



## Smart Growth Tools: Risk Analysis Process & Interactive Value Assessment

HDR

HDR | HLB  
Decision Economics Inc.  
January 28, 2006

---

---

---

---

---

---

---

---

---

---

### Presentation Overview

- Firm Background
- Risk Analysis Process (RAP®) Overview
- Interactive Value Assessment Demo
- Applicability of RAP/IVA to Smart Growth

---

---

---

---

---

---

---

---

---

---

### Firm Background

- HDR presence in Canada – HDR|HLB Decision Economics Inc.
- Offer consulting services in Canada, U.S. and globally
- Key service areas are:
  - Third-party Risk Analysis;
  - Forecasting;
  - Financial and Business Case Analysis;
  - Cost-Benefit Analysis; and,
  - Economic Impact Analysis.

---

---

---

---

---

---

---

---

---

---

## Risk Analysis Process (RAP)

- What is RAP?
  - Broadly applicable multi-step process used to support and enhance decision-making, investment planning, negotiation, forecasting etc.
  - Enables the identification and enumeration of risks inherent in the business problem under consideration.
  - Model logic and assumptions scrutinized and refined through interactive sessions with stakeholder and expert groups.
  - Quantification and simulation of input risks allows evaluation of risk in metrics of interest to project stakeholders.

---

---

---

---

---

---

---

---

## Elements of RAP

- RAP involves the following four steps:
  - Identify the structure and logic model;
  - Quantify data assumptions;
  - Facilitate scrutiny and consensus; and,
  - Quantify the uncertainty in key outcomes probabilistically.

---

---

---

---

---

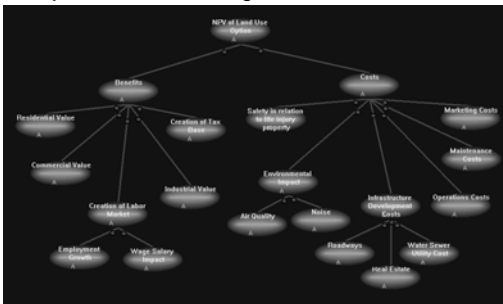
---

---

---

## Elements of RAP

- Step 1: Structure and Logic Model



---

---

---

---

---

---

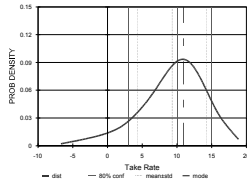
---

---

## Elements of RAP

### Step 2: Data Assumptions

Variable	Base Value	Low Value	High Value
Rate, %	10%	0%	15%




---

---

---

---

---

---

---

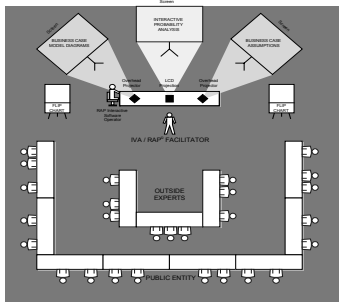
---

---

---

## Elements of RAP

### Step 3: Stakeholder Consensus




---

---

---

---

---

---

---

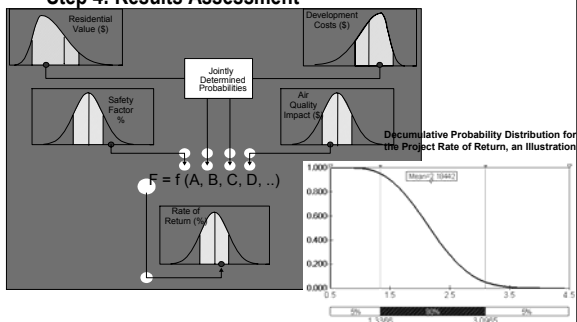
---

---

---

## Elements of RAP

### Step 4: Results Assessment




---

---

---

---

---

---

---

---

---

---

## Risk Analysis Process (RAP)

- **Benefits of RAP:**
  - Application of risk analysis provides the full range of possible project outcomes along with associated likelihoods of occurring.
    - Avoids the lack of perspective in "base", "high" and "low" case scenarios.
  - Transparency and stakeholder engagement during the study process facilitate consensus on model logic and input assumptions and in turn, lead to greater "buy-in" of outcomes.

---

---

---

---

---

---

---

---

## Risk Analysis Process (RAP)

- **Recent project examples across diverse industries:**
  - Highway user tax forecasting;
  - Toll road revenue forecasting for bond insurers;
  - Business case of facility renewal investments;
  - Impact analysis of income trust sector;
  - Transit investment cost-benefit analyses;
  - Economic evaluation of "green building" initiatives; and,
  - Evaluation of real estate development project.

---

---

---

---

---

---

---

---

## IVA – An Application of RAP

- HDR|HLB utilizes the Interactive Value Assessment (IVA) tool as a dynamic means to apply the RAP methodology in "real-time" business case decision support.
- The IVA tool encapsulates the key elements of RAP with particular emphasis on stakeholder engagement throughout the process.

---

---

---

---

---

---

---

---

## RAP / IVA Session

### Key features:

- Interactive dialog with project stakeholders;
- Transparency of approach;
- Validation of model and uncertainties in key assumptions;
- Facilitates consensus and "buy-in" from stakeholders.



---

---

---

---

---

---

---

---

## IVA Tool Demo – Model Structure and Logic



---

---

---

---

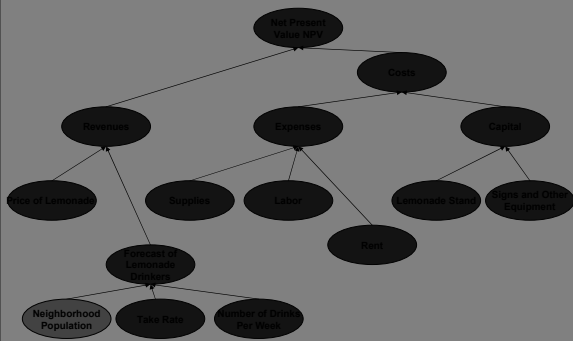
---

---

---

---

## IVA Tool Demo – Model Structure and Logic



---

---

---

---

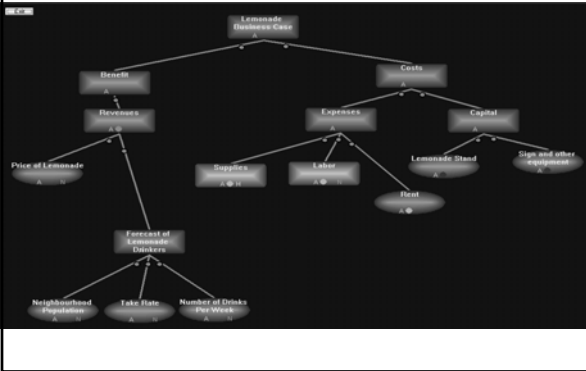
---

---

---

---

## IVA Tool Demo – Model Structure and Logic




---

---

---

---

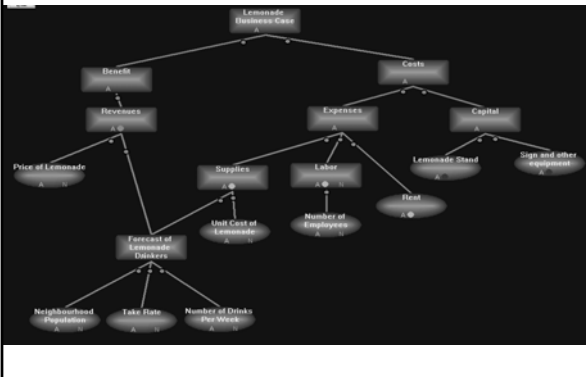
---

---

---

---

## IVA Tool Demo – Model Structure and Logic




---

---

---

---

---

---

---

---

## Preliminary Assumptions Value and Uncertainty Assessment

Variable	Base Value	Low Value	High Value
Neighborhood Population	25,000	22,500	27,500
Take Rate	10%	5%	13%
Number of Drinks Per Week	0.5	1	1.25
Price of Lemonade	\$0.5	\$0.25	\$0.75
Unit Cost of Lemonade	\$0.10	\$0.05	\$0.15
Lemonade Stand	\$5,000	\$2,500	\$6,250

---

---

---

---

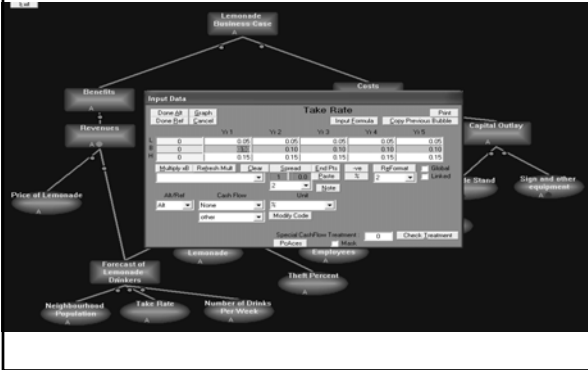
---

---

---

---

## Uncertainty Ranges For Each Variable Are Entered in The Model




---

---

---

---

---

---

---

---

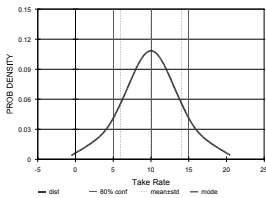
---

---

## Preliminary Assumptions Value and Uncertainty Assessment

### Take Rate (%)

Value	Low Value	High Value
10%	5%	15%



80% CONFIDENCE INTERVAL




---

---

---

---

---

---

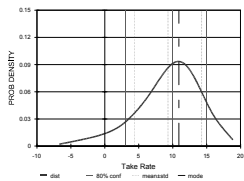
---

---

---

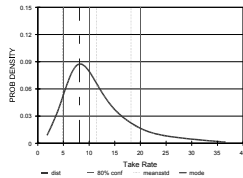
---

## The IVA Tool Can Handle Any Type of Probability Distribution



Median 10%  
Low Value 3%  
High Value 15%

Median 10%  
Low Value 5%  
High Value 20%




---

---

---

---

---

---

---

---

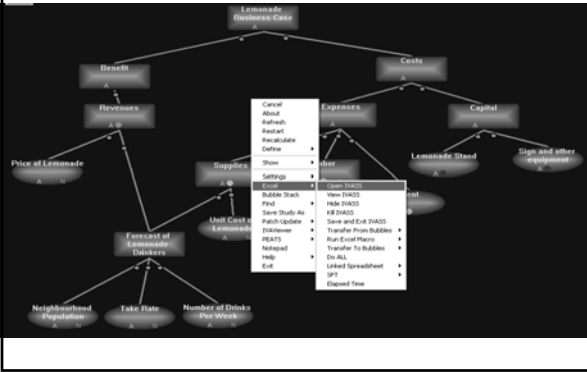
---

---





## Model Interfaces with Excel




---

---

---

---

---

---

---

---

---

---

## An Excel Spreadsheet is Created Automatically Within Minutes

	A	C	H	I	J	K
	Name	[ Units ]	2005	2006	2007	2008
	Lemonade Stand	\$	2,500.00 5,000.00	-	-	-
			6,250.00			
			22,500.00	22,500.00	22,500.00	22,500.00
	Neighbourhood Population	#	25,000.00	25,000.00	25,000.00	25,000.00
			27,500.00	27,500.00	27,500.00	27,500.00
			0.50	0.50	0.50	0.50
	Number of Drinks Per Week	#	1.00	1.00	1.00	1.00
			1.25	1.25	1.25	1.25
			2.00	2.00	2.00	2.00
	Number of Employees	#	4.00	4.00	4.00	4.00
			6.00	6.00	6.00	6.00
			0.25	0.50	0.50	0.50
	Price of Lemonade	\$ per drink	0.50	0.75	0.75	0.75
			0.75	1.00	1.00	1.00
			900.00	900.00	900.00	900.00
	Rent	\$	1,200.00	1,200.00	1,200.00	1,200.00
			1,500.00	1,500.00	1,500.00	1,500.00

---

---

---

---

---

---

---

---

---

---

## An Excel Spreadsheet is Created Automatically Within Minutes

	A	C	H	I	J	K
	Name Of Variable	[ Units ]	2005	2006	2007	2008
112						
113						
114	<b>D. CALCULATIONS</b>					
116	Forecast of Lemonade Drinkers		130,000.00	130,000.00	130,000.00	130,000.00
129	Labor	\$	58,400.00	58,400.00	58,400.00	58,400.00
131	Revenues	\$	65,000.00	97,500.00	97,500.00	97,500.00
134						
135	Supplies	\$	13,000.00	13,000.00	13,000.00	13,000.00
136						
137						

---

---

---

---

---

---

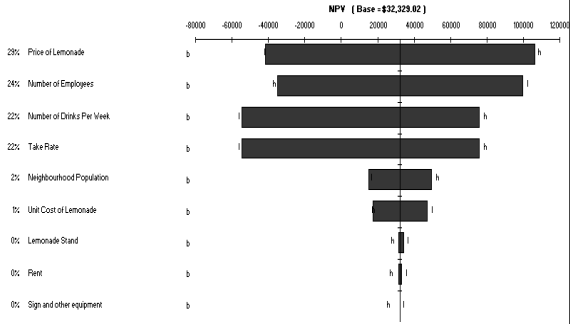
---

---

---

---

## Sensitivity Analysis Results (Referred to as the "Tornado" Diagram)




---

---

---

---

---

---

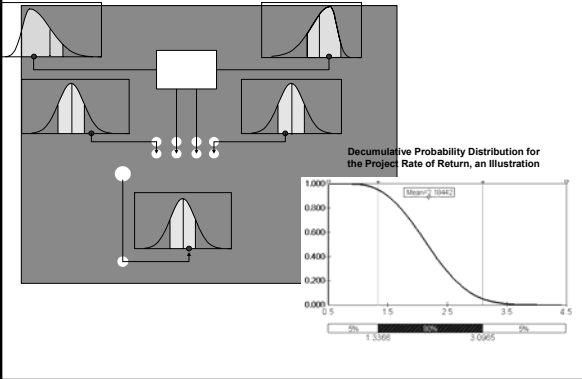
---

---

---

---

## Monte Carlo Simulations and Probability Distributions of NPV and ROI




---

---

---

---

---

---

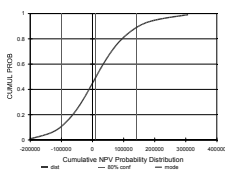
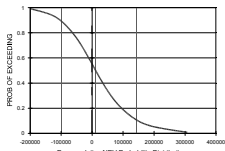
---

---

---

---

## Results of the probabilistic analysis Probability Distribution of Project NPV



NPV	Probability of Exceeding NPV
\$305,176	1%
\$191,792	5%
\$142,986	10%
\$92,186	20%
\$59,800	30%
\$34,128	40%
\$11,270	50%
-\$10,842	60%
-\$34,143	70%
-\$61,410	80%
-\$100,045	90%
-\$133,167	95%
-\$198,472	99%
\$11,290	Mean Expected Outcome

---

---

---

---

---

---

---

---

---

---

### **RAP Applicability for Smart Growth**

- **The RAP/IVA methodology offers significant value in the assessment of smart growth initiatives:**
  - Allows for a transparent and comprehensive evaluation of alternative initiatives;
  - Incorporates underlying uncertainties and risks in key input metrics and data assumptions; and,
  - Encourages interactive dialog and consensus-building by involving stakeholders and outside experts in the process.

---

---

---

---

---

---

---

---

### **RAP Applicability for Smart Growth**

- **The RAP/IVA process is currently being utilized in several areas relating to smart growth:**
  - Cost-benefit assessment of transit system investments;
  - Economic evaluation of green building initiatives; and,
  - Real estate development projects.

---

---

---

---

---

---

---

---

### **Example – Transit Cost-Benefit Analysis**

- **Engaged in cost-benefit analysis of alternative transit systems** (Light Rail Transit, Bus Rapid Transit):
  - Estimate the overall economic benefits of transit system investments (congestion management, community development, affordable mobility);
  - Assess the uncertainty in input drivers (ridership forecasts, value of time, emission unit costs etc.) through research and interactive RAP sessions with stakeholders and experts;
  - Develop risk-adjusted measures of project worthiness – net present value, internal rate of return etc.

---

---

---

---

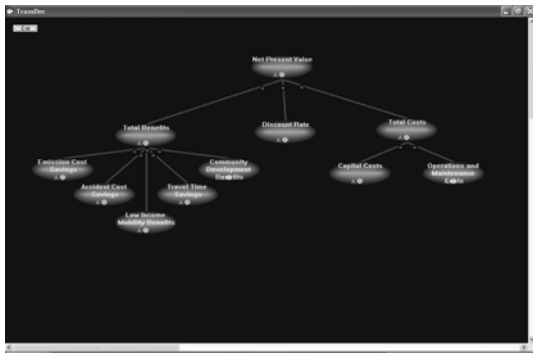
---

---

---

---

## Example – Transit Cost-Benefit Analysis




---

---

---

---

---

---

---

---

## Example – Sustainable Design Initiatives

- Engaged in economic evaluation of “green building” initiatives
  - Assessing the benefits and costs of individual green building initiatives (water conservation, waste management etc);
  - Benefits are broken down to several stakeholder categories;
  - Engaging outside experts to validate model assumptions and build consensus in the evaluation process.

---

---

---

---

---

---

---

---

## Example – Sustainable Design Initiatives




---

---

---

---

---

---

---

---

### Example – Real Estate Development

- Engaged in facilitation of downtown revitalization project:
  - Created a conceptual model for real estate development;
  - Assisting in setting up the Public-Private Partnership arrangement.

---

---

---

---

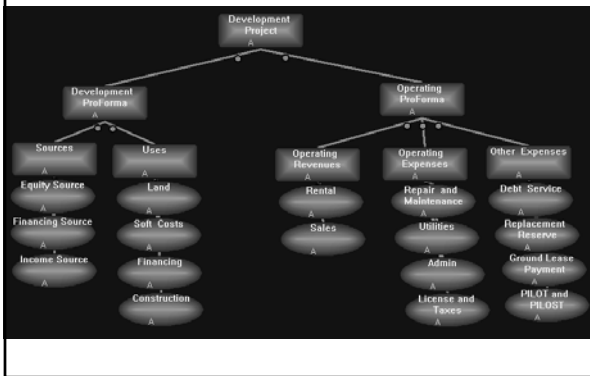
---

---

---

---

### Example – Real Estate Development




---

---

---

---

---

---

---

---

### Example – Real Estate Development

**BASE RESULTS FOR PUBLIC PRIVATE PARTNERSHIP**

Economic Indicators	Private	Public	Overall
Net Present Value (NPV)	\$ 16,820,647	\$ 1,060,699	\$ 17,881,347
Discounted Payback Period (DPP)	15.0 years	15.0 years	15.0 years
Internal Rate of Return (IRR)	10.98%	8.98%	10.83%
Capital Investment	\$ 29,807,451	\$ 3,059,400	\$ 32,866,851
Profitability Index (F NPV / PWCE)	0.56	0.35	0.54

---

---

---

---

---

---

---

---

**Questions?**

---

---

---

---

---

---

---

---