OBJECTIVE INSIGHTS

Business Analysis for the Health Care Industry

Use Decision Analysis & Long-Term Market Forecasts to Build a Targeted Product Portfolio

The Center for Business Intelligence

Westin Princeton

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Outline

- Portfolio Management: Art or Science?
- Forecasting's Role in Portfolio Management
- Measuring Portfolio Performance
- A Combinatorial Approach to Portfolio Generation
- Portfolio Optimization
- Conveying the Results

Portfolio Management: Art or Exact Science?

- Many elements converge to make portfolio management more of an art than science:
  - Human factors
    - » Corporate inertia, pet projects
  - Technical factors
    - » Disagreements over methodology, lack of risk assessment, poorly executed forecasts, complexity
- Tools exist to help make the process more quantitative and impartial, while still preserving the role of judgment and experience

> We haven't the money, so we've got to think.
> *– Lord Rutherford (1908 Nobel in Chemistry)*

Forecasting's Role in Portfolio Management

- Evaluating a portfolio first requires assessing the individual projects in the portfolio
  - Usually accomplished with long-term forecasts
  - Forecasts are the source of the quantitative metrics used to evaluate the portfolio
  - If desired, take qualitative factors into account

Forecasts–Content Is King

- The more complete the forecast, the more useful it is for portfolio planning
- In order of information content and complexity:
  - Revenue-only
  - Profit-and-loss (P&L) or income statement
    - » Ability to generate a net present value (NPV) for the project
  - P&L with development data
    - » Addresses development risk

Forecasting Risk–Beyond NPV

- Forecasts should explicitly incorporate risk
  - Avoids implicitly quantifying risk through the common, yet error-prone and misleading, method of high discount rate NPV analysis
  - Quantify:
    - » Development risk (timelines, probabilities of success)
    - » Revenue risk
- Techniques
  - Monte Carlo simulation
  - Decision trees
  - Options analysis

Prediction is very difficult, especially about the future.
– *Neils Bohr*

Measuring Portfolio Performance

- What defines a good portfolio?
  - Financial measures
  - Product measures
- Your company wants more of the good…
  - Revenues, profits, product launches
- …and less of the bad
  - Lifecycle "gaps", expenses, resource allocation, and risk (product failures, high results variance)
- Ultimately, which portfolio best satisfies corporate objectives?

Portfolio Financial Measures

- Revenue
  - Plus Growth & Timing
- Earnings
  - Plus Growth/per Share & Timing
- Cash Flow/Expenditures (Peak vs. Overall)
- NPV/Expected Value
- Probability of achieving specified goals
- Pearson Index
- Risk

Portfolio Product Measures

- Probability that at least *n* products launch
- Mean expected product launches
- Number of Products
  - Development Phase
  - Therapeutic Area

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Indices Summarize Performance

- Indices are an effective way to summarize portfolio performance for ranking purposes
- Combined Measure Score–The Portfolio Decathlon
  - Averages deterministic (static) results for each portfolio based on specified weighting
  - Emphasize factors considered most important by the company

Index Calculation Example

	Expected drug launches	Peak Revenues ($M)	Cash Flow Valley ($M)	EV ($M)	Year of Positive Cash Flow	Index Arithmetic Mean	Index Geometric Mean
Index Weight	15%	10%	20%	30%	25%		
Current Portfolio	2.3	$8,875	$121	$4,934	2009		
Index Value	0.38	0.64	0.52	0.56	0.92		
Weighted Index Value	0.28	0.32	0.52	0.84	1.15	0.62	0.54

Probabilistic Measures in Portfolio Evaluation

- Probabilistic (stochastic) measures should be incorporated in portfolio evaluation
  - Combining risk elements from the individual projects at the portfolio level exposes the *portfolio effect*

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Portfolio Effect

- Overall risk is reduced when combining risky assets in a portfolio due to diversification
  - Some assets perform well when others are performing poorly, reducing the overall variance of portfolio results
- Requires performing portfolio-level Monte Carlo simulation, since co-variance of projects with respect to each other is not known *a priori*

Combinatorial Portfolios

- If it works for drug development in the lab, why not apply it to drug development in the office as well?
- Initial set of portfolios is constructed from all possible combinations of projects
  - Assumes you don't know in advance what a superior portfolio looks like in terms of project composition
- Number of portfolios increases as power of 2
  - Portfolio of 15 projects has 2^{15} or 32,768 distinct combinations
  - Problem of selecting the best portfolio quickly becomes unmanageable as number of projects increase

Culling The Herd

- Q: How do you handle the sheer number of options presented by the combinatorial approach?
- A: Apply constraints to narrow down the number of portfolios to analyze

Concepts–
"Constant" vs. "Variable" Projects

- Constant ("Blessed") projects
  - Always included in portfolio due to strategic reasons
    - » Close to launch, would never abandon
    - » Key therapeutic area
    - » Research chief's pet project
  - Designated in advance
  - Reduces number of potential portfolios
- Variable projects
  - May or may not be included in a given portfolio, depending on constraints
  - Basis of combinatorial approach

Typical Portfolio Constraints

- Constraints are specified in advance
- Examples:
  - Upper and lower limits on number of simultaneous projects:
    - » In particular indications
    - » In each phase of development
  - Lifecycle product requirements; require certain number of:
    - » Improved formulations
    - » Second-generation products
  - Maximize positive portfolio characteristics
    - » Revenue, profits
  - Minimize negative portfolio characteristics
    - » Expenses

Screening Portfolios

- Combinatorial-generated portfolios are screened against constraints
  - Portfolios not meeting constraints are discarded
- Look at deterministic data and calculate indices for remaining portfolios
  - Top 30 portfolios as ranked by "decathlon" index score are retained for further analysis

Automation Isn't Everything

- A portfolio management system that only offers access to computer-generated portfolios neglects the role of judgment and experience
- Allow specification of *ad hoc* portfolios
  - May or may not meet logic constraints or have top index scores
  - Permits inclusion of a reference portfolio and "what-if" analysis

The Last Step: Probabilistic Analysis

- Run Monte Carlo simulation of top 30 portfolios (plus any *ad hoc* portfolios)
- Select top deterministic and stochastic portfolios for final comparison to any *ad hoc* portfolios
- Make the tough portfolio decisions
- You're done! (except for the hard work of implementation)

Conveying the Results

- Present best portfolio candidates to the decision-makers
  - One page summary for each project, with additional supporting data as needed
    - » Project rationale
    - » Summary financial data
    - » Clinical timelines, probabilities, and expenses
  - Graphs and tables comparing the top portfolios
  - Rationale for selecting each portfolio

> Make everything as simple as possible, but not simpler.
>
> – *Albert Einstein*

Project Summary Sheet Example

Project Summary for XX-53489 in Deep Vein Thrombosis

Product	XX-53489
Class	Anticoagulant
Market	Cardiovascular
Indication	Deep Vein Thrombosis
Launch	2Q2011
Version	Midyear Update
Date Prepared	31-Jul-03

Forecast Results ($ Millions)

NPV	$453.8
Risk-Adjusted NPV	$50.9
Monte Carlo Mean Revenue	$326.4
Monte Carlo Low Rev	$10.9
Monte Carlo High Rev	$384.1
Cash Flow Valley	($17.2)
Peak Year Cash Outflow	2007
Peak Year Outflow	($53.8)
Expected Cash Outflow	($68.1)

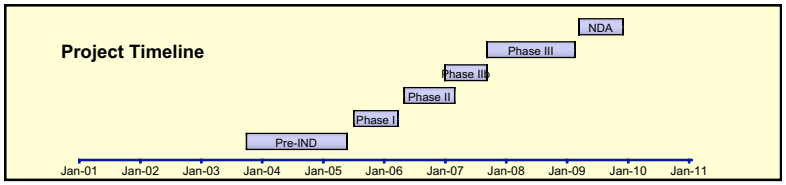
PTS	**Project**	**Average**
Pre IND	100%	65%
Phase I	40%	35%
Phase II	50%	50%
Phase IIb		
Phase III	85%	75%
NDA	90%	90%
Overall	15%	8%

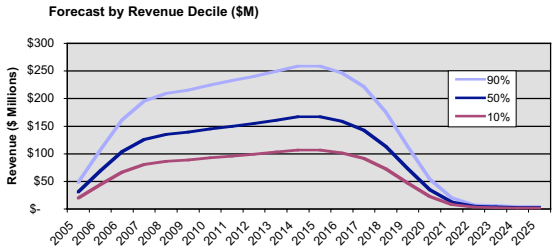
R&D ($ Million)	**Project**	**Average**
Pre IND		$3.1
Phase I	$7.3	$8.6
Phase II	$9.2	$11.6
Phase IIb		
Phase III	$25.4	$33.5
NDA	$2.4	$2.7
Overall	$44.3	$59.5

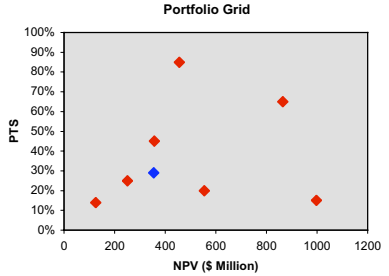
Forecast Variables	**Most Likely**	**Low**	**High**
Event Occurences (000)	2,500	1,200	4,500
% Eligible	85%	75%	90%
% Treated	50%	35%	55%
Market Share	20%	5%	30%
Revenue / Patient / Tx	$600	$200	$1,400

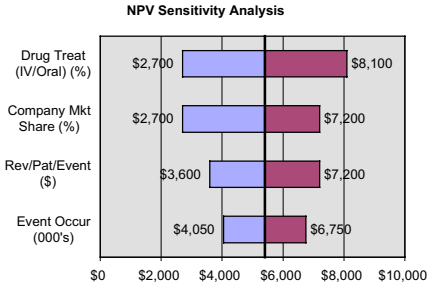
Project Rationale

1. List rationale here.









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Summary

- Good portfolio analysis requires good forecasts
  - Risk analysis improves quality of the process
  - There is more to risk analysis than NPV
- The combinatorial portfolio technique allows you to examine a large number of possible portfolios
  - Apply constraints and index rankings to reduce the complexity of the task

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