

# ***The Future of Decision Computation***

Panel Presentation

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## ***The perspective here is that of a consultant who has worked mostly on strategic business problems***

- That means that there are a lot of decision computation areas ***not*** represented, including:
  - Social/political decision making
  - Medical decision making
  - Personal decision making
  - Scientific decision making (e.g., choice and design of experiments)
  - Operational decision making (e.g., routine managerial decisions)
- The future of decision computation in these areas may be quite different than in the areas discussed here



## ***It is convenient to distinguish between “main line” decision computation and more specialized decision computation***

- The main line of decision computation describes the set of tools that the decision facilitator/analyst brings to bear on any decision problem
  - These decision problems usually involve a one-time commitment of resources in a complex and uncertain situation
  - The tool kit contains modeling tools and decision analysis tools
- More specialized decision computation tools are required in situations like the following:
  - Portfolios of ventures that require many coordinated decisions
  - Decisions that require complex, multidimensional modeling
  - Decisions that involve complex dynamics or feedback in the modeling
  - Use of real-time data and decision support systems to identify situations in which a decision-making project is called for
  - Repeated, routine decisions involving uncertainty
  - ...



# ***The ancient history of decision computation gives some hint about the future of the main-line decision computation***

- 1970s was the era of mainframes
  - Modeling: Fortran (familiar to the client), APL (A Programming Language) (“easy” for the analyst, unknown to the client)
  - Decision Analysis Tools: the beginnings of some generalized tools, but mostly *ad hoc* routines for decision trees, with “do loops” to sum over the branches of uncertainties or maximize at a decision node
  - Time Required for Analysis: I would guess 60% of the project—computers were not easy to deal with!
- 1980s was the era of personal computers
  - Modeling: VisiCalc, Lotus 1-2-3, Multiplan, Excel—spreadsheets rule! The analyst and client can work together
  - Decision Analysis Tools: decision tree analysis and sensitivity analysis tools, many of which linked to spreadsheet models
  - Time Required for Analysis: I would guess 60% of the project—spreadsheets were easy and could do so much more, but you have to manipulate the data...



# ***More recent history of decision computation probably has set the direction of the main-line decision computation***

1990s was the era of personal computers with power and connectivity

- Modeling: the spreadsheet is everywhere. Fortran makes a comeback in Visual Basic and adds power to the spreadsheet. The analyst and consultant can work together. Proprietary templates and modeling tools
- Decision Analysis Tools: influence diagram and decision tree tools have a graphic interface, and still link to spreadsheet models. Some tools help build models
- Time Required for Analysis: I would guess 60% of the project—you can do so much and incorporate so much data, but you have to obtain the data and have meetings...

My best guess about the future of the main-line decision computing

- 2000s will be the era of the internet and stupendous (from today's viewpoint) computing power
  - Modeling: the spreadsheet will rule for years to come. Templates and modeling tools become more common
  - Decision Analysis Tools: maybe a bit slicker, better integrated to templates and modeling tools
  - Time Required for Analysis: I would guess 60% of the project!!!

BUT...  
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# ***Changes will show up in decision computing involving a lot of coordinated decisions, or a lot of output or input***

- Data bases for portfolios of uncertain ventures
  - R&D projects, pharmaceutical compounds, products, business units
  - Need capability to track probabilities, uncertain cash flows, NPVs, critical variables
  - Some proprietary examples exist, but need general vision of what is needed: desired input from decision analysis results, desired output for portfolio decisions, maintenance and updating procedures, links to the decision-making processes
- Need to develop “spreadsheets” to handle multidimensional data easily and intuitively
  - By product, geography, time, alternative,...
  - Need close relation to omni-present spreadsheets
  - Need to develop general ways of achieving clarity in describing uncertainty in a multidimensional world of data
    - And, of course, incorporation of (or links to) influence diagram and decision tree tools



## ***Changes will also show up in decision computing when time dynamics and complexity is important***

- Investment decisions (options), business opportunity development (real options), systems with feedback effects (competitor, government, customer, employee,...)
- System dynamics has been around as a computational tool since the 1970s but has not yet become a routine part of the decision analysis toolkit
  - Several large decision analysis projects have been done using system dynamics programs, and we are still learning
    - When is the effort of setting up a system dynamics model justified?
    - How do we handle uncertainty in a world where mental models are made into computer models?
    - How does the model deal with future decisions, especially in an uncertain world?
  - Dynamic models of physiological systems are being built for the medical/pharmaceutical world and could be an area to be linked to decision computation



## ***The use of real-time data and decision support systems may also bring a change in decision computation***

- Can real-time data be linked to the decision process and “declare” that a decision project needs to be initiated?
- How can we support repetitive decision making in an uncertain world, using real-time data to update probability distributions?
  - E.g., entering into contracts with values depending on rapidly changing uncertainties

