EXPLAINING AND IMPLEMENTING FUTURES RESEARCH: PART I—A DEVELOPMENTAL PERSPECTIVE

by

O. W. Markley

Introduction[1]

What are the major problems faced by practitioners of the professional futures field? Both from my own experience and from what I hear from others, two concerns stand out in importance: 1. How to explain the futures field to those who are unfamiliar with its unique outlook, assumptions and methods—debunking preconceived notions and setting realistic expectations for what it entails; and 2. How to achieve successful implementation of forecasts and other futures research results, especially in organizational cultures in which decision-making based on credible foresight is not readily supported.

The purpose of this position paper is to share several approaches for making futures research more "used and useful." These include the incorporation of proven "change management" methods from the field of organization development, and the use of new ways to describe the field of futures research itself. They are meant to be "user-friendly" strategies through which to help business executives, community leaders, and other potential clients visualize the nature of futures research for themselves, and to more easily imagine how they might use futures methods for their own purposes. This essay is thus meant to complement, not to supplant, other published treatments of the futures field and its tools.

Explaining Futures Research

At an introductory level, futures work can usefully be explained by distinguishing three common ways of treating social changes and the future—*reactive, responsive,* and *creative.*

The first and certainly the most common way of dealing with various aspects of social change and the future is to ignore them, essentially assuming that although change is always occurring, the future will be like the past, only more so. Things that are getting big will get bigger; things that are getting tiny will get tinier; and

O. W. Markley *is chairman of the Graduate Program in Studies of the Future at the University of Houston-Clear Lake, Houston, Texas. Previously he directed futures research projects at the Center for Study of Social Policy, Management and Social Systems Group, SRI International, where for 10 years he was a senior policy analyst.*

so on. The population of growing regions like California and the microcomputers which its "Silicon Valley" has spawned upon the world are two cases in point. This approach involves waiting until external changes occur before dealing with them, and *reacting* to them as necessary, even though it may require the well-known mode of crisis management to do so.

The second way of treating the future is to pay attention to possible changes that will have an impact before it is too late to do anything about them, seeking foresight about the types of future conditions that are most likely. It then becomes feasible to anticipate, and proactively *respond* to ways in which the future is likely to differ from the past, rather than reacting to these changes after they have already occurred. Although this helps avoid the crisis-reaction mode, it does not necessarily help you get what you really want. As Yogi Berra, the great US baseball catcher and master of the one-line quip used to say, "If you don't know where you want to go, you can bet on the fact that you'll end up somewhere else."

In contrast to the second mode, which is to anticipate what is probable and to respond to that outlook proactively, the third mode for dealing with the future is to be *creative*, envisioning what is desired. This involves clarifying your hopes and fears for the future, and then working to promote the former but prevent the latter. Successful use of the creative approach, however, usually requires the responsive approach as well. After all, many things are changing which we cannot much influence or control. And finally, since we can't pay attention to all that is happening around us, the reactive approach is unavoidable as well.

It is thus important to use each of these three modes strategically and with effectiveness; and a central purpose of futures research is to help understand how to do so.

Evolution of the Modern Futures Research Movement

Another way to help explain the nature and function of modern futures research is briefly to review several particularly important historical "benchmarks" that shed light on how the futures field was shaped into what it is today. (This brief overview will necessarily leave out many things that would also be informative if space allowed, and it emphasizes the development of the field as practiced in the US. For a more detailed, albeit less up to date account, see writings by Jones.[2])

As a first cultural underpinning of what is now called "futures" work, I point to the Old Testament tradition of the prophets. Most people think of the word "prophecy" as dealing only with things to come, as in forecasting. But a close reading reveals this to be the second, and less important, of two major meanings of the word. The first definition can be paraphrased as "truth seer and truth teller." In the Hans Christian Andersen story, "The Emperor's New

Clothes," the naive youth who told the truth that nobody else would admit, was in this sense, acting as a prophet.

Only when both definitions come together, however, as in the oft quoted phrase, "Look at the handwriting on the wall, see what will happen to us if we don't change our ways," is the essence of the futures field revealed. By identifying key threats and opportunities that face us, and by assessing our strengths and weaknesses for treating them, futures research is clearly a prophetic profession.

The second major advance came in the mid-1930s. In order to prevent a re-occurrence of the catastrophic stock market crash and subsequent economic depression, the US Government began what has become a powerful system for defining, monitoring, modelling, analyzing and forecasting economic indicators, such as the gross national product. These indicators and their projection have been of fundamental importance ever since, both in the US and worldwide.

A third "great leap forward" in futures research came after the Second World War. The combination of the USA's "Cold War" with the USSR and its allies, and the US national will never again to be caught unprepared as with Pearl Harbor, led to the phenomenon of future-oriented "think tanks," such as the RAND corporation and the Stanford Research Institute. These, in turn, created a new battery of methods and tools for long-range forecasting and planning, systems analysis and management. The professional prophets of this era asked such questions as "What type of war might be fought in 20 years—who, where, why and with what kinds of weapons?" In responding, they invented scenarios and the Delphi technique as two of a range of methods and tools to think about *possible, probable* and *preferable* futures—and to derive implications for R&D as well as other types of strategic policy.

A fourth advance came with the liberal reformist movements of the 1960s which focused on civil rights, environmental protection and other concerns. The so-called "War on Poverty," the Peace Corps, and a new breed of think-tanks contributed participatory methods through which agencies in all sectors of society (public, private, and voluntary) could become involved in efforts to create the better society. These contributions ranged from complex methodologies for doing environmental impact assessments of technology, to relatively simple, but effective tools such as the Nominal Group Technique.

In 1973-74 the OPEC blockade wrought havoc throughout the economy. This event was an unanticipated but utterly significant source of serious cross-impacts, rapidly affecting the breadth and depth of national and international political and socio-economic systems. It has become a prototype illustration of what is often called "a wild-card scenario"—future possibilities that are not feasible to forecast at all reliably, even though they are quite obviously

185

important if and when they happen.

The consternation among serious futures researchers regarding how best to deal with such events and the socio-techno-politico-economic turbulence associated thereto, led to the fifth and final advance in the field, I would cite, namely the creation and adaptation of *strategic intelligence* methods for application in both business corporations and public agencies. This aspect of futures research has as its central mission: *the promotion of management effectiveness in spite of a turbulent environment.*

Terms such as **strategic planning** and **issues management** came from this last advance. Together with **technology assessment,** they have become the major methodologies of futures research as it is known and practiced today.

And tomorrow? If I were to be a bit prophetic myself, and to conjecture about the *future* of futures research, I would focus on the issue of implementation, and how to treat resistance to it.

Resistance to Implementation: A Central Challenge for Futures Researchers

It is unfortunately the case that strategic forecasting and futures research methods often do not work according to the textbooks. Let me illustrate one reason why by means of a case example. In 1975 I was working in a small futures research "think tank" at the Stanford Research Institute (now SRI International). SRI's president called to make a special request. He said that he had just had an urgent call from a friend of his—the president of one of the big three US automobile companies, who wanted a quick turnaround forecast on consumer demand preferences for cars during the coming decade. He wanted to know if we could do such a study within a month and be confident of our results, but do it under conditions of total secrecy. We said we could and we did—drawing a number of conclusions a few weeks later. Our main forecast was that *because of the interaction of several key trends* —principally the increase in fuel prices and the increase in conservationist values and consumer lifestyles—there would almost surely be a significantly *decreasing* market for the traditionally large US cars and a corresponding *increase* in demand for smaller and fuel-efficient, but nevertheless classy models, such as the Japanese were already starting to produce. Our recommendations followed suit.

We sent our results on, still not even knowing who the client was (although we had our suspicions). Years later, when the secrecy no longer needed to be as tightly kept, I mentioned our study to a senior planning executive at a large energy and petrochemical corporation in Houston, who filled in the rest of the story. He revealed that he had been a planner at a particular car company in Detroit at the time; and that he and his colleagues had made essentially the same forecast. Their CEO, however, would not buy

the reasoned vision of the future which they produced, so he sent to the West Coast for a second opinion. He did not believe SRI either and overrode both forecasts by ordering a continuation of the style known in the trade as "Big Detroit Iron," which brings in a far greater profit per car than do smaller, more sophisticated and fuel efficient models. The resulting debacle and its impact on the US economy is well known. Less well known is that although this company (and other US car companies as well) missed the chance to be proactively *responsive* to credible forecasts of change, it made a significant recovery only when it *reactively* imitated Japanese styles, but by then it also had to import the technology necessary for rapid retooling and efficient production. Similar examples exist in other sectors.

There are many understandable reasons why resistance to anticipatory management and planned change occur so frequently. One reason is that they tend to alter well-established patterns of power, communication and control. Another is that doing new things in new ways brings out feelings of uncertainty and the fear of failure. At least a dozen other factors could also be listed, not the least of which is the one operative in the above example: if forecasts or other futures research conclusions disagree with the personal outlook of the top executives for whom they were made, they will often be rejected or ignored. At the bottom line, it seems that we all resist the need to *change the boundaries of our ideas and our organizations to fit the changing "shape" of significant environmental forces all around us.*[3]

What can we do with the dilemma of having better tools than are often feasible to implement? Do we need to find better ways of communicating the nature of our methods and assumptions and why they are vital to good management? Or might it be that our future-oriented tools are insufficient by themselves?

I think that both are true, and that neither is sufficient by itself. We who are future-oriented professionals *do* need to add other tools to our menu of standard approaches, especially those that are more well-suited to the task of fostering implementation. And we *also* need to do a better job of communicating the essence of the tools we rely on, so that able leaders can *adapt* them as best suits their purpose, rather than *adopting* them in the form and with the terminology that futures researchers tend to prefer.

"Flawless Consulting" Tools—A Needed Addition to the Futures Field

The most direct way I know to increase the likelihood of successful implementation is to make use of a recently emerged professional field whose *raison d'etre* is the fostering of theories, tools, and skills for managing change. It is an applied behavioral science methodology usually called "organization development," but more

frequently referred to among its practitioners simply as "OD." For purposes of promoting implementation, the version of OD apt to be most useful to futures researchers may be a little handbook with the provocative title, *Flawless Consulting: A Guide to Getting Your Expertise Used.*[4] Its author, Peter Block, defines a manager as anyone who calls the shots which really matter in any given situation; every one else is a consultant, whether or not they are called that. Thus defined, it is clear that *most of us and most of our clients necessarily act as consultants most of the time,* even though we may have a title such as Manager or Director, Chairman or President. Derivatively, flawless consulting is not defined as getting the results we want all the time, but as a continuing consensual process of engagement, negotiation, and renegotiation as may be needed as the vicissitudes of organizational turbulence are treated.

Block's book and several related writings[5] set forth practical guidelines that help avoid the trap of trying to *overcome* people's resistance; and to instead do what is necessary to enlist them in the process of helping to establish such things as: 1. A revitalized sense of purposefulness, vision and mission for the organization— one that acknowledges rather than suppresses gaps between "is" and "ought"; and 2. A sense of alignment as to what is worth doing, and how it should be done, so that people naturally tend to do what is needed, even when not explicitly directed to do so.

To help envision practical ways in which this type of anticipatory leadership can be fostered, the following sections describe: 1) the essential nature of futures research; 2) how implementation-oriented OD methods can be effectively integrated with those of futures research; and 3) how the resulting synthesis can be visually portrayed for clients.

Futures Research as Applied Strategic Intelligence: An Analytic Model

As the historical overview sketched above suggests, the central objective of the futures field has shifted over the years, and has now taken on many of the characteristics of the intelligence field in order to promote the effectiveness of management in spite of environmental turbulence.

To see this analytically, rather than historically, consider the question, *"What are the minimum requirements for good management?"* Although something of an oversimplification, a good answer might be: 1. The ability either to *control* all variables having make-or-break significance for one's mission, or to *forecast* the behavior of those that cannot be controlled accurately enough to anticipate and control for their effects to the extent that is feasible; and 2. The ability to discern situations where neither control nor forecasting can be done satisfactorily and to substitute *intelligence-based strategic methods* in their stead.

Exhibit 1
**SITUATIONAL INTELLIGENCE: MATCHING THE TYPE OF
MANAGEMENT INFORMATION STRATEGY TO THE
CHARACTERISTICS OF THE SITUATION**

		Ability to *control* the issue being considered	
		HIGH	*LOW*
Planning time horizon, relative to degree of environmental turbulence (that is, *forecasting accuracy*)	*NEAR* (high)	I	II
	FAR (low)	III	IV

SITUATION I: *MANAGEMENT INFORMATION SYSTEMS*
             Indicators of the status quo
SITUATION II: *PREDICTIVE FORECASTING*
             Expectations of the "most likely" future
SITUATION III: *LONG-RANGE PLANNING*
             Longer-term projections of influences, activities, and
             accomplishments
SITUATION IV: *STRATEGIC METHODS*
             Alternative forecasts, contingency plans, scenarios, and
             situational management strategies

The framework shown in Exhibit 1 is based on this insight.[6] Arraying the two dimensions of controllability and forecastability against each other makes it easier to see the "situational relevance" of four important tools for management intelligence. The first three are frequently taught in business schools: 1. *Management information systems* —Collection, storage, summary reporting, and selective retrieval of historical, pragmatic data for short-range forecasting, planning, management, and assessment of activities and accomplishments. Frequently updated, the data provide *indicators of the status quo*. 2. *Predictive forecasting* —Anticipation of trends, trend discontinuities, and other projected occurrences expected to influence current plans and activities in significant ways. Revised periodically or when necessary, predictive forecasts yield *indicators of the expected or "most likely" future*. 3. *Long-range planning* —Coordination and alignment of long-range plans and operational programs with corporate budgets at all levels. Updated infrequently and requiring high commitment if implementation is to be more than rhetorical,

long-range plans produce *longer-term projections of influences, activities, and accomplishments.*

The fourth "methodology" is the focus of modern futures research. Traditionally it was something that good managers and executives had to learn gradually in the school of hard knocks; it has emerged only within the past decade or so as a flexible set of concepts, methods, and tools for dealing with environmental turbulence and uncertainty: 4. *Strategic intelligence* —Identification and assessment of critical planning issues; advance formulation of alternative strategies for proactively responding to anticipated challenges that otherwise would eventually have to be dealt with on a "crisis reaction" basis; and development of the organizational capacity for responding in creative ways to the challenges of emergent conditions. Done on a regular basis or when needed because of "emerging issues," it provides management with a workable approach for *strategic intelligence and shared foresight.*

Especially when used with historical examples such as the OPEC blockade and the subsequent roller-coaster series of oil price fluctuations, the analytic model shown on Exhibit 1 is useful as a way to communicate why the methods of the modern futures field are so essential for managing in turbulent times. But models of this type do not do much to help the executive see *how* to actually employ such tools, especially in light of the resistance that usually attends their use.

A Methodological Synthesis for Improved Implementation[7]

Exhibits 2 and 3 pull together most of what has been said thus far. They portray the essential elements of an integrated model which organizational leaders usually find easy to grasp—both as an overall policy strategy for becoming more proactive in their approach to executive decision-making, and as a more detailed set of specific processes to use at different times for different purposes.

The left hand side of this model incorporates most of the strategic tools which comprise the field of futures research: **environmental scanning, issue identification and monitoring; forecasting and projection of alternative futures; contingent impact assessment and policy analysis; planning and evaluation.** The right hand side incorporates specific OD tools that develop the capabilities needed for successful implementation. For purposes of anticipatory management, the act of doing one side without the other may be compared to trying to walk with only one leg.

Depending on what you want to do and how you want to do it, this overall approach can be begun with virtually any of the major blocks of activity shown on Exhibits 2 and 3. Personally, I like to start with the **"plan to plan"** phase of the Strategic Direction block, doing it as the type of activity which Albert Einstein called *Gedanken*

(literally, "thought experiments")—a way of thinking in which the doing of all the other blocks is visualized in various ways, resulting in agreement on how to proceed. The check-list shown on Exhibit 4 makes this type of thinking (sometimes characterized as "back of the envelope" planning) easier to do.[8]

To Dig Deeper

To further elaborate the above ideas would go beyond the scope of this essay. Specific references which provide detailed information for implementing each of the blocks on Exhibits 2 and 3 are as follows.

Strategic Assessment is a broad category which can be done in many ways. For guidance on **Environmental Assessment,** see *A Guidebook for Technology Assessment and Impact Analysis,*[9] and *Issues Management: How You Can Plan, Organize and Manage for the Future.*[10] For guidance on **Organizational Assessment** in the general context of OD, see Chapters Two and Nine of *Organization Development: Principles and Practices;*[11] especially discussion of the "Weisbord Six-Box Model" (pp. 169 ff), which was the principal point of departure for the list of items in this box of Exhibit 3. Or, see Weisbord's own formulation in "Organizational Diagnosis: Six Places to Look for Trouble With or Without a Theory."[12] An important approach to strategic assessment which is *not* reflected in the version of the model shown on Exhibits 2 and 3, but which is particularly important in many business applications is that of *Competitive Analysis.*[13]

Recognizing that strategic methods need to be tailored to the needs of different audiences, it may be helpful to cite books on **Strategic Direction** and **Strategic Planning** that are oriented toward different sectors of society:

- *Strategic Planning: What Every Manager Must Know* [14]
- *Strategic Planning for Public and Nonprofit Organizations: A Guide to Strengthening and Sustaining Organizational Achievement* [15]
- *Guide to Strategic Planning for Educators* [16]
- *Strategic Management and the United Way—A Guideline Series.* [17]

(The United Way is one of the largest charitable organizations in the US; this loose-leaf bound series comprises: 1. *Strategic Management;* 2. *Environmental Analysis,* 3. *Organizational Assessment,* 4. *Strategic Direction,* 5. *Strategic Plan,* 6. *Implementation,* and 7. *Performance Evaluation.* The conceptual model on which this guideline series is based served as a point of departure for the model shown here on Exhibits 2 and 3.)

Among the best methodological works on planning with multiple scenarios (primarily for business applications, but relevant to any type of organization) are:

- *Planning Under Uncertainty: Multiple Scenarios and Contingency Planning* [18]

EXHIBIT 2

Overview Schematic of
A Strategic Development Methodology
for
Anticipatory Management

Strategic Assessment

Environmental

Organizational

Strategic
Direction

Strategic
Planning

Human and
Organization
Development

Implementation

Environmental

Organizational

Performance Evaluation

192

EXHIBIT 3

Detailed Phases of
a Strategic Development Methodology
for Anticipatory Management

Strategic Assessment

Environmental:

Social
Technological
Economic
Ecological
Political
Client/Project-Specific

Organizational:

Vision
Motivation
Leadership
Structure
Relationships
Mechanisms

Strategic Direction

Mission
Strategic thinking about
  alternatives
Goals
"Plan to plan"

Strategic Planning

Objectives
Strategies
Scenarios and Trigger
  Points
Strategic and Operational
  Plans

Human and Organizational Development

Entry/Contracting
Diagnosis
Feedback/Decision
Implementation
Recycle/Extend/Terminate

Implementation

Who?
How?
When? (both start and finish)
With what?
To accomplish what
  "evaluatable" objectives?

Performance Evaluation

Environmental:

What happened by way of results?
(Both for us and for competitors.)

Organizational:

Did we do what we said we
planned to do, and did we
do it satisfactorily?
(If not, why not?)

NOTE: In the above model, the term "implementation" is used in two different but overlapping ways. As a phase of activity within Human and Organization Development, it refers primarily to the doing of whatever is necessary to ensure that a given organizational unit has the capacity to resolve pressing problems and to successfully implement its part of the strategic plan for the organization as a whole. In other words, what might be called "developmental implementation" is different from "operational implementation."

EXHIBIT 4

A CHECKLIST OF QUESTIONS

FOR ADVANCED "BACK OF THE ENVELOPE" PLANNING

1. **Vision**. What are my (my group's) predominant ⟨ . hopes / . fears / . expectations ⟩ regarding the future of "X"?

2. **Direction**. What do I (we) particularly want to ⟨ . protect / . maintain / . achieve / . change / . create ⟩ in the ⟨ . short / . medium / . long ⟩ range?

3. **SWOT**. What are the main ⟨ . strengths / . weaknesses / . opportunities / . threats / . other factors ⟩ that need to be considered? In particular, what obstacles would prevent success if not overcome or otherwise addressed?

4. **Networking and Huddling**. How, and with whom, do I want to plan for action? What are their considerations about "X?"

5. **Technology**. What methods, tools, or strategies look promising? How rigorously might we want to use each?

6. **Commitment**. How much time and effort am I (and others I can count on) willing to dedicate to this, and for how long? What other resources are likely to be available if needed?

7. **Payoff/Costs/Tradeoffs**. Assuming that adequate time and effort is expended to implement the plans within likely resource constraints, what outcomes can realistically be expected, and when? What costs are likely? If not done, what different costs must be borne? I.e., what are the tradeoffs?

8. **Go/No Go.** Given whatever answers you have to the above questions, is the venture really worth doing? If so, who should do what? When? What are the first steps? If not, is there anything else that makes sense to do?

194

● *Scenarios: Uncharted Waters Ahead*, and *Scenarios: Shooting the Rapids* [19]

In the next block the word **human** was added to **organization development** in order to emphasize the need for training, team building, and other people-intensive aspects of OD work which, for reasons that were detailed above, I hypothesize as being essential concommitants of applied futures research in most settings. The five item list shown on Exhibit 3 are the specific steps described in the *Flawless Consulting* book described above. They are particularly useful for getting managers of various organizational units to "buy in" to the process of futures-oriented strategic management. By way of comparison, another model which I find quite useful for conceptualizing this entire process, but difficult to implement in most "real-world" organizations, is Gordon Lippitt's Organization Renewal Model. It is shown here as Exhibit 5.[20]

Good detailed guidance on **implementation** and on **performance evaluation** is hard to come by. Many titles exist, but none I would cite here. Instead I recommend that the "how" of intended implementation and evaluation be concretely visualized during the "planning to plan" stage, and that a specific individual or team accept the responsibility for monitoring compliance with whatever ends up being agreed upon, so that non-compliance does not—*as is so typically the case* —end up being ignored. The simple questions listed at the bottom of Exhibit 3 were framed with this *"realpolitik"* approach to implementation and evaluation in mind.

Summary and Conclusion

The foregoing essay introduces an easy to understand methodology for describing essential elements of futures research and of promoting their successful implementation. But it is only an introduction. The practitioner must still develop and adapt this methodology to the needs of particular situations if these ideas are to serve as an "appropriate technology" for anticipatory leadership.

In OD work, it is sometimes said that "the fundamental instrument is the consultant."[21] The same may be said for *applied* futures research.

Notes for Part I

1. Beginning in the fall of 1989, the required core curriculum of the graduate program in studies of the future at the University of Houston-Clear Lake will be changed from that described in "Preparing for the Professional Futures Field: Views from the UHCLC Futures Program," by O.W. Markley (*Futures*, February 1983, pages 47-64). The single research methods course previously required of all students will be divided into two: one emphasizing qualitative methods, to be taught in the fall; and a more advanced and quantitatively oriented course for the spring semester. Additionally, the

EXHIBIT 5

SYSTEMS RENEWAL MODEL

MACRO-ENVIRONMENT—ENVIRONMENTAL FACTORS IN THE LARGER WORLD SYSTEM
(Chapter 1) (ECONOMIC, POLITICAL, ECOLOGICAL, SOCIOLOGICAL, PSYCHOLOGICAL, BIOLOGICAL)

(Chapter 2) MICRO-ENVIRONMENT—STAGES OF GROWTH OF THE INDIVIDUAL, GROUP, AND ORGANIZATION

PLANNING STEPS (Chapter 3)

| Need or Disequilibrium Felt by a Human System | Desire for Increased Effectiveness is Articulated | Data Collection and Assessment | Diagnosis and Analysis | Identify Objectives and Management Resource Competencies | Planning and Opportunity Identification |

SOME KEY RESULT AREAS
- Improved services
- Work effectiveness
- Human Resource Optimization
- Improved relations
- Improved morale
- Social responsibility
- Creativity
- Quality of service
- Quality of life
- Productivity
- Financial Stability/Profit
(Chapter 13)

INDIVIDUAL DEVELOPMENT PROCESSES
(Chapter 7)

GROUP DEVELOPMENT PROCESSES
(Chapter 8)

ORGANIZATION DEVELOPMENT PROCESSES
(Chapter 9)

Planning for and Implementing On-Going Action/Program Steps

ESSENTIAL SKILLS
- Effective (Chapter 4) Communication
- Competent (Chapter 5) Leadership
- Managing (Chapter 6) Stress, Conflict, and Agreement

(Chapter 12) INTERNAL AND EXTERNAL RENEWAL FACILITATORS

(Chapter 10)
(Chapter 11) PLANNING AND IMPLEMENTING ACTION/PROGRAMS THROUGH RESEARCH AND TRAINING

core course entitled, "Using Systems Approaches" will be moved from the spring to the fall semester. Together, these changes will give students a better methodological preparation before completing this masters degree program.

This methodological position paper was written as one of several curricular materials being developed for the new introductory core course, *Qualitative Futures Research Methods*. In addition to the sources cited herein, it is based on research done by the author at SRI International, the NASA Johnson Space Center, and the Institute for Strategic Innovation; and it incorporates several approaches for explaining the nature and function of futures research developed for a graduation address to members and guests of Class Five of the futures-oriented executive training program of the California Law Enforcement Command College, January 29, 1988. Constructive comments by Clare Degenhardt, Ken Hamik, Tim Sullivan and Cissy Yoes are gratefully acknowledged.

2. Thomas Jones, "The Futurist Movement: A Brief History," *World Future Society Bulletin*, July-August, 1979, pages 13-25. A more in-depth treatment can be found in Thomas Jones, *Options for the Future: A Comparative Analysis of Policy-Oriented Forecasts* (New York: Praeger, 1980).

3. Donald N. Michael, *On Learning to Plan—and Planning to Learn: The Social Psychology of Changing Toward Future-Responsive Societal Learning* (San Francisco, Jossey-Bass, 1973).

4. Peter Block, *Flawless Consulting: A Guide to Getting Your Expertise Used* (Austin, TX, Learning Concepts, 1981. Distributed by University Associates, Inc., San Diego, CA.)

5. Garth Morgan, "Cybernetics and Organization Theory: Epistemology or Technique?" *Human Relations*, Vol. 35, No. 7, pages 521-537, 1982; Charles Kiefer and Peter Senge, "Metanoic Organizations in the Transition to a Sustainable Society," *Technological Forecasting and Social Change*, Vol. 22, No. 2, 1982; A. Levy, "Second-Order Planned Change: Definition and Conceptualization," *Organizational Dynamics*, Vol. 15, No. 1, pages 5-20, 1986; Peter Block, *The Empowered Manager: Positive Political Skills at Work*, (San Francisco, CA, Jossey Bass, 1987); James M. Kouzes and Barry Z. Posner, *The Leadership Challenge: How to Get Extraordinary Things Done in Organizations*, (San Francisco, CA, Jossey-Bass, 1987); and O. W. Markley, "Using Depth Intuition in Creative Problem Solving and Strategic Innovation," *Journal of Creative Behavior*, Vol. 22, No. 2, 1988.

6. This framework was first published in O. W. Markley, "Conducting a Situation Audit: A Case Study," Chapter 5 in Robert L. Heath and Associates (eds.), *Strategic Issues Management: How Organizations Influence and Respond to Public Interests and Policies* (San Francisco, Jossey-Bass, 1988).

7. The synthesis shown on Exhibits 2 and 3 is based on a model developed by the author as a project of the Institute for Strategic Innovation. Karla M. Back first suggested the need for such a model.

8. This checklist was first published in "Planning to Use Emerging Instructional Technologies: Some Useful Methods and Guidelines," by O. W. Markley, Chris J. Dede, and Karla M. Back (Chapter 5 in *Preparing for the Future of the Workplace—Vol. III: Planning Materials for Educators*, Clear Lake Shores, TX, Institute for Strategic Innovation, 1988). For other related ideas that make it easier to implement the model shown on Exhibits 2 and 3, see the "Methodological Guidelines for Interesting Times," pages 58 ff of O. W. Markley, "Preparing for the Professional Futures Field," *Futures*, February, 1983; the "Snowball Survey" methodology used in O. W. Markley, "Conducting a Situation Audit: A Case Study," Chapter 5 in Robert L. Heath and Associates, *Strategic Issues Management: How Organizations Influence and Respond to Public Interests and Policies* (San Francisco, Jossey-Bass, 1988); and the "Strategic Intelligence Cycle" and "Social Intelligence Architecture" designs described below in Part II of this position paper.

9. Alan Porter, Frederick Rossini, Stanley Carpenter, with Ronald Larson and Jeffrey Tiller, *A Guidebook for Technology Assessment and Impact Analysis* (New York, North Holland, 1980).

10. Joseph F. Coates and the staff of J.F. Coates, Inc., *Issues Management: How You Can Plan, Organize, and Manage for the Future* (Mt. Airy, MD, Lomond Publications, 1986).

11. W. Warner Burke, *Organization Development: Principles and Practices* (Boston, Little, Brown and Co., 1982).

12. Marvin R. Weisbord, "Organizational Diagnosis: Six Places to Look for Trouble With or Without a Theory," *Group and Organization Studies I*, 1976, pages 430-447.

13. Michael E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors* (New York, The Free Press, 1980).

14. Gary Steiner, *Strategic Planning: What Every Manager Must Know* (New York, The Free Press, 1979).

15. John M. Bryson, *Strategic Planning for Public and Nonprofit Organizations: A Guide to Strengthening and Sustaining Organizational Achievement* (San Francisco, Jossey-Bass, 1988).

16. Shirley McCune, *Guide to Strategic Planning for Educators.* (Alexandria, VA, Association for Supervision and Curriculum Development, 1986).

17. United Way of America, *Strategic Management and the United Way Guideline Series* (Alexandria VA: Strategic Planning Division, United Way of America, 1985).

18. Rochelle O'Conner, *Planning Under Uncertainty: Multiple Scenarios and Contingency Planning* (New York, The Conference Board, Report No. 741, 1978).

19. Pierre Wack, "Scenarios: Uncharted Waters Ahead," and "Scenarios: Shooting the Rapids," *Harvard Business Review*, Sep-

tember/October 1985, pages 73-89; and November/December 1985, pages 139-150.

20. Gordon L. Lippitt, *Organization Renewal: A Holistic Approach to Organization Development*, 2nd ed. (Englewood Cliffs, NJ, Prentice-Hall, 1982).

21. Burke, ibid, page 212.

Exhibit Sources

Exhibit 1: O.W. Markley, "Conducting a Situation Audit: A Case Study," Chapter 5 of *Strategic Issues Management: How Organizations Influence and Respond to Public Interests and Policies*, edited by Robert L. Heath and Associates, Jossey-Bass, San Francisco, CA, 1988. Reprinted with permission.

Exhibits 2-4: Institute for Strategic Innovation, ©1989 O.W. Markley. Reprinted with permission.

Exhibit 5: Gordon L. Lippitt, *Organizational Renewal: A Holistic Approach to Organization Development*, 2nd ed. 1982. Reprinted by permission of Prentice-Hall, Inc., Englewood Cliffs, NJ.

EXPLAINING AND IMPLEMENTING FUTURES RESEARCH: PART II - MORE ARCHITECTURES FOR ANTICIPATORY MANAGEMENT

by

O.W. Markley

Introduction

In Part I, futures research was described as a relatively recent methodology for *strategic intelligence and shared foresight*, especially useful in times of *environmental turbulence* —i.e., times in which it is neither feasible to predict nor to control the behavior of variables essential to the fulfillment of mission, due to the number and intensity of changes occurring in various sectors of importance.

Part II is somewhat more technical, and is of necessity quite abbreviated due to space constraints, relying extensively on graphical rather than textual exposition. Its purpose is to convey several process "architectures" which are especially appropriate for anticipating and detecting what was defined in Part I as "Type IV" (high turbulence) environments, a hitherto left out aspect of most issues management methodologies.

To introduce these architectures, it is useful to first consider a distinction made in cybernetic systems theory between what has come to be called "1st order" change and "2nd order" or "systemic" change.

1st and 2nd Order Change

Jokes and cartoons, although not customarily used to communicate technical concepts, are sometimes better than lots of words to help an audience "jump-step" away from conventional thinking and into a new and radically different way of viewing things. A cartoon which has this potential when considering futures research and the management of complex change is shown on Exhibit 1.

I have found this cartoon to be of significant assistance in helping organizational leaders to not only appreciate the difference between 1st and 2nd order change, but to also recognize the importance of developing the *organizational capacity* for creating and implementing appropriate 2nd order change strategies when significant shifts in the "sea state" of the organizational environment require it.[1]

Exhibit 1
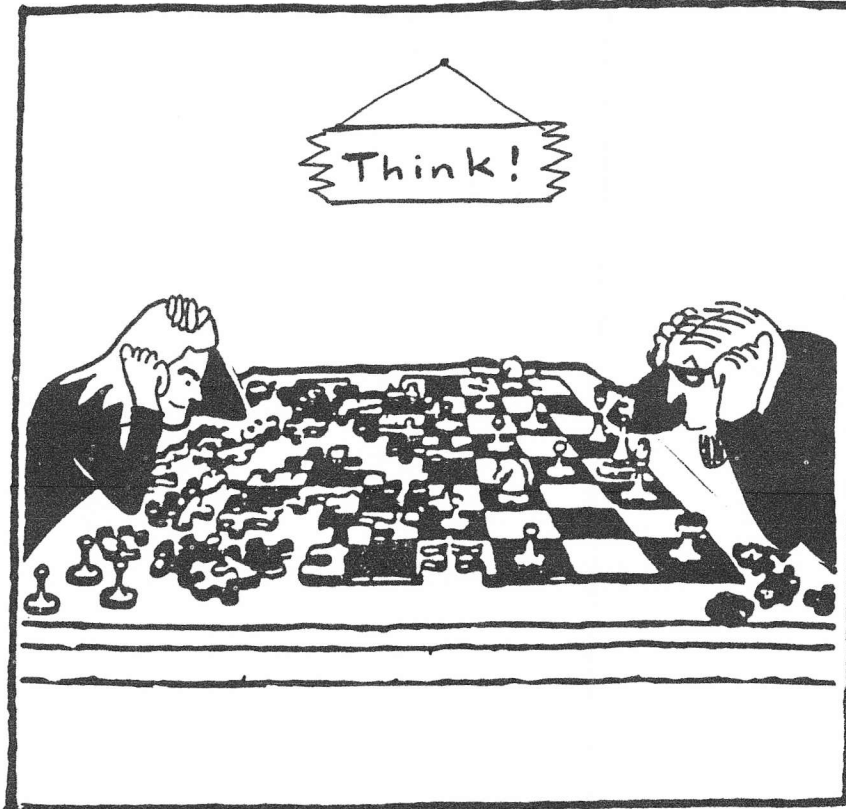
1st order change: Playing the game as you find it but moving the pieces into a new arrangement

2nd order change: Seeing the game itself in a new way and creating new types of moves

Architectures for 2nd Order Change and Anticipatory Management

In information systems work, the term "architecture" nowadays often refers not only to "bricks and mortar" buildings, but also to specifically designed configurations of hardware, software, and procedural management policies through which information is gathered, processed, retrieved and used.

As an example of the systemic nature of change which high technology management architectures may have to undergo if they are to be responsive to the potentials and needs brought by emerg-

201

EXHIBIT 2

Fifth Generation Management for Fifth Generation Technology

- First: Electronic Vacuum Tube
- Second: Transistor
- Third: Integrated Circuit
- Fourth: Very Large Scale Integration

  von Neumann Bottleneck

- Fifth: Parallel Networked Process Units and Symbolic Processing

Figure 1. Generations of computer technology.

- First: Small/Entrepreneurial
- Second: Hierarchical/Functional/Divisional
- Third: Matrix
- Fourth: CIM I - Computer Interfaced Manufacturing

  Smith/Taylor Bottleneck

- Fifth: CIM II—Computer Integrative Manufacturing of the Manufacturing Enterprise

Figure 2. Generations of enterprise management.

EXHIBIT 3

Traditional Architecture   Nodal Architecture
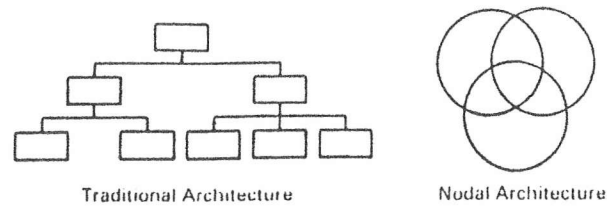
Figure 15. Shifting management architectures.

SECOND-TO-FOURTH GENERATION MANAGEMENT	FIFTH GENERATION MANAGEMENT
Functional Departments	Knowledge Centers
Jobs	Careers
Training	Education
Management by Variance	Nodal Project Management
Informational Amnesia	Informational Memory
Disposable Data	Data as an Asset

Figure 19. Contrasting characteristics of FGM.

---

ing "fifth generation" computer technologies, consider several illustrations developed by the Technical Council of the Computer and Automated Systems Association of the Society of Manufacturing Engineers (CAS/SME) in 1988.[2] These are shown on Exhibits 2 and 3.

The "Strategic Development Methodology" introduced earlier (please see Exhibits 2 and 3 of Part I) is, by the above definition, an architecture for 2nd order change and anticipatory management. A major advantage of this first model is that it uses state of the art tools that are widely practiced in major organizations. As such, it is feasible to implement in organizations as they now exist, and builds the organizational capacity for next generation applications.

A strength of this first architecture is thus its implementability. But a corresponding weakness is that it is usually implemented in an episodic fashion, and is thereby unable on an ongoing basis to systematically anticipate, detect and proactively respond to "Type IV" environmental "sea states" with respect to key issues which have make or break significance for the achievement of organizational mission.

A more advanced architecture, designed with this requirement in mind, is shown below on Exhibits 4, 5, and 6. Note the structural similarity of this architecture with that portrayed on Exhibit 3. They were developed independently.

EXHIBIT 4

A Generic Social Intelligence Architecture
for Proactive Management
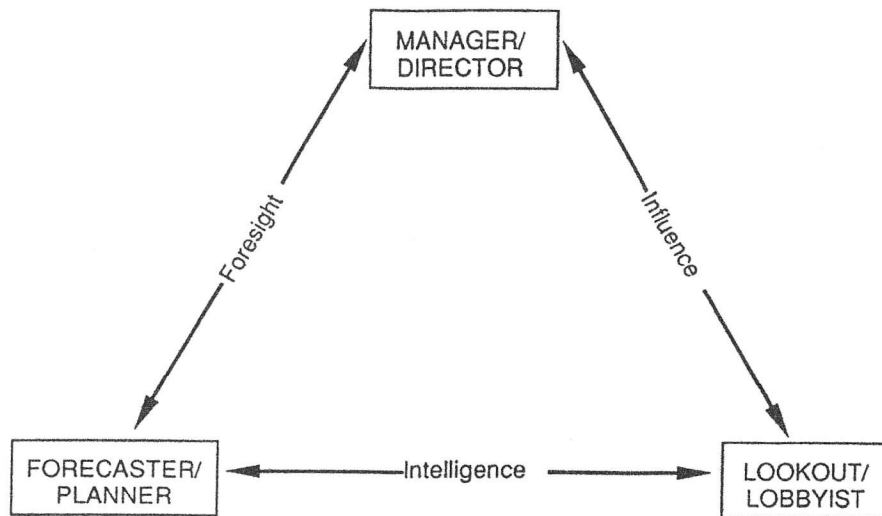
By way of review, the first architecture introduced here (Part I, Exhibits 2 and 3) emphasized specific *methods and tools* which are familiar in the field. Its main point of novelty is the way in which these methods are integrated in order: a) to increase the implementability of the left hand side; b) to increase the proactive responsiveness of the right hand side; and c) to thereby build the capacity for 2nd order, anticipatory change management by integrating both. The second architecture (Part II, Exhibits 4, 5, and 6) emphasizes a specific *organizational structure* which can be implemented both within a given organization, or within a network of organizations which have a common mission. Its main point of novelty is that it provides an ongoing basis for systematically anticipating, detecting and proactively responding to "Type IV" environmental "sea states" with respect to key issues which have make or break significance for the achievement of organizational mission. Thus, where the first architecture represents a way to increase the capacity for 2nd order change; the second architecture represents an actual 2nd order *change* that organizations can make to bring this capability into actual practice.

EXHIBIT 5

Social Intelligence and Proactive Management
Within a Formal Organization

MANAGERS
(CEO, Key Executives,
and their staff

ORG-
ANIZATION
DEVELOPMENT
(to facilitate the
"organizational capacity" for
proactive management of change

Identification of key "planning issue" options and future outlooks re: external and internal environments; Assistance with strategic planning process

Collaboration in strategic planning

Selection of options for in-depth study and strategic development; Supervision of strategic planning process; Requests for expert foresight

Early warning in emerging crisis (both in external and internal environments); Advice and assistance in crisis management

Collaboration in "issues management"

Requests for intelligence on selected planning issues; Assignment to temporary task force efforts dealing with emerging issues and reactive policy concerns

FORECASTER/
PLANNERS
(in departments of Corp.
Planning,Human Resource
Management, Etc.)

Long-range intelligence; Contingent forecasts and impact analysis

Collaboration in planning & issues management

Short-range intelligence; Pattern Recognition on emerging issues having long-range significance

LOOKOUTS
(in departments of Corp.
Relations, Public Affairs,
Issues Management, Etc.)

The third architecture, to be introduced next, represents closely sequenced series of questions, which when answered, increase not only the implementability, but also the political effectiveness, of whatever strategies come to be chosen.

A Political Process Architecture for Anticipatory Management

Exhibit 7 provides an overview of another process architecture, this one more associated with the practice of issues management, and designed in large part to resolve two seemingly opposite problems that often afflict applied futures research:

1) most people who are practical "movers and shakers" in man-

EXHIBIT 6

Social Intelligence and Proactive Management
Within a Community or Network of Organizations

COMMUNITY
LEADERS
(Elected officials,
Executives, Board
Members, etc.)

ISSUE
CHAMPIONS*

Expert Foresight; Consultation
on "anticipatory" agenda and
strategy; Recommendations;
Research support: $;
Collaboration in participative studies;
Recommendations

Improved power and access to
influence processes; consultation
on "reactive" agenda and tactics;
Influence support; Collaborative
roots action; Collaborative
lobbying; Recommendations

FUTURISTS
(Forecasters,
Planners,
Strategists, etc.)

LOBBYISTS
(Executive or legislative aids
and external consultants;
professionals in departments
of public affairs, issues
management, etc.)

Long-range intelligence;
Anticipatory policy opportunities;
Improved access to "knowledgeables"

Short-range intelligence; "Street smarts" re:
threats and opportunities; Improved access to
"influentials"

*Sometimes called a "networker" or "point man", the "issue champion"
(like the "product champion" described by Peters and Waterman in
In Search of Excellence) provides the legitimacy, inspiration, and coor-
dination necessary for successful collaborative action.

agerial or political settings tend to ignore the fact that there is much
information available that could illuminate their actions;

2) most people who are "researchers and analysts" in academic
or administrative staff settings tend to ignore that there are a variety
of political customs that must be reflected if information is to be
effectively used by practical leaders.

Dubbed "The Strategic Intelligence Cycle," its purpose is to give
an organization the capability to realistically envision:

- The nature of important cause and effect relationships and cross-cutting factors which influence a given issue strongly;
- How the issue and related factors are perceived by important interest groups;
- The workings of different social institutions and systems in which the issue is embedded.

The Strategic Intelligence Cycle represents a practical method of approach through which these difficult understandings can be developed within realistic time and resource constraints. It embodies the methods and styles that good lobbyists, regional development leaders, and other successful social change agents tend to use in their day to day work. Originally introduced in the book *Information and the Future: A Handbook of Sources and Strategies,* [3] this architecture was created by an informal "knowledge engineering" research process which led to the synthesis of three essential types of expertise for knowledgeably influencing the future:

- *Information research* (as practiced by reference librarians)
- *Forecasting and strategic planning* (as practiced by futures researchers)
- *Public relations and issues management* (as practiced by political lobbyists).

A central characteristic of the Strategic Intelligence Cycle is that in addition to helping select preferred strategies for directly influencing change, it also emphasizes the *refinement* of information seeking, once it is clear what action-oriented strategies the information is intended to support, so that the theoretical assumptions of "2nd order cybernetics" involving the "learning to learn" process sometimes called "double loop learning" can be honored in practice. [4] Toward this end, the "80-20 rule" is often useful to invoke. Simply stated, it is to go fast and get 80% of the results you want in 20% of the total time you think you have. Then sit down and figure out what to do next. You may or may not want to spend the remaining 80% of the time you budgeted to get the final 20% of information or accomplishment you initially envisioned. Based on what you just learned, something else may now appear much more important.

Exhibits 8, 9, 10, and 11 depict the essential details of each phase of the model. For more information on each, please see pages 124-135 of *Information and the Future*, where this methodology was first published. Experienced practitioners will recognize that the elements shown in each phase, although moderately detailed, represent a vast simplification of matters that are highly complex and often ambiguous. They are presented this way, not with the idea that they will rigorously fit all situations for which they may be applied, but with the knowledge that, when combined with the other architectures introduced above, it is feasible to learn whatever is necessary to adapt them successfully to the needs of the specific situation.

EXHIBIT 7

An Overview of the Strategic Intelligence Cycle

```
┌──────────────┐                                              ┌──────────────┐
│   DEFINE     │                                              │  IMPLEMENT   │
│   CONTEXT    │                                              │  STRATEGIES  │
└──────┬───────┘                                              └──────▲───────┘
       │                                                             │
       ▼                                                             │
┌──────────────┐   ┌──────────────┐   ┌──────────────────┐   ┌──────────────┐
│    ASK       │   │   DEVELOP    │   │  ASSESS CENTRAL  │   │    SELECT    │
│  ESSENTIAL   │──▶│   NEEDED     │──▶│    PLANNING      │──▶│  STRATEGIES  │
│  QUESTIONS   │   │ INFORMATION  │   │     ISSUES       │   │              │
└──────▲───────┘   └──────────────┘   └──────────────────┘   └──────┬───────┘
       │                                                             │
┌──────┴───────┐   ┌──────────────────────────────┐                 │
│   REDEFINE   │◀──│     REFINE INFORMATION/       │◀────────────────┘
│   CONTEXT    │   │     INTELLIGENCE NEEDS        │
└──────────────┘   └──────────────────────────────┘
```
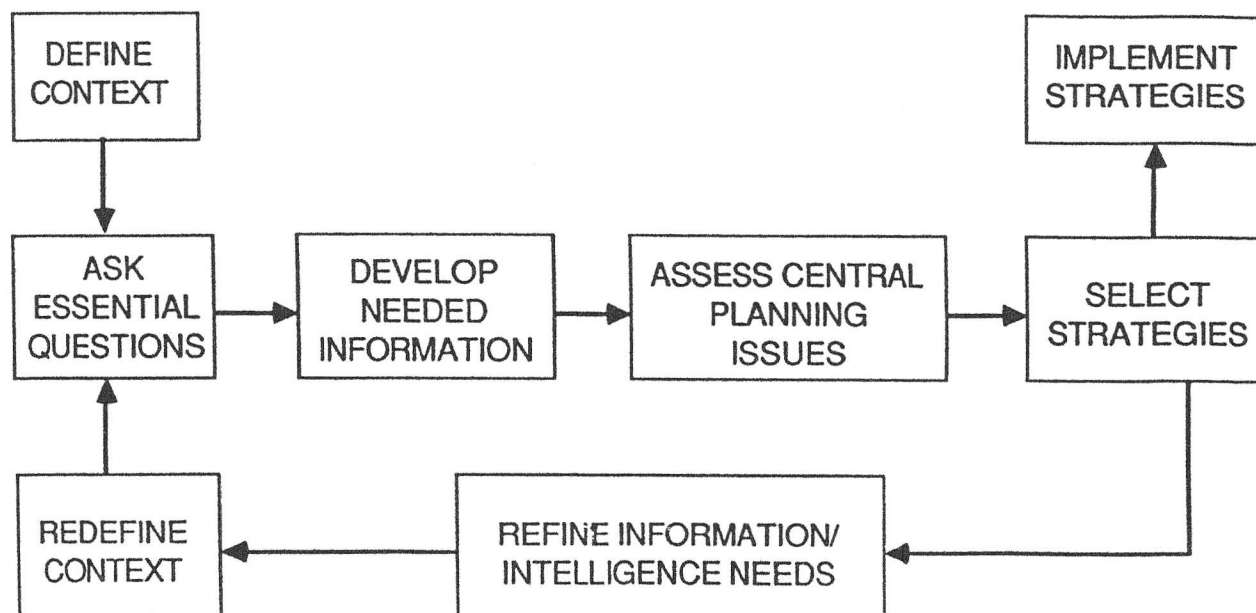
EXHIBIT 8

The Strategic Intelligence Cycle

Phase 1: Get Underway

A. Define Context of Inquiry
(to ensure clarity and alignment
of key purposes and results):

1. What are the nature and needs of the
   target audience and outcomes that
   are desired ?

2. What are the resources and
   constraints that will shape what
   is feasible to attempt ?

3. What are the criteria through which to
   judge effectiveness ?

B. Explore Essential Questions
(to identify and understand key
planning issues):

1. What is the likely future of "X" ?

2. What is the preferred/feared future
   of "X" ?

3. What factors have previously
   controlled or strongly influenced what
   happens to "X" ?

4. Who are the people and institutions
   whose behaviors will most strongly
   influence "X" ? ("influentials")

5. Who has a strong stake in the
   outcome of "X" ? ("stakeholders")

6. What trends, issues, policies or other
   forces may be emerging that may
   strongly impact on "X" or our ability to
   influence "X" ? ("cross impacts")

7. Who is the most knowledgeable
   about the above questions·?
   ("knowledgeables")

```
DEFINE                              IMPLEMENT
CONTEXT                             STRATEGIES

ASK          DEVELOP      ASSESS CENTRAL      SELECT
ESSENTIAL    NEEDED       PLANNING            STRATEGIES
QUESTIONS    INFORMATION  ISSUES

REDEFINE     REFINE INFORMATION/
CONTEXT      INTELLIGENCE NEEDS
```
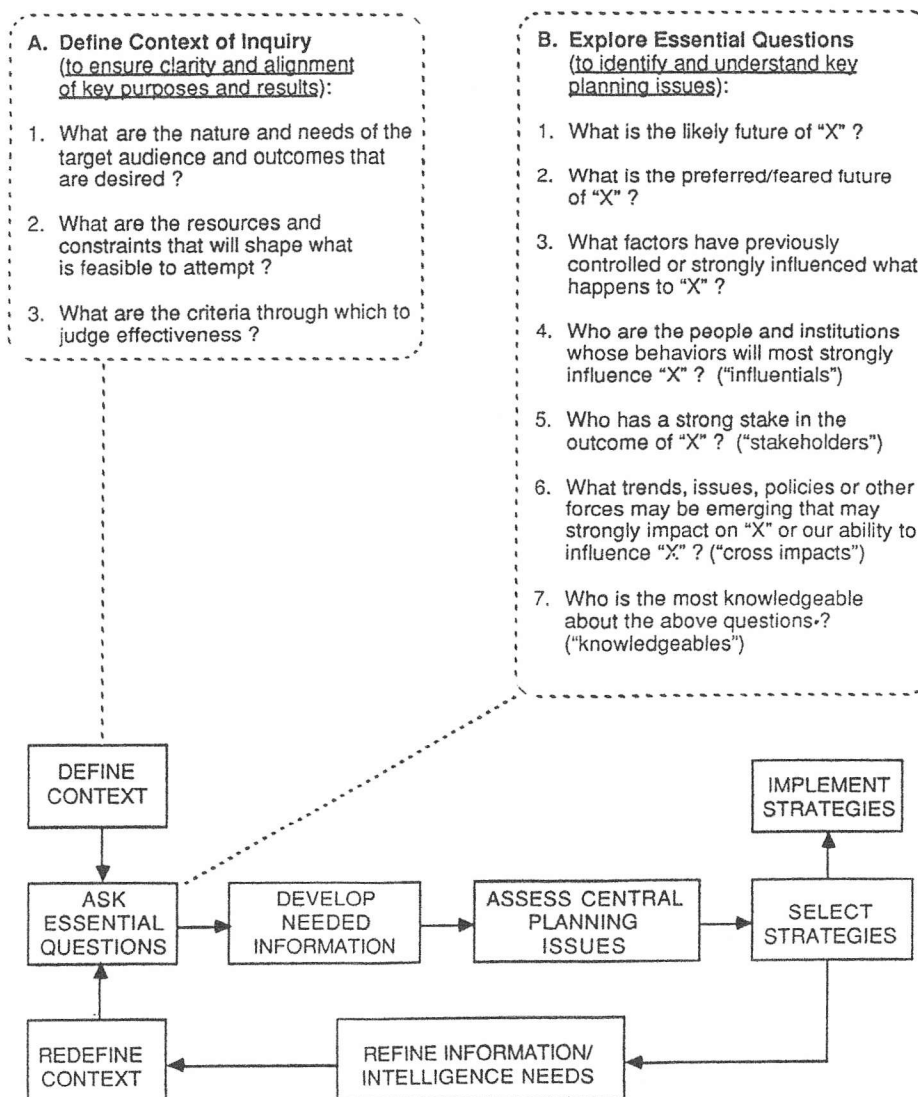
EXHIBIT 9

The Strategic Intelligence Cycle

Phase 2: Develop a Change Oriented Information Framework
(to organize and manage needed information)

a. Historical Context of "X"

- Past writings of importance

- Legislative and/or judicial history

- Other historical factors of importance (e.g., key vested interests)

b. Key Actors and Agenda

- Influentials

- Stakeholders
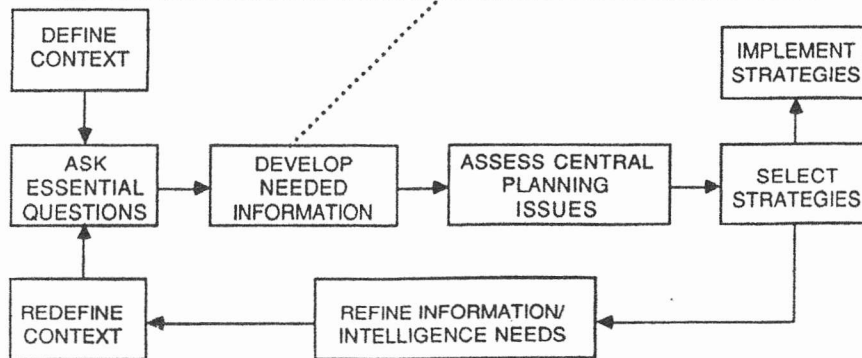
- Knowledgeables

c. Key types of Information

- Documents

- Contacts

- Messages

d. Alternative Approaches

- Ideologies

- Schools of thought

- Policy proposals

- Possible coalitions

e. Things to Monitor

- Media coverage

- Movement in key policy proposals

- Changes in "story" of key actors

- Changes in other key factors

DEFINE CONTEXT → ASK ESSENTIAL QUESTIONS → DEVELOP NEEDED INFORMATION → ASSESS CENTRAL PLANNING ISSUES → SELECT STRATEGIES → IMPLEMENT STRATEGIES

REDEFINE CONTEXT ← REFINE INFORMATION/ INTELLIGENCE NEEDS ←

EXHIBIT 10 !

The Strategic Intelligence Cycle

PHASE 3. Assess Central Planning Issues
(to develop appropriate strategies)

a. Identify critical factors, obstacles
    and incentives

What factors must be influenced if
the future of "X" is to become what
we want it to be ?

What obstacles are likely to prevent
us from influencing things as we
would like ?

What incentives can be brought to
bear to overcome obstacles ?

b. Estimate critical timing
    relationships

Are any key factors likely to
become "acute" and require a
crisis-reaction strategy that would
be less effective or more costly
than a proactive response ?

What is the likely sequence and
timing of events that will most
strongly influence "X" assuming
that we do not intervene
"proactively" ?

c. Identify Probable and
    Desirable Roles

Who are the relevant players ?

What is the range of roles that
each is likely to play, assuming
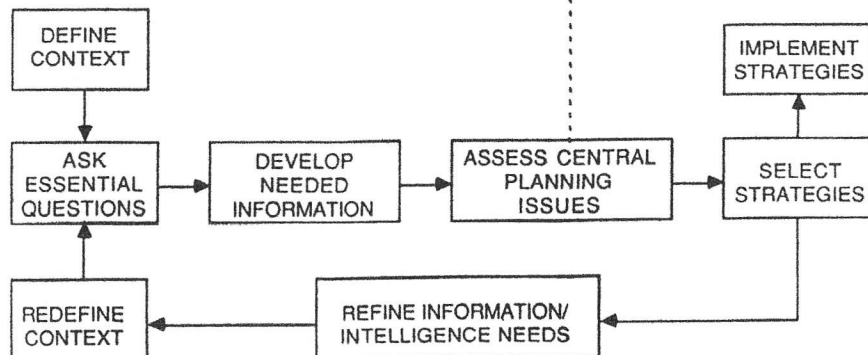either that we do, or that we do
not act proactively ?

```
┌──────────┐                                              ┌──────────────┐
│  DEFINE  │                                              │  IMPLEMENT   │
│ CONTEXT  │                                              │  STRATEGIES  │
└──────────┘                                              └──────────────┘
     │                                                          ▲
     ▼                                                          │
┌──────────┐   ┌──────────┐   ┌──────────────┐   ┌──────────────┐
│   ASK    │   │ DEVELOP  │   │   ASSESS     │   │    SELECT    │
│ESSENTIAL │──▶│  NEEDED  │──▶│   CENTRAL    │──▶│  STRATEGIES  │
│QUESTIONS │   │INFORMATION│   │  PLANNING    │   │              │
└──────────┘   └──────────┘   │   ISSUES     │   └──────────────┘
     ▲                        └──────────────┘          │
     │                                                  │
┌──────────┐   ┌──────────────────────────┐            │
│ REDEFINE │◀──│   REFINE INFORMATION/    │◀───────────┘
│ CONTEXT  │   │   INTELLIGENCE NEEDS     │
└──────────┘   └──────────────────────────┘
```

211

EXHIBIT 11

The Strategic Intelligence Cycle

Phase 4. Select Strategies
(to successfully influence the future of "X")

- Take direct action

- Engage in single-issue lobbying

- Collaborate with coalition networks to develop a broad range of proactive agenda

- Publicize selected issues or points of view

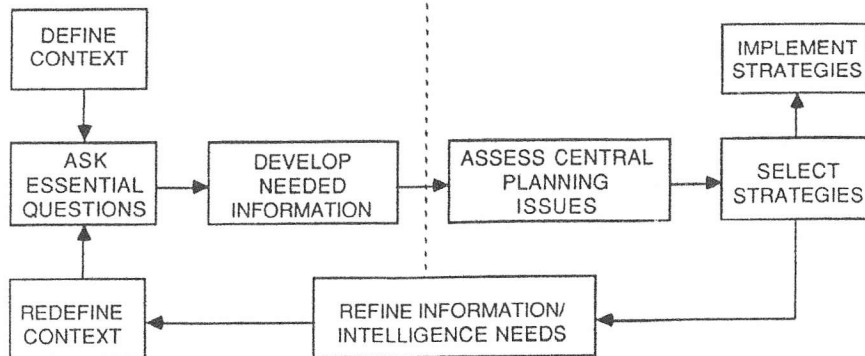- Develop needed information to answer critical questions

Phase 5. Refine Information/ Intelligence Needs

a. Type of Information

- Statistical data

- Authoritative reports

- Knowledgeable experts

b. Immediacy of Source

- Primary sources (personal communication or original writing)

- Secondary Sources (popular literature, news media, trade/professional working papers, etc.

- Tertiary sources (summaries, abstracts, indexes, etc.)

| DEFINE CONTEXT | | | | IMPLEMENT STRATEGIES |

| ASK ESSENTIAL QUESTIONS | DEVELOP NEEDED INFORMATION | ASSESS CENTRAL PLANNING ISSUES | SELECT STRATEGIES |

| REDEFINE CONTEXT | REFINE INFORMATION/ INTELLIGENCE NEEDS | |

Summary and Conclusion

The architectures and other guidelines presented in this two-part methodological position paper are the result of a decade-long search for efficient and effective approaches through which to explain and to implement the poorly understood field of futures research. An important by-product of this search is the recognition that the organizational capacity to implement forecasts, strategic plans, and other change-demanding results of futures research doesn't just happen. It must be created.

If futures research tools are to contribute all they are intended to and capable of, therefore, the "field" of futures research may itself have to be envisioned and practiced in new ways. Some possible directions of new growth are described herein.

Notes for Part II

1. Readers wanting a theoretical and/or practical discussion of the distinction between 1st and 2nd order change may find the following two references particularly useful: A. Levy, "Second-Order Planned Change: Definition and Conceptualization," *Organizational Dynamics*, pages 5-20, Summer 1986; and L. Hoffman, "Beyond Power and Control: Toward a 'Second Order' Family Systems Therapy," *Family Systems Medicine*, Vol. 3, No. 4, pages 381-396, 1985. Also see O. Markley, "Conducting a Situation Audit," Chapter 5 in R. L. Heath and Associates, *Strategic Issues Management: How Organizations Influence and Respond to Public Interests and Policies* (San Francisco, Jossey-Bass, 1988).

In general, 1st order (change) theories, tools and practices tend to be more suitable for what are defined in Part I as Type I, II, and III Environments, whereas environments having Type IV characteristics tend to require second-order approaches.

2. C. Savage, "CIM and Fifth Generation Management: Reflections Inspired by the CASA/SME Round Table on Fifth Generation Management" (P.O. Box 93, Dearborn, MI, Society of Manufacturing Engineers, Reference Publications Division, 1988).

3. A. Wygant and O. Markley, *Information and the Future: A Handbook of Sources and Strategies* (Greenwood Press, 1988).

4. See G. Morgan, "Cybernetics and Organization Theory: Epistemology or Technique?" *Human Relations*, Vol. 35, No. 7, pages 521-537, 1982.

Exhibit Sources

Exhibit 1: Adapted from various sources by the author.
Exhibits 2 and 3: Charles M. Savage, *Fifth Generation Management for Fifth Generation Technology*, Society of Manufacturing Engineers, Dearborn, MI, 1988. Reprinted with permission.
Exhibits 4-11: Alice Chambers Wygant and O.W. Markley, *Information and the Future*, Greenwood Press, Westport, CT, 1988. Reprinted with permission.