

Decision By Objectives

(How to convince others that you are right)

Ernest Forman, DSc.
Professor of Management Science
George Washington University

Mary Ann Selly
Expert Choice Inc.

"Not everything that counts can be counted and not everything
that can be counted, counts" – Albert Einstein

Dedication/Acknowledgments

To our family, friends, colleagues, teachers and students:

We dedicate this book to, and acknowledge those who have come before us; those whose paths have crossed ours, both directly and indirectly; and those who have shared their ideas with us and have permitted us to share our ideas with them.

Chapter 1	1
Introduction: Management Decision-Making Today	1
The Need for Better Decision-making	2
Tradeoffs.....	5
BOGSAT	5
Cognitive limitations	6
Satisficing.....	6
Common Simplistic Strategies	7
Cognitive Decision Rules	8
Unimportant vs. Crucial Decisions.....	10
Resistance to Change.....	11
Requisites for Change.....	11
The Analytic Hierarchy Process	13
Chapter 2	15
Problem Solving and Decision-Making	15
Problem Solving	15
Decision Making	18
Intelligence, Design, Choice.....	18
Decision-making is a Process.....	21
Analysis vs. Synthesis	22
Quantitative vs. Qualitative	22
Objectivity vs. Subjectivity	24
Linear versus Non-Linear.....	25
Chapter 3	27
Decision-making Concepts & Methodologies.....	27
Alternatives - Pros and Cons	27
Misuse of Numbers.....	31
Levels of Measurement	32
Nominal	32
Ordinal	33
Interval.....	33
Ratio	34
Weights and Scores	37
Channel capacity and short term memory	38
Need for Hierarchical Structure.....	39

Orders of magnitude.....	39
Arbitrary assignment	40
Absolute versus relative	40
Words instead of numbers	40
Chapter 4	43
The Analytic Hierarchy Process and Expert Choice	43
The Analytic Hierarchy Process	43
Beyond Weights and Scores.....	45
Inconsistency	46
Causes of Inconsistency	47
Clerical Error	47
Lack of Information.....	47
Lack of Concentration	48
Real World Is Not Always Consistent.....	48
Inadequate Model Structure	48
Compensatory and Non-Compensatory Decision-making.....	49
Principles and Axioms of the Analytic Hierarchy Process	50
Expert Choice	53
Developing a Decision Hierarchy	54
Goal	54
Objectives	55
Alternatives.....	55
More Complex Hierarchies	56
Establishing Priorities.....	62
Pairwise Comparisons	62
Eigenvalues and Eigenvectors	63
Numerical judgments.....	67
Graphical judgments.....	68
Verbal judgments.....	68
Synthesis.....	78
Sensitivity	79
A Typical Application of AHP/EXPERT CHOICE.....	82
Seven Step Process for Choice	109
Other decision-making ‘recipes’	111
Musts and Wants	111

Summary of the benefits of AHP	113
Incremental Improvement	113
Chapter 5	127
From Brainstorming to Structuring to Evaluation and Choice.....	127
Brainstorming	127
Creativity	128
Narrowing Down	129
Categorizing and Combining.....	129
Voting	130
Multiple Choice	130
Rating	131
Considering Multiple Objectives.....	132
Structuring	133
Top Down Structuring.....	134
Bottom Up Structuring	134
From Pros/Cons to Objectives.....	136
Evaluation and Choice.....	137
Chapter 6	139
Other Topics / Refinements.....	139
Missing Judgments	139
Using Hard Data	140
Converting to Pairwise	141
Transformation of data	141
Artificial Clustering of Elements – Linking Clusters.....	143
Ratings Approach	144
Absolute vs. Relative Measurement	144
An Overview of a Ratings Model.....	146
Creating the Ratings Model from Evaluation and Choice.....	147
Using Ranges for Intensities.....	148
Using the Same Intensities for all Objectives.....	149
From absolute to relative measurement.....	150
Ideal and Distributive Synthesis Modes (Preventing or allowing rank reversals)	151
The Cause of Rank Adjustment.....	153
Closed and Open Systems – Scarcity and Abundance	154

Closed and Open Synthesis Modes with AHP	156
Illustrative Example.....	162
When is scarcity germane?	173
Summary.....	174
Structural adjustment / Product adjustment.....	175
Structural adjustment.....	175
Product Adjustment	177
Complete Hierarchy.....	179
Benefit/Cost.....	181
Benefit/Cost/Risk	184
Pairwise Comparisons versus MAUT Swing Weights.....	187
Integrating with Quantitative Methodologies.....	190
Linear Programming.....	190
Queueing Models.....	198
Critical Path Method.....	202
Forecasting	205
Integer Programming.....	205
Chapter 7	213
Forecasting - The Forward Process	213
Illustration 1 – Synthesizing Forecasting Methods for a Composite forecast	215
Illustration 2 – Selecting a Forecasting Method.....	217
Illustration 3 – Deriving Probability Distributions.....	218
Illustration 4 – Forecasting Alternative Outcomes.....	222
Illustration 5 – Forecasting models interacting with choice model(s).....	226
Illustration 6 -- Deriving Scenario Likelihoods.....	228
Illustration 7 – Analytical Planning (The Forward/Backward Process).....	230
Chapter 8	235
Resource Allocation	235
Methodology Overview.....	239
Identify/design alternatives	240
Identify and structure the organization’s goals and objectives	241
Prioritize the objectives and sub-objectives	242

Measure Alternatives' Contributions	243
Find the Best Combination of Alternatives	243
Discrete Alternative Resource Allocation	244
Benefit/Cost Ratios—Sort and Allocate.....	251
Maximizing Benefits -- Optimization	253
Flexibility of Benefits Optimization Approach:.....	267
Constraints for dependencies.....	267
Constraints representing Synergy.....	268
Orders of Magnitude Considerations.....	273
Summary of B/C Ratios vs. Optimization of Benefits:	274
Activity Level Resource Allocation	276
Benefit/Cost Ratios.....	278
Maximizing Benefits -- Optimization	283
Resource Allocation Summary.....	287
Chapter 9	291
Meetings, Meeting Facilitation and Group Support Systems (GSS)	291
Groups and meetings	291
Dissatisfaction with outcomes of meetings	300
What is a meeting?	300
Meeting Model	301
Meeting Outcomes: Relational as well as Task.....	302
A Meeting Facilitation Framework	303
Facilitation activities by meeting stage	305
Pre-meeting activities	305
During Meeting activities	306
Chapter 10	309
Feedback.....	309
Intuitive and Formal Feedback.....	309
Top Down Evaluation of Bridge Selection AHP Model.....	311
Top Down and Bottom Up	314
AHP with Feedback –A more formal mechanism.....	316
Iterating for feedback	318
Supermatrix for feedback	322
Intuitive versus formal feedback	322
The Analytic Network Process.....	324

A Car buying example with Feedback	325
Links in a Feedback Network Model	328
Summary of Steps in Building a Feedback Network	330
Chapter 11	331
Empowered for the Future.....	331
Everything That Counts.....	331
Beyond Buzzwords.....	331
Empowered.....	332
Appendix I.....	333
Contemporary Management Trends	333
Strategic Planning.....	333
Total Quality Management.....	334
Malcom Baldrige Award	338
Assessing the Voice of the Customer	340
Value Based Value Pricing.....	344
Value Pricing	345
Competitive Value Analysis.....	347
Competitive Value Pricing	348
Planning for Value.....	352
Quality Loss Function	352
Prioritizing Defects and Evaluating Solutions with AHP	357
Quality Function Deployment and The House of Quality.....	360
Benchmarking.....	365
Benchmarking Effort Results	368
Cause and Effect or Fishbone diagrams	371
Appendix II.....	375
Case Studies.....	375
AHP at the Inter-American Development Bank.....	375
INTRODUCTION	375
THE ACCOUNT RECONCILIATION PROJECT	376
Decision Support Environment	377
Intelligence Phase.....	378
Design Phase	379
Choice Phase	379
AHP For Future Navy Sea-Based Platforms	386

Carrier Attribute Prioritization	390
Step 1 –Determine Appropriate CVX Tasks	391
Step 2 –Prioritize CVX Tasks	391
Step 3 –Develop CVX Attributes	396
Step 4 –Prioritize CVX Attributes.....	397

Chapter 1

Introduction: Management Decision-Making Today

Decision-making is a process of choosing among alternative courses of action in order to attain goals and objectives. Nobel laureate Herbert Simon wrote that the whole process of managerial decision-making is synonymous with the practice of management.¹ Decision-making is at the core of all managerial functions. Planning, for example, involves deciding what should be done? When? How? Where? By whom? Other managerial functions, such as organizing, implementing, and controlling rely heavily on decision-making.

Today's fast changing and global environment dictates that a successful enterprise have a rich decision-making process. This means not only gathering and processing data, but also making decisions with the support of state-of-the-art decision methods. Decision-making is the very foundation of an enterprise, and sound decision-making is absolutely necessary for gaining and maintaining a competitive advantage.

In many enterprises the decision process entails great time and effort in gathering and analyzing information. Much less time and effort go into evaluating alternative courses of action. The results of the analyses (there are often many, for example financial, marketing, operations, and so on) are intuitively synthesized to reach a decision. Research has shown that although the vast majority of everyday decisions made intuitively are adequate, intuition alone is not sufficient for making complex, crucial decisions. Organizations that use modern decision support methods can gain and maintain a competitive edge in leading and managing global business relationships that are influenced by fast changing technologies and complicated by complex interrelationships between business and governments.

¹ Herbert A. Simon, *The New Science of Management Decision* (New York: Harper & Row, 1960), pp. 40 - 43.

This book will help you learn and apply methods to gain and maintain a competitive edge.

Specifically, this book will help you to:

- Prioritize
- Evaluate alternatives
- Allocate resources
- Deliver powerful presentations
- Justify/defend recommendations
- Make meetings more effective
- Improve communications
- Achieve consensus
- Eliminate fifty percent of your business worries

The Need for Better Decision-making

Few people today would doubt the importance of relevant information when making vital decisions.

Yet many people are unaware of the need for a logical approach to the decision itself. They consider it sufficient to collect data, analyze the data, and then simply “think hard” in order to arrive at a good decision. They use seat of the pants approaches or simplistic strategies for analyzing their decisions. In his book, Crucial Decisions, Irving Janis provided evidence that “A poor-quality decision-making process (which characterizes simplistic strategies) is more likely than a high-quality process to lead to undesirable outcomes (including disastrous fiascoes).”² He asserted “When all vital decisions are made on the basis of a simplistic strategy, the gross misperceptions and miscalculations that remain uncorrected are likely to lead to disaster sooner or later — usually sooner rather than later.”³

There are some who have already recognized the need for what Janis called vigilant decision-making. Janis stated: “When executives are asked how they go about making the most consequential decisions, some of them

² Irving L. Janis, *Crucial Decisions — Leadership in Policymaking and Crisis Management* (New York: The Free Press, 1989), p 287.

³ Janis, *Crucial Decisions*, p. 89.

acknowledge that when they believe the stakes are really very high, they do not stick to the seat-of-the pants approach that they ordinarily use in daily decision-making. In fact, their accounts of what they do in such circumstances are not very different from the analytic problem-solving approach recommended in most standard textbooks in management sciences.” One of the difficulties in using the analytical problem solving approaches found in management science textbooks, however, is that they are predominantly quantitative approaches — incapable of incorporating the qualitative factors so important in vital decisions. We will, in this book, look at and resolve the quandary posed by the need to synthesize quantitative and qualitative factors in a decision process. We will come to understand what Albert Einstein meant when he said (in a letter to President Roosevelt) “Not everything that counts can be counted and not everything that can be counted, counts.”

Decision-making ability is the most important business skill

Decision-making is undoubtedly the most difficult and most essential task a manager performs⁴. Executives rate decision-making ability as the most important business skill, but few people have the training they need to make good decisions consistently. In their excellent book, *Decision Traps*⁵, Russo and Shoemaker point out that becoming a good decision-maker requires coaching just like becoming a good athlete. Coaches have learned that excellent athletic performance depends on techniques that *can* be taught. Some of these techniques are counter intuitive and therefore extremely difficult to learn by trial and error. Experienced golfers love to watch athletic baseball players step up to the tee and swing as hard as they can, only to miss the ball completely. A golf instructor can quickly teach the athletic baseball player what is not intuitive — that the left arm (for a right-hander) should be kept almost straight, unlike during a baseball swing, and that swinging easier will usually make the golf ball go further. Techniques like ‘keeping your head down’ (or ‘eyes on the ball’), work well in several

⁴ C. H. Kepner and B. B. Tregoe, B.B. *The Rational Manager: A Systematic Approach to Problem Solving and Decision-Making*, McGraw Hill, New York, NY, 1965.

⁵ Russo, J. Edward and Shoemaker, Paul J. H., *Decision Traps*, Doubleday, New York, N.Y., 1989.

sports, like golf, tennis and baseball. But someone who has not played any of these sports will intuitively ‘lift’ their head to see where the ball is going before the swing is completed.

Decision-making skills can also be taught. Common mistakes when making crucial decisions, like those in Table 1, can be avoided using some fairly simple methods and techniques.

Table 1 – Common mistakes when making crucial decisions

1. Plunging in	Gathering information and reaching conclusions without thinking about the crux of the issue or how decisions like this one should be made
2. Frame blindness	Setting out to solve the wrong problem because your framework causes you to overlook attractive options or lose sight of important objectives
3. Lack of frame control	Failing to define the problem in more ways than one, or being unduly influenced by the frames of others
4. Overconfidence in your judgment	Failing to collect key factual information because of overconfidence in your assumptions and opinions
5. Shortsighted shortcuts	Relying on ‘rules of thumb’ for crucial decisions, or on the most readily available information
6. Shooting from the hip	Trying to keep straight in your head all the information relating to the decision rather than relying on a systematic procedure
7. Group failure	Assuming that a group of smart people will automatically make a good decision even without a good decision process
8. Fooling yourself about feedback	Failing to learn from evidence of past outcomes either because you are protecting your ego or because you are tricked by hindsight
9. Not keeping track	Assuming that experience will make lessons available automatically
10. Failure to audit your decision process	Failing to create an organized approach to understanding your own decision process

When things get tough

Good decision-making is a luxury when business is booming or budgets are expanding. However, when things get tough, good decision-making is a necessity. Bill Wolman, Chief Economist Businessweek and CNBC, has said “Any idiot can manage during inflation (when the economy is growing). At times like these it takes good management and when good management is required, I get nervous.” W. Edwards Demming, father of TQM, observed that “A declining market exposes weaknesses: Management in an expanding market is fairly easy. It is difficult to lose when business

simply drops into the basket. But when competition presses into the market, knowledge and skill are required for survival.”⁶

Tradeoffs

Reaching a decision will ordinarily involve making trade-offs among the objectives relating to a decision – a difficult and poorly understood aspect of decision-making. Decisions become difficult when they involve several competing objectives. The greater the number of objectives – the more complex the decision.

People have a poor understanding of how they make trade-offs

Research conducted over the past quarter century has demonstrated conclusively that people have a poor understanding of how they make such trade-offs.⁷ Experimental evidence has shown that “people do find it difficult to make consistent judgments when more than one attribute is involved,” and therefore there is “a strong argument for providing some structured means of helping them ‘think through’ their choices.”

BOGSAT

The most frequently used method for decision method today is what is sometimes referred to as the *BOGSAT* – a **B**unch of **O**ld **G**uys/**G**als **S**itting **A**round **T**alking). Even though there may be considerable preparation for a *BOGSAT*, including information-gathering, and detailed analyses (e.g., financial, marketing, technical, political, etc.), there are numerous problems with this approach. According to Peter Beck, “These sessions are often dominated by the leader and rarely facilitated. The leader sets the tone and is often not challenged. If the group starts down the wrong path they rarely look back.”⁸ The *BOGSAT* is so universal that your competitors have most likely

⁶ W. Edwards Demming, “Transformation of Western Style of Management”, in P.R. Krishnaiah and C. R. Rao, eds. *Handbook of Statistics*, Vol. 7, Elsevier Science Publishers, 1988.

⁷ R. L. Cook, and K. R. Hammond, “Interpersonal Learning and Interpersonal Conflict Reduction in Decision-Making Groups.” in *Improving Group Decision Making in Organizations: Approaches from Theory and Research*. New York: Academic Press, 1982), p. 19.

⁸ Discussion with Peter Beck, Decision Technology, Arlington, VA.

been using it as well – so you may not have yet been at a competitive disadvantage. However, times are changing and many organizations have been abandoning the BOGSAT in favor of more capable methods. Before looking at these methods, let's first consider why BOGSAT decision-making is inadequate.

Cognitive limitations

Psychologists have proven time and time again that the human brain is limited in both its short-term memory capacity and its discrimination ability (channel capacity) to about seven things.⁹ A BOGSAT discussion typically involves dozens of 'things', e.g., issues, alternatives, pros, cons, objectives, criteria, etc. Then what do we do?

Satisficing

Bazerman¹⁰ points out that the economist's model of the rationality assumes that decision-makers following the following logical steps with perfect judgment:

1. Perfectly defining the problem
2. Knowing all relevant information
3. Identifying all criteria
4. Accurately weighting all the criteria according to his/her goals.
5. Accurately accessing each alternative on each criterion.
6. Accurately calculating and choosing the alternative with the highest value

However, Herbert Simon claims that humans lack both the knowledge and computational skills necessary to make decisions in a manner compatible with economic notions of rational behavior¹¹. Simon refers to this as bounded rationality.

We argue that decision-making for *every* complex, crucial decision takes place under constraints of human information-processing limitations.

⁹ See discussion on page 6.

¹⁰ Max Bazerman, *Max H., Max H., Max H., Max H., Max H. Judgment In Managerial Decision Making*, John Wiley & Sons, 1986.

¹¹ Hogarth, Robin, *Judgment and Choice*, John Wiley & Sons, New York, 1987. p62.

What do people do when confronted with these limitations? Hogarth explains:

“Simon has suggested several strategies that people use to reduce the cognitive demands of decision-making in order to make ‘reasonable’ decisions. First, people delimit the scope of the decision problem by imposing constraints, that, conceptually at least, can be thought of as eliminating whole regions of the payoff matrix. In other words, people consider only part of the total decision problem. Second, people simplify the evaluation of outcomes by, in essence, seeking to characterize whether outcomes are or are not acceptable. The key concept is that of an *aspiration level*. That is, prior to learning of the levels of outcomes that can be reached by taking different actions, the decision-maker is assumed to fix a level to which he or she aspires and which is acceptable. It is important to note that adopting aspiration levels reduces the need to search for information to evaluate alternatives and possible states of the world. This strategy therefore considerably reduces the need for and processing of information.”

“The use of aspiration levels is thus the primary mechanism by which people can reduce the costs of information processing and yet still act in a purposeful manner. However, the use of aspiration levels is not without its costs. In Simon’s model, the aspiration level is a device used to simplify choice. Its use suggests a willingness to balance the quality of a decision against the cost, and frequently impossibility, of being able to engage in more extensive analysis.”

The use of aspiration levels, or what Simon referred to as *satisficing*, is a non-compensatory decision-making approach because an alternative that does not meet one of the aspiration levels cannot compensate with superior performance with respect to other objectives. Satisficing is but one of the common simplistic strategies identified by Irving Janis, in his book *Crucial Decisions - Leadership in Policymaking and Crisis Management*¹².

Common Simplistic Strategies

Janis identified different categories of rules that people use as strategies to cope with their constraints. These include cognitive decision rules, affiliative decision rules, and self-serving / emotive rules.

¹² Irving L. Janis, *Crucial Decisions - Leadership in Policymaking and Crisis Management*, The Free Press, New York, N.Y., 1989.