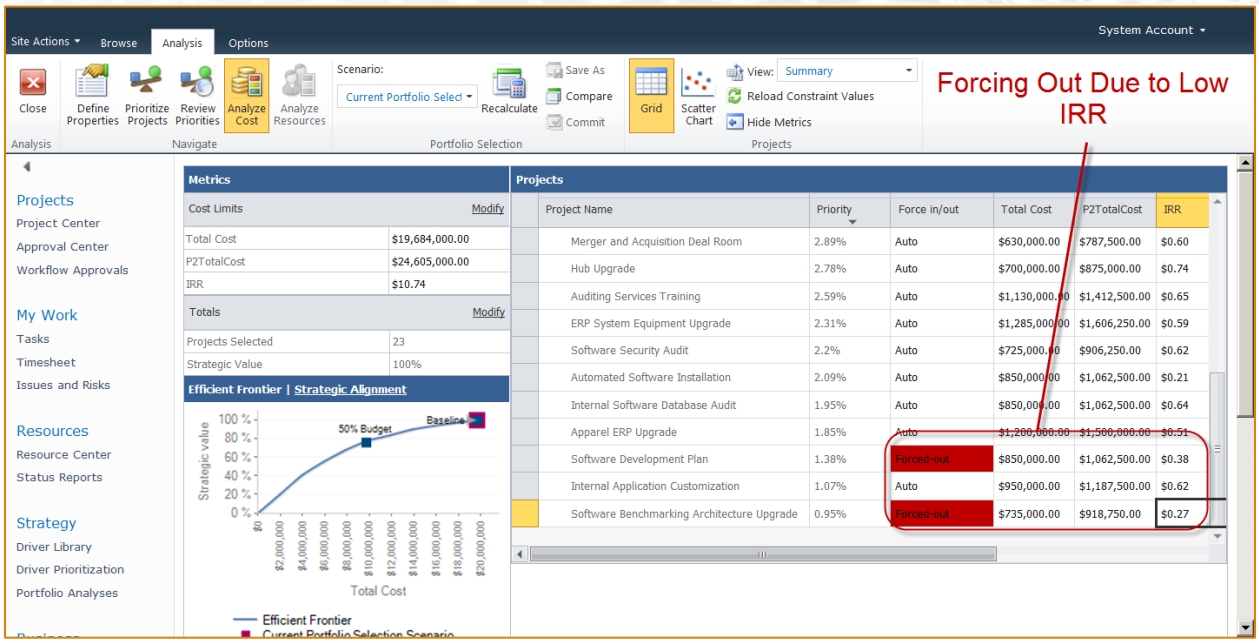


Figure 91: Screening the Portfolio

Enforcing Dependencies

As described on page 42, Project Server 2010 allows the definition of four kinds of dependencies.

Type	Description
Dependency	The primary project will not be selected unless all of the dependent projects have been selected. No specific execution sequence is implied by this dependency, simply an all or nothing selection mechanism. This dependency also does not imply that the primary project will be selected if all of the dependent projects are selected – only that the primary project will not be selected if all of the dependent projects have not been.
Mutual Inclusion	Either all projects are included, or all projects are excluded. Users should consider using this dependency in the scenario of program management, where each of the projects must be implemented to garner the benefits of the program.
Mutual Exclusion	This dependency may be used for multiple competing projects. The portfolio analysis process will select the most viable project based on cost and resource constraints. Once the viable selection has been made, all other competing projects will be excluded. Organizations should consider using this if multiple competing avenues to achieve the same goal have been identified – but only one is required.
Finish to Start	With Finish to Start dependencies, the user selects a primary project that must complete prior to the start of successor projects. This dependency does not imply the successor projects will be selected, but only sets the stage for the sequence in which they may be selected. Organizations should consider using this dependency in conjunction with the Mutual Inclusion dependency to ensure that all projects in a given sequence are a) selected, and b) selected in the appropriate sequence.

Table 10: Dependency Types

The Cost Analysis functionality as a non-timephased analysis only uses the first three dependency types. These three dependency types are not affected by the planned start date of the project. Finish to Start, as a timephased dependency, is not relevant to Cost Analysis, but is relevant to the Resource Analysis procedure that will be performed later.

To enforce dependencies within a specific scenario, click the Option ribbon from the top, and select the Enforce Dependencies check box.

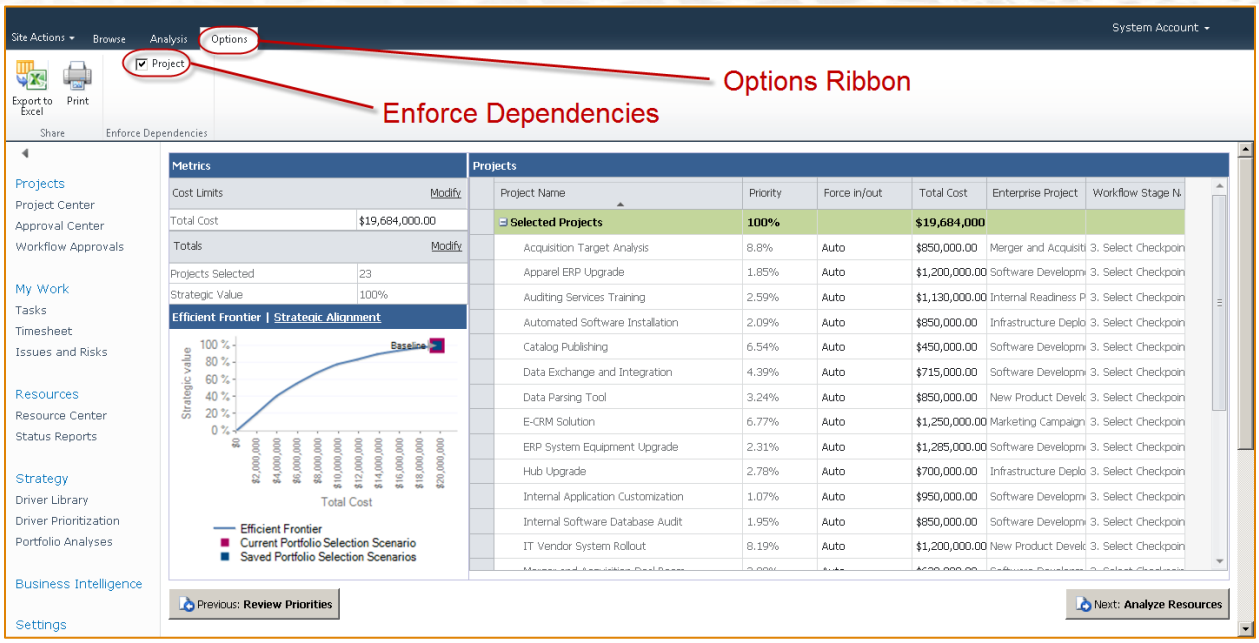


Figure 92: Enforcing Dependencies in Cost Analysis

Click the Recalculate button to recalculate the scenario with dependencies enforced.

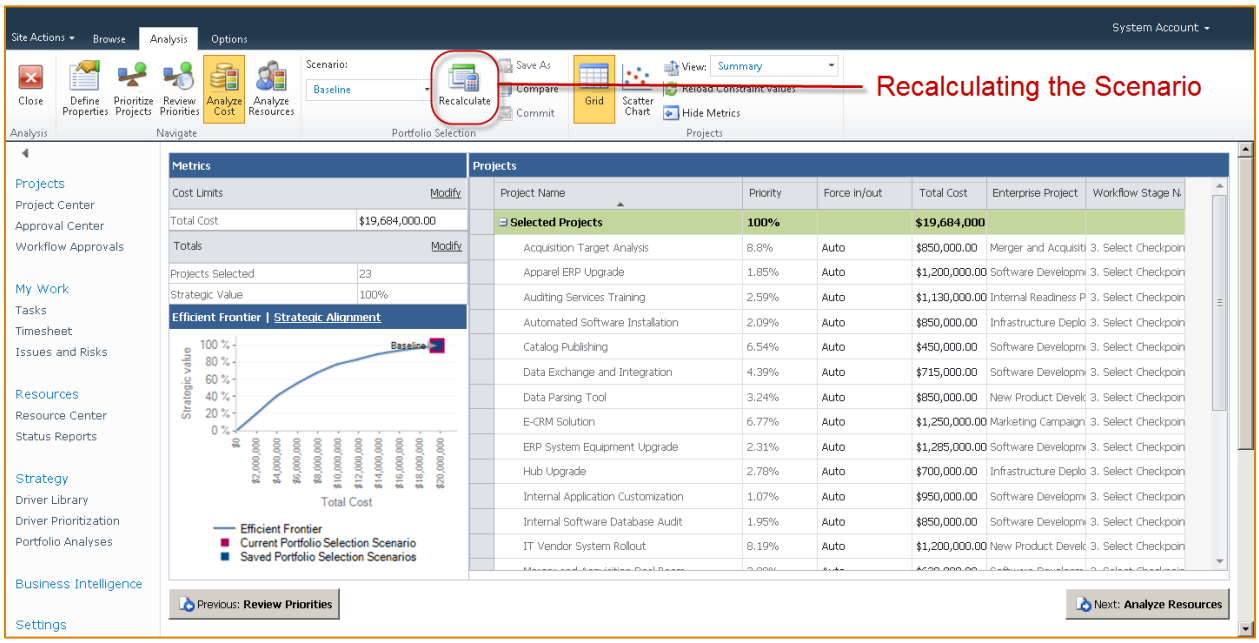


Figure 93: Recalculating the Scenario

When using dependencies, it is recommended that the user make a list or report of all dependencies configured to assess those that may be affecting the recalculated scenario. The reason to do this is that the calculation may not necessarily identify the specific dependency affecting the analysis. If no standard report of all dependencies exists, the user may have to comb through the dependency interface to identify the factors that may be affecting the analysis.

Forcing Projects In/Out

Specific projects may also be forced in or out of the specific scenario. Forcing projects in or out allows the organization to include specific projects required for regulatory or leadership preference reasons. Typically, forcing projects in or out may result in a scenario off of the efficient frontier curve as the revised portfolio drives a suboptimal resource allocation. A suboptimal resource allocation may still be acceptable to the organization, in which case, the efficient frontier may be used to illustrate the impact of decisions not in alignment with identified strategic drivers.

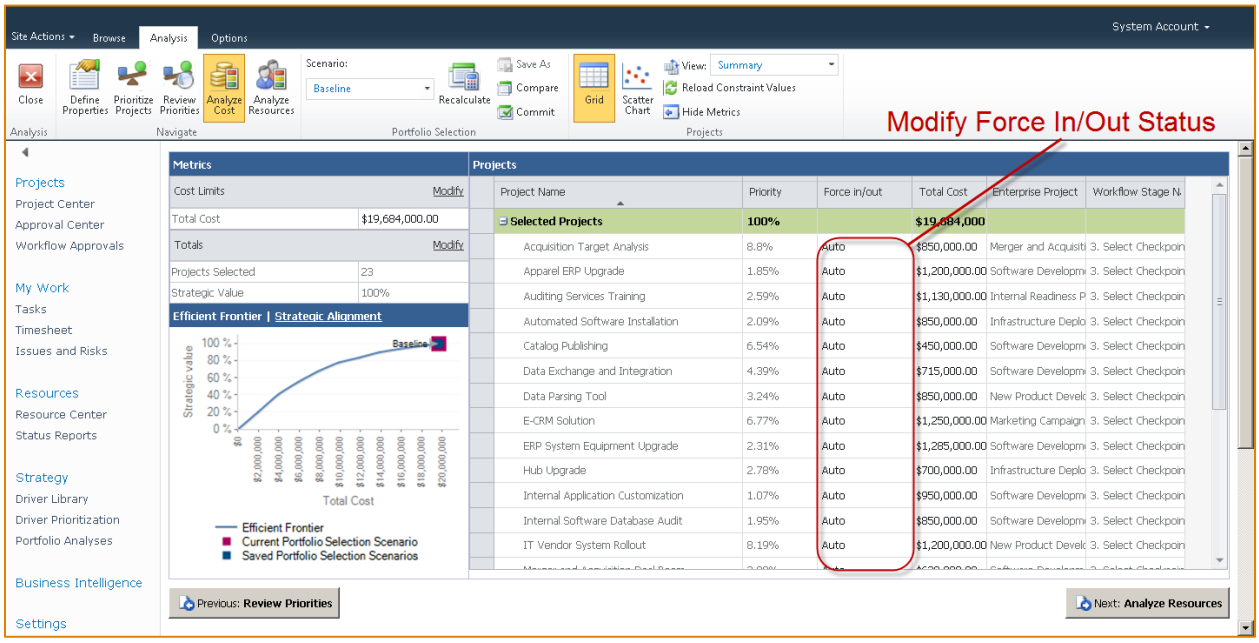


Figure 94: Forcing In/Out Projects

As Microsoft Project Server does not provide a method of filtering portfolios automatically, organizations may use the Force In/Out option to manually screen portfolios for projects not meeting specific criteria, such as NPV or IRR. Organizations using this feature to screen portfolios may consider adding aliases to the Force Out option such as “Insufficient IRR,” or “Negative NPV.”

Saving the Scenario

After performing what-if analysis, the Analyze Resources button will be greyed out until the specific scenario has been saved.

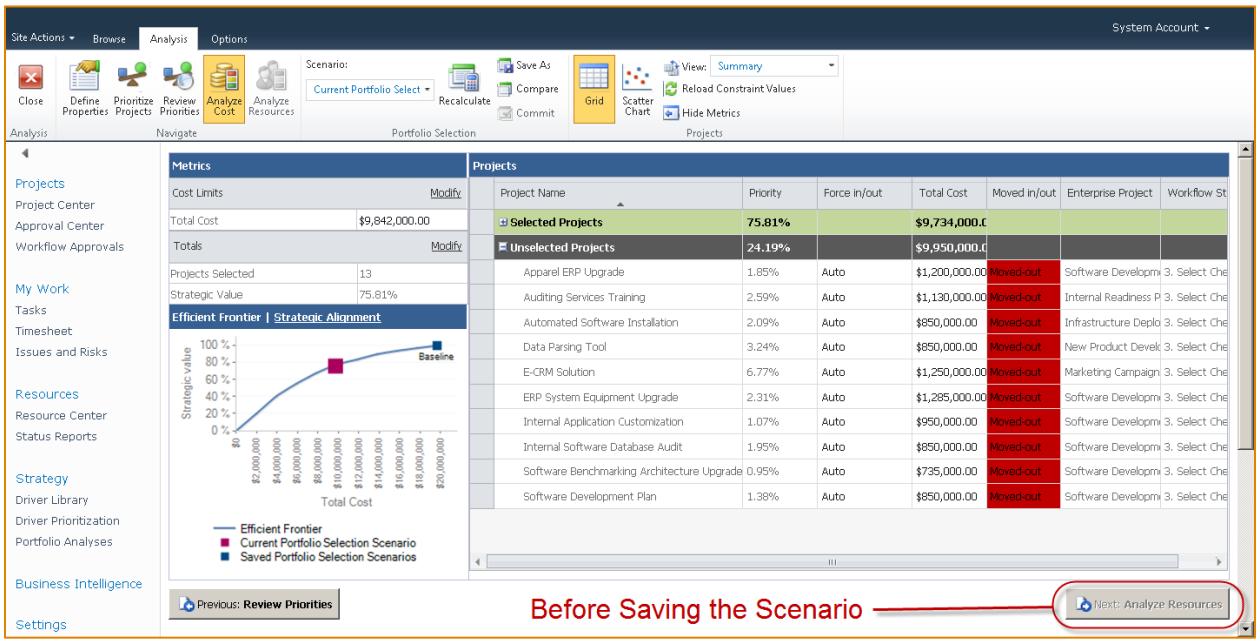


Figure 95: Inactive Analyze Resources Button

Save the scenario by clicking on the Save As button in the Analysis ribbon.

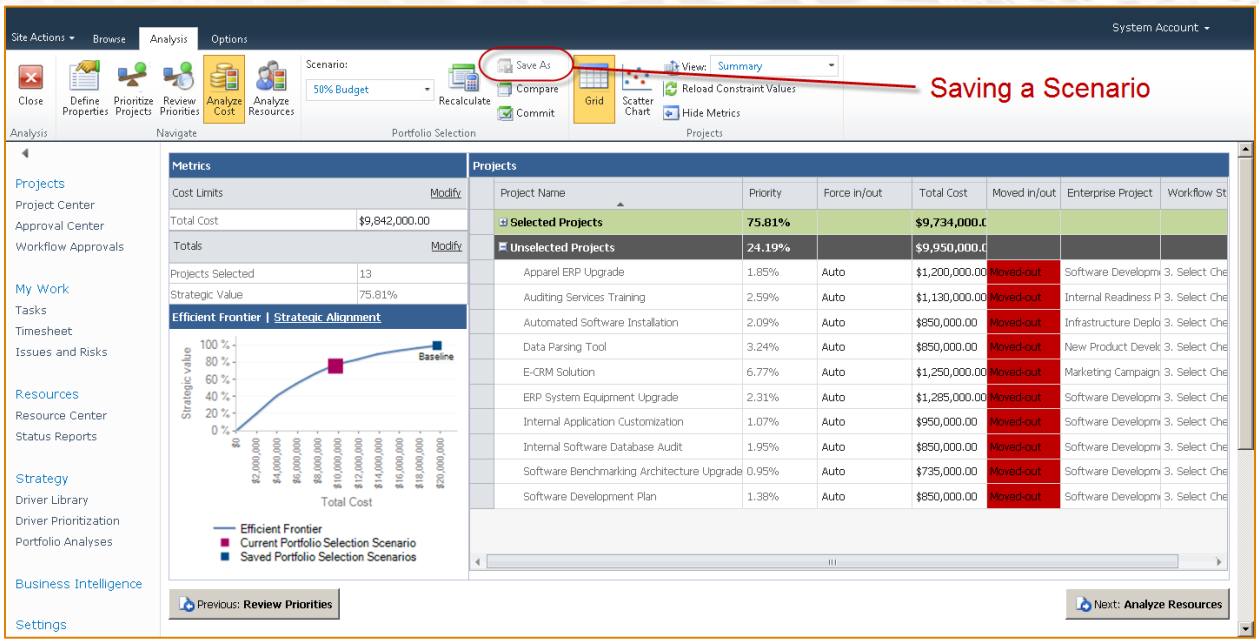


Figure 96: Saving the Scenario

The scenario is added to the list of scenarios in the Portfolio Analysis page.

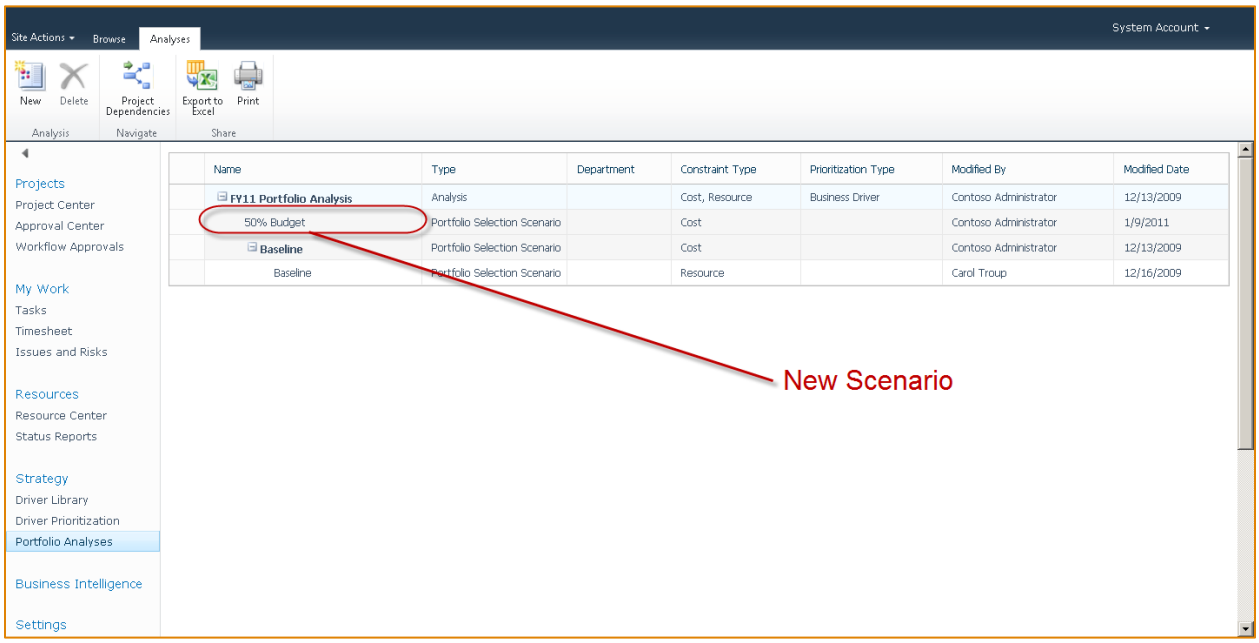


Figure 97: The Newly Added Scenario

Scenarios are listed on this page in alphabetical order. Organizations may consider developing a standard naming convention for scenarios to ensure traceability during the analysis process.

Once the scenario has been saved, the Analyze Resource button will be active again. The system may now create a new Resource Analysis as a subset of the saved scenario.

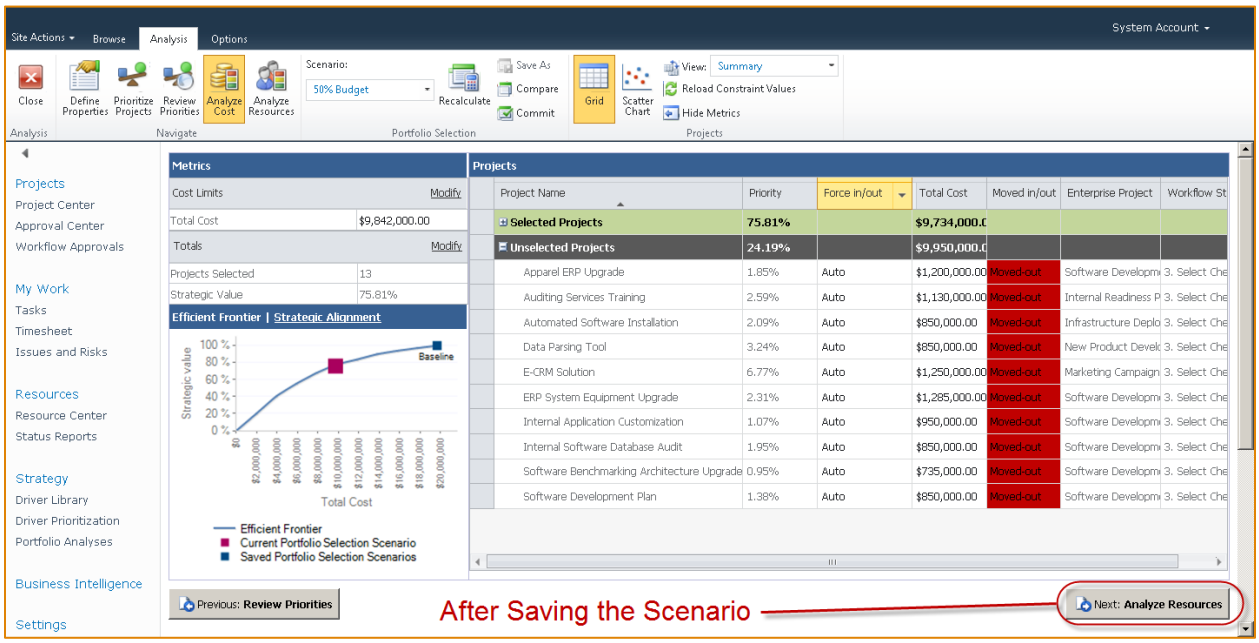


Figure 98: Active Analyze Resources Button

Note the difference between saving a scenario and committing a scenario:

Action	Description
Saving a Scenario	The scenario is saved for comparison against other scenarios. No project fields are modified.
Committing a Scenario	The selected scenario is chosen, and up to 6 project level custom fields are populated. If custom workflows have been deployed, the commit process may initiate specific steps within the workflow. For more on committing scenarios, refer to page 88.

Table 11: Committing vs. Saving a Scenario

Comparing Scenarios

Once the scenario has been saved, it may be compared with other scenarios in the same analysis.

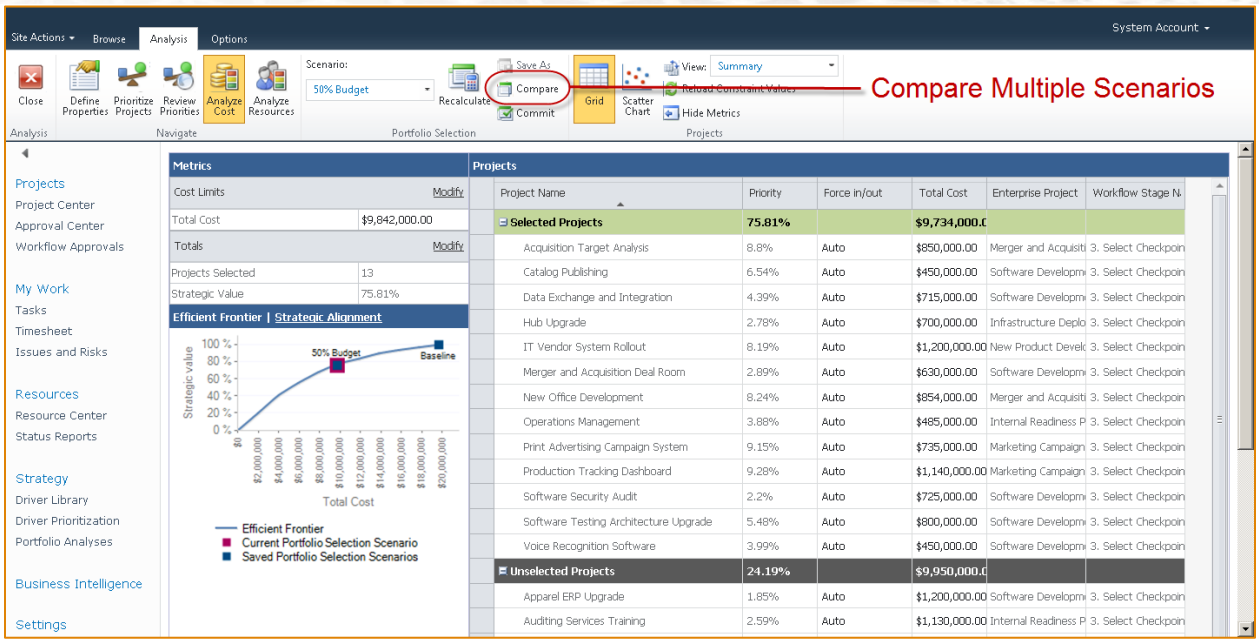


Figure 99: Navigating to the Compare Scenario Page

The Compare Scenario page displays specific elements of each scenario.

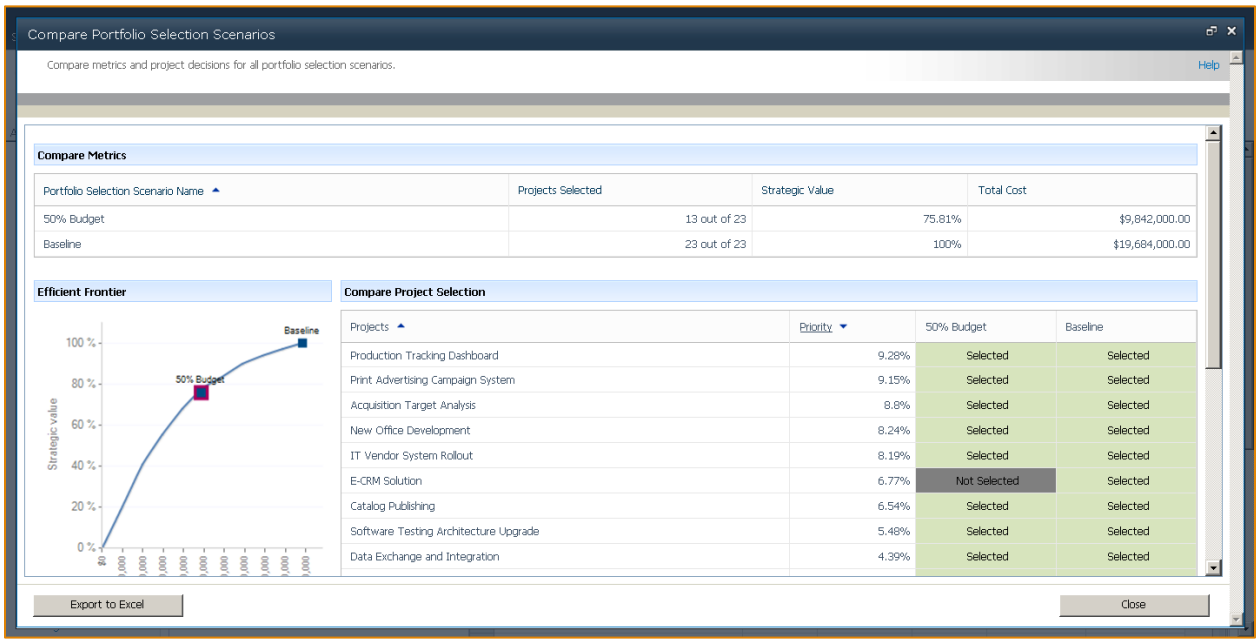


Figure 100: The Compare Scenario Page

The efficient frontier calculation will not display when comparing both cost and resource constrained scenarios. The resource constrained scenarios are plotted from a subset of the projects already selected in the Cost Analysis function. As a result, the efficient frontier for Resource Analysis is based on a different definition of 100% strategic value for the organization.

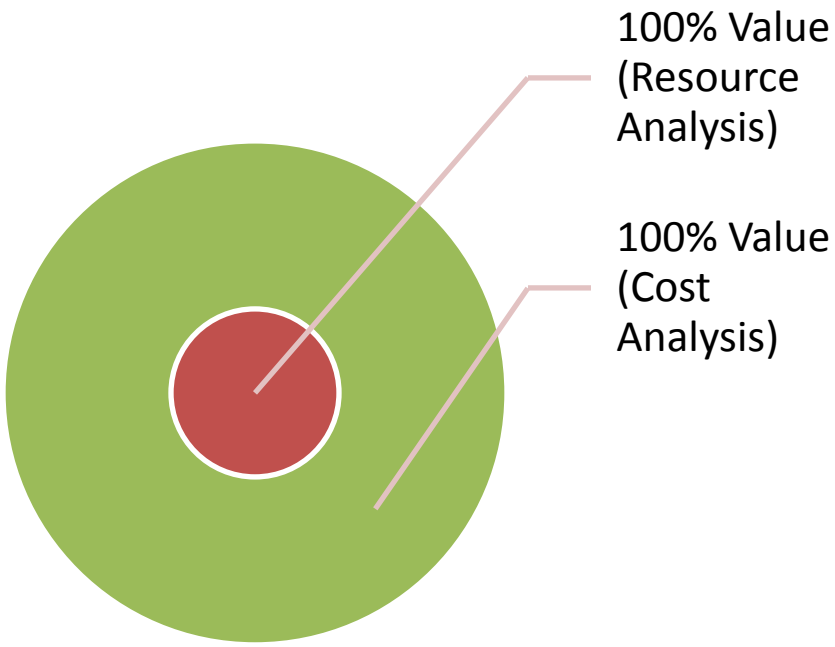


Figure 101: Comparing Cost and Resource Analysis Values

Committing the Scenario

Upon completing the Cost Analysis process, the user may opt to commit the selected scenario. The Commit button is available on the Analysis ribbon.

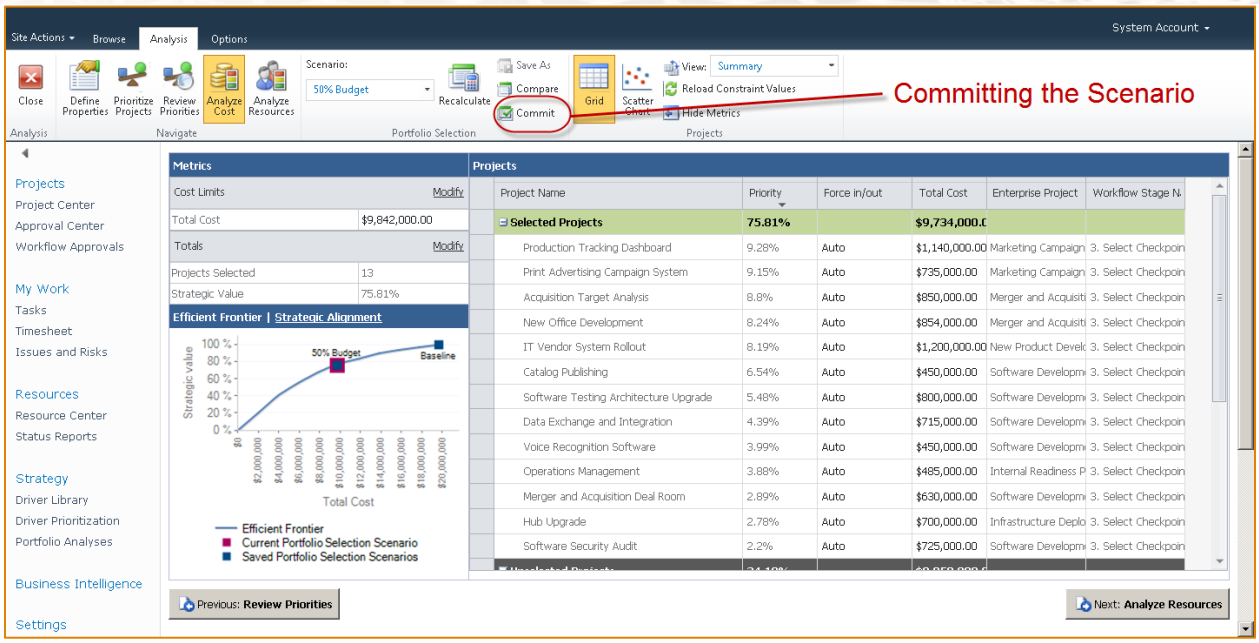


Figure 102: Committing the Scenario

The Commit button triggers the population of a total of six project level fields. Only two of those fields are relevant to the Cost Analysis functionality.

1. Committed Portfolio Selection Decision (Cost)
2. Committed Portfolio Selection Decision Date (Cost)

Those fields perform the following functions:

Field	Description
Committed Portfolio Selection Decision (Cost)	Shows the result of a cost constraint analysis on a project. Options available include Selected, Unselected, Forced In, Forced Out, or Custom Forced In/Out.
Committed Portfolio Selection Decision Date (Cost)	Shows the commitment date of a Portfolio Selection Scenario as determined during cost constraint analysis.

Table 12: Project Level Committed Fields

An additional four project fields are committed after the Resource Analysis process. For more information on committing the selected scenario after performing the Resource Analysis, refer to page 119.

7. Performing Resource Analysis

After completing the Cost Analysis process, the organization is left with a subset of the total project list that has been deemed feasible to execute within the defined constraints. The Resource Analysis functionality allows the organization to further explore constraints by mapping the remaining selected projects to the available resource pool, assessing timephased resource requirements against timephased resource availability.

The resource analysis scenarios constitute the further definition of the specific cost analysis scenario, and should be considered a further refinement of the saved scenario.

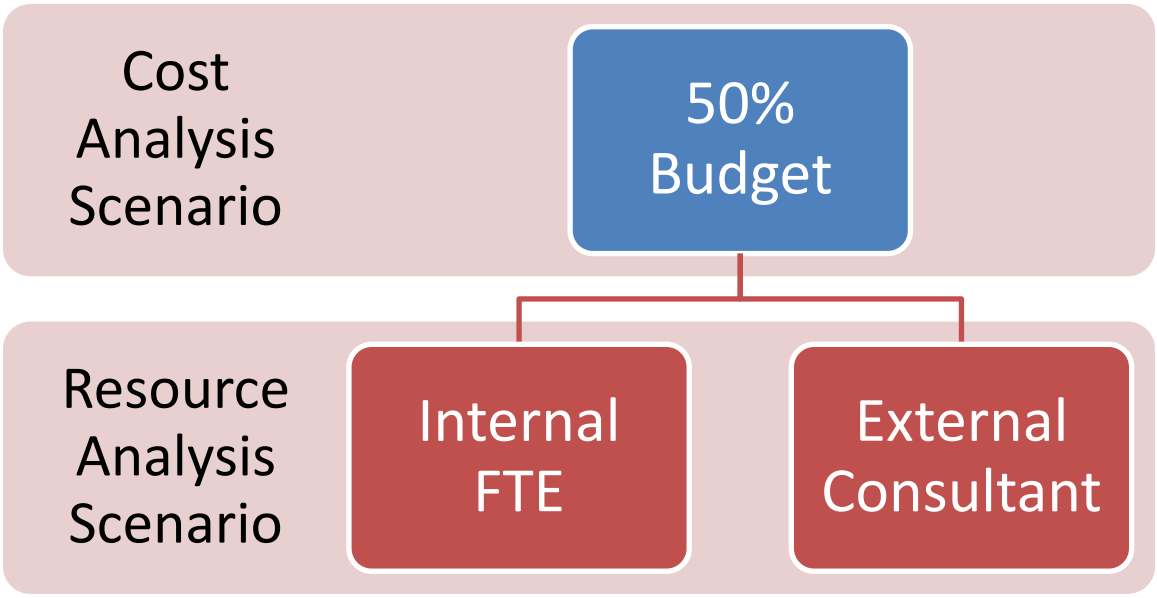


Figure 103: Analysis Scenario Structure

The Resource Optimization Calculation

Initially, the baseline resource analysis calculation consists of the selected projects from the cost analysis process measured against the available resource pool.

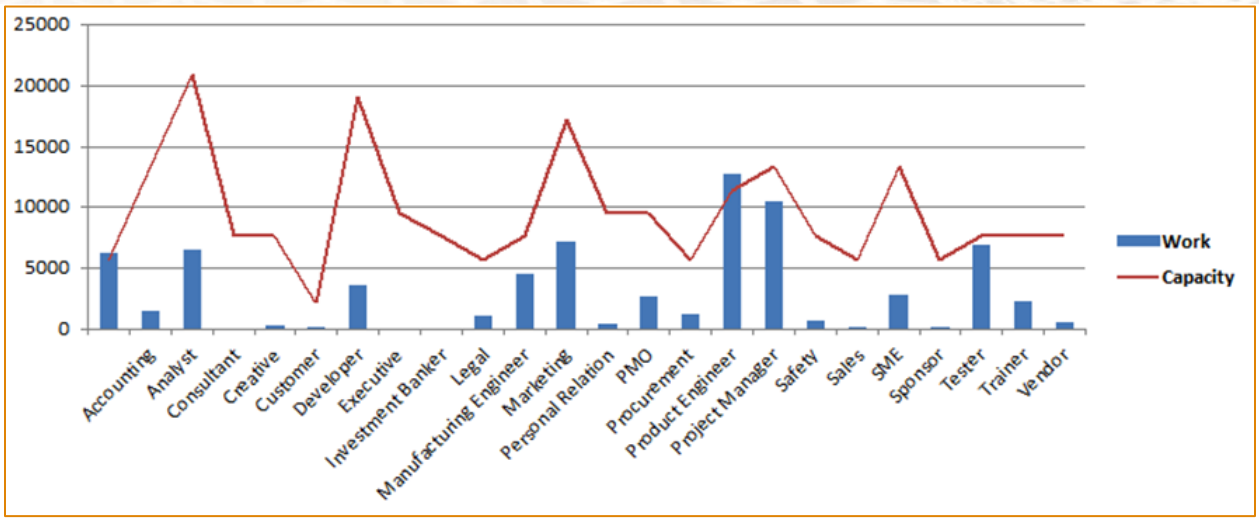


Figure 104: Resource Capacity by Role (Sample Excel Report)

Projects are staffed on a first come first serve basis, in order of priority. Hence, the top ranked project will be decremented against the available resource pool. Afterwards, the second highest ranked project will be decremented against the remaining resources….and so on and so forth. If a project exceeds the total available supply of resources within any specific time period, the project is excluded from the selection.

Below is a sample report of the role-based capacity within a sample database:

	Quarter1	Quarter2			Quarter3			Quarter4	
Row Labels		April	May	June	July	August	September	October	November
Accounting	1024	352	336	352	352	352	352	336	352
Analyst	2048	704	672	704	704	704	704	672	704
Consultant	512	176	168	176	176	176	176	168	176
Customer	0	0	0	0	0	0	0	0	0
Developer	512	176	168	176	176	176	176	168	176
Investment Banker	512	176	168	176	176	176	176	168	176
Manufacturing Engineer	512	176	168	176	176	176	176	168	176
Personal Relation	512	176	168	176	176	176	176	168	176
PMO	512	176	168	176	176	176	176	168	176
Procurement	512	176	168	176	176	176	176	168	176
Product Engineer	512	176	168	176	176	176	176	168	176
Sales	512	176	168	176	176	176	176	168	176
SME	1024	352	336	352	352	352	352	336	352
Tester	512	176	168	176	176	176	176	168	176

Figure 105: Timephased Resource Capacity (By Role)

Project Server 2010 compares these numbers to the aggregated demand of each project for resource roles within each time period.

The saved cost analysis scenario from the previous section, when assessed from an enterprise resource availability perspective, yields the following results. The projects marked as "Not Selected" exceeded the available resource supply within a specific time period.

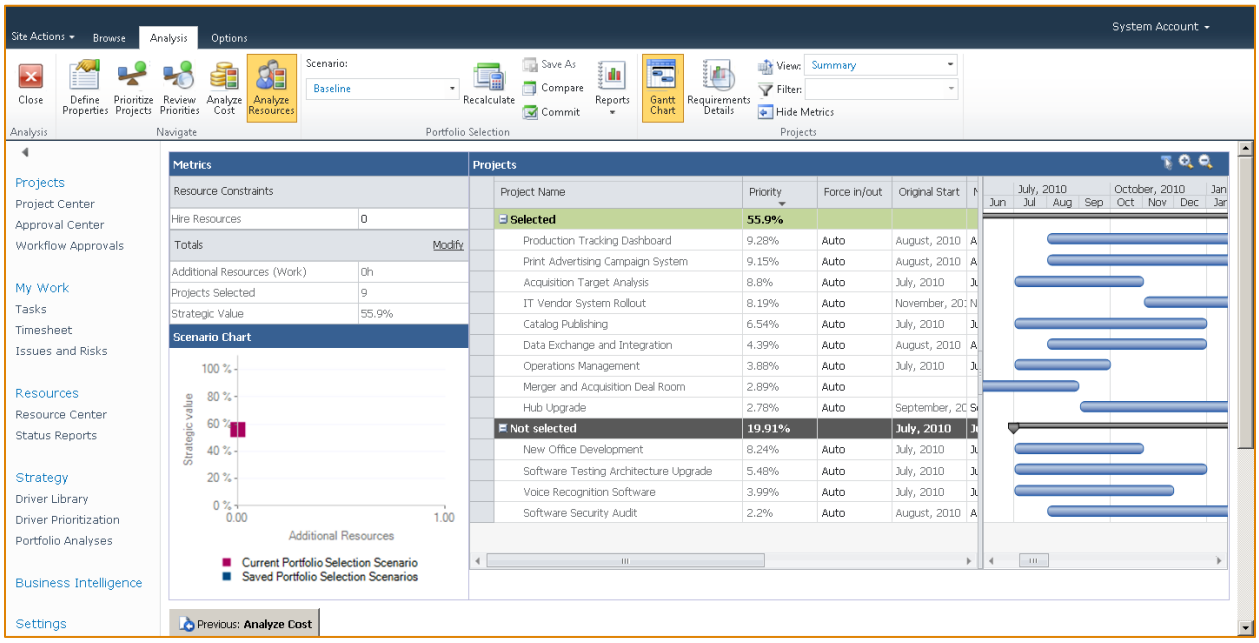


Figure 106: Resource Analysis Baseline

In the portfolio analysis summary page, the baseline resource analysis is automatically saved.

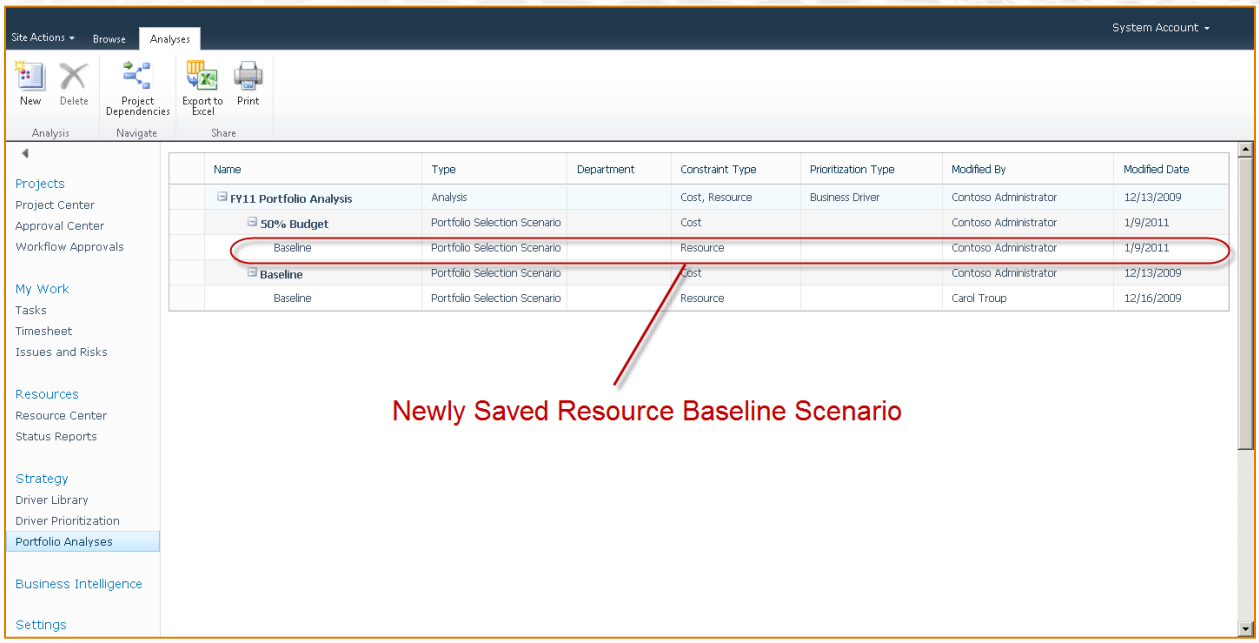


Figure 107: Reviewing the Saved Scenarios

The Requirements Details View

The Requirements Details view allows users to examine the calculated scenario in more detail.

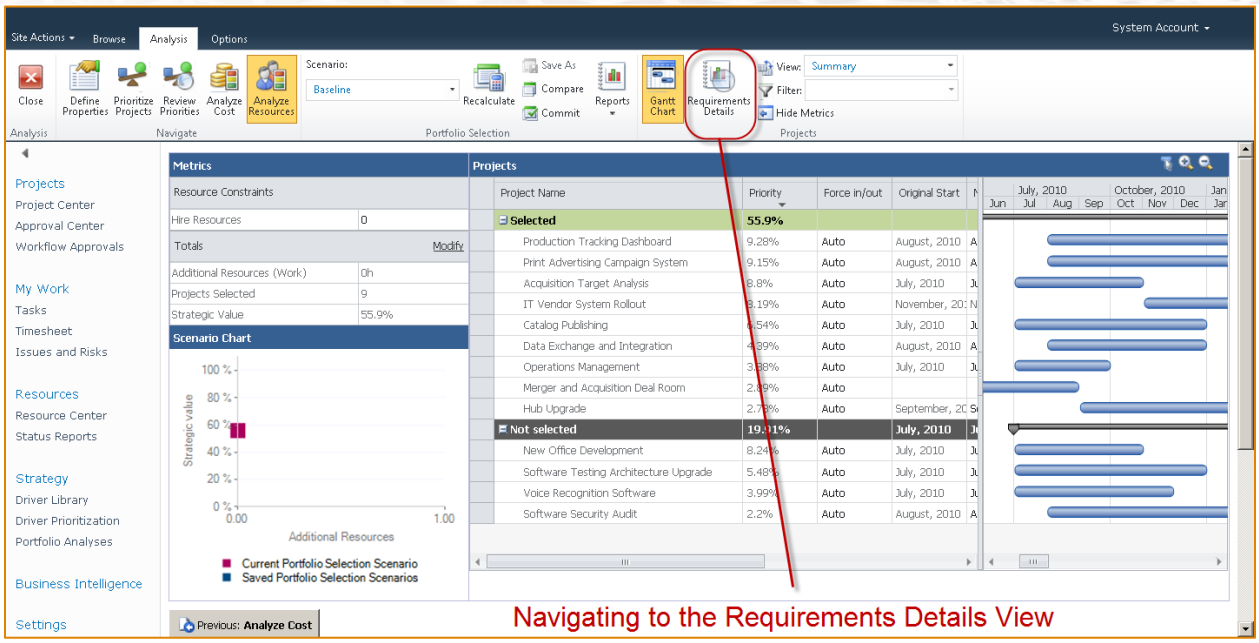


Figure 108: Navigating to the Requirements Detail View

The Requirements Details view only displays the scenario information based on the default resource profile. This view does not recalculate based upon the addition of incremental resources as part of the process of performing what-if analysis.

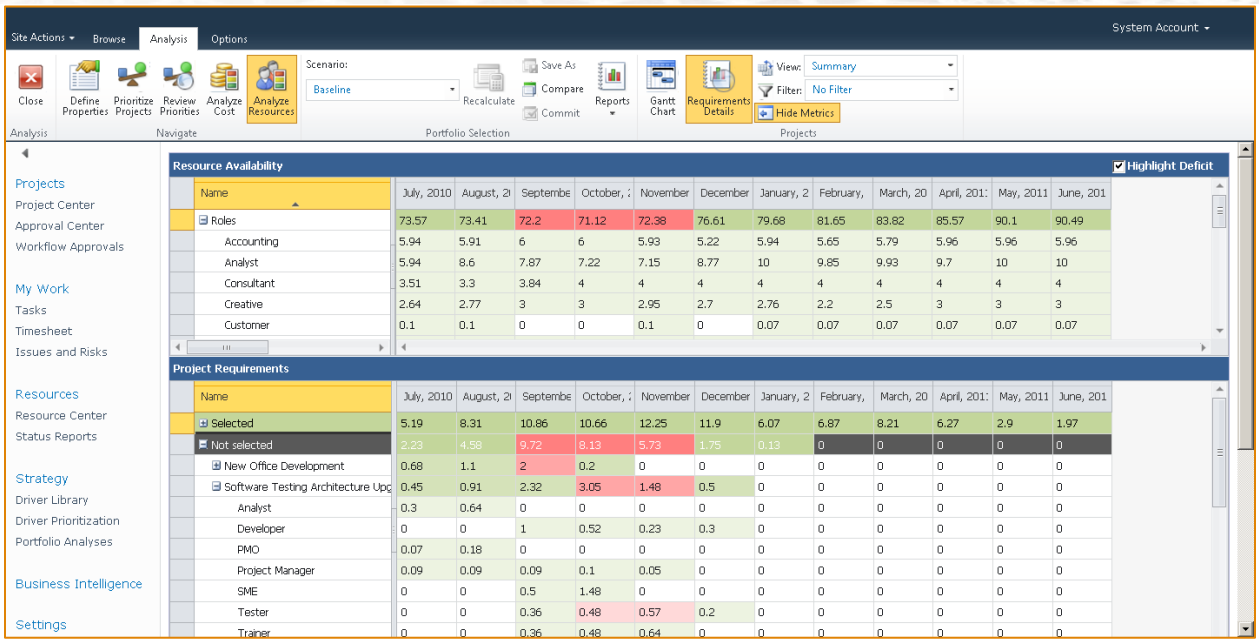


Figure 109: The Requirements Detail View

Many of the settings on the Options ribbon are inactive when the Requirements Details view is displayed. Users must return to the Gantt Chart and change key parameters to perform what-if analysis.

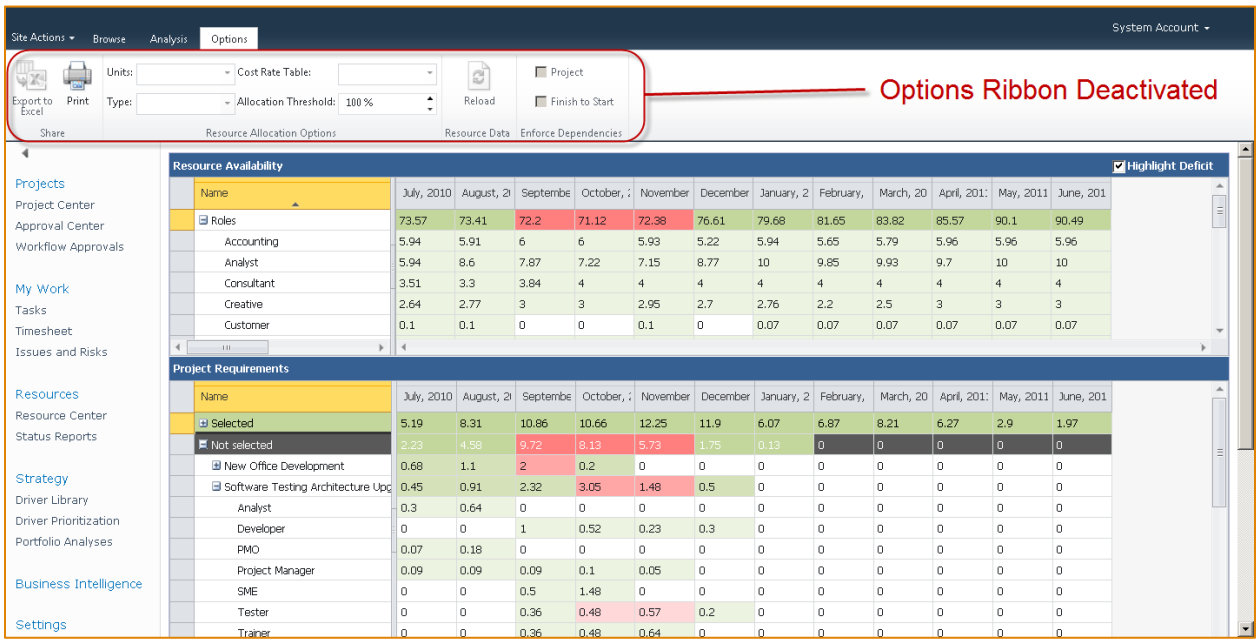


Figure 110: Inactive Options Ribbon

The Resource Availability section at the top of the page is derived from the enterprise resource capacity figures. The values as displayed are already decremented by the demand profile of the projects excluded when the portfolio analysis was originally created.

If the Highlight Deficits option is selected, specific cells will be highlighted in red. This view does not display the specific shortfall for the flagged projects, but rather indicates those time periods when the requirements exceed the supply.

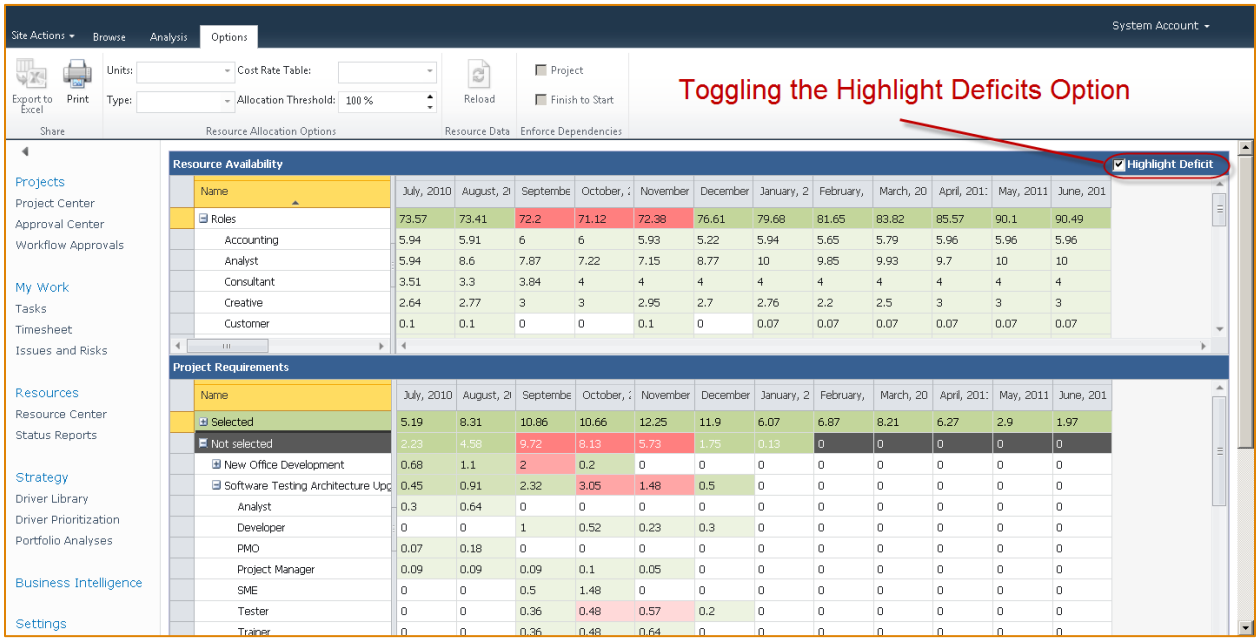


Figure 111: Highlighting Resource Deficits

For a more detailed review of the specific deficit for each project, the user may refer to the Deficits and Surplus Report accessible under the Reports tab in the Analysis ribbon.

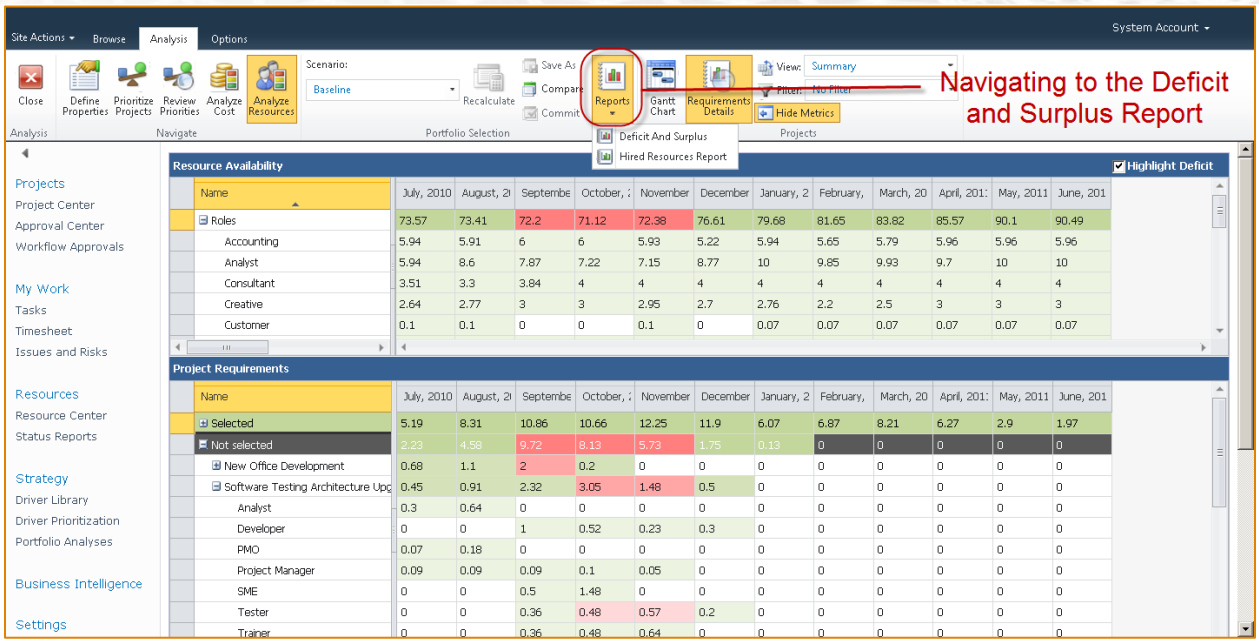


Figure 112: Navigating to the Deficit and Surplus Report

Users may slide the divider bar on the Project Requirements section to the right to expose project level fields.

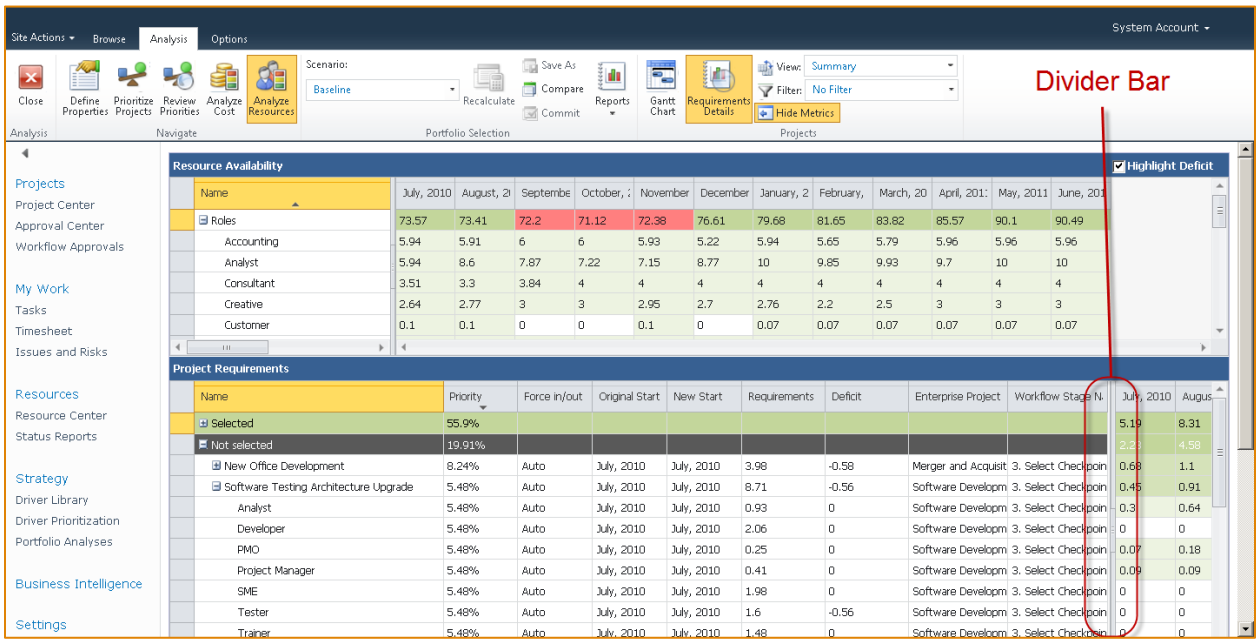


Figure 113: Exposing Project Level Fields

These fields may not be edited on this page. The user must return to the Gantt Chart to modify the editable fields.

Field	Description
Priority	The priority of the project as defined in the project prioritization interface.
Force In/Out	Displays the forced status of the project.
Original Start	The start date of the project as scheduled in the project plan.
New Start	The revised start date as determined by the user after performing resource analysis. This field is editable within the Gantt Chart view.
Requirements	The Requirements field represents the total man-month (or man-quarter) requirements for the project or role. The system calculates the requirement for each specified time period, and then sums up the row to determine the Requirements field.
Deficit	The Deficit field represents the total man-month (or man-quarter) deficits incurred by the project or role. The system calculates the deficit for each specified time period, and then sums up the data to determine the Deficit field. This view does not display the actual deficits for each time period. That data is displayed in the Deficit and Surplus report.

Table 13: Key Field Definition

The following illustration demonstrates how the Requirements field is calculated. Each of the resource requirements within a specific time period are summed and then totaled into the Requirements field. A value of “2.6” in this context means that the project has a total shortfall of 2.6 FTE months for the duration of the analysis.

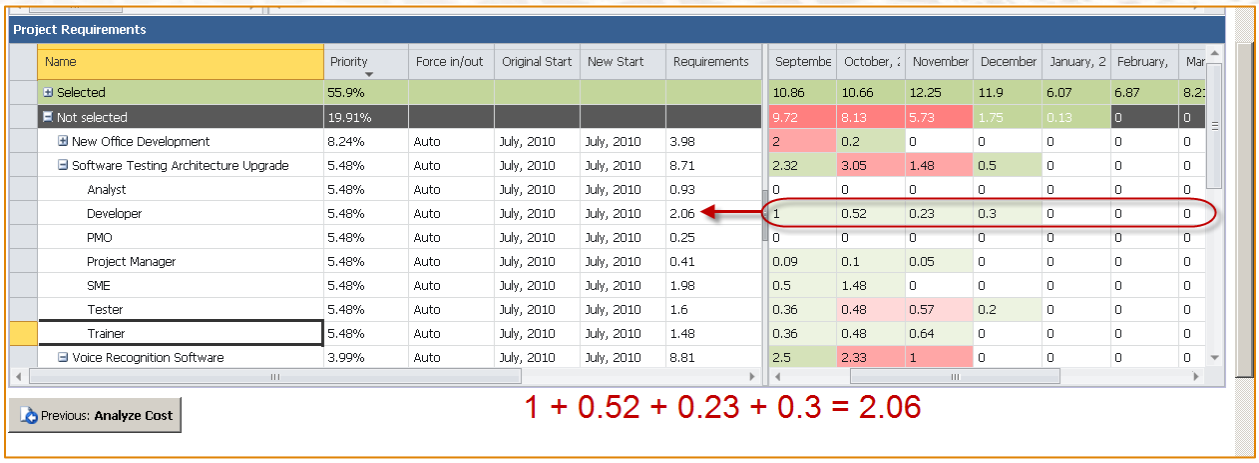


Figure 114: Defining the Requirement Field

The Deficit field is calculated as the sum of the deficit for each time period. The source data for this calculation is not displayed in the Requirements Details view.

The Deficit and Surplus Report

Project Server 2010 provides two reporting views to support the Resource Analysis function: the Deficit Surplus Report and the Hired Resources Report.

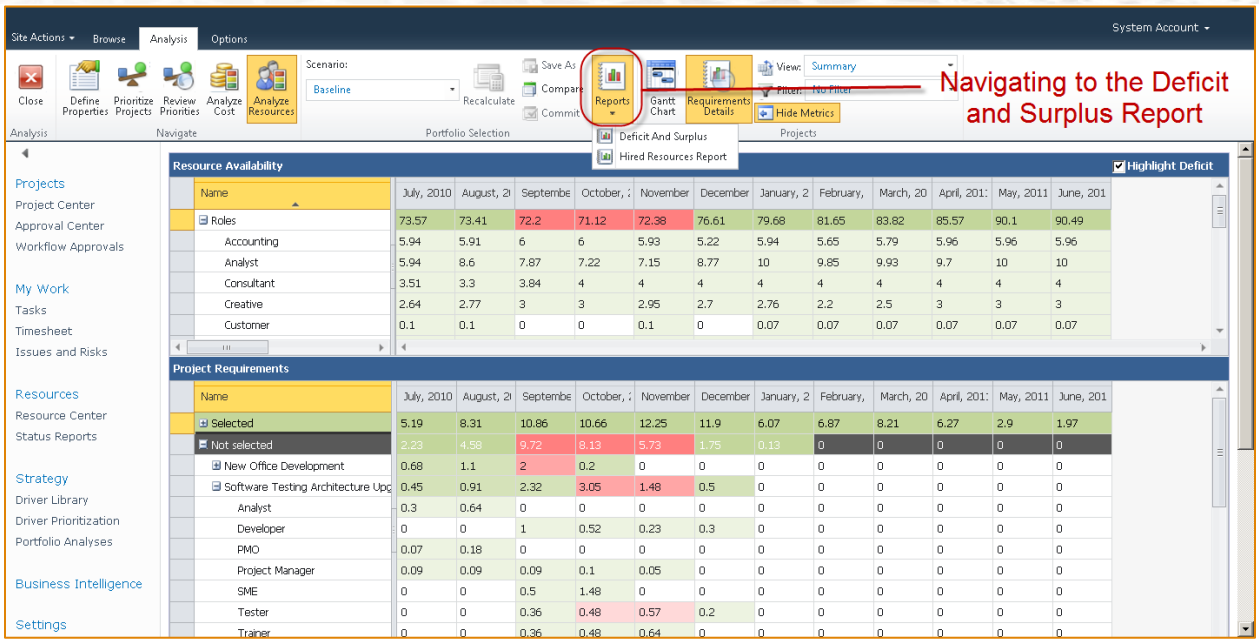


Figure 115: Navigating to the Deficit and Surplus Report

The Deficit and Surplus Report is calculated by taking the timephased availability values for the enterprise resource pool and then subtracting out the timephased resource requirements for the projects in the portfolio. The resulting numbers indicate either the surplus or deficit for each role.

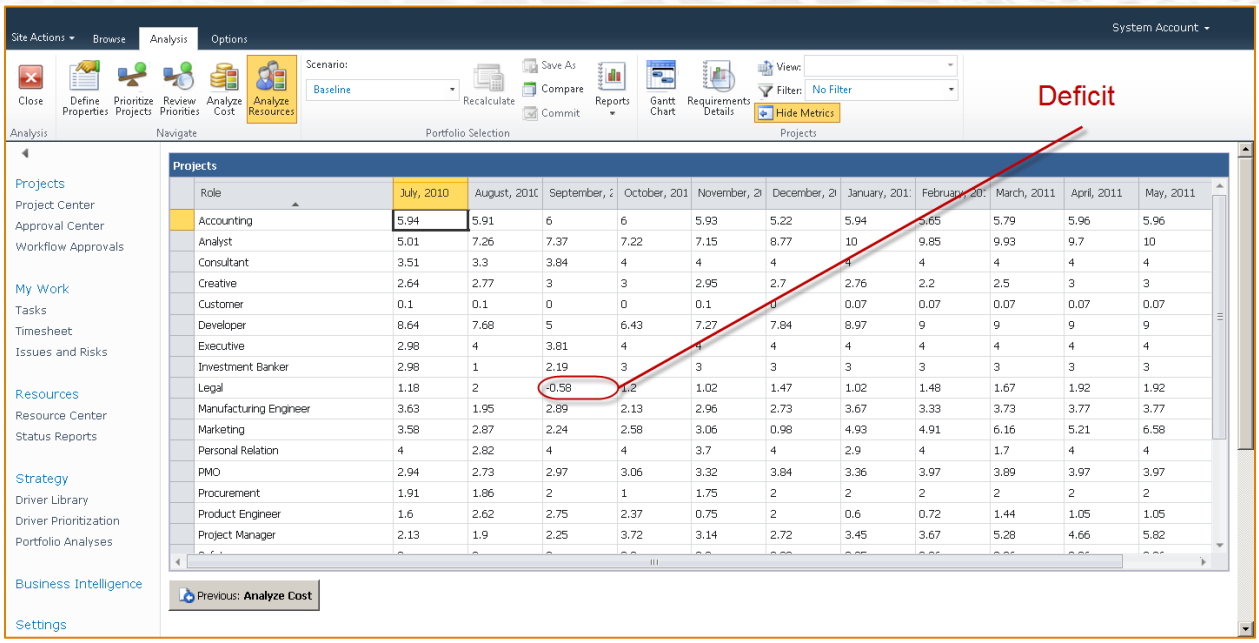


Figure 116: The Deficit and Surplus Report

Unlike the Requirements Detail view which only includes the base resource supply, the Deficit and Surplus Report also includes any additional resources included as part of the what-if analysis process. As a result, if organizations choose to use the incremental resource calculations, the Deficit and Surplus Report may display the unintended resource surpluses caused – and perhaps provide an opportunity to assess opportunities to add other projects to absorb the extra capacity.

The Hired Resources Report

The Hired Resource Report is the other Resource Analysis report available under the Reports button on the Analysis ribbon.

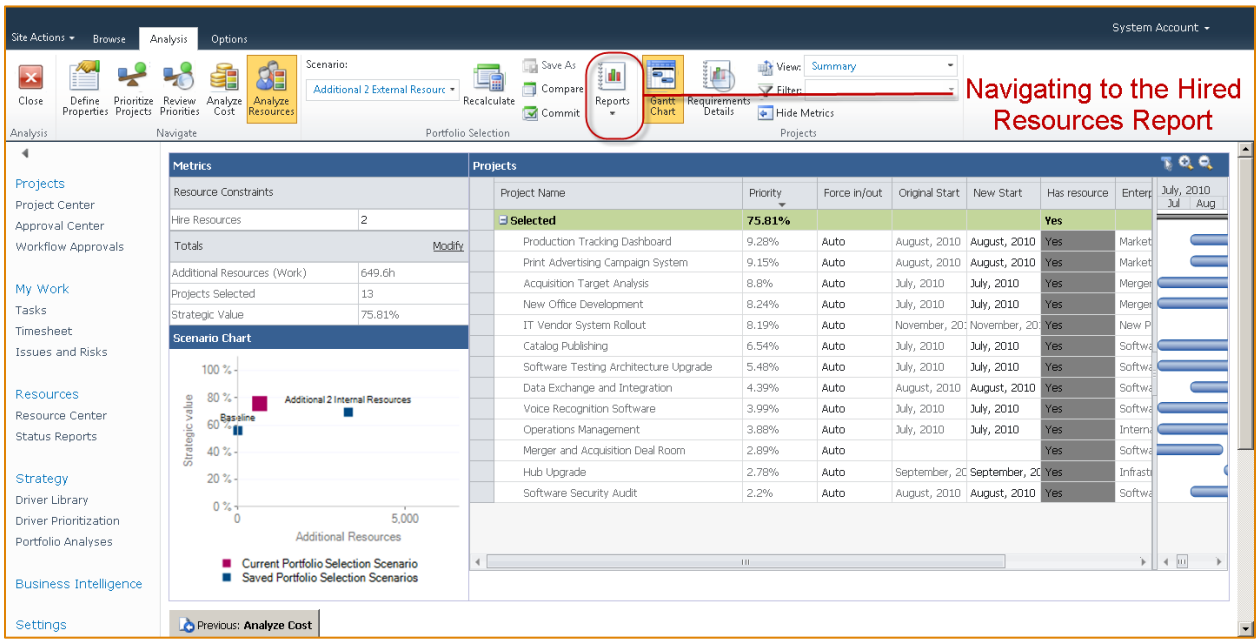


Figure 117: Navigating to the Hired Resources Report

The Hired Resources report identifies each of the resource gaps and then displays the key details about the resource hired to fill those gaps.

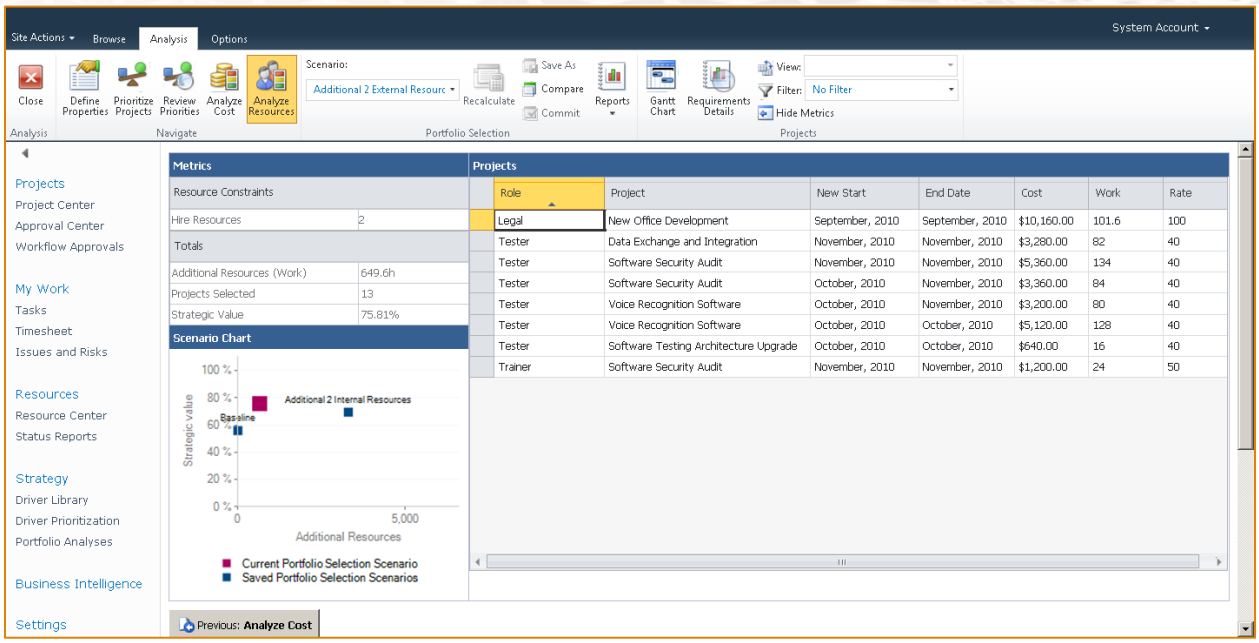


Figure 118: The Hired Resources Report (External Resource)

In the above example, the following fields are displayed:

Field	Description
Role	The role required to fill the specific resource gap as defined by the custom resource field identified for role definition.
Project	The project requiring the resource.
New Start	The start date of the resource.
End Date	The end date of the resource. The end date for external resources will be the end of the specific resource gap. The end date for internal resources will be the ending date of the planning window as defined when the analysis was created.
Cost	Cost is defined as Work X Rate, with the rate defined below.
Work	The number of hours that the resource will work between the New Start and the End Date. For internal resources, the number of hours may not be dedicated to a project, but may represent “bench” time after the resource shortfall has been resolved.
Rate	The rate is the average standard rate of all resources in the resource pool mapped to the specific required role, using the rate table cost designated in the Options ribbon.

Table 14: The Hired Resources Report Fields

The following example displays the same calculations with internal resources and not external resources. Internal resources are hired at the beginning of the resource gap and kept on staff throughout the remaining period of the specific portfolio analysis.

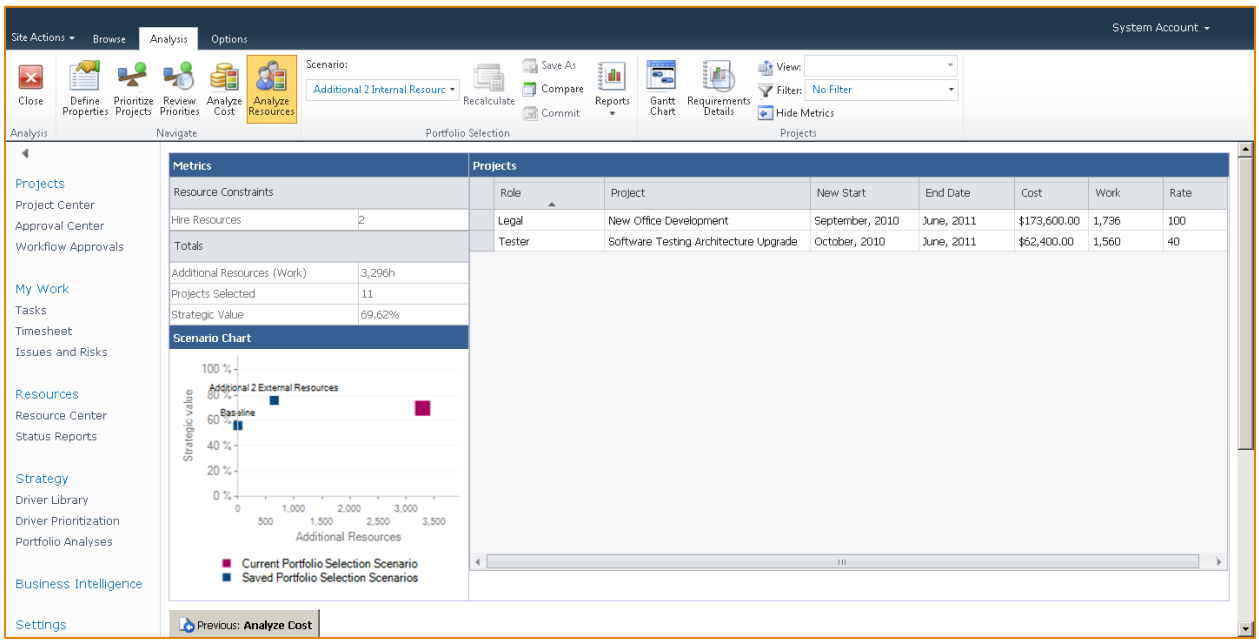


Figure 119: The Hired Resources Report (Internal Resource)

Performing What-if Analysis

Like the Cost Analysis functionality, the Resource Analysis functionality allows the user to perform what-if analysis on the projects within the scenario. Resource Analysis allows users to toggle scheduling and resource information to optimize the portfolio.

The following variables may be modified to assess the impact on the overall portfolio:

- Forcing Projects In/Out
- Project Dependencies
- Project Start Dates
- Incrementally Adding Cost
- Incrementally Adding Resources

Most of these options may be controlled on the Options ribbon:

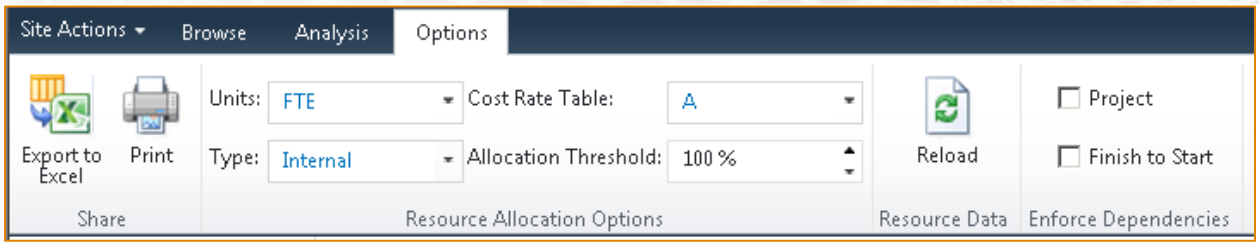


Figure 120: The Options Ribbon

The project start dates may only be modified in the Gantt Chart view. For more information on changing the project start date, refer to page 108.

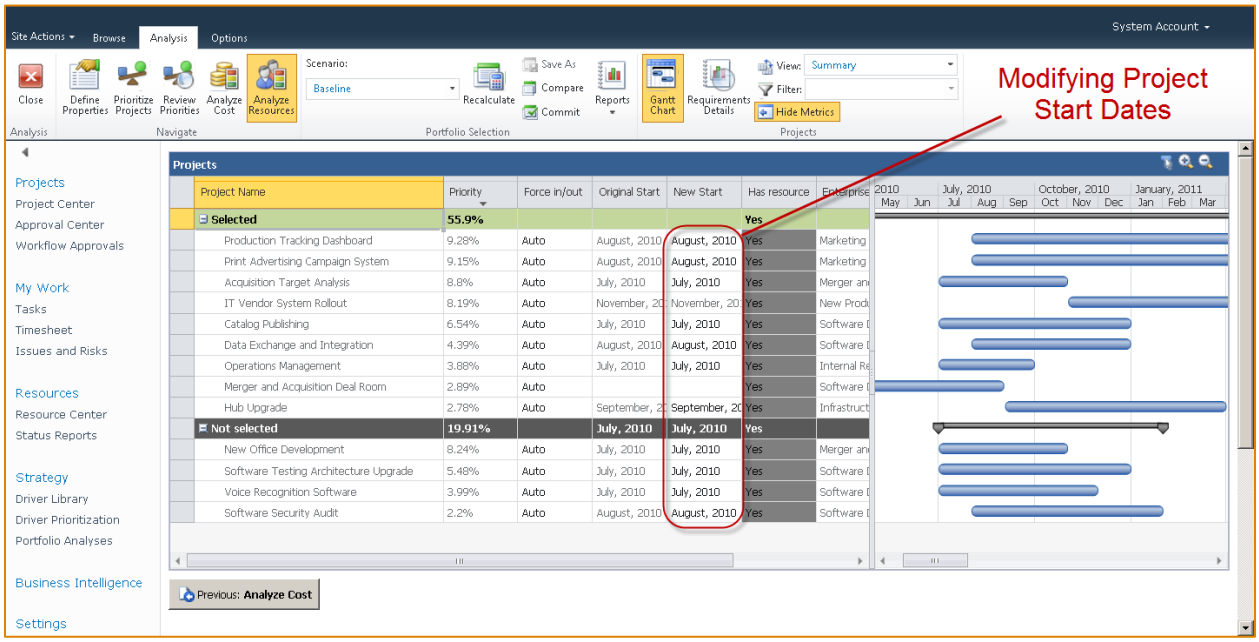


Figure 121: Modifying Project Start Dates

The user must click the Recalculate button on the Analysis ribbon after changing any of these variables.

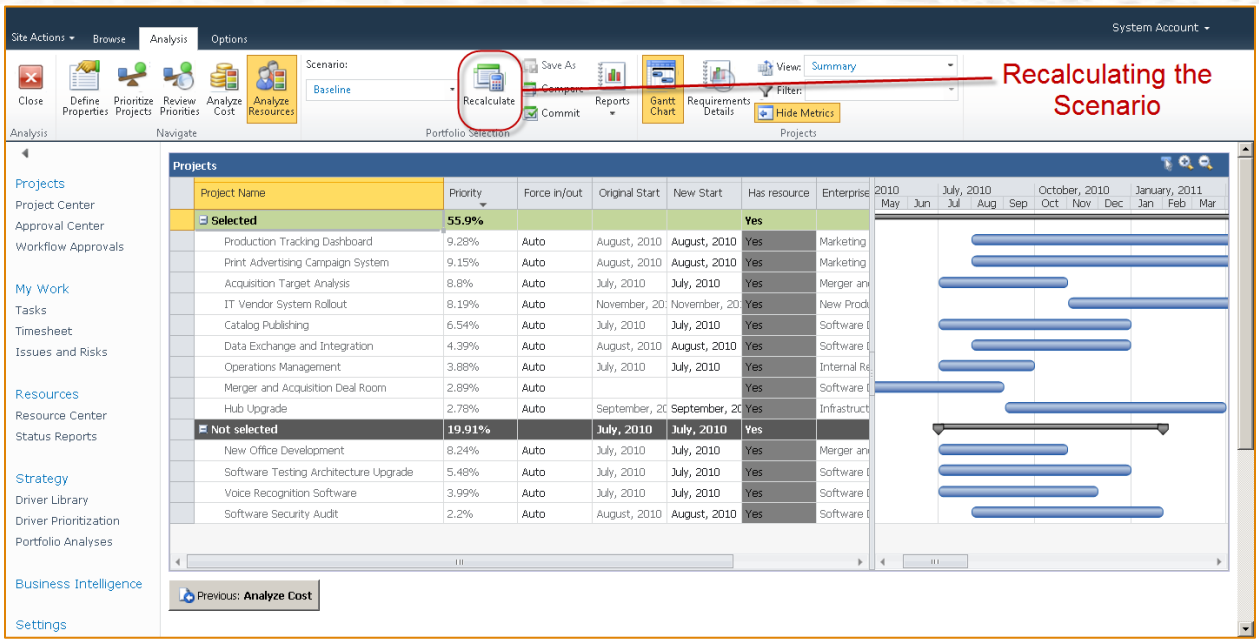


Figure 122: Recalculating the Scenario

Should the resource supply or demand profile change significantly, the user may also trigger a reload of the resource data for revised calculations by clicking on the Reload button on the Options ribbon.

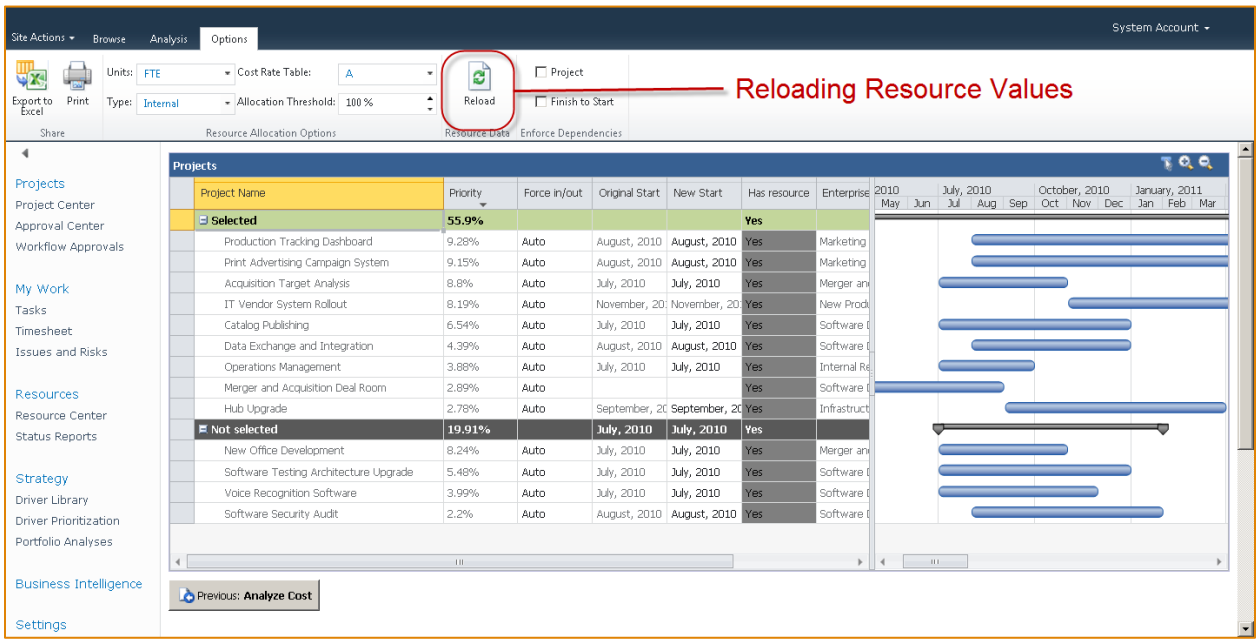


Figure 123: Reloading Resource Values

Changed resource profiles may cause the Reload process to invalidate many of the saved scenarios as the underlying data set has been modified. If the resource data has changed significantly, the organization may opt to recreate the entire portfolio analysis to ensure a quality output.

Forcing Projects In/Out

Projects may be forced in or out of the calculation in the Gantt Chart view. This feature works much like the similar function in the Cost Analysis module.

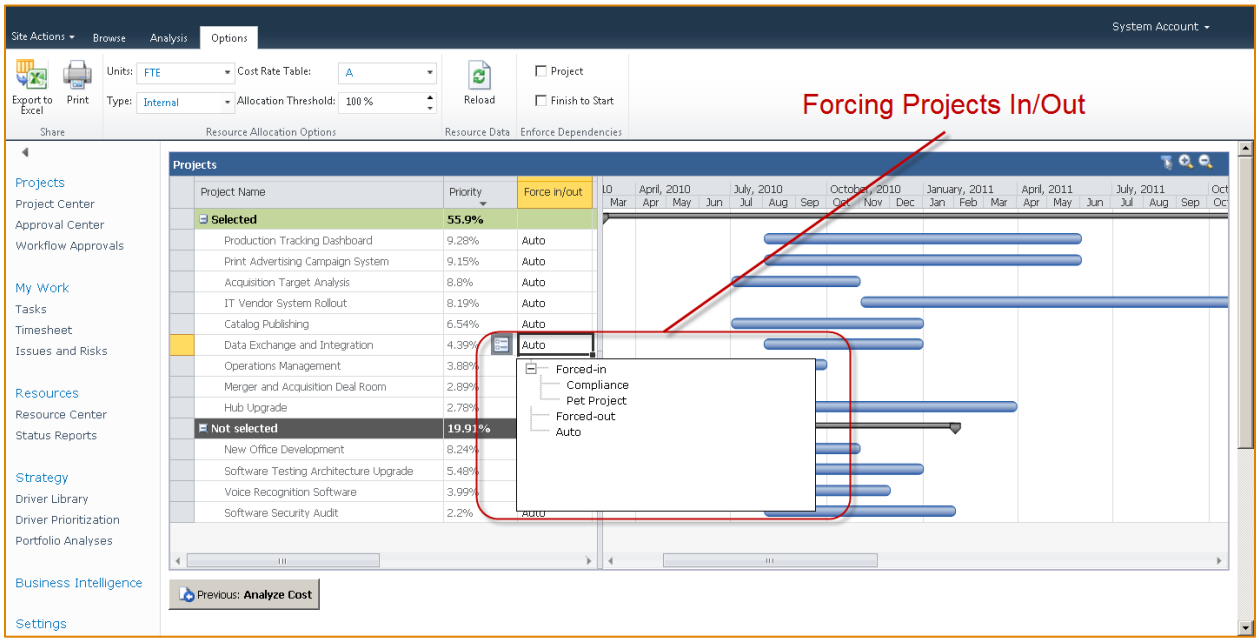


Figure 124: Forcing Projects In/Out

Forcing projects out of the calculation effectively removes them from the resource allocation queue and frees the resource supply to potentially populate other projects.

Forcing projects into the calculation effectively places the projects at the top of the resource allocation queue. If too many projects are forced into the calculation, and insufficient resources are available to support the forced in projects, the system will display an error message.

The portfolio selection scenario could not be calculated because of one or more of the following reasons:

- The portfolio constraint limit is less than the requirements of all forced-in projects for at least one period of time.
- Project dependencies are enforced and conflicting or overly complex dependency relationships exist.
- An internal resource allocation engine error.
- Cannot calculate portfolio selection scenario.

Figure 125: Resource Analysis Error Message

Modifying the Project Start Date

Users may also modify the start date for the project and recalculate the scenario. This allows users to model different scenarios by attempting to smooth resource demand peaks through resource leveling. Modifying the start date does not affect the actual project plans as saved in Project Server. Instead, the New Start Date field is saved specifically to the analysis and copied to the project level Committed Planned Start Date field when the Commit button is selected.

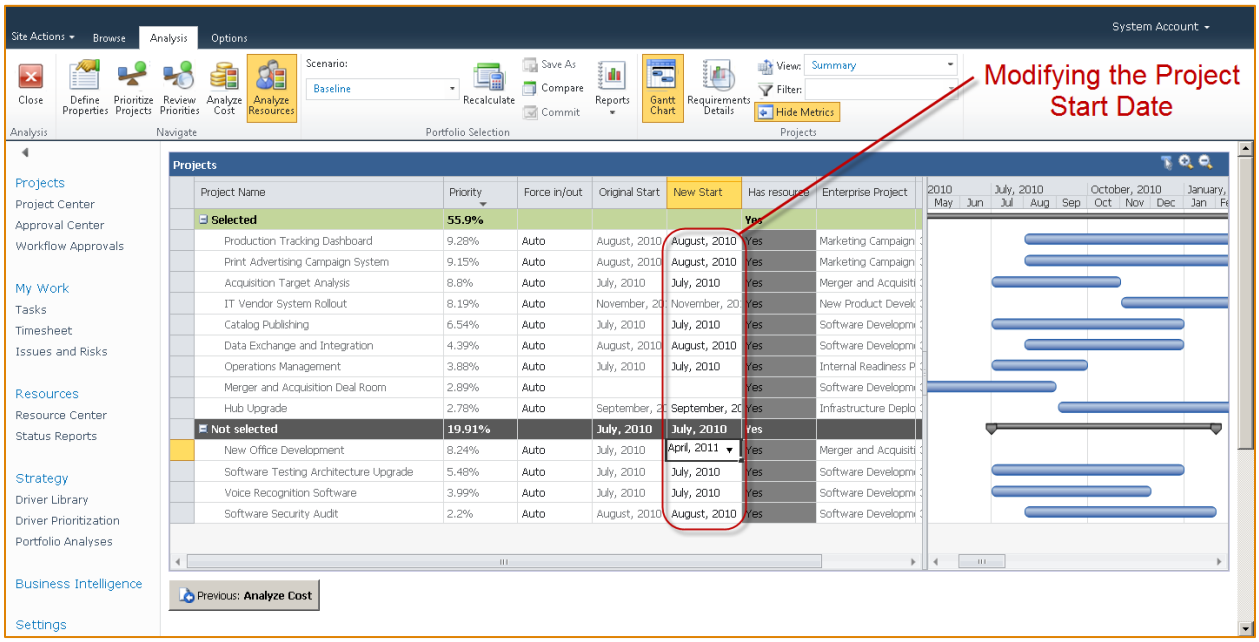


Figure 126: Modifying the Project Start Date

After changing the start date, the user must again click the Recalculate button to assess the impact on the scenario. Recalculating the scenario assesses the new timephased resource demand profile against the available organizational capacity.

Enforcing Dependencies

The Resource Analysis provides two options for enforcing project dependencies, both found on the Options ribbon.

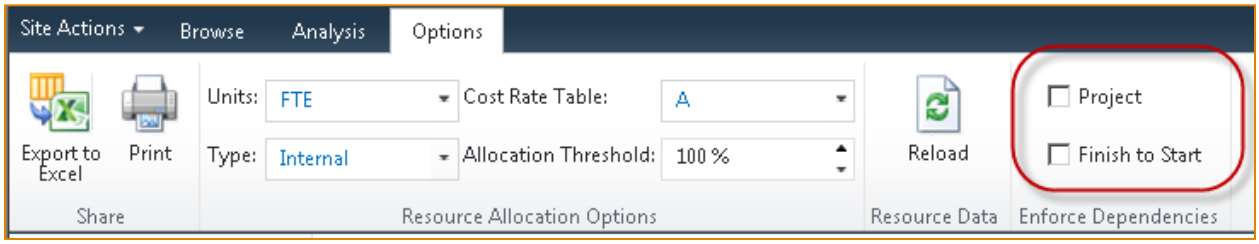


Figure 127: Enforcing Project Dependencies

Users may select to enforce either the three Project dependency types, or the Finish to Start dependency type.

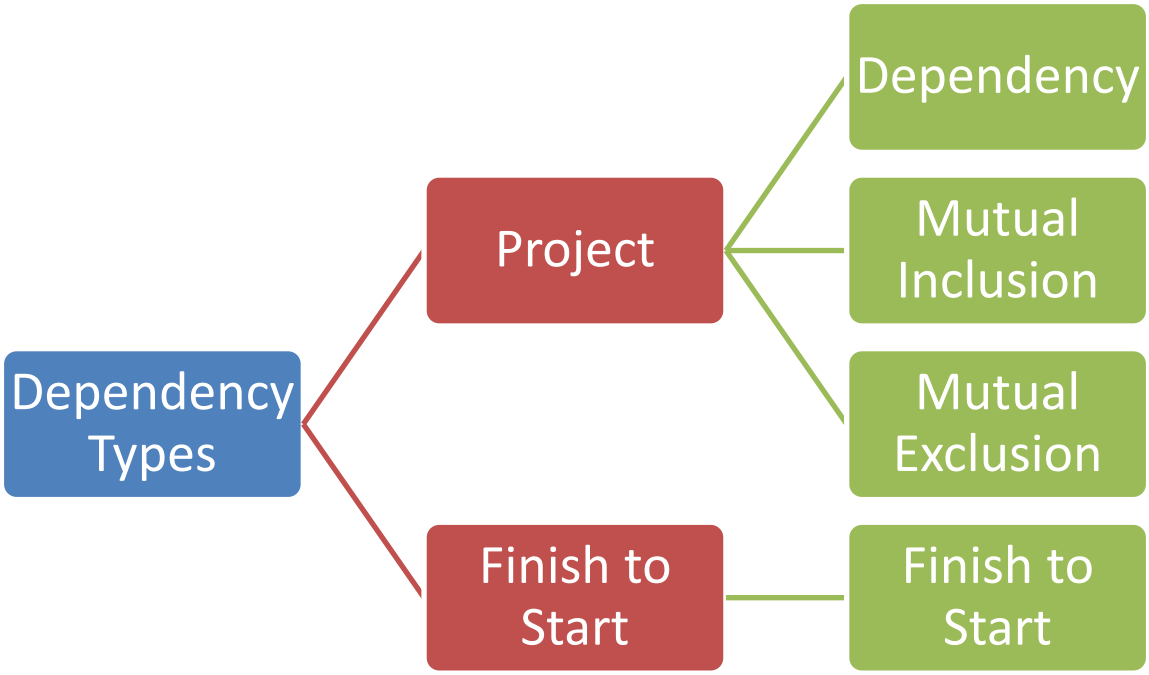


Figure 128: Dependency Classifications

The user must click the Recalculate button to assess the impact of the dependency on the scenario. **The system will calculate whether or not a project is causing an error in the calculations but will not suggest a new start date for the project**.

Hence, users who recalculate and get the error message below should review the dependencies assigned to projects within the scenario and manually assess which dependencies are causing the calculation issue. This assessment may be a difficult process, but is made easier by keeping careful records of all of the dependencies created when defining the portfolio.

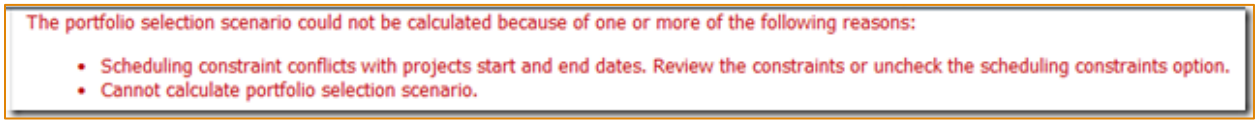


Figure 129: Dependency Caused Calculation Error Message

Incrementally Adding Resources

One of the primary functions that Resource Analysis allows the user to perform is to model the impact of adding resources to the resource pool on the selected projects. This functionality is controlled through settings on the main Gantt Chart view as well as on the Options ribbon.

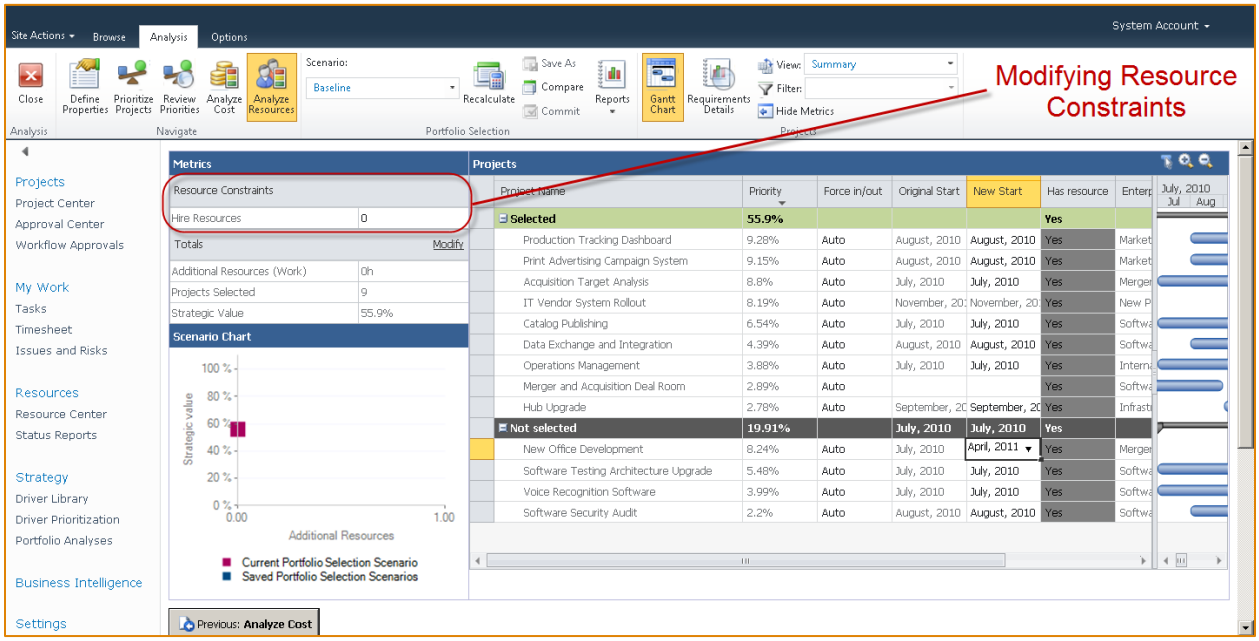


Figure 130: Modifying Resource Constraints

The behavior of the Resource Constraint option is controlled by the Options ribbon.

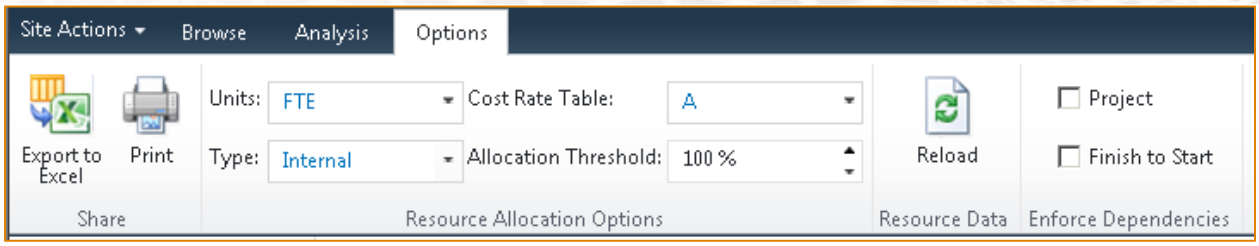


Figure 131: The Options Ribbon

The resource allocation items on the ribbon govern the analysis calculations in a number of ways:

Item	Impact
Units	Select "FTE" or "Cost." FTE sets the Resource Constraint field to accept a number of resources as the input. As an example, the organization may model the revised portfolio when adding 2 FTE to the resource pool. Selecting Cost sets the Resource Constraint field to accept the maximum incremental budget allowed for the portfolio recalculation. As an example, the organization may model the revised portfolio when adding $250,000 to the available resource budget.
Type	Select "Internal" or "External." Internal resources are hired to fill the first calculated deficit, and then remain on staff for the remainder of the period defined in the portfolio. For example, in a one year planning window which starts on January 2011, an internal resource brought on board to fill a gap in June 2011 will remain on staff through December 2011, incurring six months of full time costs. An internal resource may only be hired in units of 100%. External resources are governed by the setting in the Allocation Threshold cell, and may be hired only for the time period required by the deficit. A part time external resource may be hired in June 2011 to fill a specific deficit, and then removed from the payroll at the end of the month. The minimum allocation for each external resource is controlled by the Allocation Threshold field.
Cost Rate Table	The Cost Rate Table may be set to values "A" through "E," and affects the cost of the incremental resource added. Project Server 2010 will calculate any additional resources at the average cost per role of the existing resources in the enterprise resource pool. As an example, if three resources have a standard rate in Cost Rate Table A of $45, $50, and $55, the average rate for Table A will be $50. If the costs for Rate Table B are $100, $110, and $115, then selecting Cost Rate Table B will result in an average cost of $110. Some organizations may choose to maintain one rate table for internal costs, and one rate table for external consultant costs.
Allocation	The allocation threshold controls the minimum allocation that an external

Item	Impact
Threshold	resource may be hired for. Setting the allocation threshold to 25% allows the system to calculate external resources in units of .25 FTE. Setting the allocation threshold lower will generally reduce the calculated incremental cost of a scenario, as it allows for the planning to be much more granular.

Table 15: Resource Allocation Options

The following table illustrates how the system calculates the average cost per role.

Role	Resource	Cost Rate A	Cost Rate B
Analyst	Amy Stroud	$ 75	50
Analyst	Ben Spain	$ 100	75
Analyst	Chris Gray	$ 125	100
Analyst	Hatim Aiad	$ 150	125
Analyst	Lori Penor	$ 75	50
Analyst	Martin Berka	$ 100	75
Analyst	Steve Masters	$ 125	100
Analyst	Stuart Rivchun	$ 150	125
Analyst	TiAnna Jones	$ 75	50
	AVG:	$ 108	$ 83

Figure 132: Defining the Average Cost per Role

The results of the calculations may be reviewed in the Hired Resources Report accessible under the Reports button in the Analysis ribbon. For more information on using this report, refer to page 102.

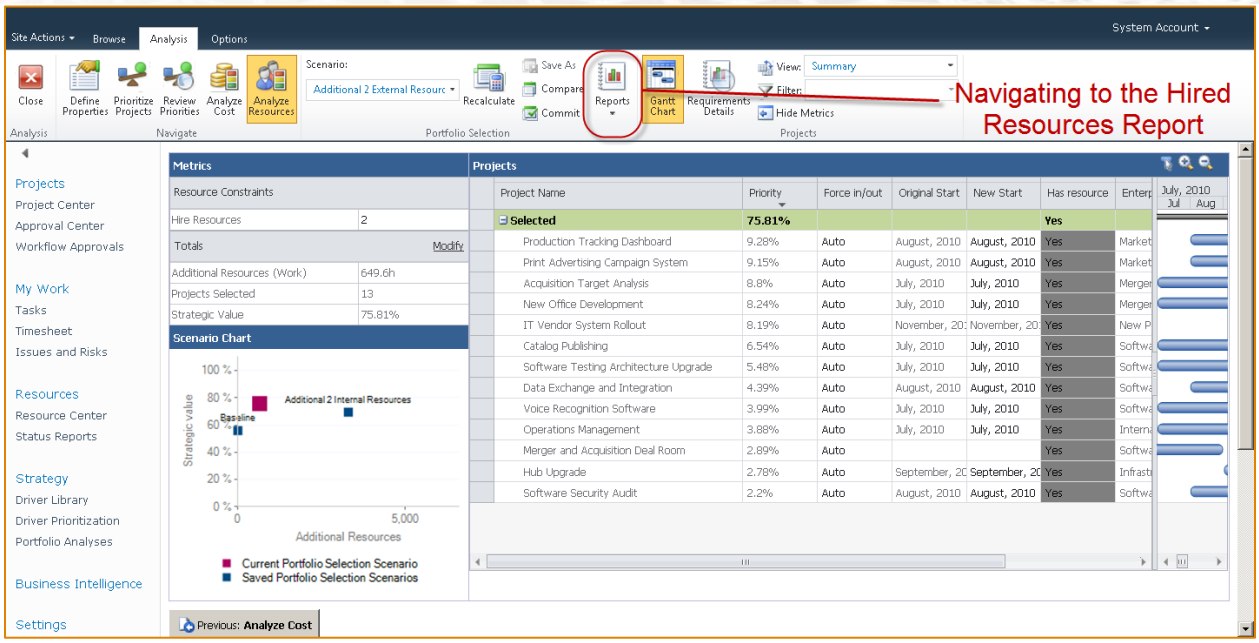


Figure 133: Navigating to the Hired Resource Report

The Hired Resources report displays a number of calculations based on the revised resource pool:

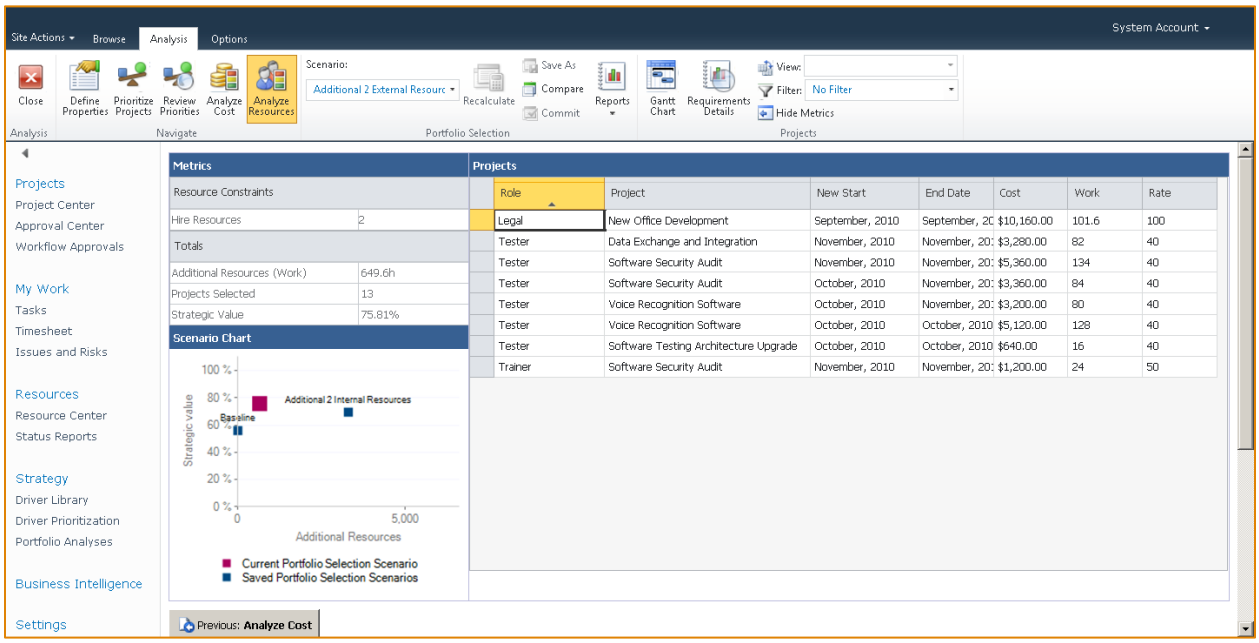


Figure 134: The Hired Resources Report

In the following example, two external resources at a minimum allocation of 100% allow the system to calculate a strategic value for the portfolio of 75% with a total selection of 13 projects. Two internal resources result in a portfolio value of 60% and 11 projects.

The difference in calculations is a result of the decreased flexibility of the internal resource. Once hired to meet a specific need, that internal resource is considered part of the resource pool, and may only be used to work on projects that require that specific skill set. External resources are far more flexible, and may continuously be brought into the organization and expelled as needed to meet various resource needs.

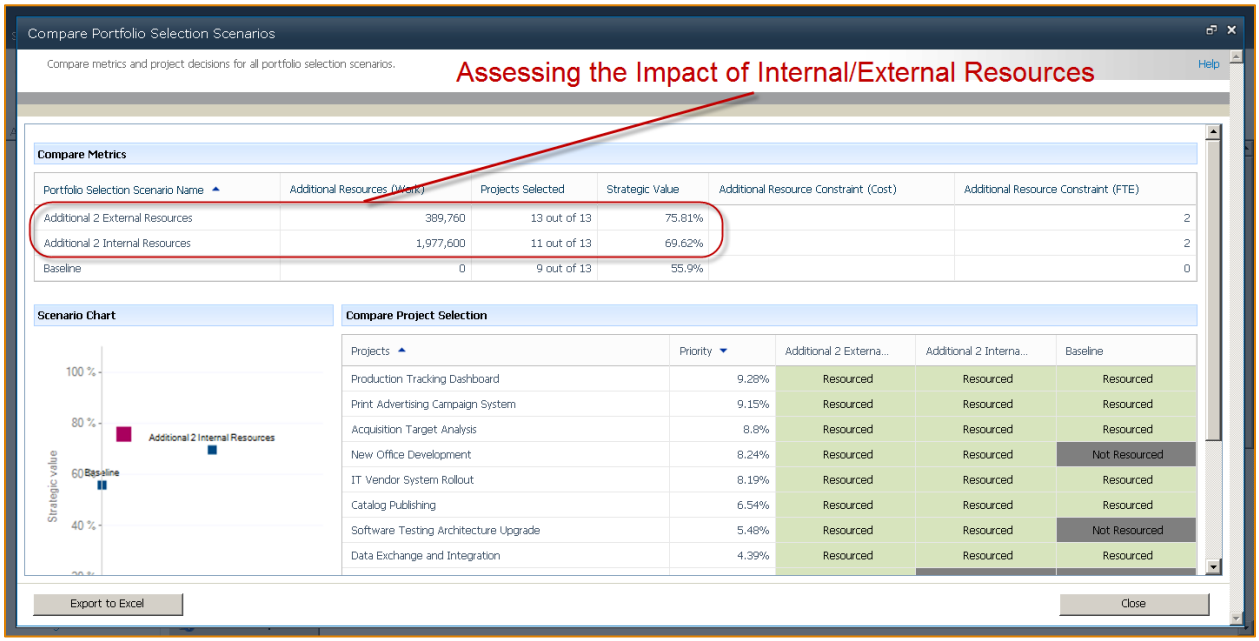


Figure 135: Comparing Multiple Scenarios

As of this writing, the Compare Scenario page exhibits a minor bug whereby the incremental work performed by the added resources is multiplied by a factor of 600. In the scenario above, the number 1,977,600 should be replaced by 1,977,600/600 to read "Additional Work: 3,296," or the recalculation resulted in an incremental increase of 3,296 man hours.

Incrementally Adding Cost

Incrementally adding cost is managed in a similar fashion as adding resources. The main settings reside on the Options ribbon. Change Units to Cost to change the calculation method.

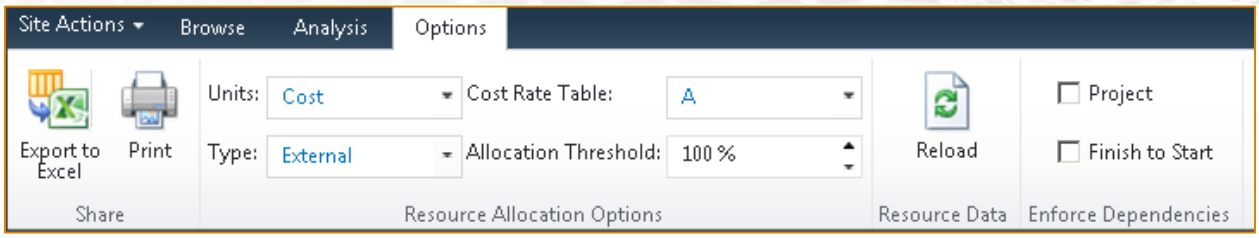


Figure 136: Changing Units to Cost

The remaining options available within the tab perform essentially the same function as when Units are set to FTE.

Once the Units field has been set to "Cost," the user may input the incremental cost:

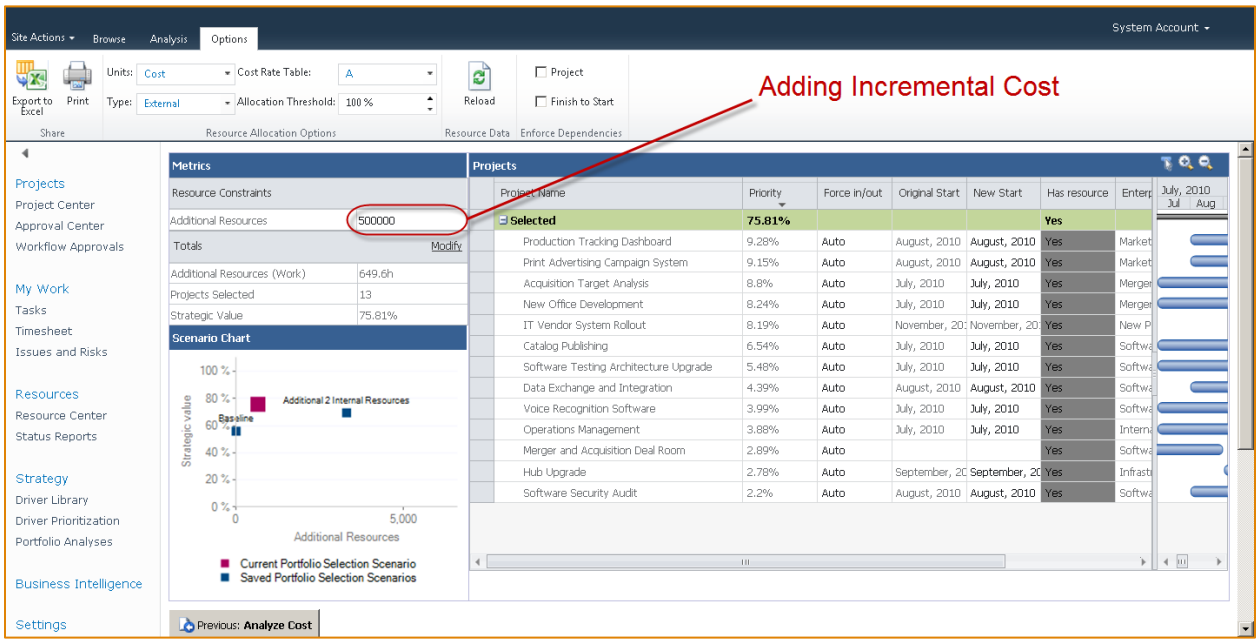


Figure 137: Adding Incremental Cost

After changing the Additional Resources constraint, the user must click Recalculate on the Analysis ribbon to recalculate the scenario.

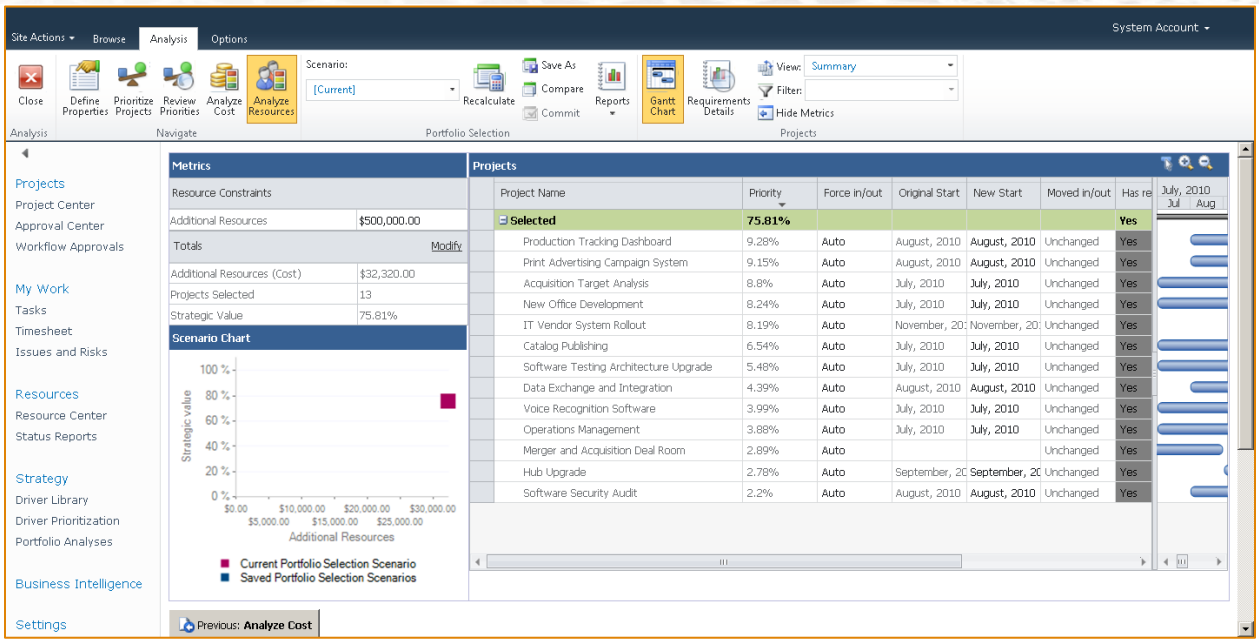
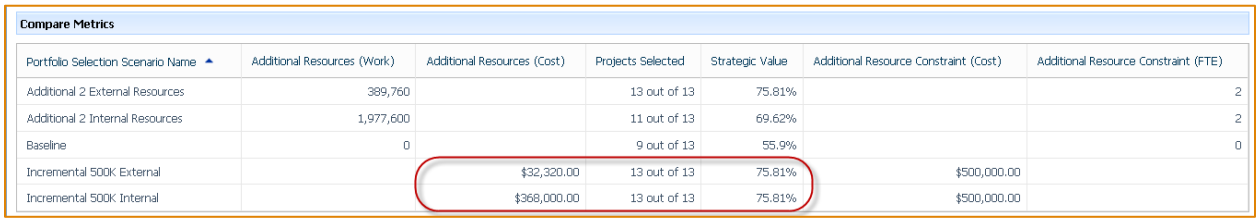


Figure 138: Revised Scenario with Additional Cost

The revised scenario may then be saved and compared with other saved scenarios. In the illustration below, the same incremental costs are added, with one scenario being set to use external resources and one to use internal resources.



Compare Metrics

Portfolio Selection Scenario Name	Additional Resources (Work)	Additional Resources (Cost)	Projects Selected	Strategic Value	Additional Resource Constraint (Cost)	Additional Resource Constraint (FTE)
Additional 2 External Resources	389,760		13 out of 13	75.81%		2
Additional 2 Internal Resources	1,977,600		11 out of 13	69.62%		2
Baseline	0		9 out of 13	55.9%		0
Incremental 500K External		$32,320.00	13 out of 13	75.81%	$500,000.00	
Incremental 500K Internal		$368,000.00	13 out of 13	75.81%	$500,000.00	

Figure 139: External vs. Internal Resources

The internal resource calculation results in an additional cost for resources of 1000% the cost of external resources. This is because the internal resource is kept full time for the remainder of the planning window, while the external resource is kept only as needed.

The additional cost field is calculated as the additional cost above what is already invested in the enterprise resource pool to add resources to support the project selected in the scenario.

Figure 140: Defining Incremental Cost

The additional cost does not represent the incremental cost of adding an entire project. A portion of the cost of additional projects may be absorbed by existing resource availability within the resource pool.

8. Completing the Analysis

Projects have been selected within defined constraints. The remaining projects have been assessed against the available resource capacity. After the organization has validated a specific portfolio, it is time to commit the scenario and begin the project execution process for those projects that have been selected.

After saving a number of scenarios, the user may review the saved scenarios in the Compare Portfolio Selection Scenario page.

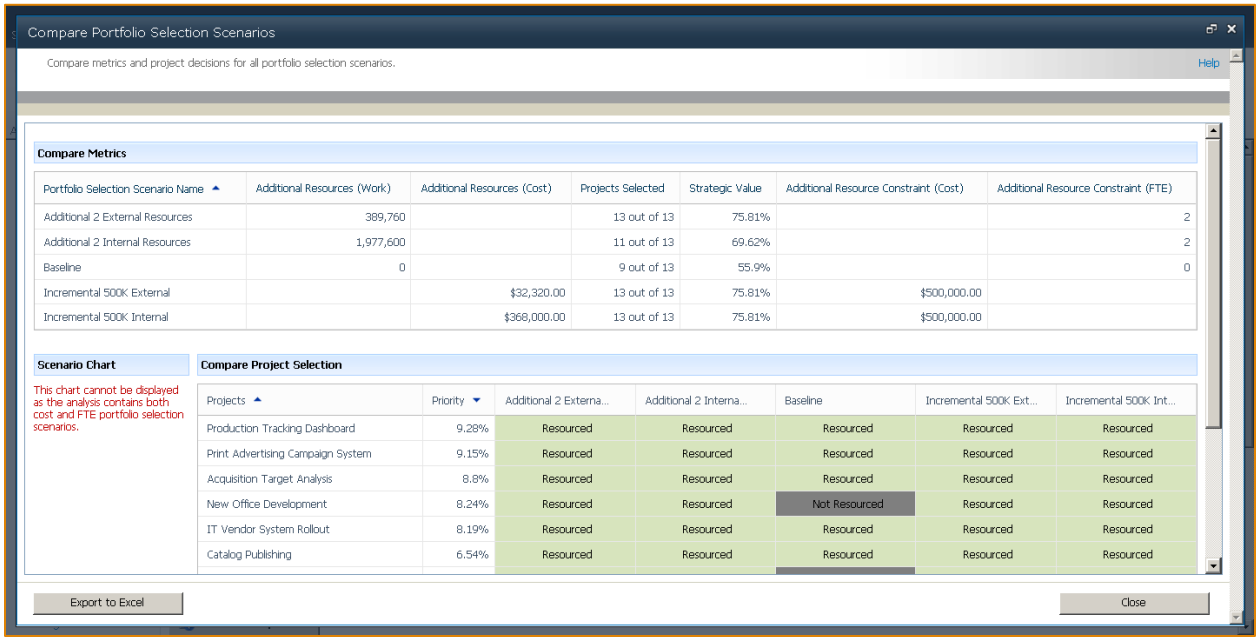


Figure 141: The Compare Portfolio Selection Page

This page allows an easy overview of all the scenarios. As scenarios are listed in alphabetical order, the user may wish to consider establishing an appropriate and descriptive scenario naming convention.

Organizations should continue to tweak the parameters of the analyses until the results for each of the calculations appear consistently aligned with the organizational priorities. Once this has occurred, the scenario probably stands a reasonable chance of organizational acceptance. After reviewing the scenarios, the user may navigate via the Portfolio Analysis page to the chosen scenario and commit it.

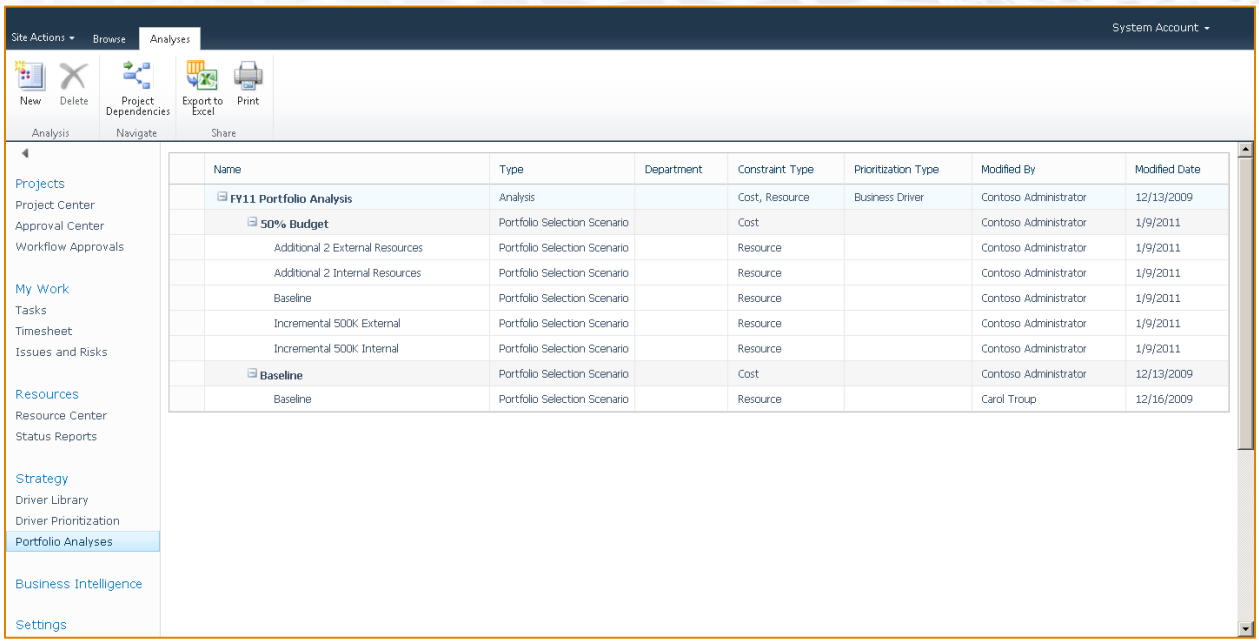


Figure 142: The Portfolio Analysis Page

Committing the Scenario

As discussed above, the last step in using the Portfolio Analysis Module within Project Server 2010 is committing the selected scenario. Committing populates up to six project level fields, and more importantly perhaps, may trigger custom approval workflows. For more information on developing custom demand management workflows, refer to the online site for Microsoft Project Server Demand Management resources: http://technet.microsoft.com/en-us/projectserver/ff899331.

The Commit button is available on the Analysis ribbon.

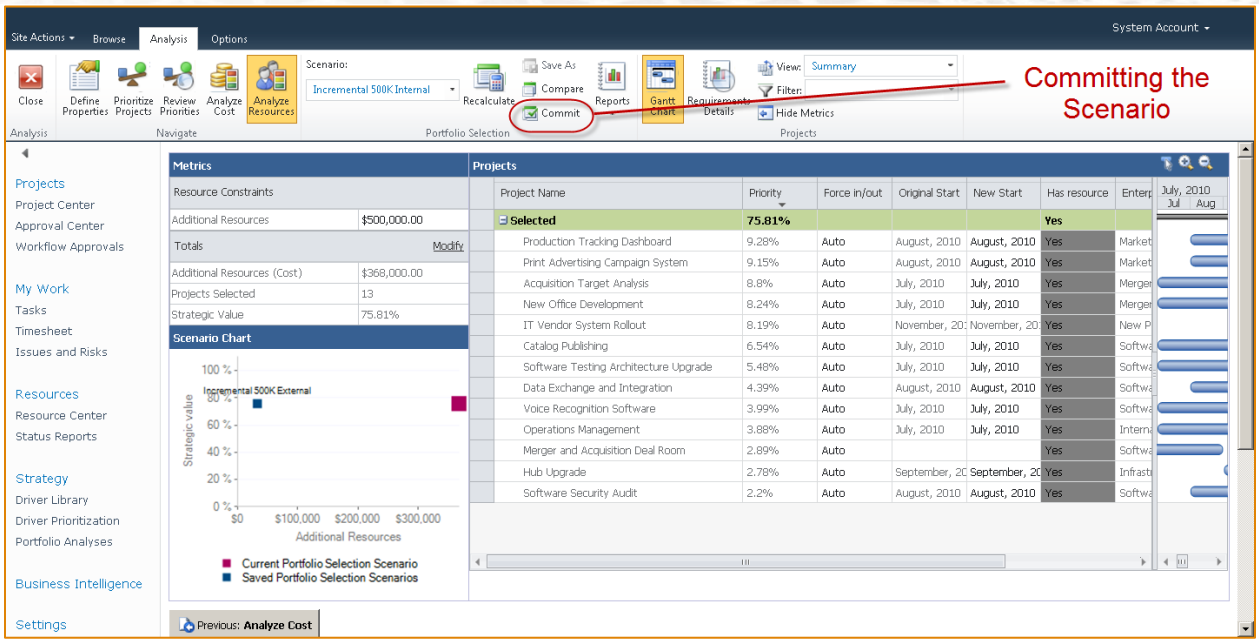


Figure 143: Committing the Scenario

The Commit button triggers the population of a total of six project level fields. Those six fields are:

1. Committed Planned End Date
2. Committed Planned Start Date
3. Committed Portfolio Selection Decision (Cost)
4. Committed Portfolio Selection Decision (Schedule)
5. Committed Portfolio Selection Decision Date (Cost)
6. Committed Portfolio Selection Decision Date (Schedule)

Those fields are available for use in Project Center views or reports and perform the following functions:

Field	Description
Committed Planned End Date	Specifies the finish date of the project as committed to in a Portfolio Selection Scenario during resource constraint analysis.
Committed Planned Start Date	Specifies the start date of the project as committed to in a Portfolio Selection Scenario during resource constraint analysis.
Committed Portfolio Selection	Shows the result of a cost constraint analysis on a project. Options

Field	Description
Decision (Cost)	include Selected, Unselected, Forced In, Forced Out, or Custom Forced-In/Out.
Committed Portfolio Selection Decision (Schedule)	Shows the result of a resource constraint analysis on a project. Options include Selected, Unselected, Forced-In/Out, or Custom Forced-In/Out.
Committed Portfolio Selection Decision Date (Cost)	Shows the commitment date of a portfolio selection scenario as determined during cost constraint analysis.
Committed Portfolio Selection Decision Date (Schedule)	Shows the commitment date of a portfolio selection scenario as determined during resource constraint analysis.

Table 16: Project Level Committed Fields

All of the committed fields are available for use within the Project Center views. Below is a custom view listing all projects and all of the committed fields. Note that some of the projects have already been committed.

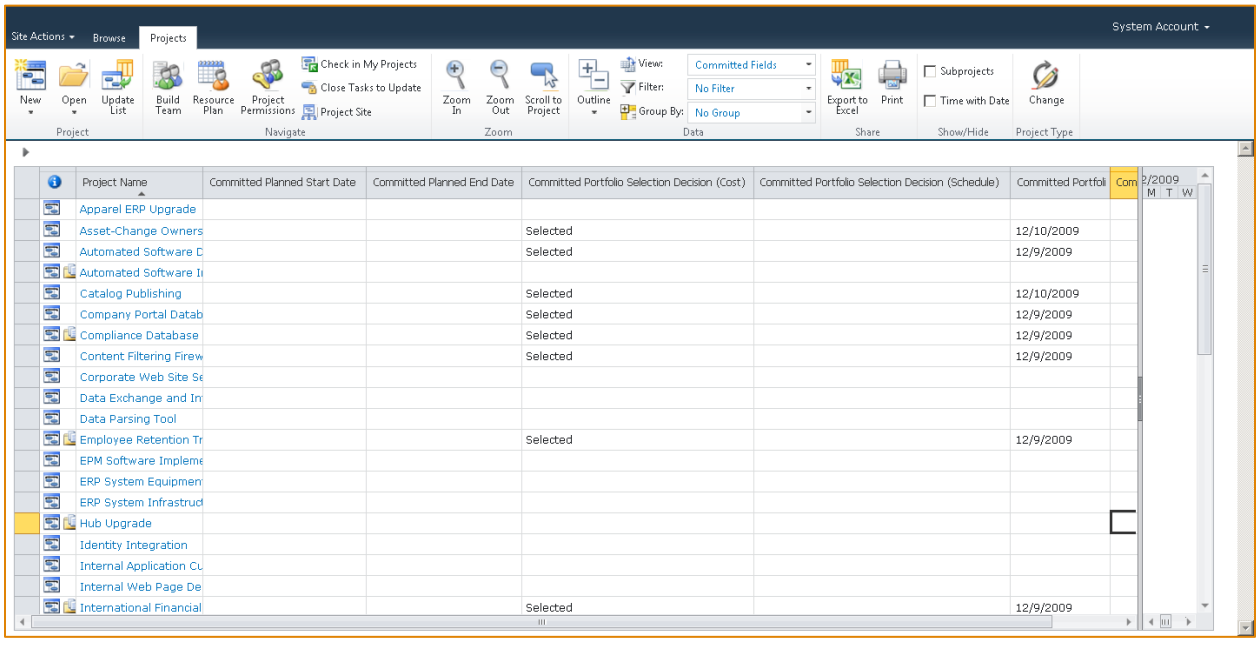


Figure 144: Project Center View

Once the Cost Analysis has been committed, the Selection Decision (Cost) and Selection Decision Date (Cost) fields are populated:

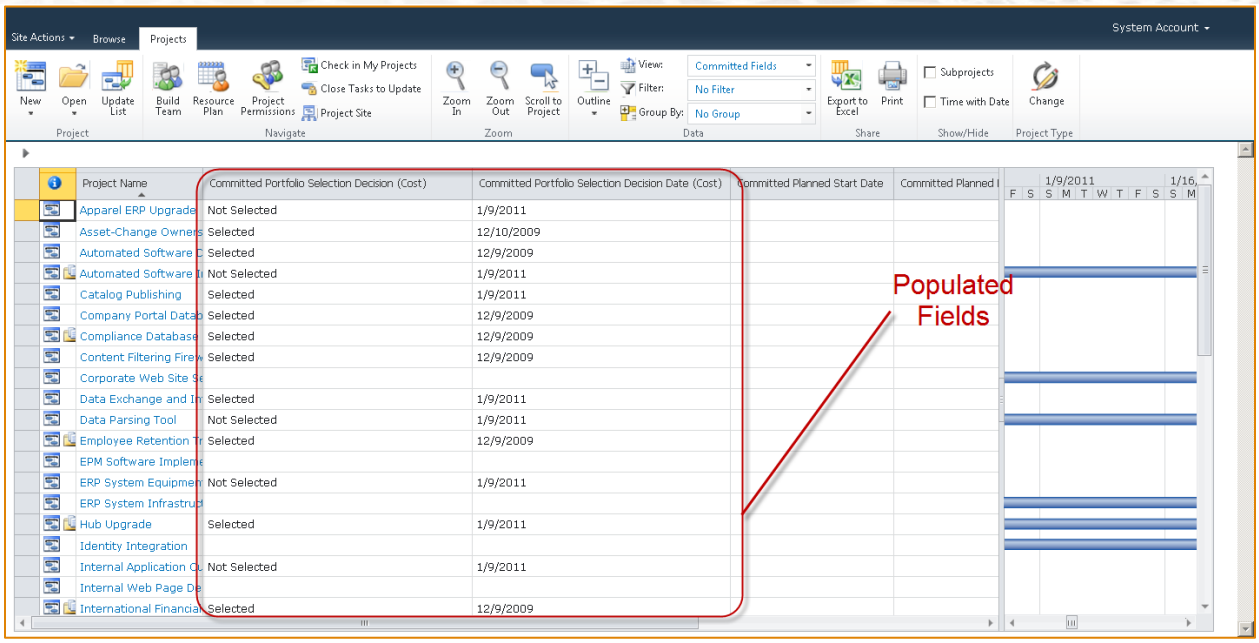


Figure 145: Committing the Cost Analysis

Committing the Resource Analysis scenario will populate the remaining four fields.

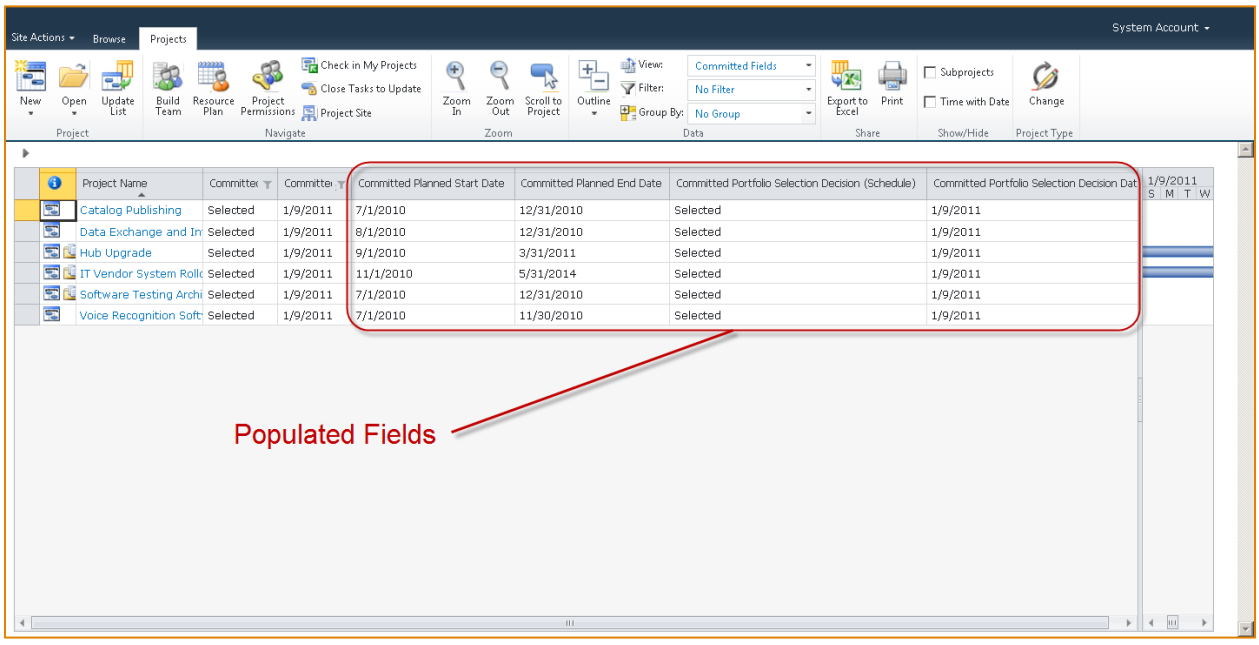


Figure 146: Fields Populated by the Committing the Resource Analysis Scenario

The projects do not need to be republished for the fields to appear in the Project Center view.

Kicking off the Selected Projects

After the projects have been selected, and the revised start date determined, the organization now has a validated portfolio of projects selected on the basis of sound information and detailed analysis. At this point, it is expected that most organizations will assign a project manager and begin to replace the generic resources within the plan with named resources. For the most part, these processes should be considered the traditional scope of project management with Microsoft Project and Project Server and are therefore out of scope for this document.

In addition to assigning named resources, the project manager will shift the start date for the project to match the revised start date established during the Resource Analysis process using the new Move Project command within Microsoft Project Professional 2010.

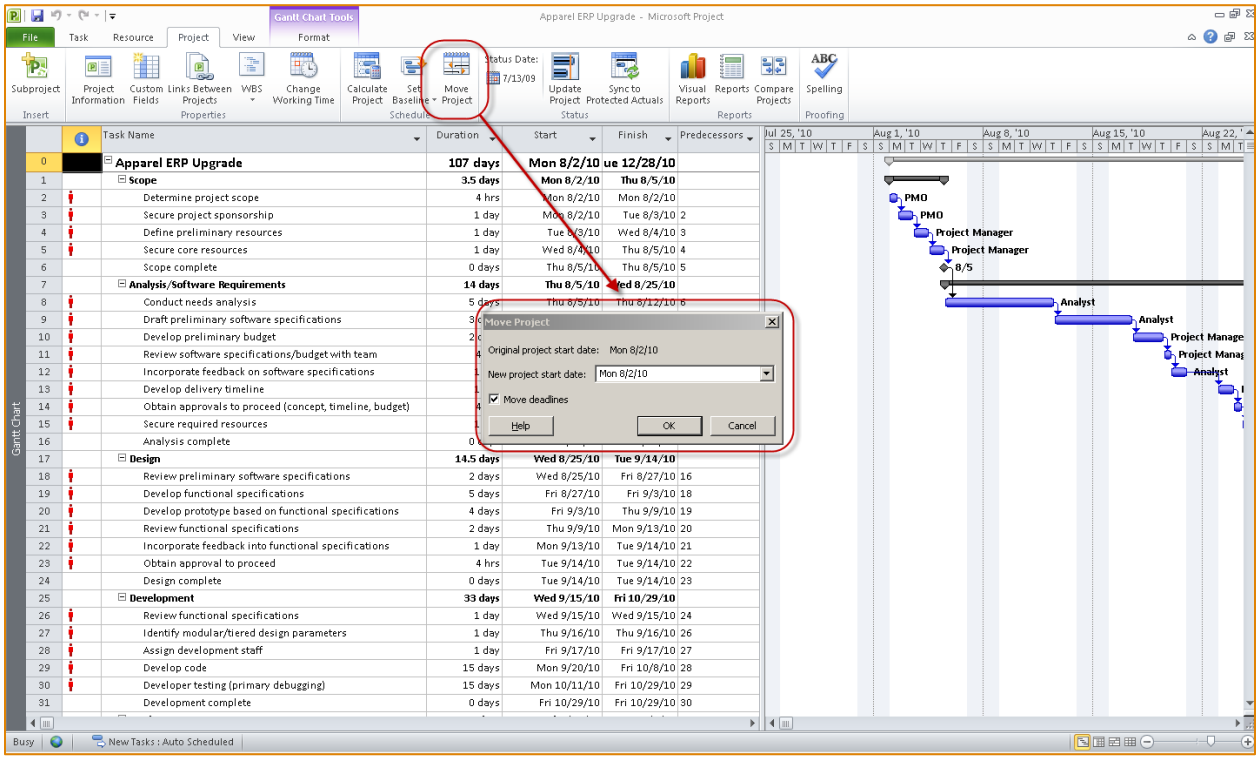


Figure 147: Moving the Project Start Date

Once named resources have been assigned, and the project start date has been set, the project manager may review resource allocations and use the Project Server resource leveling mechanism to ensure an optimal pre-execution plan.

9. Conclusion

When Project Server 2010 was first unveiled to the public at the 2009 Project Conference, I remember the general sentiment amongst many of the implementers in the audience, "Many of my clients are not ready for full project management, much less implementing portfolio management. How will I guide them in their adoption of all this new functionality? Is this simply too much of a good thing?"

That is an excellent question. How much change and process definition can an organization successfully handle? How does an organization know that it is ready to implement portfolio analysis? That is a question which has been asked at a number of conferences and symposiums.

There are many answers to that question, but for now, my answer has always been that an organization is ready to perform portfolio analysis when organizational constraints have been identified. An organization is ready to perform portfolio analysis when project schedules can be married either to cost or resource effort. An organization is ready to perform portfolio analysis when projects may be viewed in aggregate to define specific delivery constraints.

Do not implement this set of features unless your organization is actually ready to embark on this journey to portfolio management. Implementing Project Server 2010 within an organization does not require the use of the portfolio analysis module, and I would certainly recommend simply turning it off in quite a number of my own clients. Trying to implement portfolio analysis before the organization is ready will often result in frustration and a lack of focus on the EPM maturity process as a whole.

That being said, I also firmly believe that portfolio analysis is the natural next step after constraint identification. Once constraints have been made visible, organizations simply cannot afford to continue launching projects into the execution pipeline without performing detailed analyses as described within this paper.

A specific EPM tool is almost never the single solution to an organization's project management challenges. The tool should be positioned as a single platform upon which project management processes may be built, and that will support the organization through the long maturation process. For organizations ready to implement portfolio analysis, Project Server 2010 provides an excellent tool. For organizations not ready to implement portfolio analysis, Project Server 2010 provides a flexible platform that grows as the organization grows.

10. About the Author

Andrew Lavinsky is a manager with the UMT Consulting Group. Based in Houston, TX and primarily serving clients in the US South Central District, he focuses on implementing Microsoft technologies to enable organizational performance improvement.

As a professional trainer and consultant, Andrew has a diverse background providing services in such industries as oil and gas, health care, finance and IT. Andrew has lectured extensively on project and IT operations management topics within the US and abroad.

A graduate of the George Washington University, Andrew has been an active volunteer with PMI, ITSMf and a number of other professional and educational organizations. In the mid-'90s, Andrew was involved in the creation of one of the first official nongovernmental organizations in China. In the late-'90s, he served as a Peace Corps Volunteer in rural Mongolia; moving on to manage project delivery for Fortune 500 companies in the Chinese market.

For his contributions to the Microsoft Project community, Andrew was awarded the Microsoft MVP designation in July 2010.

The author welcomes any and all feedback via LinkedIn (http://www.linkedin.com/in/azlav) or Twitter (@alavinsky).

11. List of Figures

12. List of Tables

13. References

Microsoft Project 2010 Resources:

Product information

- Project 2010 product site: http://www.microsoft.com/project
- Project Team Blog: http://blogs.msdn.com/project

End-User Product Help

- Project 2010 Help http://office2010.microsoft.com/project-help
- Project 2010 Help http://office2010.microsoft.com/project-server-help
- Demand Management for Project 2010 - http://go.microsoft.com/?linkid=9739874
- Business Intelligence for Project 2010 - http://go.microsoft.com/?linkid=9726143
- Upgrade and Migration to Project 2010 - http://go.microsoft.com/?linkid=9676814

Interactive content - Videos & Sessions & Webcasts

- http://www.microsoft.com/showcase/en/US/channels/microsoftproject
- http://www.microsoft.com/events/series/epm.aspx

Project Professional 2010 and Project 2010 Demo Image:

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IT Professional related - TechNet

- Tech Center: http://technet.microsoft.com/ProjectServer
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- Developer center: http://msdn.microsoft.com/Project
- Programmability blog: http://blogs.msdn.com/project_programmability

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- http://social.msdn.microsoft.com/Forums/en-US/category/projectserver2010,projectprofessional2010/

SharePoint 2010 Products

- http://sharepoint.microsoft.com