



SOCIETY OF  
ACTUARIES



# A System to Evaluate and Compare Defined Contribution Plans



September 2016



# A System to Evaluate and Compare Defined Contribution Plans

**SPONSOR** Pension Section Research Committee

**AUTHOR** Marc Des Rosiers, FSA

## **Caveat and Disclaimer**

The opinions expressed and conclusions reached by the authors are their own and do not represent any official position or opinion of the Society of Actuaries or its members. The Society of Actuaries makes no representation or warranty to the accuracy of the information.

Copyright © 2016 All rights reserved by the Society of Actuaries

## CONTENTS

<b>Section 1: Preface and Acknowledgments .....</b>	<b>5</b>
1.1 Background .....	5
1.2 Copyright and Disclaimers.....	6
<b>Section 2: Executive Summary .....</b>	<b>7</b>
2.1 DC Evaluation Framework .....	7
<b>Section 3: The Model .....</b>	<b>8</b>
3.1 Model Description .....	8
3.2 Objective Function.....	10
3.2.1 OBJECTIVE FUNCTION BASED ON PLAN TERMS ONLY .....	11
3.2.2 OBJECTIVE FUNCTION BASED ON PLAN TERMS AND PARTICIPANT EXPERIENCE .....	11
3.2.3 DESCRIPTION OF CRITERIA USED TO DETERMINE PLAN VALUE .....	11
3.3 Plan Provisions .....	11
3.3.1 PLAN DESIGN SUBCRITERIA .....	13
3.3.2 INVESTMENT OPTIONS SUBCRITERIA .....	14
3.3.3 ENROLLMENT DESIGN SUBCRITERIA.....	16
3.3.4 COMMUNICATIONS SUBCRITERIA.....	17
3.4.1 AUTO-ESCALATION PROVIDED AND DOUBLING CONTRIBUTIONS OVER TIME.....	19
3.4.2 AUTO-ESCALATION PROVIDED AND TRIPLING CONTRIBUTIONS OVER TIME .....	20
3.4.3 NO AUTO-ESCALATION .....	20
3.4.4 EMPLOYER CONTRIBUTIONS .....	20
3.4.5 ASSUMPTIONS .....	20
3.5 Other Criteria .....	21
3.6 Plan Success .....	22
3.7 Report Summary .....	23
<b>Section 4: Weights for Objective Function.....</b>	<b>25</b>
4.1 Overall Assessment.....	25
4.2 Weights for Plan Value Objective Function.....	26
4.3 Weights for Plan Provisions Main Criteria.....	27
4.3.1 WEIGHTS FOR PLAN DESIGN SUBCRITERIA.....	27
4.3.2 WEIGHTS FOR INVESTMENT OPTIONS SUBCRITERIA .....	28
4.3.3 WEIGHTS FOR ENROLLMENT DESIGN SUBCRITERIA .....	28
4.3.4 WEIGHTS FOR COMMUNICATIONS SUBCRITERIA .....	29
4.4 Weights for Plan Adequacy .....	29
4.5 Weights for Other Criteria.....	29
4.6 Weights for Plan Success.....	29
<b>Section 5: Range of Outcomes for Evaluation Criteria .....</b>	<b>30</b>
5.1 References Used for Ranges .....	30
5.2 Plan Design.....	30
5.3 Investment Options .....	33
5.4 Enrollment Design .....	35
5.5 Communications .....	37
5.6 Plan Adequacy.....	38
5.7 Other Criteria .....	38
5.8 Plan Success .....	39
<b>Section 6: Review of Existing Approaches .....</b>	<b>40</b>
6.1 REVIEW OF EXISTING APPROACHES .....	40

<b>Section 7: Basic Ideas of the Analytic Hierarchy Process (AHP)</b> .....	<b>41</b>
7.1 Background .....	41
7.2 Pairwise Comparisons.....	41
7.3 AHP Formulas and Concepts .....	41
7.4 Application of AHP to the Model .....	41
7.5 AHP Matrix .....	44
7.6 Consistency Index .....	44
7.7 Other Criteria .....	45
7.8 Summary .....	45
<b>Section 8: Objectives, Context and Use</b> .....	<b>46</b>
8.1 Defining Objectives.....	46
8.2 Context and Use.....	46
<b>Section 9: Modifications for Canada</b> .....	<b>47</b>
9.1 The Canadian Pension Environment.....	47
9.2 Changes to the Model for a Canadian Version .....	47
9.2.1 PLAN DESIGN SUBCRITERIA .....	48
9.2.2 INVESTMENT OPTIONS SUBCRITERIA .....	48
9.2.3 ENROLLMENT DESIGN SUBCRITERIA.....	49
9.2.4 PLAN ADEQUACY CRITERIA.....	49
9.2.5 OTHER CRITERIA.....	49
Accordingly, these are removed from the Canadian framework. ....	49
9.2.6 PLAN SUCCESS CRITERIA.....	50
<b>Section 10: Conclusion</b> .....	<b>51</b>
<b>References</b> .....	<b>52</b>
Publications .....	52
Websites.....	53
<b>Appendix A: Using/Modifying the Excel Model Spreadsheet</b> .....	<b>54</b>
A.1 How It Works .....	54
A.2 Using the Model .....	54
A.2.1 DATA ENTRY TO GET THE ASSESSMENT .....	54
A.2.2 REPORT .....	56
A.2.3 OTHER WORKSHEETS.....	56
<b>Appendix B: Examples</b> .....	<b>57</b>
B.1 Base Case .....	57
B.2 Base Case Measuring Ongoing Plan Success.....	60
B.3 Higher Employer Contributions .....	60
B.4 Base Case with Auto-enrollment and Auto-escalation.....	61
B.5 Summary .....	62

# A System to Evaluate and Compare Defined Contribution Plans

## A Framework to Measure the Value and Effectiveness of Retirement Savings Arrangements

The Pension Section Research Committee commissioned a research project to develop an actuarial framework that could be used by employers and employees to assess defined contribution (DC) retirement plan benefits. This report presents the framework that resulted from the committee's work.

### Section 1: Preface and Acknowledgments

#### 1.1 Background

The food industry labels its products with a standard nutritional-information panel, which lists calories, vitamins, carbohydrates and other dietary information. By analogy, an actuarial framework for DC retirement plans should allow users and sponsors of DC programs to focus on useful metrics and focus on the substantive issues in retirement planning.

The conceptual framework resulting from this effort endeavors to achieve this goal by developing a flexible but uniform system for evaluating the effectiveness of a DC program. The system is intended to compare one program with those of other employers in the same industry or geographical area. The rating system can highlight strengths or weaknesses of the programs under review. The system is relevant both to U.S. and Canadian plans, and can be adapted to other jurisdictions. In addition to plan features, the system also considers benefit adequacy, using the actuarial value of benefits as a proxy for value.

The Project Oversight Group (POG) provided invaluable guidance and review throughout the project. Here's a list of the members:

- Marc Des Rosiers (Researcher)
- Michael Economos
- Cindy Levering
- Andrew Peterson (Society of Actuaries)
- Dylan Porter (Chair)
- Barbara Scott (Society of Actuaries)
- Andrea Sellars
- Steve Siegel (Society of Actuaries)
- Joe Tomlinson
- Jack VanDerhei

We thank the Society of Actuaries' Pension Section Research Committee for its role in envisioning this project and providing guidance and support to conduct the research and quantitative analyses.

We also thank John Lowell for his review of the draft report and numerous suggestions, many of which have been included in this report.

## 1.2 Copyright and Disclaimers

Important: DC Evaluation Framework Spreadsheet ("Software") posted on the Society of Actuaries (SOA) website is the property of the SOA and is protected under U.S. and international copyright laws. It was created for the SOA by Marc Des Rosiers, FSA.

The Software has been developed for the benefit of actuaries FOR EDUCATIONAL USE ONLY, although others may find it useful. SOA makes the Software available to individual users for their personal use on a non-exclusive basis. No commercial use, reproduction or distribution is permitted whatsoever.

SOA and the authors make no warranty, guarantee or representation, either expressed or implied, regarding the Software, including its quality, accuracy, reliability or suitability, and HEREBY DISCLAIM ANY WARRANTY REGARDING THE SOFTWARE'S MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. SOA and the authors make no warranty that the Software is free from errors, defects, worms, viruses or other elements or codes that manifest contaminating or destructive properties. In no event shall SOA or the authors be liable for any damages (including any lost profits, lost savings, or direct, indirect, incidental, consequential or other damages) in connection with or resulting from the use, misuse, reliance on, or performance of any aspect of the Software including any instructions or documentation accompanying the Software. SOA and the authors make no representation or warranty of non-infringement of proprietary rights of others with respect to the Software. The entire risk as to the uses, outputs, analyses, results and performance of the Software is assumed by the user. This Disclaimer applies regardless of whether the Software is used alone or with other software. The model, accompanying documentation, and methodologies contained herein do not represent an official position, statement or endorsement on behalf of the SOA or its members, nor should the material be construed to do so. It is the product of a research effort commissioned by the SOA to add to the library of resource tools for the evaluation of defined contribution arrangements and further knowledge in that area. The model is neither intended to preclude the use of other methodologies for the evaluation of defined contribution arrangements for any purpose nor provide a statement or position on the use, application or preferability of other methodologies as compared with the methodology described herein.

The opinions expressed and conclusions reached by the authors are their own and do not represent any official position or opinion of the sponsoring organizations or their members. The sponsoring organizations make no representation or warranty as to the accuracy of the information.

## Section 2: Executive Summary

### 2.1 DC Evaluation Framework

This report sets out a framework to evaluate the value and effectiveness of a defined contribution arrangement. It describes a flexible but uniform system that can be used to compare one program with those of other employers in the same industry or geographical area. The rating system highlights strengths or weaknesses of the programs under review.

The approach described in this report has several elements:

- An “objective function” assigns a value between 0% and 100% to a defined-contribution type plan.
- Weights for each criterion (or subcriterion) add up to 100%.
- The plan value is the sum of the product of each criterion’s weight times its value.
- Weights are determined using the techniques of the Analytic Hierarchy Process (AHP).

The objective function considers not only quantitative features, but also qualitative (soft) features that may not have a cost but have a positive impact on the retirement income for the member (e.g., auto features and retirement income solutions).

The evaluation framework is one that finds more value for plans that have higher contributions, lower fees, better features and more flexibility for the member. It compares each feature against a range of existing possibilities, recognizing plan size; includes a success measure for ongoing plans; and emphasizes the importance of auto features (auto-enrollment and auto-escalation).

The weights for the objective function must be appropriate and consistent in order for the system to be effective. Weights for this rating system are based on the principles of the Analytic Hierarchy Process (AHP), a branch of operations research. AHP is a structured technique for organizing and analyzing complex decisions, invented by mathematician Thomas L. Saaty in the 1970s.

This report provides supporting information and background for the model. Also available is a spreadsheet prototype of the model, which users can download from the Society of Actuaries’ website ([www.soa.org](http://www.soa.org)).

## Section 3: The Model

### 3.1 Model Description

The approach for the evaluation framework consists of assigning an individual value to each of the most important criteria of the DC plan and combining these values in an objective function. Weights for the objective function and its criteria are derived using the decision-making techniques of the Analytic Hierarchy Process (AHP).

The output is an index value between 0% and 100%, which provides an overall rating for the plan. There are also ratings for the performance of each main criterion used to calculate the index value. The model is flexible in that it can be used to compare a plan with its peers in the same industry or geographical region. Weights can also be modified based on the user's judgment of their relative importance.

The model consists of several elements:

- An "objective function" assigns a value between 0% and 100% to a defined-contribution type plan.
- Weights for each criterion (or subcriterion) add up to 100%.
- The index value is the sum of the product of each criterion's weight times its value.
- Weights are determined using the techniques of the Analytic Hierarchy Process (AHP).

The objective function considers not only quantitative features, but also qualitative (soft) features that may not have a cost but have a positive impact on the retirement income of the member (e.g., auto features and retirement income solutions).

#### KEY SECTIONS OF THE REPORT

This document provides the analytic and technical support for the model and contains detailed information describing the model, evaluating each criterion and determining the weights for each subcriterion, as well as references from published industry studies and surveys.

While knowledge of the supporting documentation is desirable for understanding the model fully, a user who wants to use the Excel spreadsheet version of the model directly may find that referring to the following two elements of the report is sufficient to clarify the main concepts used in the spreadsheet:

Figure 2, Model Overview

Section 3.2, Objective Function

Next to each input cell of the spreadsheet, brief instructions are provided to help users enter data quickly (in column H). The criteria for benchmarking are greatly expanded in the report:

Section 3.3, Plan Provisions

Section 3.4, Plan Adequacy

Section 3.5, Other Criteria

Section 3.6, Plan Success

Appendix A, Using/Modifying the Excel Model Spreadsheet

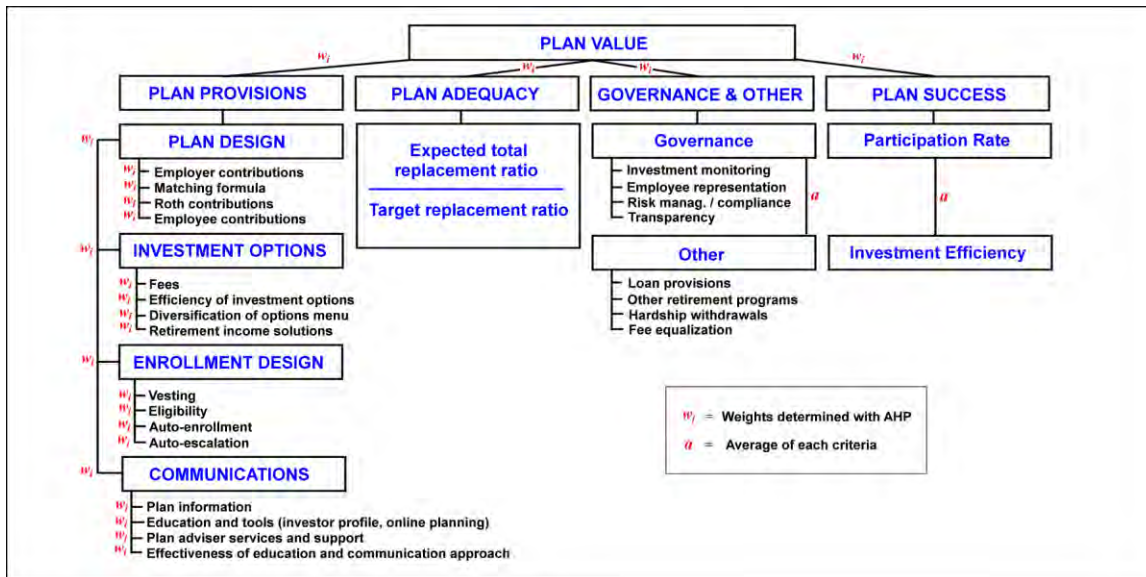
Appendix B has several examples showing the effect of varying monetary and nonmonetary features on the value of the objective function.

Canadian users may also refer to Section 9.2 to review adaptations of the model to the Canadian savings plan environment.





**Figure 2**  
MODEL OVERVIEW



### 3.2 Objective Function

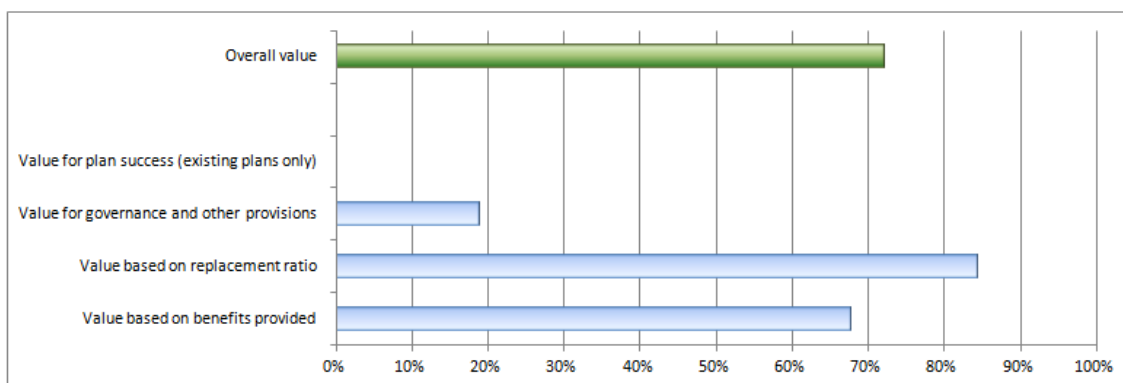
The objective function has two versions:

1. Plan assessment based on plan terms only, without regard to existing participant experience
2. Plan assessment that takes into account both plan terms and existing participant experience

There is detailed information in Sections 3 and 4 on the suggested weights and justifications for the selection of each weight. We also provide information on how to proceed to assign a value for each criterion used in the formulas.

Figure 3 is a chart showing the output of the various components of the model and the overall evaluation for a plan.

**Figure 3**  
MAIN RESULTS: OVERALL VALUE AND EACH MAIN CRITERION OF OBJECTIVE FUNCTION



### 3.2.1 OBJECTIVE FUNCTION BASED ON PLAN TERMS ONLY

For the plan assessment based on plan terms only, the plan value is expressed by the following formula:

$$\text{Plan value} = (\text{Provisions}) \times w_1 + (\text{Adequacy}) \times w_2 + (\text{Other criteria}) \times w_3$$

where  $w_i$  are weights assigned to each of the main criteria.

### 3.2.2 OBJECTIVE FUNCTION BASED ON PLAN TERMS AND PARTICIPANT EXPERIENCE

For the plan assessment that takes into account both plan terms and existing participant experience, the plan value is expressed by the following formula:

$$\text{Plan value} = (\text{Provisions}) \times w_1 + (\text{Adequacy}) \times w_2 + (\text{Other criteria}) \times w_3 + (\text{Plan success}) \times w_4$$

where  $w_i$  are weights assigned to each of the main criteria.

### 3.2.3 DESCRIPTION OF CRITERIA USED TO DETERMINE PLAN VALUE

The plan value is based on an assessment of several criteria, including plan terms, the ability to replace income over a full career, and participant behavior.

The next subsections include descriptions of the approach to determine the value for each of the main criteria:

- Provisions (Subsection 3.3)—the value provided by the plan provisions with respect to plan design, investment options, enrollment and communications
- Adequacy (Subsection 3.4)—the value provided by the replacement ratio achieved over a full career for a representative plan member
- Other criteria (Subsection 3.5)—the value provided by other factors in the plan, including governance, employee representation, compliance, loan provisions, hardship withdrawals and fee equalization
- Plan success (Subsection 3.6)—the value observed from participation levels and investment efficiency of the actual plan

Note that the value of a criterion can be determined summarily based on a quantitative evaluation when the weight is very small, since the result of the value times the weight will not make a material difference in the end result for the objective function. For example, if the weight for a particular criterion counts for 5% of the overall value for the objective function, the evaluation of this criterion does not have to be very precise. It can simply be a choice between 0%, 25%, 50%, 75% and 100%, corresponding to a qualitative assessment of “poor,” “fair,” “good,” “very good” and “excellent,” respectively.

## 3.3 Plan Provisions

This assessment looks at the value provided in the plan provisions, organized under the following subcriteria:

- Plan design
- Investment options
- Enrollment design
- Communications

The process entails comparing the provisions for each criterion for the plan against the best practice in the peer group, industry, geographical region or totality of existing plans.

Figure 4 shows the data entry and calculations in the Excel version of the model.

**Figure 4**  
**PLAN PROVISIONS DATA ENTRY**

1	PLAN PROVISIONS	Weight for Criteria	Weight Subcriteria	Subcriteria Value	Plan Analysis	Help and Comments
	<b>Plan design</b>					
	Subcriteria:				Describe provision and give a score of 0% to 100%.	
A	Employer contributions	70%	56%		Up to 5% of basic salary + bonus	Value = Min(Er rate, 9%) / 9%. (Range is 2% to 12%, above 9% scores 100%). Evaluate employee contribution level subject to matching (matching 5% or more of employee contributions gets perfect score).
B	Matching formula	10%	100%		Matching is 100% of contributions up to 5% each pay period	
			(Info for Report worksheet) Match frequency?			
C	Availability of Roth contributions	10%	100%		Available option	Roth accounts yield more retirement income than a dollar in a before-tax account and provide added flexibility for plan participants.
D	Employee contributions	10%	100%		Up to a maximum of 12%	0% to 12%; contributory plan scores 100%.
			Subcriteria value:	100%		
			Subcriteria weight:	81%		
			Value * Weight:		42%	
	<b>Investment Options</b>					
	Subcriteria:				Describe provision and select rating:	
A	Fees	51%	100%		Excellent Fees are 45 bps for assets of \$250 M	Evaluate average fees for plan size, e.g. < \$10M: 130 bps; \$10M-\$100M: 75 bps; \$100M-\$500M: 50 bps; > \$500M: 35 bps.
B	Efficiency of investment options	8%	75%		Very Good Menu has limited number of options, index funds are offered	Evaluate based on menu of investment options: simplicity, limited number of options, presence of index fund options.
C	Diversification of options menu	8%	75%		Very Good 12 fund options	Evaluate based on menu of investment options: target date options, appropriate diversification by asset class.
D	Retirement income solutions	8%	75%		Fair Systematic withdrawals offered	In-plan pension: systematic withdrawals, annuity, variable annuity, or competitive annuity bidding etc.
			Subcriteria value:	100%		
			Subcriteria weight:	15%		
			Value * Weight:		11%	
	<b>Investment Design</b>					
	Subcriteria:				Describe provision and select rating:	
A	Vesting	38%	50%		Good 20% with 2 years or 100% at 4 years	Immediate gets 100%; 3 years and above receives 0%. Consider waiting period to join the plan and workforce coverage (part-time, seasonal, hourly/salaried).
B	Eligibility	7%	50%		Good Hourly and salaried after one year of service	Consider efficiency of automatic enrollment and default investment option, if not provided 0%.
C	Auto-enrollment	37%	100%		Excellent Yes with 3.00% default	
D	Auto-escalation	18%	100%		Excellent Yes annual 3.50% increase to 6%	Evaluate efficiency of auto-escalation features; if not provided, 0%
			Subcriteria value:	100%		
			Subcriteria weight:	15%		
			Value * Weight:		12%	
	<b>Communications</b>					
	Subcriteria:				Describe provision and select rating:	
A	Plan information	13%	75%		Very Good Online account statements, electronic delivery	Statement quality, performance disclosure, online access.
B	Education and tools	13%	75%		Very Good Online access, robust tools	Investor profile, online planning.
C	Plan adviser services and support	35%	25%		Fair Annual seminar for pre-retirees	Quality and level of advice.
D	Effectiveness of education and communication approach	9%	25%		Fair Appropriate for employee group	Do communications fit demographic and socioeconomic background?
			Subcriteria value:	100%		
			Subcriteria weight:	9%		
			Value * Weight:		3%	
			Total:	100%		
	<b>Plan value based on benefits provided</b>					68%

### 3.3.1 PLAN DESIGN SUBCRITERIA

Table 1 provides guidelines for establishing the value of each plan design criterion.

**Table 1**  
PLAN DESIGN

Criteria	Value Determination
Employer contributions	<p><b>Value</b> = <math>\min(\text{Employer contribution rate, } 9\%)/9\%</math></p> <p><b>Rationale:</b> Unless employer contribution rates above 9% are common in the industry group for the plan under consideration, a plan offering a rate of 9% or more should get a maximum value.</p> <p><b>Comments</b>                      (1) The employer contribution rate can be the rate applicable if the plan participant takes full advantage of employer matching (e.g., include both matching and nonmatching contributions).                      (2) Consider in the evaluation whether basic salary and/or incentive compensation is used in the formula.</p>
Matching formula	<p><b>Value</b> = <math>\min(\text{Employer matching percentage, } 100\%)</math></p> <p><b>Rationale:</b> Higher employer matching generates more contributions.</p> <p><b>Comments</b>                      (1) “Matching formula” credits value for providing matching.                      (2) Some consider “matching leverage” an effective mechanism to incentivize employees to contribute more. For example, an employee may contribute 5% of pay when matching is 100% to generate maximum employer matching, but may contribute 10% of pay if the matching percentage is 50% to achieve the same employer match. Accordingly, the formula can be modified to hit maximum value at a threshold lower than 100%.</p>
Availability of Roth contributions	<p><b>Value</b> = 0% for no availability; 100% for availability</p> <p><b>Rationale:</b> Availability adds efficiency and withdrawal flexibility to DC plan.</p> <p><b>Comment</b>                      Because every dollar in a Roth account yields more retirement income than a dollar in a before-tax account, individuals will save more if they change from before-tax contributions to Roth contributions while maintaining the same contribution levels.</p>
Employee contributions	<p><b>Value</b> = 100% if employee contributions are allowed at a reasonable level (e.g., 5% or more); 50% if employee contributions are lower; 0% if not allowed</p> <p><b>Rationale:</b> A contributory plan generates more money.</p> <p><b>Comments</b>                      (1) Range is typically from 0% to 12%.                      (2) Include pretax and after-tax contributions.</p>

### 3.3.2 INVESTMENT OPTIONS SUBCRITERIA

Table 1 provides guidelines for establishing the value of each investment options criterion.

**Table 2**  
INVESTMENT OPTIONS

Criteria	Value Determination
Fees	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent”</p> <p><b>Rationale:</b> Lower fees result in higher net investment returns and therefore greater fund accumulation.</p> <p><b>Comments</b>                      (1) Evaluate average fees based on plan size, e.g.:                      &lt;\$10M: 130 bps                      \$10M–\$100M: 75 bps                      \$100M–\$500M: 50 bps                      &gt;\$500M: 35 bps                      (2) These average fees get a “good” rating of 50%.</p>
Efficiency of investment options	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Efficiency is evaluated in terms of simplicity, appropriate number of options, presence of low fee index funds, other criteria.</p> <p><b>Comments</b>                      (1) The user may have a different philosophy with respect to what constitutes a valuable offering. For instance, offering a very limited menu of index fund options may be viewed as a strength in that it removes the need for plan members to select active managers that rarely outperform the index.                      (2) Assigning the value may include an allowance for higher fees associated with a more diverse offering including aggressive options.                      (3) The user can add other criteria considered important.</p>
Diversification of options menu	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Diversification evaluated in terms of menu offered, presence of target date fund options, comprehensive coverage of main asset classes.</p> <p><b>Comments</b>                      (1) The user may have a different philosophy with respect to what constitute a valuable offering. For instance, target date funds manage diversification and asset allocation over time, and index funds are by definition perfectly diversified.                      (2) Although target date funds are the most common “qualified default investment option,” the user need not use them as a value criterion if they are viewed as not being appropriate for plan participants.                      (3) The user can add other criteria considered important.</p>

<p>Retirement income solutions</p>	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> The “decumulation” phase has come to the forefront in recent years. Thus, offering payment solutions instead of lump sum transfers or systematic withdrawals can transform the DC plan into a lifetime source of predictable income.</p> <p><b>Comment</b> Consider the flexibility and variety of retirement income solutions offered by the plan: in-plan pension, systematic withdrawals, annuity, variable annuity with guaranteed minimum withdrawal benefit, competitive bidding service to annuity providers, etc.</p>
------------------------------------	--

### 3.3.3 ENROLLMENT DESIGN SUBCRITERIA

Table 3 provides guidelines to establish the value for each enrollment design criterion.

**Table 3**  
ENROLLMENT

Criteria	Value Determination
Vesting	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Faster vesting secures the rights to employer funds in case of early employment termination.</p> <p><b>Comment</b> Consider a value of 100% for immediate vesting, scaling to 0% if greater than 3 years.</p>
Eligibility	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Quicker eligibility means that larger accumulations over employment service.</p> <p><b>Comment</b> Consider a value of 100% for immediate eligibility upon employment and wide-ranging workforce coverage (i.e., part-time, seasonal, hourly, salaried), scaling down to 0% for a longer waiting period and/or exclusions for multiple employee types.</p>
Auto-enrollment	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Auto-enrollment ensures that apathetic participants are not sidelined and defer or fail to build their retirement savings.</p> <p><b>Comments</b> (1) Consider the efficiency of the auto-enrollment provisions and default investment option. (2) If auto-enrollment is not provided, value is 0%.</p>
Auto-escalation	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Auto-escalation ensures participants ramp up their contributions over time to maximize retirement savings.</p> <p><b>Comments</b> (1) Consider the efficiency of auto-escalation features. (2) If auto-escalation is not provided, value is 0%.</p>

It has been noted that when plans first adopt auto-enrollment, typical deferral percentages among many participants decrease, even in plans where deferring at the auto-enrollment rate does not give rise to the full match. Accordingly, a user with this view may review the weights to reduce the emphasis of these criteria.



Another factor to consider (for U.S. plans) is whether plans with lower matching satisfy the Actual Deferral Percentage and Actual Contribution Percentage tests, and by extension the average benefit percentage test for DC plans.

Auto-enrollment may generally be a desirable plan feature for younger, lower-paid participants, who might be less likely to participate in the plan upon hire, and this criterion may be most relevant for these participants.

The user should consider the impact of auto-enrollment on deferral percentages. If they are shown to decrease, then the weight of this criterion may need to be adjusted.

### 3.3.4 COMMUNICATIONS SUBCRITERIA

Table 4 provides guidelines to establish the value for each communications criterion.

**Table 4**  
COMMUNICATIONS

Criteria	Value Determination
Plan information	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> High-quality statements, performance disclosure and online access create participant engagement.</p> <p><b>Comment</b> Consider the quality, quantity and accessibility of plan information.</p>
Education and tools (investor profile, online planning)	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Investor profile and online planning help participants determine how much and where to invest.</p> <p><b>Comment</b> Also consider the ease of use, convenience and comprehensiveness of the tools.</p>
Plan adviser services and support	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> Quality advice and support help participants set goals and take steps to achieve them.</p> <p><b>Comment</b> Consider the nature, format and frequency of advice and support.</p>
Effectiveness of education and communication approach	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Rationale:</b> A good fit between education and communications approaches leads to greater understanding and increased engagement.</p> <p><b>Comment</b> Consider the demographic composition, socioeconomic status and education level of the group.</p>

### 3.4 Plan Adequacy

The value for the evaluation of plan adequacy is the ratio of the expected total replacement ratio to the target replacement ratio over a full career. The spreadsheet also calculates values for shorter career spans for information purposes; these are part of the report shown on the “Report” worksheet.

Figure 5 shows the data input area for calculating the Plan adequacy value.

**Figure 5**  
PLAN ADEQUACY DATA ENTRY

<b>2 PLAN ADEQUACY</b>				
<u>Sample data for adequacy calculations</u>		<u>Long service</u>	<u>Medium</u>	<u>Short</u>
Entry age		35	45	55
Retirement age		65	65	65
Life expectancy		90	90	90
Include auto escalation		No <input type="button" value="v"/>		
		<u>Value</u>		
<b>A</b>	Target replacement ratio	70%		
<b>B</b>	Social security replacement ratio	40%		
<b>C</b>	Other employer-provided pension replacement ratio	0%		
	Net replacement ratio [A - B - C]	30%		
	Average employer contribution as a percent of pay	5.0%		
	Average employee contribution as a percent of pay	5.0%		
	Expected annual real rate of return	2%	2%	2%
	Accumulation factor	40.97	24.54	11.06
	Accumulated assets at retirement as a multiple of real pay	4.10	2.45	1.11
	Annuity real discount rate	1%	1%	1%
	Annuity certain to end of life expectancy	22.13	22.13	22.13
	Plan replacement ratio	19%	11%	5%
	<i>employee portion</i>	10.0%	6.0%	3.0%
	<i>employer portion</i>	9.0%	5.0%	2.0%
	Expected total replacement ratio	59%	51%	45%
	<b>Plan value based on replacement ratio</b>	<b>84%</b>	<b>73%</b>	<b>64%</b>

The value for adequacy is calculated using the following inputs:

- Entry age
- Retirement age
- Life expectancy
- Auto-escalation provided? (options are Yes—Doubling, Yes—Tripling and No)
- Target replacement ratio (RR)
- Social security RR
- Other employer-provided pension RR
- Average employer contributions as a percent of pay (Er rate)
- Average employee contributions as a percent of pay (Ee rate)
- Expected annual real rate of return ( $i_1$ )

- Annuity real discount rate ( $i_2$ ) (see comments in Subsection 3.4.5, Assumptions)
- Employee contribution rate subject to auto-escalation ( $p$ )

The following formulas are used to find the value of plan adequacy:

$$\text{Adequacy} = (\text{Expected total RR})/(\text{Target RR})$$

$$\text{Expected total RR} = (\text{Social security RR}) + (\text{Other employer-provided RR}) + (\text{Plan RR})$$

$$\text{Social security RR} = \text{Average social security RR based on income level}$$

$$\text{Other employer-provided pension RR} = \text{Replacement ratio provided by another employer-sponsored pension plan over full career}$$

$$\text{Plan RR} = \frac{\text{Accumulated assets at retirement as a multiple of real pay}}{\text{Annuity certain to end of life expectancy}}$$

$$\text{Annuity certain to end of life expectancy} = \frac{1 - \left( \frac{1}{(1 + i_2)^{\text{life expectancy} - \text{retirement age}}} \right)}{\ln(1 + i_2)}$$

$$\text{Target RR} = \text{Target replacement ratio required to provide adequate retirement income}$$

The value of accumulated assets at retirement as a multiple of real pay is equal to the sum of employee and employer accumulated assets based on the contribution rates. For employee contributions, there are three formulas, depending on the auto-escalation offered under the plan.

### 3.4.1 AUTO-ESCALATION PROVIDED AND DOUBLING CONTRIBUTIONS OVER TIME

If the plan provides for auto-escalation that results in *doubling* employee contributions over time, assuming the contribution rate increases by 1% per year from its current level, it will take  $p$  years to double the contribution rate, where  $p$  is the employee contribution rate times 100 (e.g., for a rate of 3%,  $p$  is 3):

$$\text{Ee rate} \times \left[ \frac{(1 + i_1)^p - 1}{\ln(1 + i_1)} + 2(1 + i_1)^p \left( \frac{(1 + i_1)^{\max(0, \text{retirement age} - \text{current age} - p)} - 1}{\ln(1 + i_1)} \right) \right]$$

For simplicity, in the preceding equation, it is assumed that contributions will be level for  $p$  years and double thereafter. The exponent in the last term cannot be less than 0.

For example, with  $i_1$  equal to 2% and a contribution rate of 3%, it will take three years to double to 6%, so the value is as follows:

$$.03 \times \left[ \frac{1.02^3 - 1}{\ln 1.02} + 2(1.02^3) \left( \frac{1.02^{\max(0, 65 - 35 - 3)} - 1}{\ln 1.02} \right) \right]$$

### 3.4.2 AUTO-ESCALATION PROVIDED AND TRIPLING CONTRIBUTIONS OVER TIME

If the plan provides for auto-escalation that results in *tripling* employee contributions over time, assuming the contribution rate increases by 1% per year from its current level, it will take  $2p$  years to triple the contribution rate:

$$Ee \text{ rate} \times \left[ \frac{(1+i_1)^{2p} - 1}{\ln(1+i_1)} + 2(1+i_1)^{2p} \left( \frac{(1+i_1)^{\max(0, \text{retirement age} - \text{current age} - 2p)} - 1}{\ln(1+i_1)} \right) \right]$$

For simplicity, in the preceding equation, it is assumed that contributions will be level for  $p$  years and triple thereafter. The exponent in the last term cannot be less than 0.

For example, with  $i_1$  equal to 2% and a contribution rate of 3%, it will take six years to triple to 9%, so the value is as follows:

$$.03 \times \left[ \frac{1.02^6 - 1}{\ln 1.02} + 2(1.02^6) \left( \frac{1.02^{\max(0, 65-35-6)} - 1}{\ln 1.02} \right) \right]$$

### 3.4.3 NO AUTO-ESCALATION

If auto-escalation is not provided under the plan, then the formula is as follows:

$$Ee \text{ rate} \times \left[ \frac{(1+i_1)^{\text{retirement age} - \text{current age}} - 1}{\ln(1+i_1)} \right]$$

### 3.4.4 EMPLOYER CONTRIBUTIONS

For employer contributions, the accumulated assets at retirement as a multiple of real pay are as follows:

$$Er \text{ rate} \times \left[ \frac{(1+i_1)^{\text{retirement age} - \text{current age}} - 1}{\ln(1+i_1)} \right]$$

### 3.4.5 ASSUMPTIONS

The plan adequacy calculations rest on two assumptions, which can be modified by the user:

- Expected real rate of return—the rate of accumulation for the contributions to the year of retirement. We put a default value of 2%, assuming that a balanced portfolio will earn this rate in excess of the inflation rate.
- Annuity real discount rate—the rate used to determine an annuity certain of \$1 per year increasing annually at the rate of inflation. We put a default annuity real discount rate of 1%. This assumes that the annuity certain factor is 1 for an income indexed at the rate of inflation, and assumes that other replacement ratios (for social security and employer-provided defined benefit plan) provide income that is indexed to the rate of inflation.

These values were selected to be conservative and can be modified by the user of the model. A change of 1 percentage point in each rate will change the plan adequacy by about 8%, and the total plan value calculated by the objective function by about 3%. Selection of assumptions is secondary to using the same approach for all plans under comparison.

### 3.5 Other Criteria

To have a comprehensive evaluation, we can have a qualitative assessment of other important features. Each of these criteria is evaluated quantitatively based on our scale of “poor” to “excellent” (see Table 5). Alternatively, some criteria require a yes/no answer, with values of 100% and 0%, respectively.

**Value** = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent”

**Table 5**  
VALUES FOR QUALITATIVE CRITERIA

Qualitative Evaluations	Values
Poor	0%
Fair	25%
Good	50%
Very good	75%
Excellent	100%

**Figure 6**  
DATA ENTRY FOR OTHER CRITERIA

3 OTHER CRITERIA			Value	
<b>Governance</b>				
Select rating:				
A	Investment monitoring and review process	25%		Fair
B	Employee committee representation	0%		No
C	Risk management framework and compliance	25%		Fair
D	Transparency	25%		Fair
<b>Other</b>				
Select rating:				
A	Loan provisions	75%		Very Good
B	Presence of other retirement programs with employer	0%		No
C	Hardship withdrawal provision	0%		Poor
D	Fee equalization policy	0%		Poor
<b>Value for governance and other provisions</b>			<b>19%</b>	

As shown in Figure 6, there are four categories of governance criteria:

- Investment monitoring and review process
- Employee committee representation
- Risk management framework and compliance
- Transparency

In addition, there are four other criteria:

- Loan provisions
- Presence of other retirement programs with employer

- Hardship withdrawal provisions
- Fee equalization policy

Fee equalization is a mechanism used to level expenses among participants to increase fairness and cost sharing. The term *fee equalization* is not a standard term within the industry (for background, see ERISA Section 408(b)(2)). Fee equalization credits participants for revenue sharing paid by their investments that exceeds their share of the record-keeping fee. This approach ensures that participants pay an equivalent share of their plan’s administrative expense. Rather than bundling the investment and administrative expenses, a plan charges each participant an administrative fee, based on either basis points or a per-head charge.

This category (other criteria) is included for completeness. Users may add new criteria or delete existing ones included in the objective function, based on their own evaluation. For example, some argue that employee committee representation is impractical or that flexible loan and hardship withdrawal provisions are more detrimental than beneficial to participants, because they are major contributors to leakage of funds from a plan.

### 3.6 Plan Success

Plan success represents the value observed from participation levels and investment efficiency of an actual plan. Figure 7 shows an example of data entry for measuring plan success.

**Figure 7**  
DATA ENTRY FOR PLAN SUCCESS

4	PLAN SUCCESS	Value	
	<b>Participation</b>		
	Actual participation rate	70%	3,500 are in plan for a workforce of 5,000
	Expected participation rate	75%	75% near industry average
	Score for participation		93%
	<b>Investment efficiency</b>		
	Average age of plan participants	44	
	Actual percentage of diversified equities	48%	
	Optimal equity level (100% - [participants' average age]/100)	56%	
	Value for investment efficiency		86%
	<b>Measurement of Plan Success</b>		90%

The following values are assigned to the criteria for plan success:

**Measurement of plan success** = Average of participation and investment efficiency

**Participation** = Actual participation rate/Expected participation rate

Actual participation rate = (Number of plan members)/(Number of eligible employees)

Expected participation rate = Estimated participation rate for plan size or industry

**Investment efficiency** = (Actual percentage of diversified equities)/(Optimal equity level)

$$\text{Investment efficiency} = 100\% - \left| \frac{\text{Optimal equity level} - \text{Actual percentage of diversified equities}}{\text{Optimal equity level}} \right|$$

Actual percentage of diversified equities = Plan assets invested in diversified equities, excluding company stock

$$\text{Optimal equity level} = 100\% - \frac{\text{Participants' average age}}{100}$$

Diversified equities = All equity-type investments, excluding company stock

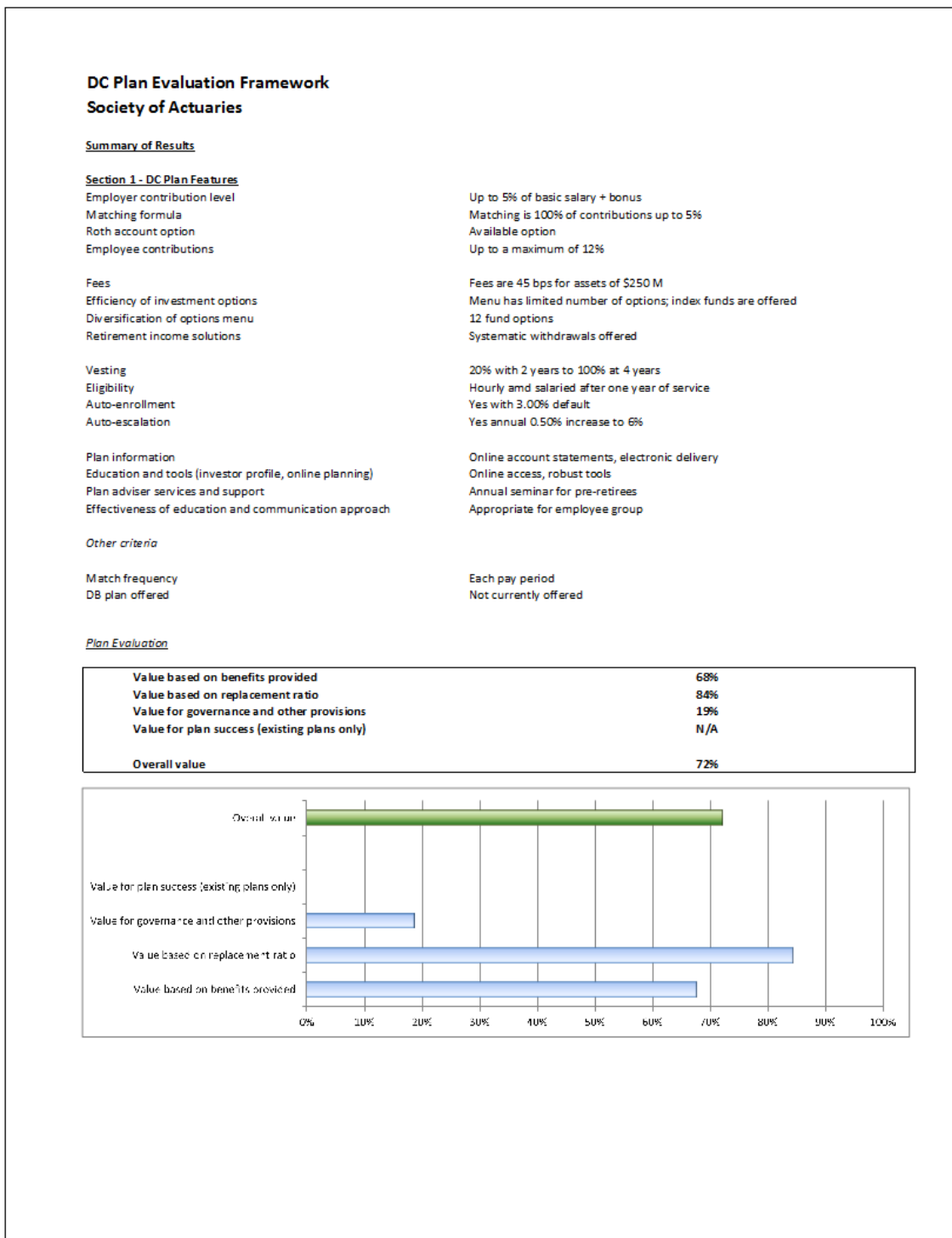
The optimal equity level is a crude estimate of the plan population's risk profile, which should be more heavily weighted in equities if the time horizon is further away in order to maximize returns.

Based on historical equity returns, equities have higher volatility over the short term but generate higher returns over the long term. So a younger population should invest more heavily on average to maximize returns, while an older population should reduce their exposure to equities to minimize volatility.

### **3.7 Report Summary**

The model has a summary report showing the plan's main features, rating for the plan features and projected income replacement percentages calculated for various career spans (see Figure 8 for an example). It also provides a list of assumptions used in the calculations and disclaimers.

**Figure 8**  
REPORT SUMMARY





## Section 4: Weights for Objective Function

### 4.1 Overall Assessment

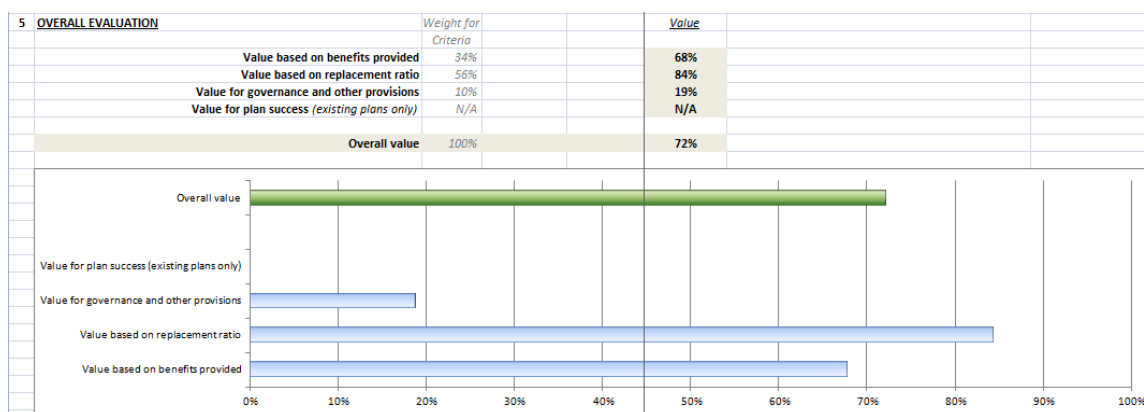
In Section 3.2, we set out the formulas for the objective function based on plan terms, adequacy, participant experience and other criteria:

$$\text{Plan value} = (\text{Provisions}) \times w_1 + (\text{Adequacy}) \times w_2 + (\text{Other criteria}) \times w_3 + (\text{Plan success}) \times w_4$$

where  $w_i$  are weights assigned to each of the main criteria.

Weights are determined using the techniques of Analytic Hierarchy Process (AHP). Section 7 sets out the main ideas of AHP. The companion spreadsheet to this report provides the judgment values of each pairwise comparison between criteria. The AHP worksheets are hidden in the spreadsheet; to unhide them, the user can right-click the tab bar and select **Unhide**. There is an AHP worksheet for the main criteria and each subcriterion. Users can modify the weights by changing the values for pairwise comparisons according to their judgment. The weights derived in each of these worksheets are linked to the “DC Framework” worksheet.

**Figure 9**  
ASSESSMENT OF THE OBJECTIVE FUNCTION



## 4.2 Weights for Plan Value Objective Function

As discussed, there are two versions of the objective function: one that takes into account participant experience, and one that doesn't. In both cases, the objective function puts emphasis on plan adequacy as the main determinant of value. The plan provisions criterion has a weighting similar to the plan success, if participant experience is taken into account. The "governance and other provisions" criterion has only a marginal weight. Table 6 shows the weights for each of the main criteria if an existing plan is taken into account.

**Table 6**

### OBJECTIVE-FUNCTION WEIGHTS: EXISTING PLAN

Criteria	Weights
Value for plan provisions	25%
Value for plan adequacy	41%
Value for governance and other provisions	7%
Value for plan success (existing plans only)	27%
<b>Total</b>	<b>100%</b>

Table 7 shows the weights for each of the main criteria if an existing plan is not taken into account.

**Table 7**

### OBJECTIVE-FUNCTION WEIGHTS: NO EXISTING PLAN

Criteria	Weights
Value for plan provisions	34%
Value for plan adequacy	56%
Value for governance and other provisions	10%
<b>Total</b>	<b>100%</b>

### 4.3 Weights for Plan Provisions Main Criteria

We put an emphasis on the plan design criterion, as it includes items such as employer contributions and matching. Investment options and enrollment design have lower weights, and their subcriteria emphasize fees, auto features and retirement income solutions. Table 8 shows the weight for each of the plan provision criteria.

**Table 8**

#### PLAN DESIGN WEIGHTS

Criteria	Weights
Plan design	61%
Investment options	15%
Enrollment design	15%
Communications	9%
<b>Total</b>	<b>100%</b>

#### 4.3.1 WEIGHTS FOR PLAN DESIGN SUBCRITERIA

Table 9 shows the weights for criteria used in the plan design subcriteria.

**Table 9**

#### PLAN DESIGN WEIGHTS

Criteria	Weights
Employer contributions	70%
Matching formula	10%
Availability of Roth contributions	10%
Employee contributions	10%
<b>Total</b>	<b>100%</b>

### 4.3.2 WEIGHTS FOR INVESTMENT OPTIONS SUBCRITERIA

Table 10 shows the weights for the criteria used in the plan design subcriteria.

**Table 10**  
INVESTMENT OPTIONS WEIGHTS

Criteria	Weights
Fees	51%
Efficiency of investment options	8%
Diversification of options menu	8%
Retirement income solutions	33%
<b>Total</b>	<b>100%</b>

### 4.3.3 WEIGHTS FOR ENROLLMENT DESIGN SUBCRITERIA

Table 11 shows the weights for criteria used in the enrollment design subcriteria.

**Table 11**  
ENROLLMENT DESIGN WEIGHTS

Criteria	Weights
Vesting	38%
Eligibility	7%
Auto-enrollment	37%
Auto-escalation	18%
<b>Total</b>	<b>100%</b>

#### 4.3.4 WEIGHTS FOR COMMUNICATIONS SUBCRITERIA

Table 12 shows the weights for criteria used in the communications subcriteria.

**Table 12**  
COMMUNICATIONS

Criteria	Weights
Plan information	12%
Education and tools (investor profile, online planning)	13%
Plan adviser services and support	35%
Effectiveness of education and communication approach	40%
<b>Total</b>	<b>100%</b>

#### 4.4 Weights for Plan Adequacy

The value for the evaluation of plan adequacy is the ratio of the expected total replacement ratio over the target replacement ratio over a full career. The values calculated for shorter career spans are for information purposes and are part of the report shown on the “Report” worksheet.

#### 4.5 Weights for Other Criteria

The value for the evaluation of other criteria is simply the average of the value for each item.

#### 4.6 Weights for Plan Success

The value for the plan success evaluation is the average of the plan participation and investment efficiency values.

## Section 5: Range of Outcomes for Evaluation Criteria

### 5.1 References Used for Ranges

As described earlier, the end user will establish the input parameters and optimal plan design criteria to be used for comparison purposes in this model. This section provides details on the potential ranges of inputs that the user may want to use for each criterion and the references for the sources used to determine these ranges (from low to high end).

In the following subsections, we will refer to the following publications, using the short forms given in parentheses:

- Aon Hewitt, *2011 Trends and Experience in Defined Contribution Plans*, 2011 (Aon)
- Deloitte / International Foundation of Employee Benefit Plans, *Annual Defined Contribution Benchmarking Survey*, 2014 (Deloitte)
- Vanguard Institutional Investor Group, *How America Saves 2014*, 2014 (Vanguard)
- Michael Clingman, Kyle Burkhalter, and Chris Chaplain, “Replacement Rates for Hypothetical Retired Workers,” Actuarial Note Number 2015.9, Office of the Chief Actuary, Social Security Administration, July 2015 (Social Security)
- BrightScope / Investment Company Institute, *The BrightScope/ICI Defined Contribution Plan Profile: A Close Look at 401(k) Plans*, December 2014 (BrightScope)
- Jack Van Derhei and Lori Lucas, “The Impact of Auto-enrollment and Automatic Contribution Escalation on Retirement Income Adequacy,” *Employee Benefit Research Institute Issue Brief*, no. 349, November 2010 (EBRI)
- PLANSPONSOR, *2014 DC Survey: Plan Benchmarking*, January 2015, <http://www.plansponsor.com/2014-DC-Survey--Plan-Benchmarking/> (PLANSPONSOR)

### 5.2 Plan Design

Table 13 shows the value criteria for assessing plan design criteria.

**Table 13**  
PLAN DESIGN VALUE CRITERIA

Criteria	Background to Establish Value of Criteria
Employer contributions	Range of contributions  <4%: 42% of plans  4%–7%: 32%  7%–9%: 9%  >9%: 17%  (Source: Vanguard)
Matching formula	Employer match design (all plan sizes)  Simple match: 40% of plans  Tiered match: 4%  Maximum dollar match: 3%

	<p>Other (lump sum or missing survey data): 37%</p> <p>None: 17%</p> <p>(Source: BrightScope)</p> <p>Percent employer match for simple match formulas</p> <p>25%: 8% of plans</p> <p>50%: 35%</p> <p>75%: 2%</p> <p>100%: 47%</p> <p>Other: 9%</p> <p>(Source: BrightScope)</p> <p>Matching information: Small plans</p> <p>&gt;100% for 1st 6% of pay: 8% of plans</p> <p>100% for 1st 6% of pay: 8%</p> <p>51%–99% for 1st 6% of pay: 15%</p> <p>50% for 1st 6% of pay: 29%</p> <p>&lt;50% for 1st 6% of pay: 33%</p> <p>Other: 7%</p> <p>(Source: PLANSPONSOR)</p> <p>Matching information: Large plans</p> <p>&gt;100% for 1st 6% of pay: 11% of plans</p> <p>100% for 1st 6% of pay: 14%</p> <p>51%–99% for 1st 6% of pay: 27%</p> <p>50% for 1st 6% of pay: 25%</p> <p>&lt; 50% for 1st 6% of pay: 19%</p> <p>Other: 4%</p>
--	---

	(Source: PLANSPONSOR)
Roth contributions	<p>Prevalence of Roth contributions offered in plans</p> <p>Offering Roth 401(k) feature: 51% of plans surveyed</p> <p>Not offering Roth 401(k) feature: 33%</p> <p>Considering offering in the future: 16%</p> <p>(Source: Deloitte)</p>
Employee contributions	<p>Distribution of average employee contribution rates</p> <p>0.1%–3.9%: 30% of plans</p> <p>4.0%–6.0%: 22%</p> <p>6.1%–9.9%: 26%</p> <p>10.0%–14.9%: 15%</p> <p>15.0%+: 7%</p> <p>(Source: Vanguard)</p>

The Aon report offers the following additional information on the prevalence of employer matching:

- Among the employers studied, 85% provide matching contributions (fixed, graded, service, or other).
- A fixed match remains most prevalent among 63% of plans, while 18% use a graded match.
- Nonmatching contributions are provided by 29% of employers.
- The most common type of fixed match is \$0.50 per \$1.00 up to 6% of pay, with 14% of employers reporting this formula.
- The second most common type of fixed match is \$1.00 per \$1.00 up to 6% of pay, reported by 10% of plans.
- A quarter of plans with a fixed match formula reported a \$1.00-per-\$1.00 match up to a specified percentage of pay.
- Employer contributions vest immediately across 43% of plans.
- The most prevalent vesting schedule remains three-year cliff vesting (18% of plans), followed by five-year graded schedule (16% of plans).



### 5.3 Investment Options

Table 14 shows the value criteria for assessing investment options criteria.

**Table 14**  
INVESTMENT OPTIONS

Criteria	Background to Establish Value of Criteria
Fees	<p>Expense ratios: Small plans</p> <ul style="list-style-type: none"> <li>&lt;25 bps: 7% of plans</li> <li>25–50 bps: 11%</li> <li>50–75 bps: 15%</li> <li>75–100 bps: 24%</li> <li>100–150 bps: 9%</li> <li>150–200 bps: 1%</li> <li>Unknown: 32%</li> </ul> <p>(Source: PLANSPONSOR)</p> <p>Expense ratios: Large plans</p> <ul style="list-style-type: none"> <li>&lt;25 bps: 13% of plans</li> <li>25–50 bps: 32%</li> <li>50–75 bps: 30%</li> <li>75–100 bps: 7%</li> <li>100–150 bps: 1%</li> <li>150–200 bps: 0%</li> <li>Unknown: 17%</li> </ul> <p>(Source: PLANSPONSOR)</p> <p>Total cost by plan assets (asset-weighted)</p> <ul style="list-style-type: none"> <li>\$1 million–\$10 million: 120 bps</li> <li>\$10 million–\$100 million: 75 bps</li> <li>\$100 million–\$500 million: 50 bps</li> </ul>

	<p>&gt;\$500 million: 30–35 bps</p> <p>(Source: BrightScope)</p>
Efficiency of investment options	<p>Average and median number of core funds available to participants</p> <p>13</p> <p>(Source: Aon)</p>
Diversification of options menu	<p>Options available (all plan sizes)</p> <p>Target date funds: 70% of plans</p> <p>Target risk funds: 40%</p> <p>Balanced funds: 73%</p> <p>Money-market funds: 64%</p> <p>Employer stock: 8%</p> <p>Stable value funds: 60%</p> <p>Real estate, REITs: 28%</p> <p>Alternative investments: 5%</p> <p>Socially responsible funds: 11%</p> <p>(Source: PLANSPONSOR)</p>
Retirement income solutions	<p>Small plans</p> <p>Variable annuity: 9% of plans</p> <p>Managed payouts: 11%</p> <p>Annuity bidding service: 4%</p> <p>None: 47%</p> <p>(Source: PLANSPONSOR)</p> <p>Large plans</p> <p>Variable annuity: 20% of plans</p> <p>Managed payouts: 14%</p> <p>Annuity bidding service: 8%</p> <p>None: 57%</p>

	(Source: PLANSPONSOR)  Prevalence  29% provide income solutions  18% offer facilitation outside of the plan  15% offer in-plan solution  (Source: AON)
--	--

The user of the model can decide the basis for determining what to include in plan fees. The average fees by plan size draw from BrightScope’s concept of "total plan cost," which includes asset-based investment management fees, asset-based administrative and advice fees, and other fees (including insurance charges) from the Form 5500 and audited financial statements of ERISA-compliant 401(k) plans. When plans use products such as mutual funds, expense data from Lipper are used to calculate fees.

The ranges provided for the diversification of the options menu typically apply to noncore options. The user may consider including in this assessment an evaluation of the diversification of core options.

### 5.4 Enrollment Design

The EBRI study “The Impact of Auto-enrollment and Automatic Contribution Escalation on Retirement Income Adequacy” demonstrates the significant potential impact that auto-enrollment can have on retirement income adequacy. This informed our decision to put great emphasis on the weights of auto features in the objective function.

Table 15 shows the value criteria for assessing enrollment design criteria.

**Table 15**  
ENROLLMENT DESIGN CRITERIA

Criteria	Background to Establish Value of Criteria
Vesting	Immediate: 45% of plans  1- to 4-year cliff/graded: 22%  5-year graded: 19%  6-year graded: 14%  (Source: Vanguard)
Eligibility	Small plans  Upon hire: 30% of plans  <3 months: 32%  4–6 months: 10%

	<p>&gt;6 months: 28%</p> <p>(Source: PLANSPONSOR)</p> <p>Large plans</p> <p>Upon hire: 74% of plans</p> <p>&lt;3 months: 20%</p> <p>4–6 months: 1%</p> <p>&gt;6 months: 5%</p> <p>(Source: PLANSPONSOR)</p>
Auto-enrollment	<p>Plans with auto-enrollment features</p> <p>Small plans (\$10 million–\$50 million): 26% of plans</p> <p>Midsize plans (\$250 million–\$500 million): 40%</p> <p>Large plans (&gt;\$1 billion): 44%</p> <p>(Source: BRIGHTSCOPE)</p>
Auto-escalation	<p>Default initial contribution rate</p> <p>&lt;3%: 18% of plans</p> <p>3%: 59%</p> <p>4%: 11%</p> <p>5%: 5%</p> <p>6%: 7%</p> <p>(Source: BRIGHTSCOPE)</p>

The Aon report offers the following additional information about the prevalence of auto features:

- In 2011, 56% of plans had automatic enrollment.
- In 78% of plans, participants that are automatically enrolled default into age-appropriate target date portfolios.
- In 66% of plans, participants that are automatically enrolled default to a contribution rate of only 1% to 3% of pay initially.
- Contribution escalation is offered by 51% of plans, and 53% make automatic rebalancing available.

## 5.5 Communications

Table 16 shows the value criteria for assessing communications criteria.

**Table 16**  
COMMUNICATIONS VALUE CRITERIA

Criteria	Background to Establish Value of Criteria
Plan information	No statistics available
Education and tools (investor profile, online planning)	No statistics available
Plan adviser services and support	Plan adviser services provided  62% of DC plans  68% of larger plans  (Source: PLANSPONSOR)
Effectiveness of education and communication approach	Balance between education and communication approach: Prevalence of approaches to raise awareness:  General and multiple communications: 73%  Group meetings: 60%  Targeted communications: 56%  Web: 52%  Printed materials: 52%  Automatic enrollment/increase: 46%  Financial counseling/advice: 39%  Individual meetings: 32%  Personalized communications: 23%

### 5.6 Plan Adequacy

The replacement ratio value for the evaluation of plan adequacy is the ratio of the plan's expected total replacement ratio divided by the target replacement ratio over a full career. A key value in the input parameters is the estimated social security replacement ratio, which is defined in the model as follows:

$$\text{Social security replacement ratio} = \text{Average social security replacement ratio based on income level}$$

We suggest using the values for 2015 from Table C of “Replacement Rates for Hypothetical Retired Workers” (Social Security).

**Table 17**  
SOCIAL SECURITY REPLACEMENT RATIO AT VARIOUS INCOME LEVELS

Income Levels	Social Security Replacement Ratios
Very low (\$12,000)	73%
Low (\$21,000)	53%
Medium (\$46,000)	40%
High (\$76,000)	33%
Maximum (\$112,000)	26%

### 5.7 Other Criteria

Governance criteria include elements such as the following:

- Investment monitoring and review process (65% of plans, according to PLANSPONSOR)
- Employee committee representation
- Risk management framework and compliance
- Transparency

Other criteria include the following:

- Loan provisions (79% of plans, according to PLANSPONSOR)
- Presence of other retirement programs with the employer
- Hardship withdrawal provisions (88% of plans, according to PLANSPONSOR)
- Fee equalization policy (13% of plans, according to PLANSPONSOR)

### 5.8 Plan Success

Plan success represents the value observed from participation levels and investment efficiency of an actual plan.

The participation level formula is the expected participation rate, which is the estimated participation rate for plan size or industry type. In the absence of an industry average, the user can assume an expected participation rate of 76%. Otherwise, use the values by industry group provided in Table 18.

**Table 18**  
AVERAGE PARTICIPATION RATES BY INDUSTRY

Industries	Plan-Weighted Participation Rates
Overall	76%
Finance, insurance and real estate	86%
Agriculture, mining and construction	76%
Manufacturing	75%
Education and health	72%
Media, entertainment and leisure	71%
Business, professional and nonprofit	77%
Transportation, utilities and communications	73%
Wholesale and retail trade	75%

Source: Vanguard.

## Section 6: Review of Existing Approaches

### 6.1 REVIEW OF EXISTING APPROACHES

There are several ranking systems in the United States. A few private organizations provide ranking systems and rate a large number of plans. Several consulting firms also have their own benchmarking system, which they use on client projects to evaluate their clients' plan design against peer organizations.

We selected a few that are representatives of existing approaches to provide background on existing systems and inform our approach.

### 6.2 OBSERVATIONS FROM APPROACHES REVIEW

One of the ranking systems provided qualitative details in addition to the overall score. The listing of extra details is useful because it highlights desirable features. Often, these features have no monetary impact on the plan sponsor but make the plan better by adding flexibility (e.g., hardship provisions, retirement income solutions). Assessing “soft” features does not contribute significantly to the overall plan value, but recognizing the presence of such features ensures comprehensive coverage of nonmonetary criteria that have great value in the eyes of plan participants. This results in a more interesting analysis and better coverage of the most important plan features.

A couple of the systems helped in determining the typical range of plan features offered in the market. It also allows us to provide suggestions on assigning values for each criterion. These are described in Section 5. We could have more granularity from the data (e.g., plan size and/or industry), but we are limited by the data to which we had access.

Another system proposed an interesting model for existing plans. We thought it would be useful to be able to measure the success of a plan by looking at participation rates and investment efficiency, using a modified approach.

Benefit adequacy is covered in a couple of reviewed models, and devise a streamlined approach that can be easily calculated in Excel.

The model proposed in this report covers most success metrics of the reviewed models and provides guidance to improve participant behavior with regard to participation and investing.



## Section 7: Basic Ideas of the Analytic Hierarchy Process (AHP)

### 7.1 Background

The Analytic Hierarchy Process (AHP) is a structured technique for organizing and analyzing complex decisions, invented by mathematician Thomas L. Saaty in the 1970s. Use of this decision-making framework is ideal, as it ranks plans based on multiple criteria, with each criterion rated in terms of its importance relative to other criteria. Rather than prescribing a “correct” decision or determining on an absolute basis the best solution, AHP helps decision makers find a solution that best suits their goals. It is a flexible system that users can adapt to address the needs of the intended audience by emphasizing appropriate criteria. In particular, each characteristic can be assessed for its importance by the actuary and client or pension committee.

AHP provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. This makes it an ideal system to evaluate pension plan designs.

AHP uses concepts from linear algebra—in particular, eigenvectors, which convert values in a two-dimensional matrix to vectors, which are then used as weights in our objective function. Interestingly, the Google PageRank search engine algorithm uses eigenvectors to arrive at its final link ranking results. This is also one of the key components of the AHP approach.

### 7.2 Pairwise Comparisons

AHP uses pairwise comparisons to establish a ranking hierarchy for each criterion and sub-criterion.

The objective function comprises these four criteria: plan provisions, plan adequacy, other criteria and plan success. We use AHP to determine the weights attached to these criteria.

The weights for the objective function must be appropriate and consistent in order for the system to be effective. AHP ensures the weights are determined using a structured approach and are consistent between each other.

When doing the pairwise comparisons, the standard approach is a qualitative judgment on a scale of 1 to 9 between each two alternatives. Part of this process includes calculating a “consistency ratio” to evaluate whether the pairwise qualitative judgment values are consistent overall.

### 7.3 AHP Formulas and Concepts

Once the hierarchy has been constructed, the alternatives are compared pairwise against each of the criteria for preference. The comparisons are processed mathematically, and priorities are derived for each node.

By definition, the priority of the goal is 1. The priorities of all alternatives always add up to 1. Priorities are numbers associated with the nodes of an AHP hierarchy. They represent the relative weights of the nodes in any group. Like probabilities, priorities are absolute numbers between 0 and 1. A node with priority .200 has twice the weight of one with priority .100. The “weight” refers to the importance or preference of the criterion.

### 7.4 Application of AHP to the Model

The next few subsections set out the procedures for determining the relative importance of each criterion in the objective function for the plan value.

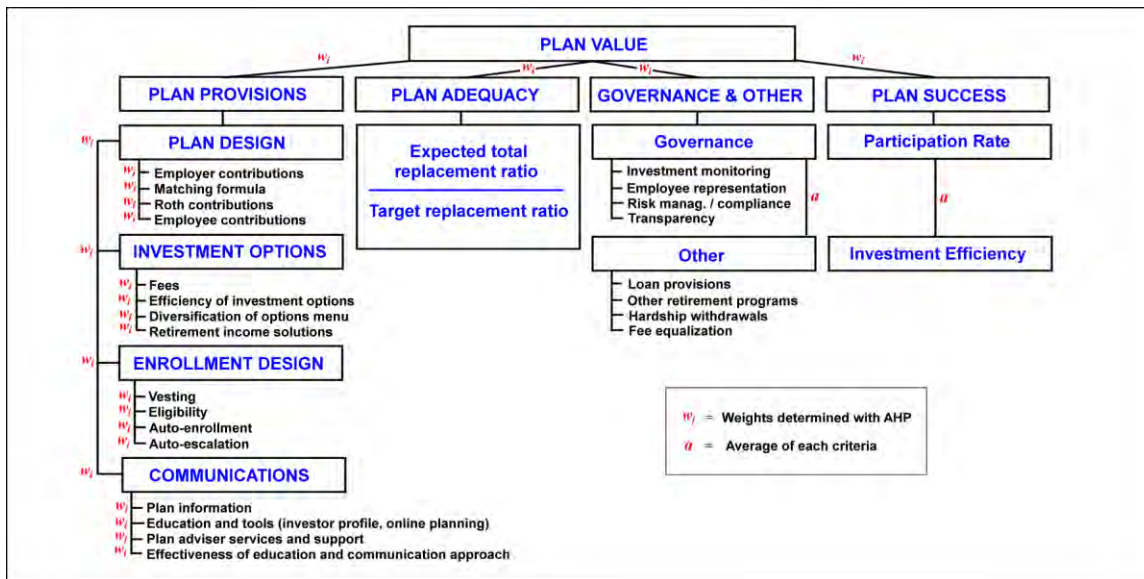
Note that the spreadsheet sets out all the formulas for each subset of criteria, so the user can review and modify it.

The goal is to determine consistent weights between the four main criteria (see Figure 12):

- Plan provisions

- Plan adequacy
- Governance and other
- Plan success

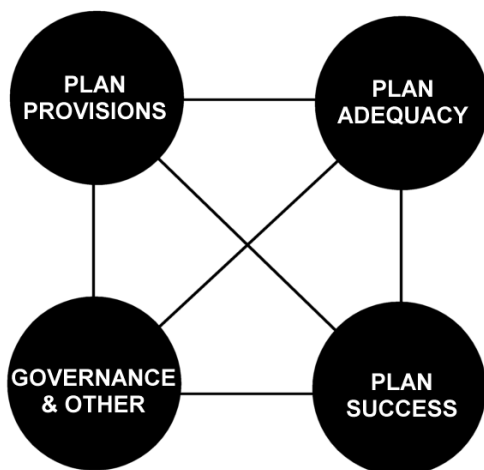
**Figure 12**  
MODEL SHOWING WEIGHTS DETERMINED WITH AHP ( $w_i$ )



Since four criteria are being compared and we need to compare each one to the others, we will make six pairwise comparisons to cover each criterion (see Figure 13):

- Plan provisions vs. plan adequacy
- Plan provisions vs. governance and other
- Plan provisions vs. plan success
- Plan adequacy vs. governance and other
- Plan adequacy vs. plan success
- Plan success vs. governance and other

**Figure 13**  
PAIRWISE COMPARISONS WITH FOUR NODES



For each comparison, we will first evaluate which member of the pair is weaker with respect to the criterion under consideration. Then we will assign a relative weight to the other candidate, using an "AHP scale" (presented in Table 19) in assigning the weights. The table shows only odd-numbered weights, but intensities of 2, 4, 6 and 8 can be used to express intermediate values.

**Table 19**  
ANALYTIC HIERARCHY PROCESS (AHP) VALUE JUDGMENT SCALE

Intensity of Importance	Definition	Explanation
1	Equal importance	2 elements have the same value
3	Moderate importance	1 element is moderately better
5	Strong importance	1 element is significantly better
7	Very strong importance	1 element is greatly better
9	Extreme importance	1 element is better than the other at the highest possible degree

Saaty's book *The Analytic Hierarchy Process* provides background and theory on why he chose the 1–9 scale and his validation of this judgment with measurable science.

The priorities are measurements of their relative strengths, derived from judgment values entered into the matrix. Mathematically speaking, they are the values in the matrix's principal or dominant right eigenvector. These values can be calculated in many ways, including by hand or using Excel.

Each pairwise element is compared against the others, and a weight is assigned based on judgment and consensus among stakeholders.

**Table 20**  
VALUE JUDGMENTS FOR EACH PAIRWISE COMPARISON

Plan provisions	1	Plan adequacy	3	Plan adequacy slightly more important than actual plan provisions
Plan provisions	5	Governance and other	1	Plan provisions such as employer contributions, vesting and enrollment significantly more important than other criteria
Plan provisions	1	Plan success	1	For an ongoing arrangement, plan provisions as important as participation levels and investment efficiency
Plan adequacy	5	Governance and other	1	Plan adequacy significantly more important than governance and other criteria
Plan adequacy	1	Plan success	1	Plan adequacy just as important as plan success
Governance and other	1	Plan success	3	Plan success somewhat more important than governance and other criteria

### 7.5 AHP Matrix

The next step is to transfer the weights to a matrix, using a method unique to the AHP. For each pairwise comparison, the number representing the greater weight is transferred to the cell that intersects in the matrix, and the reciprocal of that number is put into the cell of the other intersection, working horizontally. Reverse comparisons (B to A) produce the reciprocal of the basic comparison. This is called a reciprocal matrix.

For each pairwise comparison, the number representing the greater weight is transferred to the cell that intersects in the matrix, and the reciprocal of that number is put into the cell of the other intersection, working horizontally.

The priorities are measurements of their relative strength or weight of each criterion.

**Table 21**  
AHP MATRIX OF RELATIVE WEIGHTS

Criteria	Plan Provisions	Plan Adequacy	Governance and Other	Plan Success	Priority
Plan provisions	1	1/3	5	1	.25
Plan adequacy	3	1	5	1	.41
Governance and other	1/5	1/5	1	1/3	.07
Plan success	1	1	3	1	.27

The priority is the normalized value obtained by this formula:

$$\text{Priority for criterion } i = \text{Average of normalized values for row} = \text{Sum of normalized values for row} / \text{Number of rows},$$

where:

$$\text{Normalized value for cell } [i, j] = \text{value in cell } [i, j] / \text{Sum of values in column } j$$

### 7.6 Consistency Index

AHP comes with a method to verify whether our results are consistent: a consistency index (CI) using as the lambda max a measure of the maximum eigenvalue of the matrix =  $L_{\max} = \lambda_{\max}$ .

$$CI = (\lambda_{\max} - n) / (n - 1)$$

For each matrix of size  $n$ , Saaty's team generated random matrices and computed their mean CI value. They called that mean the Random Index (RI). These random values are presented in Table 22.

**Table 22**  
RANDOM CONSISTENCY INDEX TABLE FOR MATRIX SIZE 1 TO 5

$N$	1	2	3	4	5
Random index	0	0	1.58	0.90	1.12

The CI and RI can be used to find the consistency ratio (CR):

$$CR = CI / RI$$

A value less than or equal to 0.1 is acceptable. Larger values require that the decision maker reduce the inconsistencies by revising judgments.

Table 23 represents a composite of experiments performed by Saaty and his colleagues, using a large number of random reciprocal  $n \times n$  matrices using the 1–9 scale. The maximum eigenvalue was determined by raising each random matrix to increasing powers and normalizing the result until the process converged.

In the above case, we calculated the values in Table 23.

**Table 23**  
CONSISTENCY CALCULATIONS FOR OBJECTIVE FUNCTION

Lambda max	4.188127247
Consistency index	0.062709082
Consistency ratio	0.069676758
Assessment	Very consistent (<10%)

### 7.7 Other Criteria

We followed the same method to find the weights for all the criteria of the model that are determined using AHP.

Note that for simplicity, we used averages as weights for the “governance and other” subcriteria. It does not need a great level of precision, because the criteria weight is small and thus would not materially influence the overall result.

Similarly, we used an average for the “plan success” criteria, simply assigning equal weight to the participation rate and investment efficiency criteria. This assumes that the two criteria used to establish the value are of equal importance.

### 7.8 Summary

AHP is very useful in breaking down an unstructured situation into its component parts and arranging the parts or variables into a hierarchic order. We assign numerical values to subjective judgments about the relative importance of each variable, and this makes it possible to synthesize our judgments and determine which variables have the highest priority.

## Section 8: Objectives, Context and Use

### 8.1 Defining Objectives

Based on the original terms of reference for this project, the conceptual evaluation framework has the following objectives:

- Build a conceptual framework for actuaries to use in providing analytical advice to employers and employees regarding the adequacy of DC retirement plan benefits.
- Allow users and sponsors of DC programs to focus on important metrics and get to the substantive issues in retirement planning.
- Evaluate an individual DC plan, facilitating comparison with other employers' plans.
- Include features in a rating system that include items such as vesting, eligibility, contributions, matching, auto features, fees, replacement income, etc.
- Provide a flexible but uniform basis for evaluating the effectiveness of a DC program.
- Design a system for use by actuaries.
- Compare one program with those of other employers in the same industry or geographical area.
- Highlight strengths and weaknesses of programs under review in the rating system.
- Make the system relevant to U.S. and Canadian plans—and, if possible, to plans in other jurisdictions.

### 8.2 Context and Use

The context of the evaluation framework is one that finds more value for plans that have higher contributions, lower fees, better features and more flexibility to the member. For example, the model is not adaptable to accommodating a management or shareholder perspective seeking cost savings.

These are the general principles governing the framework:

- The model evaluates a plan, not an individual.
- It compares each feature against a range of existing possibilities.
- It recognizes plan size and can use the range of features that applies to a particular plan size in the evaluation.
- It can also incorporate a measure of the success of an ongoing plan.
- The model is based on the idea that retirement planning is a shared responsibility between the member and the sponsor/employer.
- The model recognizes the importance of auto features (auto-enrollment and auto-escalation) and the protection these features provide against the behavioral tendencies of apathy.

The audience is primarily actuaries and other mathematically inclined users. The model could be adapted for a lay audience by using a questionnaire linked to a model in the background that calculates an index value from 0% to 100%.

It is important to keep in mind that the model considers the defined contribution arrangement in isolation from other plans an employer may offer. The value of a DC plan may also be considered within the context of the employer's or industry group's compensation and benefits strategy, but that is beyond the scope of this project.

## Section 9: Modifications for Canada

### 9.1 The Canadian Pension Environment

The DC evaluation framework can easily be adapted for Canadian savings plan.

Canada's retirement income savings system is governed by the Income Tax Act (Canada) and jurisdiction-based pension legislation. Most provinces have pension legislation that applies to defined contribution pension plans. As well, the federal government has pension legislation that applies to enterprises under federal jurisdiction, such as banking, transportation and communications.

There are two main types of savings pension arrangements in Canada:

1. Group registered retirement savings plans (group RRSPs)
2. Defined contribution pension plans

The former is subject only to the Income Tax Act, which prescribes contribution limits, minimum withdrawals, acceptable investments and tax deductibility. The RRSP is an individual arrangement, which has been repackaged by capital accumulation plan (CAP) providers as a "group RRSP" for employees in a corporate setting.

The latter is subject to the Income Tax Act as above, but also to the applicable pension legislation, which prescribes minimum retirement age, investments and maximum withdrawals.

The federal government in the last few years has introduced a new type of arrangement, called the tax-free savings account (TFSA). The TFSA accepts after-tax contributions up to a limit, and investment income is not taxable. CAP providers have recently introduced this type of arrangement for employees as a "group TFSA." It is similar to Roth IRA arrangements in the United States.

### 9.2 Changes to the Model for a Canadian Version

This subsection describes the changes required to adapt the model to the Canadian pension environment. Note that the companion Excel spreadsheet has two tabs for the Canadian version. Other than the modifications mentioned here, the model functions in the same way as the U.S. version.

Note that the general structure need not be modified significantly. In particular, the plan adequacy calculation and the plan success measure are the same. As well, the number of fund options appears to be similar to that in the United States.

In the following subsections, we will refer to the following publications (using short forms given in parentheses):

- Sébastien LaRoche-Côté, Garnett Picot and John Myles, *Income Replacement during the Retirement Years*, Perspectives Statistics Canada Catalogue no. 75-001-X, August 2010 (StatsCan)
- Sun Life Financial, *Designed for Savings: The Benchmark Report on Capital Accumulation Plans in Canada*, 2014 (Sun Life)

### 9.2.1 PLAN DESIGN SUBCRITERIA

Table 24 shows changes to adapt the criteria for plan design features to make them suitable for the Canadian pension environment.

**Table 24**  
CHANGES TO EMPLOYER CONTRIBUTION FORMULAS

Criterion	Value Determination
Employer contributions	<p><b>Value</b> = <math>\min(\text{Employer contribution rate}, 5\%)/5\%</math></p> <p>(Source: Sun Life)</p>

### 9.2.2 INVESTMENT OPTIONS SUBCRITERIA

Table 25 shows changes to adapt the investment options criteria for the Canadian pension environment.

**Table 25**  
CHANGES TO INVESTMENT FEES VALUE DETERMINATION

Criterion	Value Determination
Fees	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Comments</b> Evaluate average fees for plan: Excellent: &lt;75 bps Very good: 75–100 bps Good: 101–125 bps Fair: 126–150 bps Poor: &gt;150 bps</p> <p>(No data source; based on anecdotal evidence)</p>



### 9.2.3 ENROLLMENT DESIGN SUBCRITERIA

Table 26 shows changes to adapt the enrollment design criteria for the Canadian pension environment.

**Table 26**  
CHANGES TO VESTING AND ELIGIBILITY CRITERIA

Criteria	Value Determination
Vesting	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Comments</b> Consider a value of 100% for immediate vesting, scaling to 0% for 2-year vesting</p>
Eligibility	<p><b>Value</b> = 0% to 100% based on qualitative assessment of “poor,” “fair,” “good,” “very good” or “excellent.”</p> <p><b>Comments</b> Consider a value of 100% for immediate eligibility upon employment and wide-ranging workforce coverage (i.e., part-time, seasonal, hourly, salaried), scaling down to 0% for a long waiting period (e.g., 1 year or more) and exclusions of multiple employee types</p>

### 9.2.4 PLAN ADEQUACY CRITERIA

The value for the evaluation of plan adequacy is the ratio of the expected total replacement ratio to the target replacement ratio over a full career. The spreadsheet also calculates values for shorter career spans for information purposes; these are part of the report shown on the “Report” worksheet.

For the social security replacement ratio, use the average government pension (e.g., Canada Pension Plan or Quebec Pension Plan and Old Age Security) replacement ratio based on income level (see Table 27 for examples based on B in *Income Replacement during the Retirement Years* (StatsCan)).

**Table 27**  
SOCIAL SECURITY REPLACEMENT RATIO AT VARIOUS INCOME LEVELS

Income Level	Average Government Pensions Replacement Ratio Based on Income Level
Low	40%
Medium (\$46,000)	30%
High (\$76,000)	20%

### 9.2.5 OTHER CRITERIA

Some other criteria do not apply in Canada:

- Loan provisions
- Fee equalization policy

Accordingly, these are removed from the Canadian framework.

### 9.2.6 PLAN SUCCESS CRITERIA

The participation level formula (expected participation rate) is the estimated participation rate for plan size or industry type. Statistics are available in the Sun Life report cited in Subsection 9.2, but the participation rates do not vary substantially by industry. Accordingly, for simplicity, we use an average participation rate of 80%.

## Section 10: Conclusion

We all know of the significant shift from defined benefit to defined contribution plans since the 1990s. Pension actuaries have had to adapt their expertise toward designing savings arrangements. Often plan designs have to be formulated in the context of a competitive landscape. This is where an evaluation framework can be useful. It can provide a structure around the task of determining competitiveness and implementing employer objectives.

The DC evaluation framework described in this report aims at increasing understanding of savings arrangements by proposing a rational approach to quantify on a weighted basis the various features of a savings arrangement along with its ability to provide an adequate replacement ratio in exchange for services rendered. Our review led us to identify certain plan features that should be considered when determining the quality of a savings plan.

We relied on the techniques of Analytic Hierarchy Process (AHP) to determine the appropriate weights of an objective function that calculates the value of a savings arrangement, considering quantitative features that improve retirement income and “soft” plan features that provide more flexibility. Put another way, retirement outcomes are affected by contribution levels, fees, expected returns, eligibility and vesting, auto features and the replacement ratio the plan can deliver. But plan quality is improved by providing capabilities that have little or no direct cost, such as flexible retirement income solutions, loan and withdrawal provisions, communications and planning tools, adviser services and proper governance structure. The evaluation framework combines these quantitative and qualitative features in a rational way and provides an overall estimate of the value of the plan.

The value of a plan ultimately depends on the employer contribution levels, investment fees and investment choices that will result in decent investment returns over the long term. However, from our review of existing models and other studies, we found that our model had to emphasize auto-enrollment, auto-escalation, retirement income solutions and replacement ratio adequacy to properly assess the value of a plan.

The model is flexible enough to be modified to emphasize different criteria by changing the weights or relative values for the pairwise comparisons of the various criteria.

By reporting results for each criterion (such as features, adequacy, participation rates, investment efficiency and other items that have a nonquantifiable monetary value), the framework highlights strengths and weaknesses of a plan relative to its peers or the plan “universe” as a whole.

For the plan adequacy value, we adopted a simple replacement ratio approach based on real rates of return. The selection of the expected rates of return and inflation are based on historical averages, with a bias toward conservatism. Selection of different assumptions will alter the end result, and sensitivity testing would be useful to understand the impact on results beyond the basic testing reported in this report.

A further area of research may involve seeing how the model fares in real-world situations. There are a few ways to achieve this. One is to develop computer algorithms to run the model against a large database of pension plan data—for example, the U.S. Department of Labor Form 5500 data. In conducting such an exercise, we may find that some data items are missing, and further development may be required to infer or derive values from existing data.

## References

### Publications

Aon and Financial Engines. *Help in Defined Contribution Plans: 2006 through 2012*. 2014.

Aon Hewitt. *2011 Trends and Experience in Defined Contribution Plans*. 2011.

———. *2014 Universe Benchmarks Highlights: Measuring Employee Savings and Investing Behavior in Defined Contribution Plans*. 2014.

BrightScope and Investment Company Institute. *The BrightScope/ICI Defined Contribution Plan Profile: A Close Look at 401(k) Plans*. December 2014.

Canadian Association of Pension Supervisory Authorities. “Guideline No. 8, Defined Contribution Pension Plans Guideline.” March 28, 2014.

———. “Regulated Retirement Products for DC Plan Members.” Reference document, March 28, 2014.

*Canadian Pensions and Retirement Income Planning*. 4th ed. Chapter 16. CCH Canadian, 2011.

Clingman, Michael, Kyle Burkhalter and Chris Chaplain. “Replacement Rates for Hypothetical Retired Workers.” Actuarial Note Number 2015.9. Office of the Chief Actuary, Social Security Administration, July 2015.

Côté, Jean-Daniel. *Improving Benefit Adequacy*. Mercer, March 2014.

Coyle, Geoff. *The Analytic Hierarchy Process (AHP)*. Pearson Education, 2014.

Davis, Rowland, FSA. “DC Plans: A World of Opportunities.” Presentation at SOA Annual Meeting, 2014.

Deloitte and International Foundation of Employee Benefit Plans. *Annual Defined Contribution Benchmarking Survey*. 2014.

DiCenzo, Joe. “Employees’ Retirement Choices, Perceptions and Understanding: A Review of Selected Survey and Empirical Behavioral Decision-Making Research,” Society of Actuaries presentation, March 2014.

Edwards, Phil, Holly Donovan and Chris Anast, “Defined Contribution Plan Success Factors.” Defined Contribution Institutional Investment Association white paper, May 2015.

Fink, Michael S., and Benjamin F. Cummings. *Models of Financial Advice for Retirement Plans: Considerations for Plan Sponsors*. Society of Actuaries, 2014.

Kessler, Emily. “Retirement 20/20 Measurement Framework.” Society of Actuaries, 2009.

LaRochelle-Côté, Sébastien, Garnett Picot and John Myles. “Income replacement during the retirement years.” Perspectives Statistics Canada Catalogue no. 75-001-X, August 2010.

Mindlin, Dimitry, ASA, MAAA. “Defined Contribution Plans: Can Actuaries Help?” Presentation at SOA Annual Meeting, 2014.

Palermo, Tony. “2014 CAP Suppliers Report: Sea Change.” *Benefits Canada*, December 2014.

Saaty, Thomas L. *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World*. Lifetime Learning Publications, 1982.

———. “Decision-making with the AHP: Why Is the Principal Eigenvector Necessary?” *European Journal of Operational Research*, 2002.

———. *Fundamentals of Decision Making and Priority Theory*. Rws Publications, 1994.

———. *Mathematical Principles of Decision Making*. RWS Publications, 2009.

———. *The Seven Pillars of the Analytic Hierarchy Process*. University of Pittsburgh, 2002.

Sun Life Financial. *Designed for Savings: The Benchmark Report on Capital Accumulation Plans in Canada*. 2014.

Tomlinson, Joseph, FSA, CFP. “Improving the Retirement System.” Presentation at SOA Annual Meeting, 2014.

Vanguard Institutional Investor Group. *How America Saves 2014*. 2014.

U.S. Department of Labor. “Abstract of 2013 Form 550 Annual Reports.” *Private Pension Plan Bulletin*, September 2015.

Van Derhei, Jack, and Lori Lucas. *The Impact of Auto-Enrollment and Automatic Contribution Escalation on Retirement Income Adequacy*. Employee Benefit Research Institute Issue Brief no. 349. November 2010.

Vernon, Steve, FSA. *The Next Evolution in Defined Contribution Retirement Plan Design: A Guide for DC Plan Sponsors to Implementing Retirement Income Programs*. Stanford Center on Longevity and Society of Actuaries, September 2013.

Watson Wyatt. *Maximizing the Potential of your 401(k) Plan: Are You Meeting Your Goals 2000 401(k) Index*. 2000.

## Websites

BrightScope. Frequently Asked Questions (FAQ).

<http://www.brightscope.com/faq/401k-retirement/>

———. Ratings Directory.

<http://www.brightscope.com/ratings/>

Collins, Margaret, and Carol Hymowitz, “Who's Got the Best Retirement Plan?,” Bloomberg, July 2014.

<http://www.bloomberg.com/bw/articles/2014-07-24/401-k-s-which-companies-have-the-best-retirement-plans>.

Manganaro, John. “Considering Value: A Look at the Big Picture in Plan Benchmarking.” *PLANSPONSOR*, January 2015.

<http://www.plansponsor.com/MagazineArticle.aspx?id=6442513489>

PLANSPONSOR. “Benchmarking Your 401(k) Plan.” July 1999.

<http://www.plansponsor.com/MagazineArticle.aspx?id=6442461066>

———. 2014 DC Survey: Plan Benchmarking. January 2015.

<http://www.plansponsor.com/2014-DC-Survey--Plan-Benchmarking/>

Walton, Sue. *A Numbers Game: DC Plan Sponsors Faced with More Numbers to Decipher*. Towers Watson, February 2014.

<https://www.google.ca/#q=A+Numbers+Game:+DC+Plan+Sponsors+Faced+With+More+Numbers+To+Decipher>

## Appendix A: Using/Modifying the Excel Model Spreadsheet

### A.1 How It Works

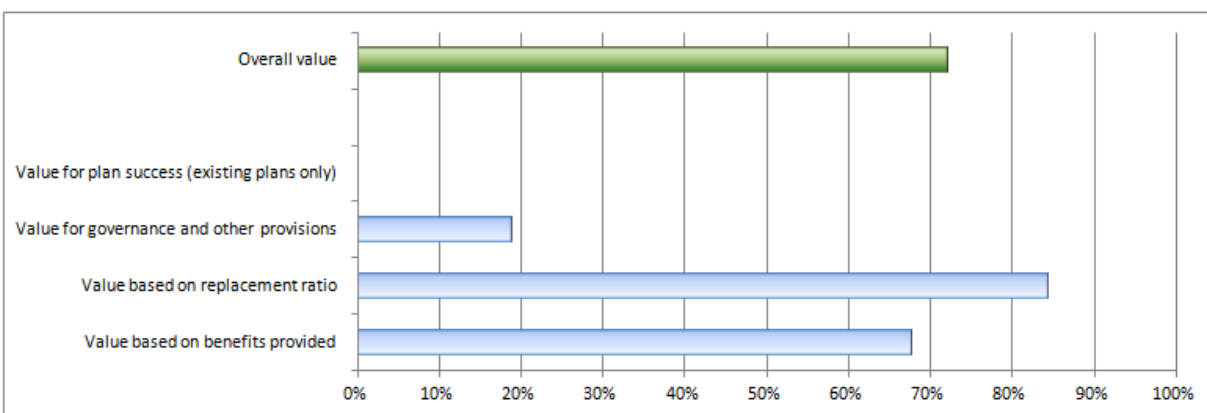
When a user completes the data entry and selections in the Excel model spreadsheet, it generates an overall valuation and a breakdown by the main criteria (see Figure 14 for an example). The current version has basic controls such as drop-down menus to make using the spreadsheet quicker.

**Figure 14**

#### OVERALL EVALUATION MEASUREMENT OF PLAN SUCCESS

Plan Evaluation

Value based on benefits provided	68%
Value based on replacement ratio	84%
Value for governance and other provisions	19%
Value for plan success (existing plans only)	N/A
<b>Overall value</b>	<b>72%</b>



### A.2 Using the Model

To get a value for a particular savings plan using the DC Evaluation spreadsheet, the user completes the data entry and completes the information requested at the “Report” tab. The remainder of this appendix details the process.

#### A.2.1 DATA ENTRY TO GET THE ASSESSMENT

Go to the 'DC Framework' worksheet, and enter the information requested.

In cell C5, select **Yes** if the plan is an existing plan; otherwise, select **No**.

##### Section 1: Plan Provisions

For each item in blue in the G column, enter the provision for the plan under review.

For employer contributions, the assessment is calculated based on the employer maximum contributions rate up to a maximum value of 9%. So a 4.5% employer contribution will result in a value of 50%, or  $\min(4.5\%, 9\%)/9\%$ .

For the other criteria, compare the provision for the plan under review with the ranges suggested in column H, and enter a value in column F. In most cases, it is sufficient to enter either 0%, 25%, 50%, 75% or 100% for the assessment.

Note that for some criteria, the user can simply enter a qualitative assessment in column G (Poor, Fair, Good, Very Good or Excellent), and the assessment in column F will be calculated automatically.

### Section 2: Plan Adequacy

If the plan provides auto-escalation of employee contributions, see whether they are expected to double or triple overtime for a career employee. If so, select **Yes – Double** or **Yes - Triple**. Otherwise, select **No**.

In column **D**, enter the target replacement ratio, assumption for average social security replacement ratio, and replacement ratio from other pension arrangement provided by employer.

Also enter employer and employee contribution rates, sample ages to use in calculations, assumptions for retirement age, life expectancy, auto-escalation assumption, real rate of return and real discount rate for an annuity certain factor used as a proxy for a non-indexed life annuity.

### Section 3: Other Criteria

For each Governance and Other criterion, enter a qualitative assessment in column **G** (Poor, Fair, Good, Very Good or Excellent), and the assessment in column **F** will be calculated automatically.

### Section 4: Plan Success

This section applies only if the user selects **Yes** in column **C5**. Otherwise, the information is not taken into account in the calculation of the final value.

Plan success is assessed based on two criteria: participation rate and average age-appropriate investment allocation to equities.

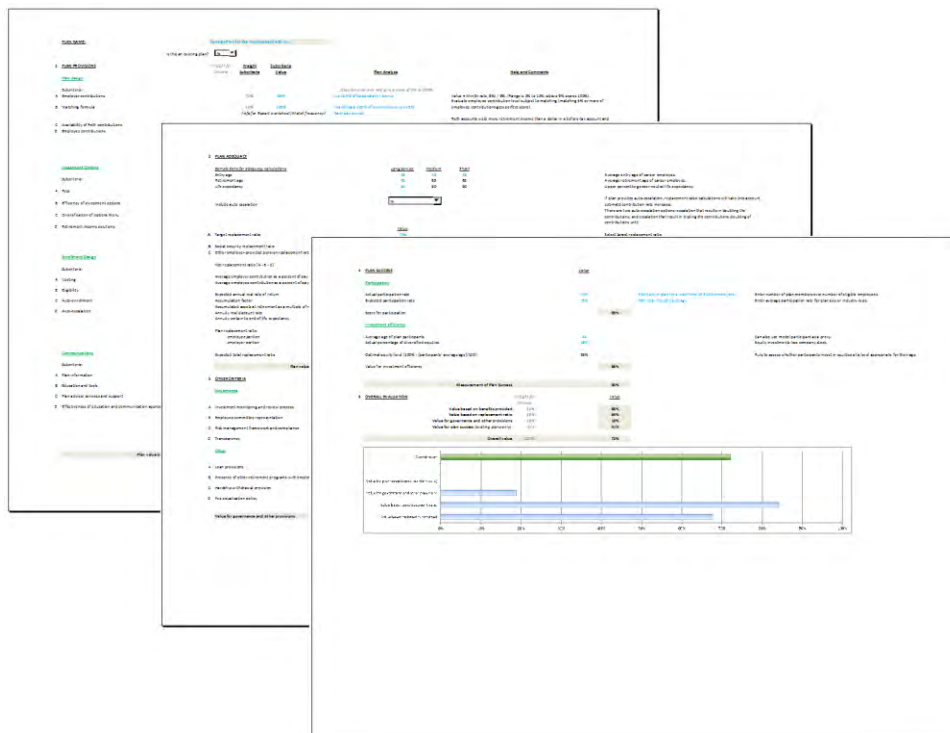
For the participation criteria, enter the ratio of number of plan members to number of eligible employees and the average participation rate for plan size or industry type.

For the investment criteria, enter the population's average age and the total plan asset allocation to equities.

### Section 5: Overall Evaluation

The value for each section is summarized, and the weights are applied to get the overall value. Figure 15 shows a sample evaluation report.

**Figure 15**  
OBJECTIVE FUNCTION EVALUATION REPORT



### A.2.2 REPORT

Go to the **Report** tab, and enter the requested information to generate a report.

Complete other related plan information in column **C** to generate a summary report with details on potential replacement ratios at various ages and a summary of assumptions.

### A.2.3 OTHER WORKSHEETS

The other worksheets provide the Analytic Hierarchy Process (AHP) logic to derive the weights used in the **DC Framework** worksheet. Usually the user has no need to change or review these calculations, and these worksheets can be removed or hidden in the final product.



## Appendix B: Examples

The examples in this appendix begin with a base case. We will then show the effect on the plan evaluation value of adding a few monetary and nonmonetary features. First we modify the base case to use the objective function that takes into account plan success. Then, in the final two examples, we modify the base case with higher employer contributions and auto features, respectively.

### B.1 Base Case

Our base case is an average plan, which an informed observer would typically find to be not a “standout” retirement plan. Table 28 gives weights and values for the subcriteria of the plan provisions.

**Table 28**

PLAN PROVISIONS: BASE CASE

Criteria	Descriptions	Values
<b>Plan design</b>		
Employer contributions	Up to 5% of basic salary + bonus	56%
Matching formula	100% of contributions up to 5%	100%
Availability of Roth contributions	Provided	100%
Employee contributions	Up to a maximum of 12%	100%
	Subcriteria weight: 61%	Subcriteria value: 69%
<b>Investment options</b>		
Fees	45 bps for assets of \$250 million	100%
Efficiency of investment options	Menu has limited number of options; index funds offered	75%
Diversification of options menu	12 fund options	75%
Retirement income solutions	Systematic withdrawals offered	25%
	Subcriteria weight: 15%	Subcriteria value: 71%
<b>Enrollment design</b>		
Vesting	20% with 2 years to 100% at 6 years	50%
Eligibility	Hourly and salaried after 1 year of service	50%
Auto-enrollment	No	0%
Auto-escalation	No	0%
	Subcriteria weight: 15%	Subcriteria value: 23%

<b>Communications</b>		
Plan information	Very good	75%
Education and tools	Very good	75%
Plan adviser services and support	Fair	25%
Effectiveness of education and communication approach	Fair	25%
	Subcriteria weight: 9%	Subcriteria value: 38%
<b>Overall value of plan provisions</b>		
Plan design	61%	69%
Investment options	15%	71%
Enrollment design	15%	23%
Communications	9%	38%
		Subcriteria value: 59%

Tables 29 and 30 show the subcriteria values for plan adequacy (Table 29) and other criteria (Table 30).

**Table 29**  
**PLAN ADEQUACY: BASE CASE**

<b>Criteria</b>	<b>Description</b>
Average employer contribution as a percent of pay	5%
Average employee contribution as a percent of pay	5%
Expected total replacement ratio	59%
	Subcriteria value: 84%

**Table 30**  
OTHER CRITERIA: BASE CASE

Criteria	Description	Value
Investment monitoring and review process	Fair	25%
Employee committee representation	No	0%
Risk management framework and compliance	Fair	25%
Transparency	Fair	25%
Loan provisions	Very good	75%
Presence of other retirement programs with employer	No	0%
Hardship withdrawal provision	Poor	0%
Fee equalization policy	Poor	0%
		Subcriteria value: 19%

Using the subcriteria values and weights from Tables 28–30, Table 31, shows the overall value of the plan in the base case.

**Table 31**  
OVERALL EVALUATION: BASE CASE

Criteria	Weight	Value
Value based on benefits provided	34%	59%
Value based on replacement ratio	56%	84%
Value for governance and other provisions	10%	19%
Value for plan success (existing plans only)	N/A	N/A
<b>Overall value</b>		69%

### B.2 Base Case Measuring Ongoing Plan Success

In the second example, we use the same values as in the base case except that the objective function takes into account plan success in the formula. Table 32 shows the value of the plan success subcriteria.

**Table 32**  
PLAN SUCCESS

Criteria	Value
Actual participation rate	70%
Expected participation rate	75%
Average age of plan participants	44
Actual percentage of diversified equities	48%
	Subcriteria value: 90%

Table 33 shows the how the overall evaluation is affected by taking into account plan success.

**Table 33**  
OVERALL EVALUATION: BASE CASE PLUS PLAN SUCCESS

Criteria	Weight	Value
Value based on benefits provided	25%	59%
Value based on replacement ratio	41%	84%
Value for governance and other provisions	7%	19%
Value for plan success (existing plans only)	27%	90%
<b>Overall value</b>		75%

### B.3 Higher Employer Contributions

Instead of 5% contributions from the employer (in a plan that matches employee contributions up to 5%), suppose the employer contributions are 8% (matching employee contributions up to 8%). Except for this change in the plan design criteria (shown in Table 34), all other values for the various subcriteria of the plan provisions remain the same. We also have a new measure of plan adequacy, as detailed in Table 35.

**Table 34**  
NEW PLAN DESIGN CRITERION FOR HIGHER EMPLOYER CONTRIBUTIONS

Criterion	Description	Value
Employer contributions	Up to 8% of basic salary + bonus	92%
	Subcriteria weight: 61%	Subcriteria value: 92%

**Table 35**  
**PLAN ADEQUACY: HIGHER EMPLOYER CONTRIBUTIONS**

Criteria	Description
Auto-escalation	No
Average employer contribution as a percent of pay	8%
Average employee contribution as a percent of pay	8%
Expected total replacement ratio	70%
	Subcriteria value: 100%

The overall value increases for the plan design and plan adequacy criteria, resulting in a higher overall evaluation, as shown in Table 36.

**Table 36**  
**OVERALL EVALUATION: HIGHER EMPLOYER CONTRIBUTIONS**

Criteria	Weight	Value
Value based on benefits provided	25%	74%
Value based on replacement ratio	41%	100%
Value for governance and other provisions	7%	19%
Value for plan success (existing plans only)	27%	90%
<b>Overall value</b>		85%

**B.4 Base Case with Auto-enrollment and Auto-escalation**

This example shows the impact of adding auto-enrollment and auto-escalation to a plan. These additions affect the enrollment design and plan adequacy criteria, as shown in Tables 37 and 38. The result is a boost in the plan evaluation assessment from 69% for the base case to 76% with these auto features (see Table 39).

**Table 37**  
**ENROLLMENT DESIGN IMPACT OF AUTO FEATURES**

Criteria	Description	Value
Auto-enrollment	Yes with 3.00% default	100%
Auto-escalation	Yes with annual 1% increase to 6%	100%
	Subcriteria weight: 15%	Subcriteria value: 78%

**Table 38**  
 PLAN ADEQUACY IMPACT: AUTO FEATURES

Criteria	Description
Auto-escalation	Yes—doubling
	Subcriteria value: 90%

**Tables 39**  
 OVERALL EVALUATION: WITH AND WITHOUT AUTO FEATURES

Criteria	Value Without Auto Features	Value with Auto Features
Value based on benefits provided	55%	68%
Value based on replacement ratio	84%	90%
Value for governance and other provisions	19%	19%
<b>Overall value</b>	<b>69%</b>	<b>75%</b>

**B.5 Summary**

Table 40 summarizes the values measured for the various examples in Appendix B.

**Table 40**  
 SUMMARY OF APPENDIX B EXAMPLES

Criteria	Value
B1. Base case: 5% employer contributions	69%
B2. Base case but with alternate formula taking into account plan success	75%
B3. Base case but with 8% employer contributions	85%
B4. Base case but with auto-enrollment and auto-escalation	75%