Decision Analysis

= Decision Engineering

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Decision Analysis in the Twenty First Century
A paradigm shift to real Decision Engineering!
Friedman observed the flattening of the world, primarily from a communications and connectedness perspective

There are many 20th century impacts on organizational decision-making

• Working in collaboration with people all over the world
• Increased uncertainty and dynamics – more disruptive influences
• Access to lots of data and expertise, but lacking ways to assimilate it
  — Einstein famously said the information is not knowledge
    – Data mining builds a giant rear-view mirror
    – It may seem like a windshield, but watch out for sharp curves or obstacles in the road.
  — Executives said the only 1/3 of the information they need for good strategy could be gleaned from perfect information about the past
  — Only Decision Analysis has the tools to turn information into useful knowledge
    – It can deal directly with uncertainties that pervade the future
    – It demands human intelligence and expertise in addition to the “data”
    – Influence diagrams make understating the structure of uncertain information easier.
• Fast paced invention and markets – decisions need to be made quickly against a very confusing background
  — Great decision-making tools and paradigms need to be in place and deployed quickly
A brief history of Decision Analysis

• 1965-66 Ron Howard defines the term Decision Analysis as a combination of Decision Theory and Systems Engineering

• 1966-~1980 Decision Analysis in pioneering mode, experimenting with application to government and industry

• 1980-~1990 Decision Consulting well established in the commercial arena and in WDC “beltway firms”

• 1990-~2000 Decision Analysis spreads to internal specialist groups, with Pharmaceutical Companies adopting it as a way of life, as well as selected others such as Chevron in the Oil Industry, Boeing in Commercial Airplanes. DA software routinely used by “power users.”

• 2000-~2010 Decision Analysis packaged in software for industry non-specialists to use by themselves. Software is adaptable to user terminology and processes while retaining DA soundness. DA rigor is particularly important in making credible comparisons across portfolios.

• 2010 & beyond. Decision Analysis embedded in the culture and operations of organizations, and seen as needed for competitive success.
Decision Analysis is for gaining clarity of action when you don’t “know” what to do.

- If you have long experience that you are sure is applicable, make the decision and get on with it!
  - But remember people like Galdwell(2005) have demonstrated many cases where intuition goes wrong.
  - Beware – Often people incorrectly apply inappropriate operational habits to strategic situations.
- If you have “inner knowing” of what to do – then do it!
- But when you don’t “know”, or when you want to reassure yourself that your experience is correct, or if you want to delegate to others or to explain to your superiors, who may not “know” or accept your “knowing,” then decision analysis is appropriate.
  - Once you accept that a Good Decision ≠ Good Outcome, one needs to define a good decision, and a process to create it before the outcome is known
  - Decision Analysis applied well, which I call Decision Engineering becomes the very definition of a good decision!
Good Decisions require Intelligent Engineering

- Would you design a bridge by guessing the size of various structural members?
- Would you build a chemical plant by asking an “expert” to guess the size of various process elements?
- Would you like the pilot of your aircraft to fly through fog without instruments?
- Then why do people expect executives to use “gut feel” to make decisions?
- Decisions need to be engineered just like bridges and chemical plants
  - There are sound engineering procedures to arrive at good decisions
  - They are also engineered to involve the right people and to guide and motivate excellence in implementation
  - This discipline is called Decision Analysis = Decision Engineering!
Decision Analysis furnishes the foundational tools to embed in organizational decision processes.
But real organizations must achieve their purposes by mobilizing resources in a confusing environment.
Adopting the Nine Principles helps Smart Organizations create a culture that supports good decision-making.

We can test to see if the principles are operational.

<table>
<thead>
<tr>
<th>Principle</th>
<th>It’s Smart. . .</th>
<th>It’s Not Smart. . .</th>
<th>Operational Test for Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Value Creation Culture</td>
<td>to aim always at value creation</td>
<td>to divert attention to other goals</td>
<td>Value creation is a compelling argument for change</td>
</tr>
<tr>
<td>2. Creating Alternatives</td>
<td>to create valuable options</td>
<td>to do the first thing you think of</td>
<td>Multiple alternatives are created and evaluated</td>
</tr>
<tr>
<td>3. Continual Learning</td>
<td>to anticipate and benefit from change</td>
<td>to get stuck where you are</td>
<td>Improvements are continually identified and acted upon</td>
</tr>
<tr>
<td>4. Embracing Uncertainty</td>
<td>to know what you do not know and to know what you cannot influence</td>
<td>to pretend you know or try to control outcomes you cannot influence</td>
<td>Uncertainty is understood, communicated, and managed – new information is valued</td>
</tr>
<tr>
<td>5. Outside-In Perspective</td>
<td>to know where you stand</td>
<td>to believe provincial illusions</td>
<td>Meaningful information is available from the outside</td>
</tr>
<tr>
<td>6. Systems Thinking</td>
<td>to know the full implications of actions and events</td>
<td>to be myopic</td>
<td>People understand complex cause-and-effect relationships</td>
</tr>
<tr>
<td>7. Disciplined Decision-Making</td>
<td>to take charge of your own destiny</td>
<td>to allow your competitors or fate to determine your future</td>
<td>Systematic decision processes are used routinely</td>
</tr>
<tr>
<td>8. Open Information Flow</td>
<td>to aggressively inform and be informed</td>
<td>to build power by withholding information</td>
<td>People have rapid, unrestricted access to information</td>
</tr>
<tr>
<td>9. Alignment and Empowerment</td>
<td>to coordinate everyone effectively</td>
<td>to micromanage, or not manage at all</td>
<td>A common understanding of strategies for value creation coordinates the organization</td>
</tr>
</tbody>
</table>
The keystone is a Value Creation culture – it is the driver for Value-Based Management.
These principles are guides to:

- **Philosophy**—that embraces fundamental principles of excellence in strategic decision-making
- **People**—who do what it takes to make and implement quality decisions
- **Organization and Culture**—that promote and reward decisions that create value
- **Support Systems**—that make it easy to apply the principles and actualize the best practices
Analysis of over 500 IQ tests has shown that smarter companies perform better – the discipline is worth it!
Eliminate “Rogue” patterns of behavior that dumb-down organizations; E. G.

• **Corporate Liar’s Contest**
  — Managers submit overstated budget requirements anticipating that top management will cut them back to the amount they really need.
  — Management second-guesses proposals knowing they are overstated.
  — In addition to the waste created by this process, it also produces a breakdown in communication about the actual decisions and turns more into a negotiation of a budget number.
  — Both sides regard the others as liars or unreasonable.

• **Cult of the CEO / Outsourcing Intelligence**
  — A belief that the CEO (or other leadership group or a consulting firm or a weekend retreat) will set the strategy and the rest of management’s job is simply to implement it. Often money is put into buckets for markets, technologies, departments, without knowledge of how those buckets pay off.
  — Blame the CEO when the strategy fails to work. Fire him/her for a better one. [People take little personal responsibility for strategy – they just follow orders.]

• **Project Champion Process**
  — Project champions are expected to advocate their proposals and make the business cases while management is expected to critique and ultimately approve or reject the proposals. [Nobody discusses the real risks and rewards]
Analytical Rogue: Superficial Values or Feel Good Prioritization

• Well-meaning committees judge value with some sort of scoring system, often with each committee member voting or dividing up points on various factors such as probability of success, commercial potential, strategic fit, etc.
  — Technically these systems often subsume a logical model by applying direct “judgment” of the committee members, when there good reasons to believe that the members are not equipped to make this “visceral calculation.”
  — Scores are added when logically they should be combined in other ways; for example, probability of success should be multiplied by the value given success.
  — Finally the scoring systems often cover up a political process of “I’ll vote for your project if you’ll vote for mine.”
• The scoring approach usually evolves into an exercise in manipulating the weights to get your favorite projects funded, rather than providing real insight into which course of action should be taken.
  — The more controversy in a situation, the more pressure there is for manipulation.
  — These scores too often do not have the objective power to change people’s minds about what is in their best interest.
• One client put it this way “these methods add sophistication without adding knowledge.”
Many organizations and academics confuse operational strength with strategic intelligence.
Operational decisions dominate management’s attention. They create relentless, tactical, internally focused pressure. We use honed experience and feedback.
Strategic management is different. The learning loop is too long. We can’t afford the time to learn from mistakes.
The skills required for effective operational management are counterproductive in strategic management.

<table>
<thead>
<tr>
<th>Strategic Management</th>
<th>Operational Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Focuses on the important issues</td>
<td>• Attends to detail and follow-through</td>
</tr>
<tr>
<td>• Considers long time horizons</td>
<td>• Concerns itself with near-term performance</td>
</tr>
<tr>
<td>• Treats uncertainty strategically</td>
<td>• Treats uncertainty statistically</td>
</tr>
<tr>
<td>• Chooses among significantly different alternatives</td>
<td>• Avoids new alternatives—“Just do it!”</td>
</tr>
</tbody>
</table>
Each project needs to be managed for strategic value creation and operational excellence.

Strategic Project Management–Do the right things
Position project to create the most value.

Operational Project Management–Do the things right
Balance cost, schedule and performance.
All projects need to be managed with the same principles of strategic value creation and operational excellence.
Operational portfolio management focuses on conformance to budgets and schedules, expedites projects and manages overall portfolio resources.
Strategic Portfolio Management creates a level playing field for getting the most value from the portfolio, meeting growth goals, and determining the optimum budgets.
Excellence in both perspectives creates maximum value through a smart and high performance organization. But you must wear a completely different hat to do each well!
As projects proceed to commercialization the uncertainty the analysis shifts from “Can we do it?” to “How well can we do it?”

The decision system should be engineered to shift focus at each gate: Moving from a relatively low investment decisions using close view of product development and a long view of the marketplace to a huge commercial investment requiring more detailed contemplation and models of competitive markets.
The “classic” Decision Quality Chain states the elements that must be addressed for any high-quality decision.

Elements of Decision Quality

- Meaningful, Reliable Information
- Clear Values and Trade-offs
- Logically Correct Reasoning
- Commitment to Action
- Appropriate Frame
- Creative, Doable Alternatives
- Appropriate Frame

These links also specify good design principles for decision processes.
Somik Raha, a recent SU PhD, added personal values to the chain, which motivates effective implementation.
To make clear, credible and acceptable choices, a level playing field is needed, usually including per review.

Project teams conduct project evaluations. Peers and experts review projects. Executives make decisions.


Understand project economics. Identify issues that matter. Compare project forecasts. Rank project productivity.

SDP 2013-03-20
“Portfolio Navigator showed us what our portfolio could deliver in meaningful, bottom-line terms and gave us real insight into which projects to fund.”

Executive
Major Oil Company
Like many organizations, we faced significant challenges...

- Business needs for technology were not being met in a timely fashion
- Corporate growth objectives demanding more for less
- Technologists keeping projects alive too long
- Inconsistent project evaluations
- Not enough project failures
- Difficulty comparing projects of different types
- Limitations of thumbs up / down approach to project prioritization
Management chose to implement a value-based portfolio project and portfolio decision process.

Before: a roll-up event

- Project Evaluations
  - Specify & quantify uncertainty
  - Clear standards
  - Give teams real direction

- Peer & Expert Review
  - Transparency
  - Credibility and Comparability

- Portfolio Decisions
  - Value-based
  - Solid information
  - Strategic Alignment

- Uncertainty Tracking
  - Baseline assessments
  - Updates based on evidence

After: a value-based management process

- Project Justifications
  - Business cases

- Portfolio Decisions
  - Subjective Factors
The result: acceleration of technology to business opportunity.
Summary

Goal was to develop a process & tools to:

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Benefits of a Portfolio Mgt Process for Heavy Oil Technology

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Delivering A Billion Dollars — Lessons In Portfolio Evaluation

Ken Edwardsson – Global Leader
Dow AgroSciences
September 15, 2008
New Software Enables Our Process To Work Better

Initial Process And System:
• Process tools pushed to participants
• Elaborate database with emailed templates
• Data collection and analysis steps very sequential
• Complex financials and support data
• Analysis of database aggregations and project comparisons done in spreadsheets

Result:
• Project and local teams spending 100’s of hours on data accuracy and aggregation
• Version control a nightmare
• Little energy going into critical thinking about projects, lots of energy into servicing the process.

Current Process And System:
• Deployed Portfolio Navigator from SmartOrg
• Acts as single source of project information
• Web-based evaluation at concept, project and portfolio levels
• Built around decision + risk mgmt. tools
• Easy to add additional features we needed

Result:
• Huge time savings
• Effort has shifted from aggregation of data to value analysis
• Information available in real time
• Lots of energy now going into improving returns at concept and project level.
Key Takeaways For Portfolio Management

Master Project Management execution basics:
– Use a well-documented, rigorous process
– Have clear role accountabilities
– Relentlessly measure and make decisions on facts

Create an Innovation Culture
– To feed the portfolio and link to customers/markets

Build Portfolio Management discipline:
– Deploy best practice value and risk management tools
– Use software to simplify and enable execution
– Create an organizational focus to:
  -- maximize and track the value of investments
– Connect strategies to portfolio value
“We have applied SmartOrg solutions to hundreds of projects, helping us reduce cost or drive growth. The cumulative impact on Boeing: hundreds of millions of dollars.”

Dave Leonhardi
Boeing
Today’s trends are forcing the evolution of decision analysis methods and delivery systems.

• Organizations are once again into decentralization and empowerment
  — Agile organizations push responsibility as low as possible
• Executives and managers are much better trained and familiar with decision analysis and similar approaches.
  — In the 60’s and 70’s most had no clue about decision analysis
• Everyone is looking for instant gratification, and they expect high-speed decision analysis
  — They are used to having information at their fingertips, and participating in global teams
  — They want their strategic decisions made quickly too, so they can move on to operational effectiveness.
• By making the process of strategy creation and decision operational, we play into their new mindset
  — Strategy and operational thinking are very different.
  — But the process of creating strategy is an operational process.
**Paradigm shifts from “Flattening of the World”**

**From:**
- Decision Doctor
- Client
- Consultant Knows Best
- Managing Large Projects
- Custom Tailored
- Time out for DDP
- Empowered Consultants

**To:**
- Capability Builder
- Customer
- Customer Knows Best
- Empowering Teams
- Off the Rack
- DQ in the Work Flow
- Empowered Customers
Where does the decision engineering profession stop?

1. **Decision Analyst** (nerd version) - responsible for processing numbers

2. **Decision Facilitator** - responsible for productive meetings

3. **Decision Consultant** - responsible for attaining commitment

4. **Decision Engineer** - responsible for organizational design: process, systems, training, etc.

5. **Decision Change Agent** - responsible for personal, organizational, and cultural change necessary for routine, high quality decision making
The Ten Commandments of Decision Analysis

1. **Decision Analysis in the One Master Discipline** – do not follow false fads.
2. **Work for the Decision-Maker** and serve the organization he/she represents.
3. **Construct a monetary value measure** – nobody puts “scores” in the bank.
4. **Beware of rates of return** – nobody puts ratios in the bank either.
5. **Have no regret** – do not covet the pie you did not get or the other guy’s pie.
6. **Beware of difference lotteries** – they never happen.
7. **Beware of triage** – often “no brainers” have the biggest improvement potential.
8. **If the problem is technically hard, change your frame** – avoid “constraints”
9. **Start simple and iterate** – use the simplest model that gives decision clarity.
10. **Change with the times and join in the new paradigm** – the world is now flat!
The new world of Decision Engineering
It’s frightening (and exciting)!
APPENDIX

Useful Tools
A Decision Hierarchy clearly shows what is being decided now.

Example: Manufacturing Plant Modernization

Policy Decisions
- Continue manufacturing

Strategic Decisions
- Plant configuration and location
- Technological stretch
- Product range
- Quality and cost position
- Marketing strategy

Tactical Decisions
- Product design
- Manufacturing operations
- Marketing plans

Take as given
Focus on in this analysis
Decide Later
The Decision Hierarchy Determines Decision Columns in a Strategy Table

Listing the options helps illustrate the scope chosen for decision-making; options will be combined later into strategic alternatives.
A Strategy Table reduces and incredible number of strategy possibilities into a few for evaluation.

<table>
<thead>
<tr>
<th>Strategy Alternatives</th>
<th>Plant Configuration and Location</th>
<th>Technological Stretch</th>
<th>Product Range</th>
<th>Quality and Cost Position</th>
<th>Marketing Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggressive Modernization</td>
<td>Current</td>
<td>State of art</td>
<td>Full line</td>
<td>Quality and cost leadership</td>
<td>Sell quality and influence market growth</td>
</tr>
<tr>
<td>Moderate Modernization</td>
<td>Close #1</td>
<td>Proven</td>
<td>One basic line and specialties</td>
<td>Improved quality; deferred cost reduction</td>
<td>Sell quality</td>
</tr>
<tr>
<td>Consolidation</td>
<td>Close #1; build domestic greenfield</td>
<td>Current</td>
<td>Value-added specialties only</td>
<td>Minimal quality improvements</td>
<td>Current</td>
</tr>
<tr>
<td>Run Out</td>
<td>Close #1; build foreign greenfield</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Influence diagrams are another key tool that identifies important variables and relationships in a decision problem.
The diagram also can identify information sources and show how their knowledge will be integrated.
Influence diagrams prove useful at several points in the decision process.

- Identifying key factors that need to be considered
  - Sources of value
  - Uncertainties
  - Decisions
  - Information needs

- Structuring how information will be assessed

- Specifying relationships for the spreadsheet evaluation model

An effective influence diagram saves time by ensuring that the evaluation “begins with the end in mind.”
Selected References


