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Value-Centered R&D

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Overview

- Value Philosophy
- Principles for Value-Centered R&D
  - Characterizing Value
  - Assessing Value
  - Managing Value
- Organizational (Re)Design
- Observations

Value Philosophy

- Value focuses on organizational outputs (or outcomes), rather than inputs.
- Value relates to benefits of outcomes, rather than outcomes themselves.
- Value implies relevant, usable, and useful outcomes.

Characterizing Value

1) Value is created in R&D organizations by providing “technology options” for meeting contingent needs of the enterprise.
2) R&D organizations provide a primary means for enterprises to manage uncertainty by generating options for addressing contingent needs.
3) A central challenge for R&D organizations is to create a portfolio of viable options; whether or not options are exercised is an enterprise challenge.

Example Option-Based Valuations of Technology Investments

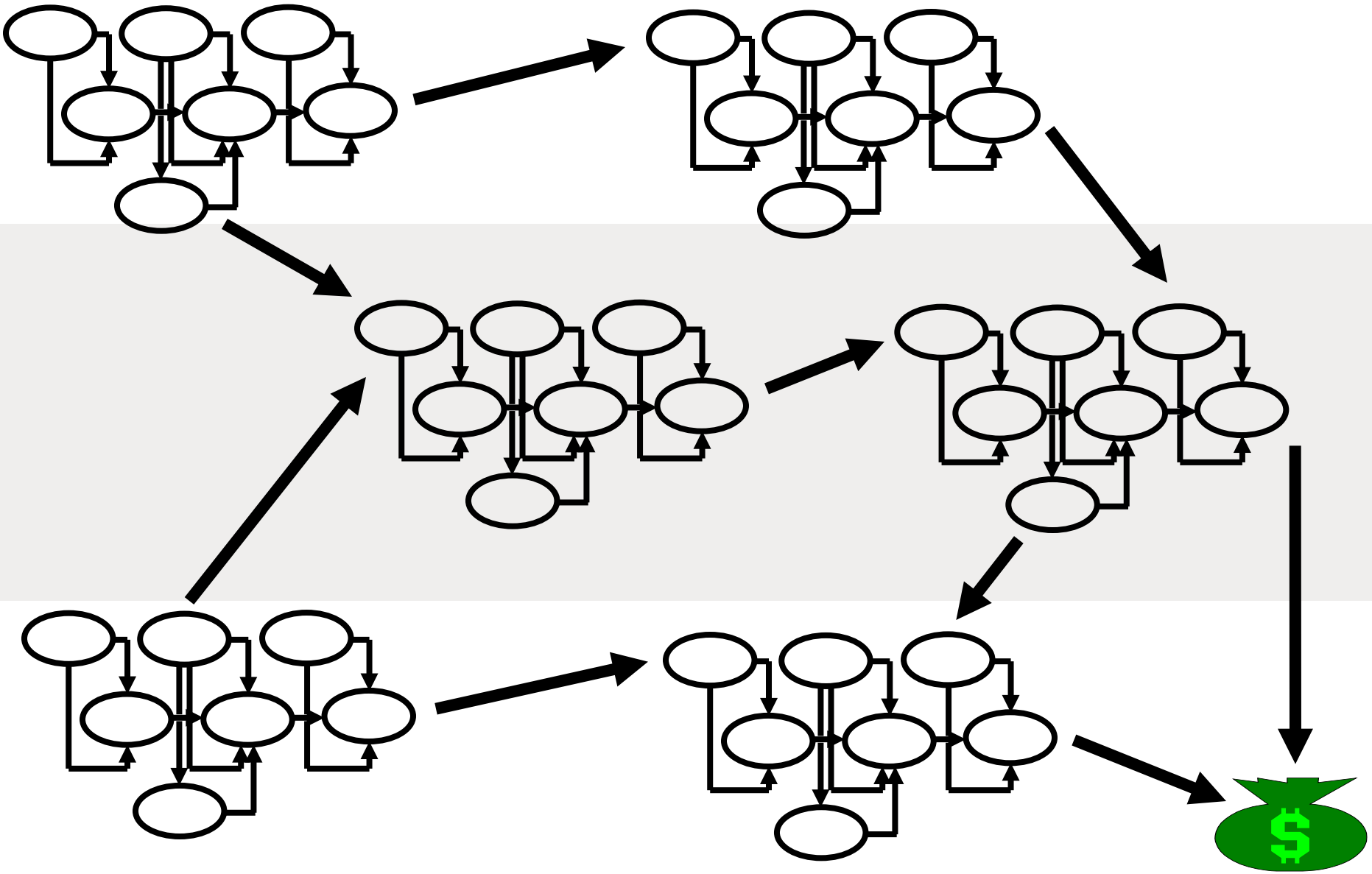
Technology	Option Purchase	Option Exercise	Net Option Value
Aircraft (manufacturing)	R&D	Deploy Improvements	8
Aircraft (unmanned)	R&D	Deploy System	137
Auto Radar	Run Business	Expand Offerings	133
Batteries (lithium ion)	R&D	License Technology	215
Batteries (lithium polymer)	R&D	Acquire Capacity	552
Optical Multiplexers	R&D	Expand Capacity	488
Optical Switches	Run Business	Expand Offerings	619
Security Software	Run Business	Add Market Channels	267
Semiconductors (amplifiers)	Invest in Capacity	Expand Offerings	431
Semiconductors (graphics)	R&D	Initiate Offering	99
Semiconductors (memory)	R&D	Initiate Offering	546
Wireless LAN	Run Business	R&D	191

Total Net Option Value = $4.2 Billion

Assessing Value

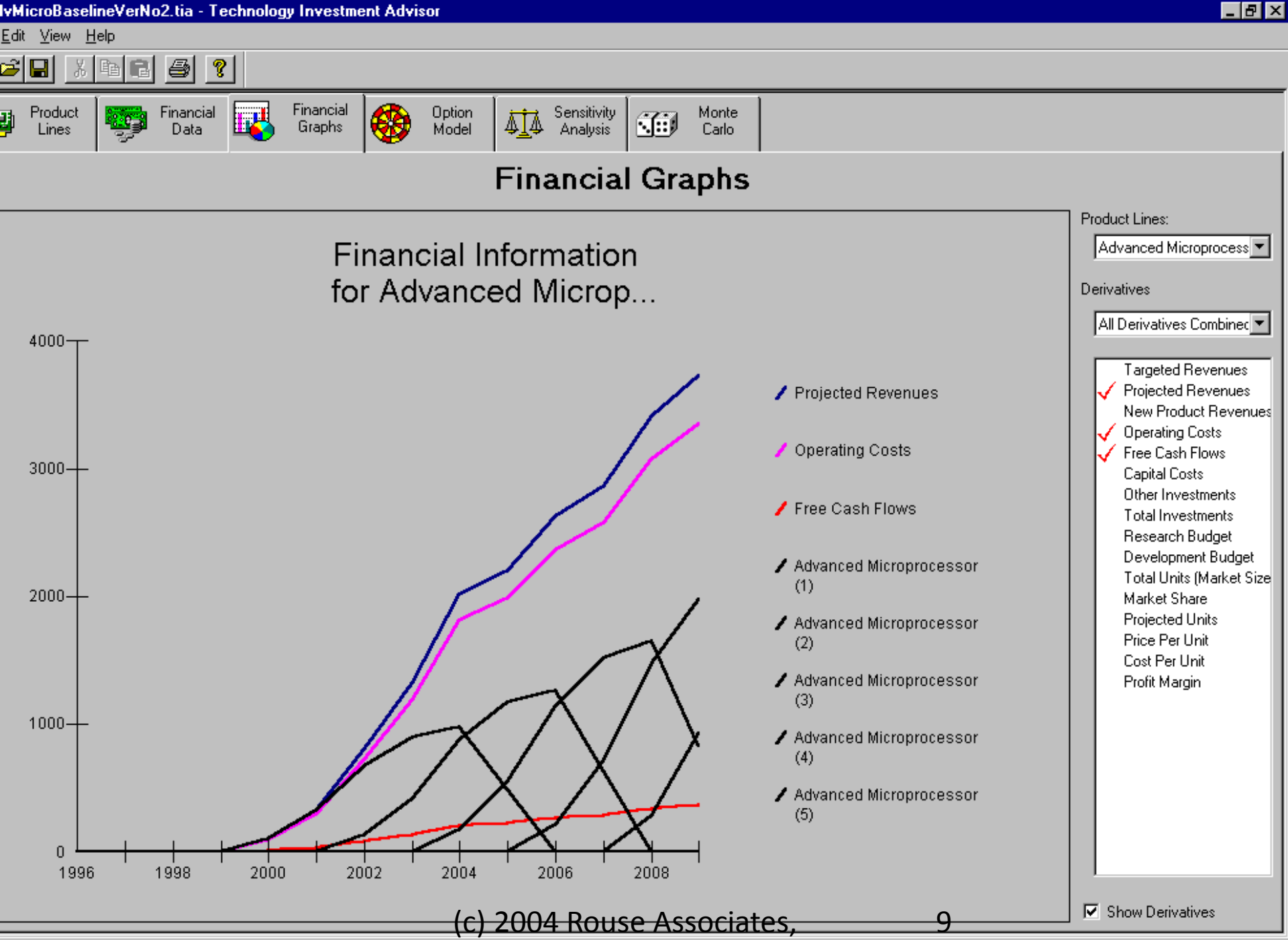
4) Value streams, or value networks, provide a means for representing value flow and assessing the value of options created.
5) Valuation of R&D investments can be addressed by assessing the value of the options created in the value network.

Example Value Network



PROJECTING VALUE FLOW

- Projections based on baseline on market penetration and product life cycles
- Projections based on organizational simulations of healthcare delivery
- Projections based on user behaviors in interactive online games



EMORY UNIVERSITY | Georgia Institute of Technology | Predictive Health Institute

Powered by Tennenbaum Institute

Ecosystem Level

Payment Capitated 0.25 — Pay for Outcome 0.75

Capitated Payment $300 — 400 — $3,000

Healthcare Inflation Rate 0% — 7 — 20%

Economy Inflation Rate 0% — 2 — 10%

Discount Rate 0% — 3 — 20%

Cost Model ○ ADA/AHA ◉ Emory

Termination Age ◉ 65 ○ 80

Organization Level

DM*

Risk Threshold* (8-year risk of DM)** 0 — 0.25 — 0.5

% Risk Reduction (Annual) 0% — 55 — 100%

CAD/CHD**

Risk Threshold* (10-year risk of CAD/CHD)** 0 — 0.25 — 0.5

% Risk Reduction (Annual) 0% — 45 — 100%

Program Length (per participant) 1yr — 3 — 10yrs

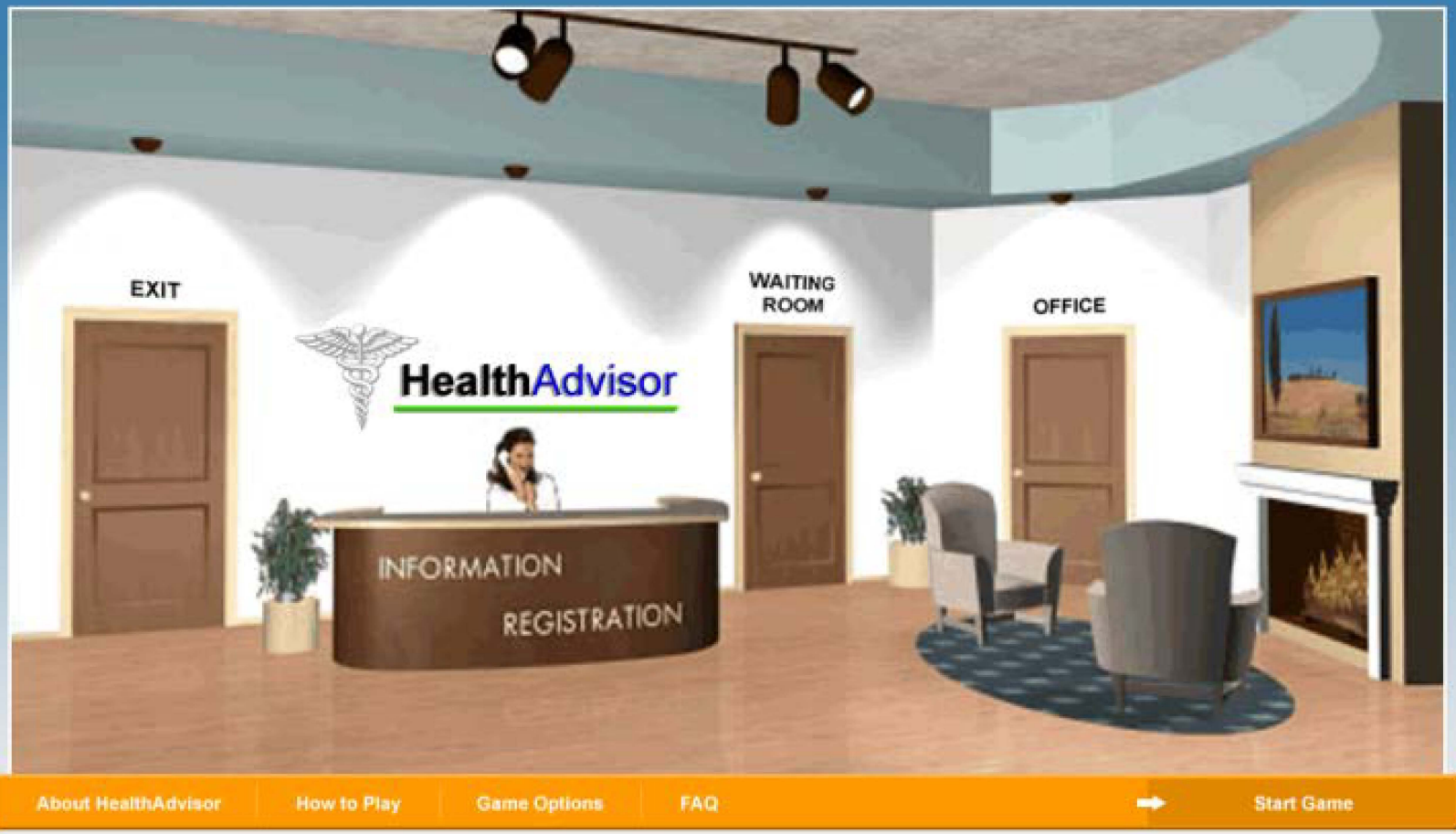
Participant Growth (Annual) 0% — 10 — 10%

Entering Age 25 — 25 — 45

Full Assessment Cost $300 — 300 — $1000

* DM = Diabetes Mellitus
** CAD = Coronary Artery Disease, CHD = Coronary Heart Disease
*** If a participant's risk is higher than the specified risk threshold, he/she will be classfied as a high-risk participant.

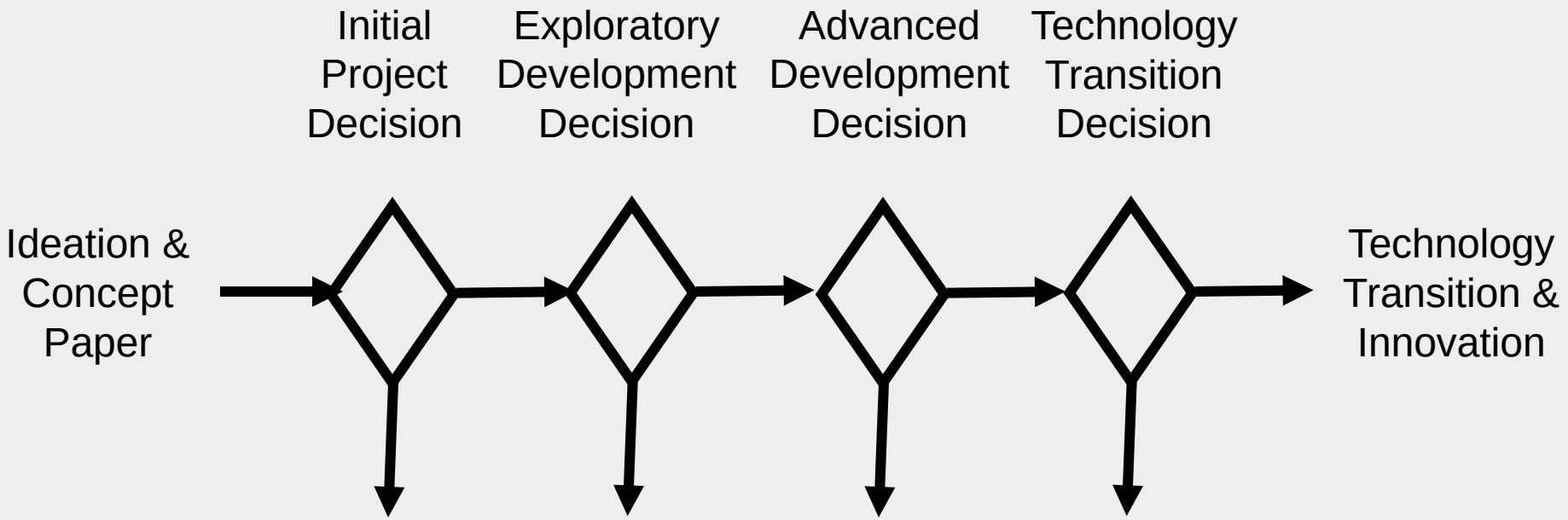
Run



Multi-Stage R&D Management

- Multi-Stage Value Stream
- ***R&D World*** Organizational Simulation
- Multi-Attribute Decision Model

Multi-Stage Value Stream



R&D World for Forest Products

	Input Factors								Responses (in $1,000s)				
	Valuation	Vola-tility	Budget Allocation Across Stages				Budget Variability	Arrival Rate Var.	Delay Factor	Total Deployed Value	# Proj	Total Expend.	Profit (TDV - TE)	Yield (TDV/ TE)
			2	3	4	6								
1	Stage-Gate	0.60	0.115	0.195	0.494	0.196	0.10	0.10	0.0	$1,788,389	232	$703,993	$1,084,396	2.54
2	NPV	0.60	0.115	0.195	0.494	0.196	0.10	0.10	0.0	1,861,890	218	667,799	1,194,091	2.79
3	Options	0.60	0.115	0.195	0.494	0.196	0.10	0.10	0.0	1,815,999	201	659,004	1,156,995	2.76
4	NPV	0.60	0.150	0.220	0.469	0.161	0.10	0.10	0.0	1,878,079	209	747,365	1,130,714	2.51
10	Stage-Gate	0.60	0.115	0.195	0.494	0.196	0.10	0.10	0.0	1,788,389	232	703,993	1,084,396	2.54
11	Stage-Gate	0.60	0.200	0.400	0.300	0.100	0.10	0.10	1.0	1,394,330	114	695,761	698,569	2.00
12	Options	1.00	0.300	0.150	0.250	0.300	0.90	0.80	0.5	2,134,936	128	586,120	1,548,816	3.64
13	NPV	0.10	0.200	0.200	0.350	0.250	0.10	0.10	0.0	1,439,508	186	679,621	759,887	2.12
14	Options	1.00	0.200	0.200	0.350	0.250	0.10	0.10	0.0	2,378,322	156	657,506	1,720,816	3.62
15	Stage-Gate	1.00	0.100	0.400	0.400	0.100	1.00	0.10	0.0	1,555,939	138	582,051	973,888	2.67
16	Options	0.90	0.400	0.400	0.050	0.150	0.50	0.70	0.0	353,437	22	607,469	(254,032)	0.58

For 16 very reasonable allocation decision policies, profits range from ($254,000,000) to $1,720,616,000.

Multi-Attribute Model

Decision Criteria	Idea ➔ Concept Paper	Concept Paper ➔ Initial Project	Initial Project ➔ Exploratory Development	Exploratory Development ➔ Advanced Development	Advanced Development ➔ Technology Transition
Strategic Fit	NA	Possible	Definite	Priority	Programmed
Payoff	NA	Imaginable	Articulated	Projected	Demonstrated
Schedule	NA	One-year deliverables	Multi-year sequence of deliverables	Multi-year sequence of demonstrations	Technology transition plan
Resources	No budget	Discretionary budget available	Budget scoped appropriately	Costs/benefits projected	Costs/benefits assessed
Technical Risk	NA	NA	Anticipated	Managed	Minimized
Application Risk	NA	NA	NA	Anticipated	Managed
Personnel	Interest & commitment	Commitment & credibility	Commitment & credibility	Credibility & availability	Credibility & availability
Competencies	Desirable & obtainable	Desirable & developing	Available internally & externally	Available internally & externally	Demonstrated & available

Managing Value

6) Decision making processes -- governance – are central in managing the flow of value.
7) Organizational structure affects value flow, with significant differences between hierarchical vs. heterarchical structures.
8) Individual and team affiliations and identities affect value flow; dovetailing processes with disciplines is essential.

Managing Value – Cont.

9) Champions play important, yet subtle, roles in value flow; supporting champions is necessary but not sufficient for success.
10) Incentives and rewards affect value flow; aligning these systems with value maximization is critical.

Organizational (Re)Design

Principle	Key Concept	"As Is"	"To Be"
1	Technology Options	Strengths, Weaknesses & Deficiencies	Programs to Remediate Deficiencies
2	Uncertainty Management		
3	Portfolio of Options		
4	Value Stream/Networks		
5	Option-Based Valuation		
6	Decision Making Processes		
7	Organizational Structure		
8	Individuals & Teams		
9	Champions		
10	Incentives & Rewards		

Observations Related to Healthcare Delivery

- There is an inherent conflict between payers and providers, especially when one organization pays and another organization receives the benefits.
- Alternative payment mechanisms -- fee for service, capitation, pay for outcomes – have enormous implications for how best to organize delivery.
- Appropriate framing of “the system” is critical to understanding sources of problems and improving outcomes – what seem to be exogenous variables may be sources of great leverage.

Summary

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