Credit Risk Modeling and Decisioning Conference

Larry Rosenberger      May 30, 2002

Strategy Science: Breakthrough in Data-Guided Decision-Making
Basics of Strategy Science

Recent Lessons from the Field

Speculations on the Future
Topics

- Basics of Strategy Science
  - What’s the breakthrough?
  - What is Strategy Science?
  - Extending existing notions
- Recent Lessons from the Field
- Speculations on the Future
Current Industry Practice:
Decision strategy design driven by judgment

- **External Data**
- **Internal Data**
- **DATA MGMT.**

**ANALYTICS**
- Predictive Analytics
- Exploratory Analysis / Data Mining

**Predictions**
- Insights

**Judgmental Strategy Design**
**AUTOMATED STRATEGY EXECUTION**

**Prospects & Customers**

**Reactions**
**Actions**
The Breakthrough: Adding science to strategy design

- External Data
- Internal Data

Information

Optimal Decision Strategies

DATA MGMT.

ANALYTICS

Predictive Analytics

Exploratory Analysis / Data Mining

“Strategy Science”

Decision Modeling

Strategy Optimization

Strategy Refinement

INSIGHTS

Predictions

Reactions

Actions

Prospects & Customers
Strategy Science – 3 Step Methodology
Replaces guesswork in strategy design with science

**Decision Modeling**
- Build a graphical model for one or more decisions
- Establish mathematical relationships

**Strategy Optimization**
- Solve for profit-improvement strategies - subject to constraints on key metrics

**Strategy Refinement**
- Refine strategies for interpretability, robustness and ease of deployment
Simplified Decision Model for On-going Credit Line

Decision models drive Strategy Science

Modeling your customers reactions to your actions is key!
Optimization and refinement produce a better decision strategy.

Risk Score
- Low
- Medium
- High

Utilization
- Low
- Medium
- High

Balance
- Low
- High

Expert Decision
- $5,000

Optimal Decision
- $3,000
- $5,000
- $8,000
Credit Scoring $\rightarrow$ better PREDICTIONS

- Strategy Science $\rightarrow$ better DECISIONS
Predicting vs. Decisioning
Prediction focus

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Judgmental Decision Strategies

Expert Judgment

Profits Score
Response Score
Revenue Score
Risk Score

Data

Prospects & Customers

Actions
Predicting vs. Decisioning

Decision Focus

Profit Score

Response Score

Revenue Score

Risk Score

Data

Data

Data

Data

Optimal Decision Strategies

Strategy Science

Decision Modeling

Strategy Optimization

Strategy Refinement

Actions

Prospects & Customers

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Credit Scoring $\rightarrow$ better PREDICTIONS
- Strategy Science $\rightarrow$ better DECISIONS
- Risk Management $\rightarrow$ better loss control
  - Strategy Science $\rightarrow$ better trade-offs
  - Strategy Science $\rightarrow$ better understanding of trade-offs
Trading-off volume versus losses

Baseline operating point
Profit implications of the volume vs. loss trade-off
Creating the Efficient Frontier
Exploring Trade-offs Among Key Business Metrics

<table>
<thead>
<tr>
<th>Profit / account</th>
<th>Change</th>
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</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>$73</td>
</tr>
<tr>
<td>Profit / account</td>
<td>$78 (+7%)</td>
</tr>
<tr>
<td>Profit / account</td>
<td>$95 (+30%)</td>
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Basics of Strategy Science

Recent Lessons from the Field
- Where are we?
- “Scar tissue”

Speculations on the Future
Where Are We?
The "3rd Decision Revolution"
Within 1 year after launching Strategy Science,

- 2 countries: U.S., U.K.
- 3 credit products: credit card, direct & indirect loans
- 8 decision areas in the customer life-cycle
- 26 projects in progress/completed for 16 clients
<table>
<thead>
<tr>
<th><strong>Strategy Science for Financial Services</strong></th>
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<tbody>
<tr>
<td><strong>Customer Acquisition Decision Models</strong></td>
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<tr>
<td>Bankcard</td>
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<tr>
<td>Pre-Screen</td>
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<td>Intro APR</td>
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<td>Go-to APR</td>
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<td>Intro period</td>
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<td>Rewards offer</td>
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<tr>
<td>Affinity offer</td>
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<tr>
<td>Credit line assignment</td>
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<tr>
<td>Installment loan terms and pricing</td>
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<tr>
<td>Indirect auto loan terms and pricing</td>
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<td><strong>Customer Management Decision Models</strong></td>
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<td>Bankcard</td>
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<td>Credit line management</td>
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<tr>
<td>Authorizations</td>
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<td>(early stage collections)</td>
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<tr>
<td>Collections</td>
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<tr>
<td>Retention and Loyalty programs</td>
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<tr>
<td>Cross-sell</td>
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<td><strong>Supporting Analytics</strong></td>
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<tr>
<td><strong>Capabilities</strong></td>
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<tr>
<td>Data Spiders</td>
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<tr>
<td>ClusterBots</td>
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<tr>
<td>Utility Functions</td>
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<tr>
<td><strong>Methodologies</strong></td>
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<tr>
<td>Pre-Market</td>
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<tr>
<td>Offer Testing</td>
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<tr>
<td>Learning Strategies</td>
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</tbody>
</table>
Where Are We?
Early results to date

- On target to achieve 20-30% profit improvement in this “3rd Decision Revolution”
  - Early field tests outperforming benchmark strategies
  - Some “early adopters” have gone beyond their first application of Strategy Science
- “Fast followers” are paying serious attention
- It’s too early for “proven only” players
Scar Tissue
Hard stuff → really hard stuff

- Success requires large doses of:
  - Mathematical modeling “art”
  - Data analysis “savvy”
  - Domain expertise injection

- Success forces numerous innovations
Insightfully model customer reactions to lender actions

Insightfully choose key business metrics for trade-off analysis of conflicting business objectives

Insightfully represent business constraints for iterative optimization

Balance simplicity versus complexity
Hard Stuff → Really Hard Stuff
Data analysis “savvy”

- Estimate quantitative relationships based on both data and expert judgment to account for:
  - Holes in the data
  - Confounding effects of multiple decisions
  - Exogenous variables and influences
- Estimate uncertainty of estimates
- Balance simplicity versus complexity
Create tools and methodologies to inject business judgment flexibly and at multiple points

Engineer resulting strategies for:

- Transparency/Interpretability
- Robustness
- Ease of deployment

Balance simplicity versus complexity
Hard Stuff → *Really* Hard Stuff

Forced innovations

- Consumer preferences
  - Stated preferences/intentions
  - Observed preferences/revealed intentions
- Action-based prediction
  - Existing tools but new methodologies
- “Learning strategies” – new role for experimental design
  - Efficient “horse racing” versus “horse breeding”
Basics of Strategy Science

Recent Lessons from the Field

Speculations on the Future

- Technical directions
- Impact on decision-making
Where Is Strategy Science Going?
Technical directions

- Inject “feed-forward control” in the face of dynamics!
  - Economic stress testing
Feed-Forward Control
Simulating different economic conditions

- Current Balance
- Credit Bureau Score
- Behavior Score
- Current Limit
- Simulate expected changes in the model inputs
- Alter the relationship between model elements
- Alter constraints
- $ Rev
- Good / Bad
- Credit Limit Change
- Alter output
- Profit
- $ Loss
Where Is Strategy Science Going?

Technical directions

- Inject “feed-forward control” in the face of dynamics!
- Economic stress testing
- Model many decisions and integrate tightly-coupled ones
Model Many Decisions ... And integrate the tightly coupled ones

Potential Customer

Prescreen Decision
Prescreen Accepted

Contact Decision
Responder

Product Offer and Activation Enhancement

New Customers Prospects

Responders

Approve, Product Offer Decision
Accept Product

Activation Enhancement

Prescreen Decision
Prescreen Accepted

No Response

No Activation

Rejected

No Response

No Activation

Don't Accept

Active Customers

Inactive Customers

Retrieval, Usage Decision
User

Payer

Payment Management Decision

Delinquent Customers

Customer Service

Account Management
-Credit Lines
-Pricing
-Payment Policies

Former Customers

Attriter

Closed Account

Defaulted Customers

Collection Data

Portfolio Acquisition

Portfolio Sale

Current Customers

Inactive Customers

Reactive Inactive Customers Decision

Solicit Decision
Responder

Accept Product

No Response

Don't Accept

No Activation

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Where Is Strategy Science Going?
Technical directions

Inject “feed-forward control” in the face of dynamics!

- Economic stress testing
- Model many decisions and integrate tightly-coupled ones
- Design and build multi-tier control systems
Multi-Tier Decision Control Systems
Function → line of business → enterprise

Card Portfolio
- Portfolio Objectives
  - Product mix
  - Profit contribution
  - Loss reserves
  - Acquisition growth

ENTERPRISE
- Trade-off Levers
  - Customer mix
  - Market growth
  - Capital allocation
  - Capital reserves

Pre-Screen
- Business Objectives
  - Acct acquisition cost
  - Response
  - Portfolio growth

Initial Credit Line
- Business Objectives
  - Activation
  - Contingent liability
  - Retention
  - Balance transfer

Credit Line
- Business Objectives
  - Retention
  - Receivables
  - Contingent liability
  - Losses

Collections
- Business Objectives
  - Dollars recovered
  - Collection costs
  - Third party mgt

Profit
EPS
Market Share

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Where Is Strategy Science Going?
Changing decisions and decision-making processes

- Quantifying trade-offs
  - Operating over the cliff! But how far?
Quantifying Trade-offs
Simplified indirect auto loan pricing

Risk score → Accept/Reject → Offer → Take/No Take → Profit

Custom Risk Score

Market Data

Deal Data

“Response” Score → Good/Bad
Efficient Frontier
The staircase to credit loss hell
A Closer Look at an Efficient Frontier
Profit vs. Market Share (“Take Rate”)

Total profit vs. take rate
(for 1 million prospects)

Total profit (in millions)
Historical operational point

Take rate

Total profit
Where Is Strategy Science Going?
Changing decisions and decision-making processes

- Quantifying trade-offs
  - Operating over the cliff! How far?
- Changing dialogs & roles of key players – “data-assisted BOGSAT technology”
  - Business objectives & trade-offs
  - Recent changes in the marketplace
  - Future uncertainties
Imagine being able to **explore** the impact of policy changes, the sensitivities of your business constraints, and the forces of economic and competitive change on any decision strategy... **before** it’s implemented.
Conclusions

► Strategy Science is HUGE!

► “Early adopting” continues, while “fast following” is starting-up

► It’s really hard stuff!
Strategy Science: Breakthrough in Data-Guided Decision-Making

Questions & Answers