

Newsletter

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Warner North Receives Ramsey Medal

[Picture](#) (13 Kb)

Dr. Warner North was awarded the Frank P. Ramsey Medal at the October INFORMS meeting in Dallas, given for career achievement in decision analysis. The award recognizes his extensive contributions in public sector applications of decision analysis, particularly those involving environment protection. Dr. North has thirty years of experience as a decision analysis practitioner, ten with SRI International and the past twenty years with Decision Focus in Mountain View, California, of which he was a co-founder. Decision Focus has recently merged with Aeronomics Incorporated to form DFI/Aeronomics, which has 250 staff members in offices in Mountain View, Atlanta, Washington, D.C., and London.

Dr. North has consulted to a wide variety of companies and government agencies, in areas ranging from energy policy and space mission planning to risk management for toxic chemicals and sites containing toxic and radioactive materials. In addition to his consulting experience, Dr. North has served for nearly 20 years on many committees of the Science Advisory Board of the US Environmental Protection Agency and the National Research Council of the National Academy of Sciences. Dr. North has been a part-time faculty member at Stanford University for more than 20 years, and for the past six years has taught courses on public policy with respect to energy and the environment in Stanford's Department of Engineering-Economic Systems and Operations Research. In addition to the Decision Analysis Society of INFORMS, Dr. North is active in the Society for Risk Analysis. He served as president of this international professional society in 1991-2.

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From the Chair

Decision Analysis Problems for Classroom Use Revisited

Don Keefer

In my column last December, I proposed we develop a set of contemporary decision analysis problems for classroom use and share them with each other via the DAS web site. The gist of that column (I will be happy to send you a copy if you wish) is that the academics among us need additional realistic problems that utilize structuring tools such as influence diagrams, encourage formulations in terms of variables rather than solely in terms of trees, use graphical sensitivity-analysis tools such as tornado diagrams, and generally utilize the capabilities of PC-based decision analysis software. We need additional sequential decision problems that do not appear to be contrived simply to require the calculation of reversed conditional probabilities and additional multiattribute problems from the private sector. While these problems can be short and simple or long and elaborate, they should look realistic, have plausible story lines, and pay at least some attention to data acquisition. Clearly, we need contributions from consultants and practitioners, who deal with real problems daily, as well as from academics.

Since that column did not lead to the submission of any problems from readers (assuming there actually are some readers), I am hereby making good on my threat to write a problem for communal use myself. The problem that appears on page 4 is simple enough for most of it to be solved by hand, so it can be utilized prior to the introduction of software if desired, with later parts assigned as relevant topics and tools are covered. Note that it illustrates some aspects of the data acquisition process rather than simply presenting the NPV's needed for the decision tree as "given." It asks for an influence diagram as well as a decision tree and requires sensitivity analyses, at least one of which would be very tedious without using software. Embellishing the basic problem or the set of questions provided is straightforward.

John Butler of UT Austin has kindly volunteered to handle the web site for these problems, the location of which (courtesy of Jim Dyer) will be http://www.bus.utexas.edu/~dyerj/DA_probs/. If you can provide a suitable problem that is not subject to copyright or confidentiality difficulties, please send it in machine-readable form to John. Ideally, send him the problem as a text message or as a file attachment (e.g., in Word or WordPerfect format) at the following e-mail address: jbutler@utxvms.cc.utexas.edu. If this is not feasible, you can mail your submission to John at the following address: John Butler, c/o Professor James S. Dyer, CBA 5.202 (B6500), Graduate School of Business, University of Texas at Austin, Austin, TX 78712-1175.

Solutions should be available from the authors for all problems submitted, although they need not be in machine-readable form. Depending on the response to this initiative, we may consider developing a separate web page for solutions, with suitable security to

prevent students from illicitly obtaining solutions to their assignments. Each problem posted on our web site will include the name, e-mail address, and telephone number of the author (a) to give the author whatever credit this confers and (b) to enable interested readers to contact the author to get solutions, to comment on the problem, to ask for additional background information, etc.

If a few of us would each provide one problem having at least one or two of the characteristics cited above, it would benefit the teaching of decision analysis, and thus our profession, significantly. Please contribute a suitable problem if you are able to do so.

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Society News

Awards

The Frank P. Ramsey Medal was awarded to **D. Warner North** (Decision Focus Incorporated) for his distinguished contributions to the field of decision analysis, especially in the area of environmental applications. The Best Publication Award for 1995 was given to **James E. Smith** and **Robert F. Nau** (Duke University) for their paper "Valuing Risky Projects: Options Pricing Theory and Decision Analysis" which appeared in *Management Science*. The Student Paper Award was given to **Oswaldo F. Morera** (a student of **David Budescu** at the University of Illinois-Chicago) for his paper "A Psychometric Analysis of the 'Divide and Conquer' Principle in Decision Analysis."

Pictures

[Bob Nau, Detlof von Winterfeldt, Warner North, Don Keefer, Oswaldo Morera, and Dennis Buede](#) (25 Kb)

[Bob Nau](#) (47 Kb)

[Oswaldo Morera](#) (42 Kb)

Working Papers On-Line

The Working Paper Abstracts page is active again. A number of new working papers are listed, and many can be downloaded in pdf or other standard document formats. Thanks to **John Butler** at the University of Texas for organizing and maintaining this page - and send him the abstracts of your own working papers at jbutler@utxvms.cc.utexas.edu if you would like to see them listed there.

References Updated

The extensive list of decision theory references compiled by **Peter Wakker** has been updated as of October 1997 - see the Decision Analysis References page on our web page. Thanks to Peter for providing this great service to the decision research community.

Montréal Program

The titles and abstracts of papers in sessions sponsored by the Decision Analysis Society at the INFORMS/CORS Joint Meeting in Montréal (April 26-29 1998) are available here. Thanks to **Jim Smith** and **David Lowell** for organizing this cluster of sessions.

Seattle Meeting

Decision Analysis Cluster chairs for the INFORMS Seattle meeting (October 25-28, 1998) are **Dana Clyman** (University of Virginia) and **Pat Noonan** (Emory University). Please contact them ASAP if you are interested in organizing a sponsored session for the Seattle meeting.

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Teaching

Mominco

Don Keifer

The Ministry of Natural Resources of a foreign country has asked Mominco, a large international minerals company, to consider bidding for the exploration and mining rights for a large tract of land in that country. In conversations with the Ministry, Mominco has been told that a cash bid of \$90 million would be "nearly certain" to win Mominco these rights. Based on this information and on experience in dealing with such situations before, Mominco's management believes that a bid of \$90 million would have a probability of 0.95 of winning the rights. However, based on the current financial needs of the country's government and the likely levels of interest of competitors in this tract, management also believes that a much lower bid would not necessarily be turned down. Consequently, Mominco is also considering two other possible bid levels, \$40 million and \$65 million, as well as not bidding at all. Management believes these bids would have probabilities of 0.33 and 0.75, respectively, of winning the rights to this tract.

Mominco's management already knows that a valuable mineral deposit lies within the tract, but the size of the deposit remains highly uncertain. Sensitivity analysis has shown that the size of the deposit is the crucial uncertainty in evaluating the tract's profitability - i.e., it is much more important than the other uncertainties present. Based on available data and on their experience and judgment, Mominco's geologists have used standard probability assessment methods to come up with the cumulative probability distribution for the size of the deposit, which is shown in the figure below.



In order to use this information in a decision tree, it is necessary to approximate the continuous distribution shown with a discrete distribution. The extended Pearson-Tukey approximation is suitable for that purpose. It utilizes the 0.05, 0.50, and 0.95 fractiles (5th, 50th, and 95th percentiles) from the underlying continuous distribution as the three possible values in the approximating discrete distribution and assigns them probabilities of 0.185, 0.630, and 0.185, respectively. Note that these three fractiles correspond to 20, 40, and 80 million tons in this case.

Mominco's planning staff has determined that V , the net present value (NPV) to Mominco from developing the tract after taxes, royalties, etc., but excluding the bid, can be represented by

$$V = S \times m - c,$$

where S is the (uncertain) size of the deposit, m is the profit margin per unit of deposit recovered, and c is the fixed cost of developing the resource. Values for profit margin per unit and the cost of development are estimated to be \$4 per ton and \$70 million, respectively, and are believed to be reasonably accurate. If Mominco wins the rights, its overall NPV from the project is V minus the discounted after-tax amount of the successful bid — roughly 70% of the bid in this case.

Questions

A. Draw an influence diagram for Mominco's decision problem that shows the variables (decisions and uncertainties), the evaluation measure, and the relationships among them. You need not include numerical data at this stage.

B. Draw a neatly labeled decision tree representing Mominco's decision problem. Include probabilities and branch values throughout the tree and a value for the evaluation

measure (NPV) at each endpoint to represent the overall consequences of following that path.

C. Assuming management wishes to use expected NPV as the criterion for decision making, solve the decision tree from part B by hand and show the optimal strategy on it by indicating the optimal alternative (or crossing out all non-optimal alternatives) at each decision node. Please show the expected value at each decision and probability node so that the steps in your solution can be followed (you need not show all of the arithmetic.) NOTE: You are welcome to check your solution via a computer program if you wish.

D. Express the optimal strategy you found in part C verbally: i.e., describe the best initial choice and the best choices for subsequent decisions that may arise (if any). Also, specify the corresponding (optimal) expected NPV verbally.

E. Find the probability distribution (PDF, or PMF), or "risk profile," corresponding to the optimal strategy and present it in tabular form.

F. Management is concerned about the sensitivity of the decision in part C to the probability, hereafter denoted by p , of winning the rights with a \$40 million bid. Find the "critical value" of p (to two decimal places) at which the optimal strategy in part C changes and describe the new optimal strategy. Does this change in strategy make sense? Explain.

G. Management is also concerned about the effects of risk aversion on the optimal strategy from part C. Assume Mominco's risk preferences for NPV can be represented by an exponential utility function of the form $-\exp(-x/r)$, where x represents NPV and r is Mominco's risk tolerance. What is Mominco's optimal strategy if its risk tolerance is \$25 million and what is the corresponding certainty equivalent? At what level of risk tolerance (to the nearest \$1 million) does the optimal strategy change from that in part C to the strategy you just found? Explain intuitively why this change occurs. Are there additional changes in strategy as risk tolerance decreases below \$25 million? Explain.

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Working Papers

The following working paper abstracts have been received since the Dallas INFORMS meeting and are available on our web site. Currently, working papers are assigned a number based on the year and order they were received. If you would like to list an abstract and/or paper at this site or if a paper on this list has been subsequently revised and/or accepted for publication, please notify John Butler at jbutler@utxvms.cc.utexas.edu so that this information can be added to the archive.

"An Experimental Investigation of Forward-Looking Non-Financial Performance Disclosures" by J. Richard Dietrich, Steven J. Kachelmeier, Don N. Kleinmuntz, and Thomas J. Linsmeier; October 1997 (WP970013)

"Correlations and Copulas for Decision and Risk Analysis" by Robert T. Clemen and Terence Reilly; March 1997 (WP970012)

"Dependent Decision Analysis" by Robert T. Clemen and Terence Reilly; November 1996 (WP970011)

"Does Decision Analysis Work: A Research Agenda" by Robert T. Clemen; April 1996 (WP970010)

"Combining Probability Distributions from Experts in Risk Analysis" by Robert T. Clemen and Robert L. Winkler; October 27, 1997 (WP970009)

"Simple Probabilistic Evaluation of Portfolio Strategies" by William B. Poland; October 4, 1997 (WP970008)

"Relative Risk Value Models" by Jianmin Jia and James Dyer; May 1996 (WP970007)

"Risk-value theory" by Jianmin Jia and James Dyer; May 1997 (WP970006)

"Measures of perceived risk" by Jianmin Jia, James Dyer and John Butler; October 1997 (WP970005)

"Generalized disappointment models" by Jianmin Jia, James Dyer and John Butler; September 1997 (WP970004)

"Attribute weighting methods and decision quality in the presence of response error: A simulation study" by Jianmin Jia, Gregory W. Fisher, and James Dyer; April 1997 (WP970003)

"A simulation technique for the sensitivity analysis of multi-criteria decision models" by John Butler, Jianmin Jia, James Dyer; September 1996 (WP970002)

"A Multiattribute Utility Analysis of Alternatives for the Disposition of Surplus Weapons-grade Plutonium" by James Dyer, Thomas Edmunds, John Butler and Jianmin Jia; May 23, 1997 (WP970001)

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A Conversation with Warner North

Thomas Eppel

This conversation followed Dr. North's remarks in Dallas at the Decision Analysis Society Awards Presentation.

TE: What have been the major advances in the theory and practice of decision analysis over the last 25 years?

WN: Looking back 25 years to my initial applications experience, the planning to Mexico's electric power system and US government decisions on weather modification for hurricanes and on landing a spacecraft on Mars, I think the surprising aspect is how little has changed. My predecessors among the Ramsey Medalists had given us a well-stocked kit of decision analysis tools 25 years ago. I believe one of the best additions to the tool kit is the influence diagram. The concept of the influence diagram, as a way to condense and simplify a large decision tree while explicitly highlighting conditionality in the uncertain variables, was developed by Allen Miller on a project for the US Department of Defense that I supervised for SRI International. It was a good example of how the demands of a complex application can stimulate innovation.

Over the past 25 years there has been great progress in numerical computation, and in the power of large, complex models to represent economic and environmental systems that are the subject for decision making. My colleagues Dean Boyd, Ed Cazalet, and Bob Phillips have made important contributions in applying decision analysis to complex markets and enterprises with decentralized decision making on product offerings and product pricing.

TE: Given your experiences in a variety of applications, what have been and what are the major obstacles in implementing decision analysis?

WN: Decision analysis is a framework that needs filling out with the right problem-specific details. The most valuable output from decision analysis is insight, not the numerical results. The usefulness of decision analysis reflects the quality of the inputs (information, values/preferences, alternatives), how effectively these inputs have been organized into an analysis, and how well the insights from the analysis have been communicated to those with decision responsibility. My experience is that decision analysis requires partnership with people highly experienced in the areas applicable to the decision problem. In order to have effective partnership, each side must understand not just the other's vocabulary, but also the culture. Throughout my career I have spent a great deal of time learning about subjects important to the decision problems I have worked on, such as environmental protection. I have had the opportunity to learn from experts in a wide variety of engineering and scientific disciplines, and I have tried to teach concepts of decision analysis in return. I have also learned a great deal from social scientists interested in behavioral decision theory and perceptions about uncertainty and risk.

So I conclude that a major obstacle in the application of decision analysis is failure to achieve effective communications between the decision analyst and those people with whom he or she must work. Practicing decision analysis is like practicing law or

medicine. There is a great deal of substantive knowledge that one must have to be professionally qualified, but, in addition, a lawyer must be effective in working with clients and a doctor with patients.

TE: What specific problems did you encounter in the public policy context?

WN: The public policy context is decision making in a democratic society. Therefore, the outcomes of concern are outcomes to a group, a portion of society, rather than to an individual or a corporate entity that has one "bottom line." Often there is controversy that confounds assessment of information and assessment of values/preferences. Many people do not trust "the experts" from government agencies, leading corporations, and the academic community on emotionally charged issues such as global climate alteration or the disposal of nuclear waste. Our political leaders must run for reelection, so they have strong practical limits on the extent that they can act in ways counter to public sentiment. A century before the present age of mass communications, Abraham Lincoln warned, "In this age, in this country, public sentiment is everything. With it, nothing can fail; against it, nothing can succeed. Whoever molds public sentiment goes deeper than he who enacts statutes, or pronounces judicial decisions."

Lincoln's admonition implies that we analysts should be humble and realistic about what we can accomplish. We can hope to educate our leaders so they will have a better understanding of complex issues, and we may be of modest help in assisting leaders who wish to explain their positions on such issues to the public.

We should be patient about progress toward more rational decision making in the public sector. We should build trustworthy institutions and processes for decision making, rather than expecting that the progress we have made with one group of leaders will extend to the next group. Participation in institutions like the National Research Council of the National Academy of Sciences and the EPA Science Advisory Board has persuaded me that their carefully packaged and peer-reviewed scientific advice serves an important need. This advice can help assure that the rationales for decisions are, at least, not clearly inconsistent with scientific knowledge and stated public policy goals.

Decision analysts need to be diplomats. Most scientists have been trained in classical statistical methods rather than Bayesian decision theory, and this situation is not going to change quickly. Scientists see themselves as seeking truth, not aiding decision making in an uncertain world. Scientists have their biases and political agendas just as other citizens in a democracy do. As a result of their expertise, scientists are frequently put in the position of being authoritative sources of advice to decision makers. A decision analyst who can be trusted by different contending factions among the experts can sometimes help reduce controversy by showing how disagreements about the preferred decision stem from different judgments about information, values/preferences, or the feasibility of alternatives. The difference from corporate applications is that there is seldom one decision maker who can give a charter to "do a decision analysis" and serve as the main recipient for the analysis that results. A decision analyst who formulates and then explains an analysis, working with many contending parties in a political controversy,

may receive much criticism and little credit. My experience indicates that at least some people will recognize and value the contribution.

TE: What are the key challenges that ought to be addressed in future research?

WN: I think those in the academic decision analysis community should strive to be more interdisciplinary and to interact more with other parts of INFORMS and with other disciplines in science and engineering. In the public sector as well as in many corporate decision problems, many people share decision responsibility and many, possibly different people, provide informational inputs. Economists, political scientists, sociologists, business management and public administration scholars all strive to understand how people interact in making decisions. We decision analysts ought to recognize the limitations of an approach intended to aid one decision maker to choose rationally among a set of alternatives, based on using probability theory to describe uncertainty in the consequences of these alternatives and utility theory to assess values and preferences for these consequences.

We live in an age of information explosion. The Internet is giving us desk-top access to data archives and libraries beyond the wildest dreams of the analysts of my era, who trudged to the computer center as graduate students to run programs off punched cards, and then went to the library to read through 3 x 5" card catalogues and racks of journals to see if anyone had previously published the ideas emerging from our research.

There is great value in being able to use information for a decentralized decision system, where computers enable lower-level managers to remember past history and to act quickly on current information; assure that their actions will be implemented; and evaluate the consequences of the actions against organizational goals. My colleagues at DFI/Aeronomics are heavily involved in "Revenue Management" systems of this type to aid management in businesses such as airlines, hotels, and rental car companies. In the face of uncertain and fluctuating demand, agents for these companies seek to sign up customers to use the available capacity in a way that both (1) gives a diverse set of customers the tradeoffs they want between convenience and price, and (2) generates additional revenue for the company.

In this information age much effort is going into assembling huge data bases and management information systems. Just how is this information to be used? How will residual uncertainties be dealt with? Developers of management information systems often say that their purpose is to improve decision making. Making large amounts of information quickly accessible is a commendable accomplishment. I believe it is far better if the system can help users to identify and obtain the information that is most important for the decision(s) that the users face. I think there is great need in the future for such decision support systems in environmental management and in a large number of other decision making areas.

Both in the public and private sectors we need more careful evaluation of the value of additional information, as opposed to "paralysis-by-analysis"—too much information

gathering and analysis – or "extinction by instinct " – not enough. A sign of progress is that both the recent Presidential/Congressional Commission on Risk Assessment and Risk Management and the National Research Council in its report, *Understanding Risk*, commend value-of-information analysis.

*(The Risk Commission reports are available on the Internet at www.riskworld.com and *Understanding Risk* at www.nas.edu.)*

TE: Given the diversity of backgrounds in our membership, what are your thoughts on the interface between academia and industry? How can the Decision Analysis Society foster a constructive dialogue between the two?

WN: We need both ongoing dialogue and to avoid the parochialism of talking only to our own community. Being a decision analyst is clearly compatible with a home base in one of a variety of traditional academic disciplines and involvement in a wide assortment of industry and public application areas. There is much to be gained by comparing aids to decision making across academic disciplines and areas of application. The Decision Analysis Society can be a good forum where we can talk to each other about the progress we are making and about what further skills, analytical techniques, or research breakthroughs we think we need for additional progress. We ought to maintain a lively dialogue with experienced leaders and decision makers, both in the corporate and public sector, who can tell us much about what they think they need for improved decision making, and why.

TE: What advice would you give a student or a professional who wants to get into decision analysis?

WN: First, obtain a good training in decision analysis and computer aids for information management and analysis. You need a good set of technical tools and skill in using them. Then you need to specialize in one or more areas where the tools can be usefully applied. Select an area for application and learn what you need to know to be able to communicate effectively with the people that you will have to work with in this area. Learn the vocabulary, get an overview of the subject matter, and develop an understanding of the institutions. To be effective in implementing decision analysis you will need to become sophisticated in the politics of the decision process and the art of persuading people.

As you gain experience, I hope you will enjoy your successes and not become discouraged when your recommendations are not followed. It is a long campaign to impact a society whose leaders are now largely ignorant of how decision analysis can aid decision making. Collectively, we may accomplish much more than the sum total of our individual efforts. So, please help maintain and build the professional community: the universities, the professional societies, the National Research Council, and work cooperatively with others in scientific, engineering, and business management disciplines to spread the knowledge of decision analysis concepts and how they may be used.

Last fall, my wife and I toured Europe, and I had the opportunity to reflect on the achievement represented by Chartres and other great cathedrals erected during the Middle Ages. These edifices resulted from many decades of effort by communities who had shared goals and put the technology of their time to effective use to realize these goals. Few of the artists and architects are remembered by name, but their collective accomplishments still inspire those of us who visit, twenty generations later.

My wife and I also visited the museum in Vinci, Italy, which proudly displays models of the innovative ideas of Leonardo, the most illustrious man ever to come from this little town. Whereas in our century Leonardo's ideas are hailed as far ahead of his time, few of his mechanical inventions were recognized as valuable until long after his death.

What will people many generations hence say about those of us who are laboring to improve decision making? Will a few of our leaders be known for innovative ideas that reached practical implementation centuries later — or will we be known as a group who were able to work within our society to get improvements in decision making accomplished?

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Decision Analysis Theory/Practice Symbiosis in Puerto Rico

Miguel A. Arrieta-Morales

After reading Jim Smith and Bob Winkler's article on What Academia Needs from Industry in the D.A. Newsletter dated August 1977, I decided to respond to the challenge they posed: "How can a practitioner help in convincing students that decision analysis can be helpful, have a competitive advantage in the workplace and application value?"

In 1982, I formally entered decision analysis when I began my doctoral studies on the subject, leaving behind the field of Clinical Psychology for that of Micro-Economics, Logic and Ethics. During 1978, as a Clinical Psychologist I founded The Institute for Human Development with the idea of applying decisional and cognitive counseling to business and personal development.

Psychology, which is sometimes viewed as the subjective "human" oriented side, tends to ignore logic, cost-benefit analysis in decision making and effectiveness/efficiency issues as a process. In addition, it labels individuals, which in turn excuses them from assuming responsibility for their own actions. In traditional behavior theory, the paradigm is to explain behavior based on past history and the situations that caused it. Instead, decision analysis is oriented towards the future in terms of goals and individual values that should be respected in their decision making.

In business, results (economic transactions, productivity, services, e.g.) are no more than the output of the decision that people make in each transaction; the "hard stuff" image of the business world is the collective or historical consequence of those decisions. As decision analysts we pay attention to the procedure involved in making those decisions: the "how". And this is so because based on the way (the how) that people manage and work with the information is that they will obtain specific and expected goals and results. In other words, decision making in business should not be about using and /or applying data, and facts, but about processes. In this sense, as decision analysts, we are a step ahead. It is through the process that we manage specific information, in specific ways to obtain specific goals, all in a context of a minimum of uncertainty and risk.

That was how, as an academic and pioneer decisional consultant on the island, I penetrated the world of industrial organizations, manufacture services and government. Since people are natural decision makers, empowerment is needed so that, in this modern world of globalization and extremely critical transactions, we focus not only on making decisions, but making effective decisions, driven by the quest for economic results and based on sound ethical values. Now, for more than seventeen years, The Institute for Human Development has served as decision consultant to dozens of major public and private institutions in Puerto Rico. By providing and counseling in decision analysis techniques, individuals learn how to focus on free-will, take control of their lives through the decision-making process, and eventually reach their goals in business and personal life as well as in their self-perception as community and global citizens. We refer to the application of this upwardly constructive philosophy as "Vertical Living" (Vida Vertical). Since this method has proven to be quite successful and has been accredited by the Puerto Rico General Education Council, educational programs have been developed specifically for the areas of Business Administration (executive management), Education (formal teaching/learning experiences), and Mental Health (personal counseling) providing an integral perspective of human beings in their professional and personal ambiances.

Since the beginning of our endeavor, we have applied this perspective by converting our experience, academic knowledge and theories into a series of working models. With the help of decisional paradigms, our instructors have been able to demonstrate how the concepts and strategies of "Vertical Living" can be used in everyday living, as well in obtaining long-term goals in all areas of personal and socio-economic endeavors.

In the field of business for example, the program is known as Management for Excellence, with a focus on developing values in service excellence. This approach is based on a method of exchange between managers and employees, where each takes a position and becomes accountable for his or her own decisions. By expanding on decision-making criteria, an individual is able to make progress in satisfying the expectations of clients, both external and internal. Ethical matters are discussed, and executives learn through the decision-making process to take a stand and develop leadership skills that are aimed at achieving objectives and win-win relationships. By implementing these values, participants will know what to consider when making decisions. This in turn will enhance team building and strengthen the company's position in the market. We have implemented a "hands-on" outlook, teaching how to achieve the

objectives mentioned previously on a day-to-day basis, using the decision analysis model, taking into account that decision analysis is called the "Technology of Thought".

We have provided consulting and or reengineering services, based on decision-making training, to more than 45 organizations in Puerto Rico in the following areas: manufacturing/sales, (pharmaceuticals, food, construction, computers); services (banking, insurance, health, private education, Information Systems, engineers); Government (Industrial Development, Public Education, Human Resources, Insurance); Professional Associations (teachers, lawyers, engineers, Certified Public Accountants).

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Is Decision Analysis Part of Total Quality Management?

Robert F. Bordley

The Quality Movement which permeates many, if not most, major companies in the US and Japan is based in part on the Taguchi/Box approaches to decision-making. In these approaches, one:

- (a) Identifies a problem & a criterion measuring solution of the problem;
- (b) Brainstorms factors — some controllable by the decisionmakers, some not—which might cause or affect the problem;
- (c) Constructs a fishbone diagram relating these factors to the criterion;
- (d) Specifies levels (i.e. alternative settings) for each factor. (In decision analysis, one generally uses 10/90 intervals to getting settings for uncertain factors and strategy tables to get settings for controllable factors.);
- (e) Treats some of those levels as prespecified, some as varying randomly (somewhat like the decision hierarchy of decision analysis);
- (f) Assesses which factors seem to have the biggest first-order impact on the criterion by using a design of experiment approaches to assess how the criterion changes when the various factors are set to various levels;
- (g) Constructs a chart(which is essentially a tornado chart rotated 90 degrees) displaying how various factors impact the criterion;
- (h) Eliminate a factor if varying the setting of that factors doesn't cause the criterion to change much;

(i) After eliminating the less important factors, repeat steps (e) through (f) where one examines not only the direct impact of a factor but also the impact of their interactions;

(j) After eliminating the less important factors, a task team now constructs a solution to the problem.

While this approach leaves out some critical steps of decision analysis (e.g., decision trees and decision/risk timelines), it really seems remarkably similar to decision analysis as practiced in large corporations. I've also found that some students versed in Taguchi techniques viewed this as somewhat like a simplified form of Taguchi designed for strategic (as opposed to operational quality) decisions.

This striking similarity raises two questions:

(a) Should we practitioners be marketing Decision Analysis as an integral part of TQM (or as an extension of TQM to strategic decision-making)?

(b) Should we, both practitioners and academics, be publishing our papers in TQM journals (like Quality Progress)?

(c) Can we accelerate the diffusion of decision analysis in industry by packaging a Quality Decision Analysis Methodology as an extension of TQM?

(d) Can we increase the job prospects of academicians by telling their deans that decision analysis is part of TQM?

(e) Should the Risk Section of the American Statistical Association (which I currently chair) be doing more to present decision analysis to statisticians as a framework for design of experiments?

(f) Is Ron Howard our counterpart to Deming, Taguchi and Box?

I'd appreciate people sending me a note at robert_bordley@notes.gmr.com.

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