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ABSTRACT

An approach to environmental analysis and forecasting that educational policymakers can employ in dealing with the level of uncertainty in strategic decision making is presented. Traditional planning models are weak in identifying environmental changes and assessing their organizational impact. The proposed approach does not lead decision makers to conclude that the uncertainty they perceive in the external environment has been reduced. It enhances their capability to deal with a changing environment by making the uncertainty they perceive explicit (via analysis and evaluation of alternative future states of an organization's environment and the source of change within it). Topics of discussion include: environmental analysis and forecasting; issue identification; environmental scanning; structuring issues; forecasting; cross impact analysis; alternative scenarios (demonstration, driving force, and system change); policy analysis; and action plans. A case study illustrating the application to the strategic planning process of a two-year college is provided. It looks at the participants in the process (drawn from across the college's administrative and instructional staff), scanning the external environment from a variety of sources, forecasting external changes, refining the forecast, developing the cross impact model, developing alternative scenarios, conducting the policy analysis, incorporating the strategies into the college's ongoing activities, and benefits and limitations. Problems, issues, and needed research are noted. It is concluded that by using the best available information, it is possible to anticipate plausible alternative futures and limit the number of unanticipated possibilities to the smallest possible set. Contains 180 references. (SM)

MANAGING UNCERTAINTY: ENVIRONMENTAL ANALYSIS/FORECASTING IN ACADEMIC PLANNING

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MANAGING UNCERTAINTY: ENVIRONMENTAL ANALYSIS/FORECASTING IN ACADEMIC PLANNING[1]

The external environment of institutions of higher education can be characterized by change and turbulence. Administrators of colleges and universities have witnessed major shifts in the demographics of their institutions' clientele. External agencies have tightened their control of policy-making and fiscal decisions made by the institutions' administration. There has been a growing criticism of the value of the curriculum offered and the quality of instruction provided by many institutions of higher education. Less obvious, but no less significant, there has been a pervasive spread of electronic technologies through American society, challenging the dominant instructional and managerial paradigm found in the majority of American higher education institutions. In short, the accelerating rate, magnitude and complexity of change occurring in all sectors of American society have created vulnerabilities and opportunities across the higher education "tableau" (Keller, 1983).

The rapidity and volume of changes have resulted in less lead time for administrators to analyze changes in their institutions' external environment and to formulate appropriate strategies. In addition, the risks and uncertainty involved in implementing a particular strategy or set of strategies have intensified. In summary, the turbulence in higher education's external environment challenges the capability of decision-makers to effectively anticipate changing conditions.

This phenomenon of rapid shifts led to a recognition among administrators and organizational theorists of the need for a comprehensive approach to institutional planning that emphasizes sensitivity to the effects of environmental shifts on the strategic position of the institution (Ellison, 1977; Cope, 1978). An administrator's analysis of the organization's environment is critical in accurately assessing the opportunities and threats that the environment poses for the institution and in developing the strategic policies necessary to adapt to both internal and external environments.

All organizations, including colleges and universities, are perceived by contemporary organizational theorists as social systems existing in and interacting with their environment (Aldrich, 1979; Scott, 1981). An organization's environment is essentially all those factors external to it that affect it or are perceived to affect it. Hall

(1977) divides an organization's environmental factors into two categories: the limited number of factors that directly affect it (the task environment), and the almost unlimited number of factors that influence all organizations in the society (the general societal environment). In essence, the task environment is composed of the set of factors that are unique to each organization, while the general societal environment includes environmental factors that are the same for all organizations.

Factors in the task environment are readily apparent to college and university administrators (e.g., clients/students, revenue sources, government educational policies and regulations, etc.). However, the distinction between the organization's task environment and the general societal environment is not always clear. Particularly under turbulent conditions, factors in the general societal environment "break through" into the organization's task environment (Kast and Rosenzweig, 1979). Consequently, changes in the general societal environment can, and often do, have significant effects on the organization, effects well documented in the literature of organizational analysis (Osborne & Hunt, 1974; Hall, 1977; Kast & Rosenzweig, 1979; Scott, 1981).

The uncertainty faced by a decision-maker in planning strategically is compounded by an increasingly dynamic and uncertain environment (Emery and Trist, 1980). Terreberry (1968) concluded that organizations must be prepared to adapt even more to the influence of external forces. Most environments are dynamic and, consequently, rich in possible opportunities as well as possible threats to the organization. Therefore, the strategic planner and policy-maker cannot analyze the condition of the future environment by assuming that it will remain in a static state (i.e., in an orderly and incremental progression into the future).

Contingency approaches to organizational theory have focused upon the effect of environmental change in creating uncertainty for policy-makers formulating organizational strategy (Anderson & Paine, 1975; Lindsay & Rue, 1980; Boulton, Lindsay, Franklin & Rue, 1982). Duncan (1975) describes three factors that contribute to this sense of uncertainty: (a) a lack of information about environmental factors that would influence a given decision-making situation; (b) a lack of knowledge about the effects of an incorrect decision; and (c) the inability of the decision-maker to assess the probability that a given environmental factor will affect the success (or failure) of the organization or one of its subsystems in fulfilling its mission. In a later study, Leblebici and Salancik (1981) also found that the uncertainty experienced by a decision-maker arises from his or her inability to predict the outcomes of certain

actions. This inability to predict decision outcomes is derived from two sources. The first is the nature of the world in which we live--multivariate, complex, and interrelated. The second is the probabilistic quality of our world--an event can occur tomorrow, next week, or next year that could affect the interrelationships of variables, trends, and issues. In essence, the more turbulent and complex the organization's environment appears, the less able an administrator is to anticipate the probability of success in implementing a particular strategy.

Traditional planning models are weak in identifying environmental changes and assessing their organizational impact. In his analysis of the approaches to planning exhibited by American educational institutions, Ziegler (1972) identified two primary assumptions that characterize the weakness of these models: (a) the organization's environment will remain essentially static over time; and (b) the environment is composed of only a few variables impacting on education. In essence, the underlying assumption of most current educational planning is that environmental change will be a continuation of the rate and direction of present (and past) trends. These trends are manifested in the "planning assumptions" typically placed in the first part of an institution's strategic or long-range plan. Therefore, many administrators implicitly expect a "surprise-free" future for their institutions. We know, however, that change, not continuation, will be the trend, and the further we go out into the future, the more true this will be. An approach is needed that enables administrators to detect signals of change in all sectors of the environment and to link environmental information to the organization's strategic management (Ansoff, 1975).

The purpose of this chapter is to describe an approach to environmental analysis and forecasting that educational policy-makers can employ in dealing with the level of uncertainty associated with strategic decision-making. Unlike traditional models of planning, such an approach does not lead decision-makers to conclude that the uncertainty they perceive in the external environment has been reduced. Rather, the focus of this approach is to enhance their capability to deal with a changing environment by making the uncertainty they perceive in that environment explicit (Fahey, King, and Narayanna, 1981). This is accomplished through the analysis and evaluation of alternative future states of an organization's environment and the sources of change within it. In this chapter, we will explain one model of this approach and demonstrate its application in a case study. We conclude with an examination of the issues and

questions posed by the application of this model to educational institutions, and suggest directions for future research in this emerging methodological domain.

Environmental Analysis and Forecasting

Environmental analysis and forecasting are based upon a number of assumptions, among them the following (Boucher and Morrison, in press):

- The future cannot be predicted, but it can be forecasted probabilistically, taking explicit account of uncertainty.
- Forecasts are virtually certain to be useless or misleading if they do not sweep widely across possible future developments in such areas as demography, values and lifestyles, technology, economics, law and regulation, institutional change.
- Alternative futures including the "most likely" future are defined primarily by human judgment, creativity, and imagination.
- The aim of defining alternative futures is to try to determine how to create a better future than the one that would materialize if we merely kept doing essentially what is presently being done.

A model based upon assumptions like these is shown in Figure 1. Basically, the model states that individually or as a group we identify *issues* or *concerns* that may require attention through reflecting on our own *experience* as well as gathering information from sources that we *scan* . These issues are then *structured* by their relevance to policy (i.e., each issue is reduced to the least important element that may affect policy). Issues are then defined in terms of their component parts--*trends* and *events.* Univariate *forecasts* of trends and events are generated and subsequently interrelated through *cross-impact analysis.* In turn, *alternative futures* are written into *scenarios* that stimulate the development of policies for each scenario. These policies are *analyzed* for their robustness across scenarios. The purpose of the entire exercise is to derive a final list of *policies* that effectively address the issues and concerns identified in the initial stage of the process. These policies are then implemented in *action plans.*

Insert Figure I about here

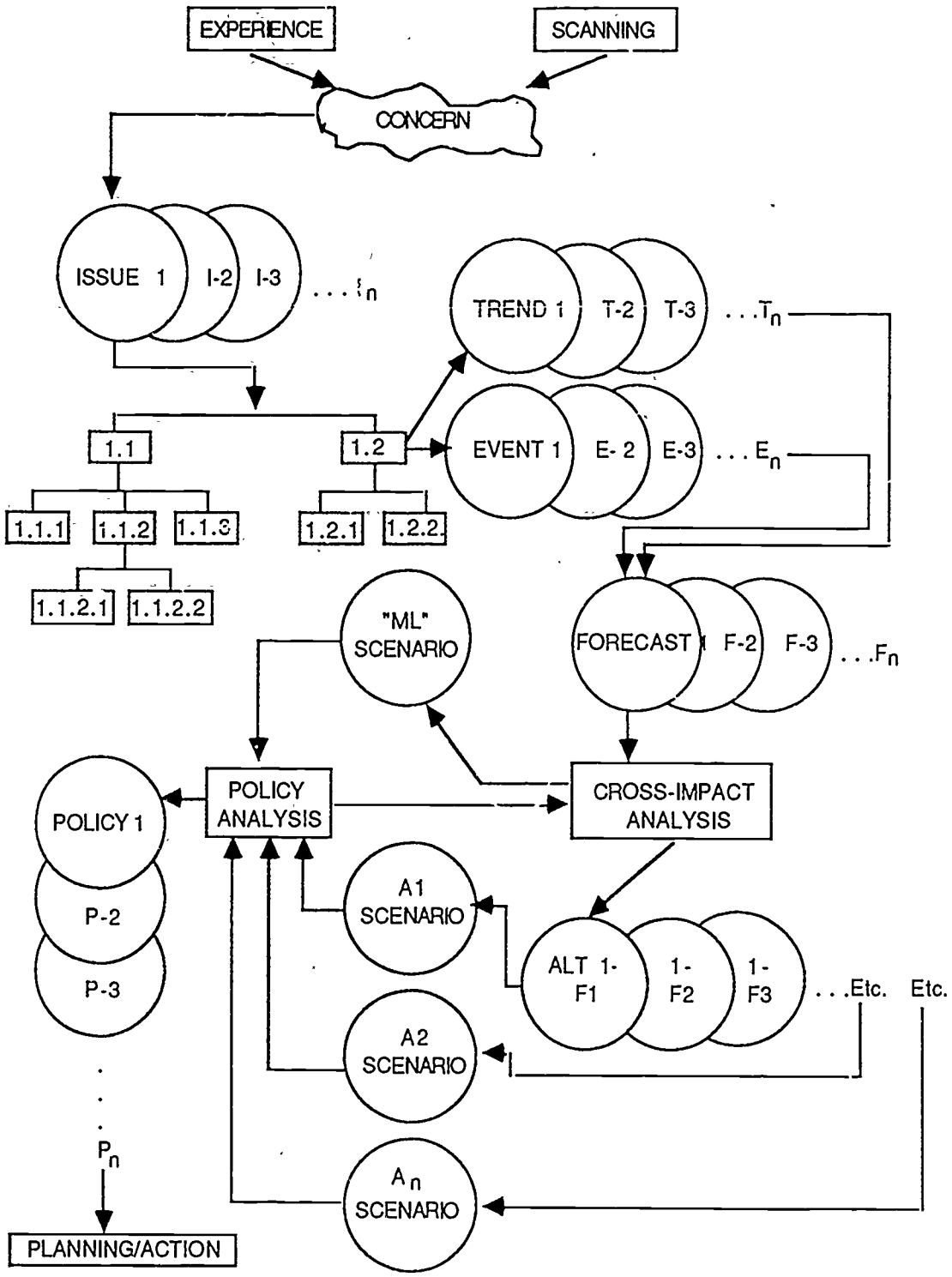

Figure 1. A Model for Applied Futures Research

(Adapted from Boucher and Morrison, in press)

Issue Identification

A wide range of literature provides insights into how issues are recognized by decision-makers. Included is literature related to problem-sensing and formulation (Keisler and Sproul, 1982; Lyles and Mitroff, 1980; Pounds, 1969), normative strategy development (Nutt, 1979), decision-making (Alexis and Wilson, 1967; Mintzberg, Raisinghani, and Theoret, 1976; Segev, 1976), and environmental scanning (Augilar, 1967; Kefalas and Schoederbeck, 1973; and King, 1982). Regardless of how issues are identified there is agreement that inconsistencies perceived within the environment stimulate the decision-maker to further examine the issue (Dutton & Duncan, 1987).

The articulation of issues/concerns is particularly critical for effective strategic planning. A central tenet of strategic management pervading both the literature of organizational theory (Lawrence and Lorsch, 1967) and traditional business policy (Andrews, 1971) is that the proper match between an organization's external conditions and its internal capabilities is critical to its performance. Accordingly, the primary responsibility of the organizational strategist is to find and create an alignment between the threats and opportunities inherent in the environment and the strengths and weaknesses unique to the organization (Thompson, 1967).

A number of writers have recognized that the strategist's perceptions of the environment and the uncertainty it represents to the organization are key to the strategy-making process (Aguilar, 1967; Anderson & Paine, 1975; Bourgeois, 1980; Hamrick, 1982). Hatten and Schendel (1975) and Snow (1976) further suggest that the effectiveness of the strategy an organization pursues is dependent upon the strategist's ability to identify and evaluate major discontinuities in the environment. This ability is dependent upon the experience the strategist brings to this task as well as his or her ability to systematically scan the contemporary external environment.

Scanning

A major tool to identify discontinuities in the external environment is environmental scanning. Aguilar (1967) defined environmental scanning as the systematic collection of external information in order to lessen the randomness of information flowing into the organization. According to Jain (1984), most environmental scanning systems fall into

one of four stages: primitive, ad hoc, reactive and proactive. In the primitive stage, the environment is taken as unalterable. There is no attempt to distinguish between strategic and non-strategic information; scanning is passive and informal. In the ad hoc stage, areas are identified for careful observation, and there are attempts to obtain information about these areas (e.g., through electronic data base searches), but no formal system to obtain this information is instituted. In the reactive stage, efforts are made to continuously monitor the environment for information about specific areas. Again, a formal scanning system is not utilized, but an attempt is made to store, analyze and understand the material. In the proactive stage, a formal search replaces the informal searches characteristic in the earlier stages. Moreover, a significant effort is made to incorporate resulting information into the strategic planning process.

Aguilar suggests that environmental assessment is more effective where a formal search replaces the informal search of the environment. The formal search uses information sources covering all sectors of the external environment (social, technological, economic and political) from the task environment to the world. A comprehensive system includes specifying particular information resources (e.g., print, TV, radio, conferences) to be systematically reviewed for impending discontinuities. Examples of such systems are found mainly in the corporate world (e.g., United Airlines, General Motors); less comprehensive systems are now appearing in colleges and universities (Hearn and Heydinger, 1985; Morrison, 1987), although recent literature advocates establishing formal environmental scanning systems to alert administrators to emerging issues (Cope, 1981; Keller, 1983).

Structuring Issues

Issues may be *structured* by identifying their parts in policy-relevant ways. In Figure 1, the result of this structuring process is shown as a relevance tree--in effect, an outline of the specific topics that should be addressed. In general, the goal is to break down each top-level issue until, on the lowest level, we have assured ourselves that every important subject has been identified. At this point, the conceptual structure of the issue should be clear and can be stated in terms of trends and events. *Trends* are a series of social, technological, economic or political characteristics that can be estimated and/or measured over time. They are statements of the general direction of change, usually gradual and long-term, and reflect the forces shaping the region, nation, or society in general. This information may be subjective or objective. For example, a

subjective trend is the level of support for a public college by the voters in the state. An objective trend would be the amount of funding provided to all public institutions in the state. An *event* is a discrete, confirmable occurrence that makes the future different from the past. For example, "Congress mandates a period of national service for all 17-20 year olds."

Structuring the issues involved in the planning problem includes developing a set of trends that measure change in individual categories, along with a set of possible future events that, if they were to occur, might have a significant effect on these trends, or on each other. The trend and event set is chosen to reflect the complexity and multidimensionality of the category. Ordinarily, this means that the trends and events will describe a wide variety of social, technological, economic, and political factors in the regional, national and global environment.

Forecasting

Having defined the trend and event sets, the next step is to forecast subjectively the items in each of these sets over the period of strategic interest (e.g., the next 15 years). For the trends, the likely level over this period is projected. This is an *exploratory forecast.* It defines our expectation, not our preference. (*Normative forecasts* define the future as we would like it to be.) Similarly, the probability of each event over the period of interest is estimated, again on the same assumption.

It is important to distinguish between the terms "prediction" and "forecast." Science depends upon theoretical explanation from which predictions can be made. With respect to the future, a prediction is an assertion about how some element of "the" future will in fact materialize. In contrast, a forecast is a probabilistic statement about some element of a possible future. The underlying form of a forecast statement is, "If A occurs, plus some allowance for unknown or unknowable factors, then maybe we can expect B or something very much like B to occur, or at least become more or less probable."

It is also important to distinguish the criteria for judging predictions and forecasts. Predictions are judged on the basis of their accuracy. Forecasts are judged, according to Boucher (1984), on the following criteria:

1. *Clarity*. Are the object of the forecast and the forecast itself intelligible? Is it clear enough for practical purposes? Users may, for example, be incapable of rigorously defining "GNP" or "the strategic nuclear balance," but they may still have a very good ability to deal with forecasts of these subjects. On the other hand, they may not have the least familiarity with the difference between households and families, and thus be puzzled by forecasts in this area. Do users understand how to interpret the statistics used in forecasting (i.e., medians, interquartile ranges, etc.)?

2. *Intrinsic credibility*. To what extent do the results "make sense" to planners? Do the results have "face validity"?

3. *Plausibility*. To what extent are the results consistent with what the user knows about the world outside of the scenario and how this world *really* works or *may* work in the future?

4. *Policy relevance*. If the forecasts are believed to be plausible, to what extent will they affect the successful achievement of the user's mission or assignment?

5. *Urgency*. To what extent do the forecasts indicate that, if action is required, time must be spent fairly quickly to develop and implement the necessary changes?

6. *Comparative advantage*. To what extent do the results provide a better foundation now for investigating policy options than other sources available to the user *today* ? To what extent do they provide a better foundation now for future efforts in forecasting and policy planning?

7. *Technical quality*. Was the process that produced the forecasts technically sound? To what extent are the basic forecasts mutually consistent?

These criteria should be viewed as filters. To reject a forecast requires making an argument that shows that the item(s) in question cannot pass through all or most of these filters. A "good" forecast is one that survives such an assault; a "bad" forecast is one that does not (Boucher and Neufeld, 1981).

Boucher and Neufeld stress that it is important to communicate to decision-makers that forecasts are transitory and need constant adjustment if they are to be helpful in guiding thought and action. It is not uncommon for forecasts to be criticized by decision-makers. Common criticisms are: the forecast is obvious; it states nothing new; it is too optimistic, pessimistic or naive; it is not credible because obvious trends, events, causes or consequences were overlooked. Such objections, far from undercutting the results, facilitate thinking strategically. The response to these objections is simple: If something important is missing, add it. If something unimportant is included, strike it.

If something important is included but the forecast seems obvious, or the forecast seems highly counterintuitive, probe the underlying logic. If the results survive, use them. If not, reject or revise them.

A major objective of forecasting is to define *alternative* futures, not just the "most likely" future. The development of alternative futures is central to effective strategic decision-making (Coates, 1985). Since there is no single predictable future, organizational strategists need to formulate strategy within the context of alternative futures (Heydinger and Zenter, 1983; Linneman and Klein, 1979). To this end, it is necessary to develop a model that will make it possible to show systematically the interrelationships of the individually forecasted trends and events.

Cross-Impact Analysis

This model is a *cross-impact model.* The essential idea behind a cross-impact model is to define explicitly and completely the pair-wise causal connections within a set of forecasted developments. In general, this process involves asking how the prior occurrence of a particular event might affect other events or trends in the set. When these relationships have been specified, it becomes possible to let events "happen"--either randomly, in accordance with their estimated probability, or in some pre-arranged way--and then trace out a new, distinct, plausible and internally consistent set of forecasts. This new set represents an alternative to the comparable forecasts in the "most likely" future (i.e., the "expected" future). Many such alternatives can be created. Indeed, if the model is computer-based, the number will be virtually unlimited, given even a small base of trends and events and a short time horizon (e.g., the next ten years).

The first published reference to cross-impact analysis occurred in the late 1960s (Gordon, 1968), but the original idea for the technique dates from 1966, when the co-inventors, T.J. Gordon and Olaf Helmer, were developing the game "FUTURES" for the Kaiser Aluminum Company.[2] In the first serious exploration of this new analytic approach, the thought was to investigate systematically the "cross correlations" among possible future events (and only future events) to determine, among other things, if improved probability estimates of these events could be obtained by playing out the cross-impact relationships and, more important, if it was possible to model the event-to-event interactions in a way that was useful for purposes of policy analysis (Gordon

and Haywood, 1968). The first of these objectives was soon shown to be illusory, but the second was not, and the development of improved approaches of event-to-event cross-impact analysis proceeded (Gordon et al., 1970), with most of the major technical problems being solved by the early 1970s (Enzer et al., 1971).

The next major step in the evolution of cross-impact analysis was to model the interaction of future events and trends. This refinement, first proposed by T.J. Gordon, was implemented in 1971-1972 by Gordon and colleagues at The Futures Group, and was called trend impact analysis, or TIA (Gordon,1977). Similar work was under way elsewhere (Helmer, 1972; Boucher,1976), but TIA became well-established, and it is still in use, despite certain obvious limitations, particularly its failure to include event-to-event interactions.

Two strands of further research then developed independently and more or less parallel with the later stages in the creation of TIA. Each was aimed primarily at enabling cross-impact analysis to handle both event-to-event and event-to-trend interactions and to link such a cross-impact modeling capability to more conventional system models, so that developments in the latter could be made responsive to various sequences and combinations of developments in the cross-impact model. One strand led to the joining of cross-impact analysis with a system dynamics model similar to the one pioneered by Jay Forrester and made famous in the first Club of Rome study (Meadows et al., 1972). This line of research--again directed by T.J. Gordon--produced a type of cross-impact model known as probabilistic system dynamics, or PSD.

The second strand led to a cross-impact model known as INTERAX (Enzer, 1979), in which the run of a particular path can be interrupted at fixed intervals to allow the user to examine the developments that have already occurred. The user can also examine the likely course of developments over the next interval and can intervene with particular policy actions before the run is resumed. Since the development of INTERAX, which requires the use of a mainframe computer, some work has been done to make cross-impact analysis available on a microcomputer. A simple version has been developed (Policy Analysis Simulation System--PASS) by the Institute for Future Systems Research (Greenwood, SC) for the Apple II computer (Mecca and Adams, 1985). A comprehensive version will be released in late 1988 by the Bravo Corporation (West Hartford, CT) for an IBM AT (Morrison, 1988, July-August). These microcomputer

based models greatly enhance the ability to conduct cross-impact analyses, and, therefore, to write alternative scenarios much more systematically.

Alternative Scenarios

Scenarios are narrative descriptions of possible futures. A single scenario represents a history of the future. The "most likely" future, for example, contains all of the forecasts from the forecasting activity in a narrative weaving them together from some point in the future, describing the history of how they unfolded. Alternatives to this future are based upon the occurrence or non-occurrence of particular events in the event set. Such alternatives define unique mixes of future environmental forces that may impact on a college or university. The range of uncertainty inherent in the different scenarios (which are, themselves, forecasts) changes the assumption that the future will be an extrapolation from the past (Zentner, 1975; Mandel, 1983). Within the context of an alternative future depicted by a scenario, the decision-maker can identify causal relationships between environmental forces, the probable impacts of these forces on the organization, the key decision points for possible intervention, and the foundations of appropriate strategies (Kahn and Wiener, 1964; Sage and Chobot, 1974; Martino, 1983; and Wilson, 1978). By providing a realistic range of possibilities, the set of alternative scenarios facilitates the identification of common features likely to have an impact on the organization no matter which alternative occurs. It is conventional to create from three to five such histories to cover the range of uncertainty.

Numerous approaches can be taken in the writing scenarios, ranging from a single person writing a description of a future situation (Martino, 1983) to the use of an interactive computer model that uses cross-impact analysis to generate outlines of the alternatives (Enzer, 1980a, 1980b; Mecca and Adams, 1985; Goldfarb and Huss, 1988). A broader range of scenario writing approaches is described by Mitchell, Tydeman, and Georgiades (1979), Becker (1983), and Boucher (1985).

Any of a number of scenario taxonomies, each with its own benefits and limitations, may be used to guide the development of a scenario logic (Bright, 1978; Ducot and Lubben, 1980; Hirschorn, 1980; Boucher, 1985). The most comprehensive of the taxonomies, however, is that of Boucher (1985) which has been updated in Boucher and Morrison (in press). In this taxonomy there are four distinct types of scenarios: the

demonstration scenario, the driving force scenario, the system change scenario, and the slice-of-time scenario. The first three types are "path through time" narratives; the fourth is a "slice of time" narrative.

The *demonstration scenario* was pioneered by Herman Kahn, Harvey De Weerd, and others at RAND in the early days of systems analysis. In this type of scenario, the writer first imagines a particular end-state in the future and then describes a distinct and plausible path of events that could lead to that end-state. In the *branch-point* version of this type of scenario, attention is called to decisive events along the path (i.e., events that represent points at which crucial choices were made--or not--thus determining the outcome). Thus the branch points, rather than the final outcome, become the object of policy attention. As Kahn and Wiener (1967) point out, they answer two kinds of questions: (a) how might some hypothetical situation come about, step by step? and (b) what alternatives exist at each step for preventing, diverting, or facilitating the process?

The major weakness of the demonstration scenario, as Boucher (1985) points out, is that it is based upon "genius" forecasting, and, is therefore dependent upon the idiosyncrasies and experiences of individuals. However, this type of scenario (like all methods and techniques in this field) is useful in both stimulating and disciplining the imagination .

The *driving-force scenario*, perhaps the most popular type of scenario in governmental and business planning (Goldfarb and Huss, 1988; Ashley and Hall, 1985; Mandel, 1983), is exemplified by Hawken, Oglivy, and Schwartz's *Seven Tomorrows* (1982). Here the writer first devises a "scenario space" by identifying a set of key trends, specifying at least two distinctly different levels of each trend, and developing a matrix that interrelates each trend at each level with each other. For example, two driving forces are GNP growth and population growth. If each is set to "high," "medium," and "low," there are nine possible combinations, each of which defines the scenario space defining the context of a possible future. The writer's task is to describe each of these futures, assuming that the driving force trends remain constant.

The purpose of the driving force scenario is to clarify the nature of the future by contrasting alternative futures with others in the same scenario space. It may well be that certain policies would fare equally well in most of the futures, or that certain

futures may pose problems for the institution. In the latter case, decision-makers will know where to direct their monitoring and scanning efforts.

The major weakness of the driving-force scenario is the assumption that the trend levels, once specified, are fixed--an assumption that suffers the same criticism directed to planning assumptions in traditional long-range planning activities (i.e., they ignore potential events that, if they occurred, would affect trend levels). The advantage of this type of scenario, however, is that when well executed, the analysis of strategic choice is simplified, a function of considerable value at the beginning of an environmental or policy analysis when the search for key variables is most perplexing.

The *system-change scenario* is designed to explore systematically, comprehensively, and consistently the interrelationships and implications of a set of trend and event forecasts. This set, which may be developed through scanning, genius forecasting, or a Delphi, embraces the full range of concerns in the social, technological, economic and political environments. Thus this scenario type varies both from the demonstration scenario (which leads to a single outcome and ignores most or all of the other developments contemporaneous with it) and from the driving-force scenario (which takes account of a full range of future developments but assumes that the driving trends are unchanging), in that there is no single event that caps the scenario, and there are no *a priori* driving forces.

The system-change scenario depends upon cross-impact analysis to develop the outline of alternative futures. The writer must still use a good deal of creativity to make each alternative intriguing by highlighting key branch points and elaborating on critical causal relationships. However, this scenario suffers from the same criticisms that may be leveled at driving-force and demonstration scenarios: although everything that matters is explicitly stated, all of the input data and relationships are judgmental. Moreover, the scenario space of each trend projection is defined by upper and lower envelopes as a consequence of the cross-impacts of events from the various scenarios that are run. Although it is valuable to know these envelopes, this information by itself provides no guidance in deciding which of the many alternative futures that can be generated should serve as the basis for writing scenarios. This choice must be made using such criteria as "interest," "plausibility," or "relevance."

The *slice-of-time scenario* jumps to a future period in which a set of conditions comes to fruition, and then describes how stakeholders think, feel, and behave in that environment (e.g., *1984, Brave New World*). The objective is to summarize a perception about the future or to show that the future may be more (or less) desirable, fearful, or attainable than is now generally thought. If the time period within the "slice-of-time" is wide, say from today to the year 2000, it is possible to identify the macro-trends over this period (e.g., Naisbitt's *Megatrends*). In this sense a slice-of-time scenario is the same as "environmental assumptions" found in many college and university plans. The weakness of this approach is that there is no explanation as to the influences on the direction of these trends, no plausible description of how (and why) they change through time.

Variations in these types of scenarios occur according to the perspective brought to the task by scenario writers. Boucher (1985) points out that writers using the *exploratory* perspective adopt a neutral stance toward the future, appearing to be objective, scientific, impartial. The approach is to have the scenario begin in the present and unfold from there to the end of the period of interest. The reader "discovers" the future as it materializes. The most common version of this mode, "surprise free," describes the effects of new events and policies, although only likely events and policies are used. A second version, the "play out" version, assumes that only current forces and policy choices are allowed to be felt in the future (i.e., no technological discoveries or revolutions are permitted).

Writers using the *normative* perspective focus on the question, "What kind of future might we have?" They respond to this question from a value-laden perspective, describing a "favored and attainable" end-state (a financially stable college and the sequence of events that show how this could be achieved) or a "feared but possible" end-state (merger with another institution).

In the *hypothetical* or *what if?* mode, writers experiment with the probabilities of event forecasts to "see what might happen." In this mode, the writer explores the sensitivity of earlier results to changes in particular assumptions. Many "worst case" and "best case" scenarios are of this sort.

Boucher (1985) maintains that all scenarios may be placed into a particular type/mode combination. The current business planning environment, for example, with

its emphases on multiple scenario analysis (Heydinger and Zenter, 1983), places a "most likely" future (exploratory, driving force) surrounded by a "worst case" (normative--feared but possible, driving force) and a "best case" (normative--desired and attainable, driving force) scenario. Unfortunately, such a strategy ignores potentially important alternative futures from such type/mode combinations as the exploratory system change or exploratory driving force scenarios. Boucher argues that for policy analysis and planning, the driving force, system change, and slice of time scenarios provide a rich context of future environmental forces for normative demonstration scenarios.

Policy Analysis

Policy analysis is initiated when the scenarios are completed. Since a scenario represents a forecast, it is evaluated by the same criteria described earlier (i.e., clarity, intrinsic credibility, plausibility, policy relevance, urgency, comparative advantage, and technical quality). Once these criteria are satisfied, each scenario is reviewed for explicit or implied threats and opportunities, the objective being to derive policy options that might be taken to avoid the one and capture the other. It is here that the value of this approach may be judged, for the exercise should result in policies that could not have been developed without having gone through the process.

Action Plans

Action plans are directly derived from the policy options developed through reformulating each option as a specific institutional objective. Responsibilities for developing detailed action plans and recommendations for implementation may be assigned members of the planning team. Typically, these staff members have knowledge, expertise, and functional responsibilities in the area related to and/or affected by the implementation of the strategic option. The resulting action plans are incorporated into the institution's annual operational plan as institutional objectives assigned to appropriate functional units with projected completion dates (Morrison and Mecca, 1988).

A Case Study

The brief case study that follows illustrates the application of this approach to the strategic planning process of a two-year college. The institution, a public technical college located in the southeastern United States, is charged with offering a comprehensive program of technical and continuing education in concert with the economic and industrial development needs of its seven county service area. Like most two-year colleges, the institution's mission, role and program scope are greatly determined by the totality of its external relationships (Gollattscheck, 1983).

Several years ago, recognizing the institution's sensitivity to external change, the administration adopted a strategic planning process incorporating the external analysis and forecasting approach described in this chapter termed ED QUEST. The process consists of examining and testing assumptions about the future of the environment and systematically applying the results to the formulation of organizational strategies (Mecca and Adams, 1982; Morrison and Mecca, 1988). This approach was adapted by the Institute for Futures Systems Research from QUEST (Quick Environmental Scanning Technique), a group process developed at the Center for Futures Research at the University of Southern California. The original concept was developed in response to the need to focus management's attention on critical trends and events that could affect the organization's future (Nanus, 1979).

There are several underlying assumptions of the process. First, it is assumed that the forces of external trends and events affect the organizational life of colleges and universities (Dill, 1958; Bourgeois, 1980). Such forces affect the choice of strategies for accomplishing the institutional mission as well as the nature and content of that mission. Second, it is assumed that although decision-makers possess differing perceptions of the forces shaping the external environment (Anderson & Paine, 1975), it is possible that these perceptions can be merged into a common organizational view of the current as well as alternative future environments. Third, it is assumed that the effects of environmental trends and emerging issues can be forecasted probabilistically. Taking explicit account of their uncertainty provides crucial information for the strategic management of an institution (Aguilar, 1967; Etzioni, 1968).

Participants in the Process

The participants in the process were drawn from across the college's administrative and instructional staff. The 15 members of the institution's planning team represented many of the functional areas of the college (i.e. instruction, continuing education, finance and student services, etc). The president and the three vice presidents of the college were also members of the planning team. In addition to the 15 members of the planning team, 16 other staff members were selected based upon their expertise in a particular curriculum content area (e.g., business, engineering technology, industrial crafts) or for the "boundary-spanning" nature of their institutional role (e.g., admissions, job placement, financial aid, management development programs, etc.). Together, these individuals participated in environmental scanning and constituted a Delphi panel tasked to forecast relevant trends and events. The membership of this panel represented as broad a range of functional areas and organizational specialities as feasible.

Scanning the External Environment

The information and forecasts about environmental trends, issues, and developments that might have impact on the college's future were drawn from a variety of sources. Materials were obtained not only from education sources (e.g., *Chronicle of Higher Education, Change, Community College Journal*), but also from:

- general sources (e.g., *US News and World Report, Newsweek, New York Times, Atlanta Journal)*
- "fringe" publications (e.g., *Mother Jones, New Ages,*)
- periodicals covering four major areas--social, technical, economic and political (e.g., *Working Woman, American Demographics, High Technology, Business Week, Computer World*)
- future-focused journals/newsletters (e.g., *The Futurist, What's Next,* and the *Issue Management Newsletter*)
- additional information obtained from the institutional research office, including data on variables descriptive of the college's task environment (e.g., college-going rates of high school graduates, state revenues, demographic profile of state and region).

The intent of this information was to stimulate readers to identify possible future changes in the environment (i.e., trends, events, or issues) that would affect the college's future. The material was selected to provide an "information gestalt," within which members of the Delphi panel could begin to see patterns of change in the external environment. Using this material and personal experience, the members of the Delphi panel completed an open ended questionnaire. This represents Round One (R1) of the Delphi survey. The questionnaire asked each respondent to identify several trends that would have major consequences for the college during the period of the next 11 years and to identify several events believed to have both a high likelihood of occurring at some time during the same period and, if occurring, a significant impact on the institution.

Forecasting External Changes

The R1 responses were used to develop the second round (called R2) questionnaire. Typically, R1 responses reflected a general concern, "The demographics of our student body are changing rapidly." This concern needed to be restated into measurable trend statements, such as: "the percentage of Black students," "the percentage of Asian students," and "the percentage of those students older than 25 years of age." A related potential event statement was, "The percentage of minority first graders in our area is greater than 50%."

The R2 questionnaire provided the Delphi panel members with the opportunity to forecast the set of trends (N = 78) and events (N = 60) over the period of the next 11 years (e.g., 1987 to 1997.) Representative trends on this questionnaire were as follows:

- Annual number of manufacturing jobs moving to the developing countries (e.g., Mexico, Korea, etc.) from the U.S.
- Number of new jobs annually created by industrial development and expansion in the state
- Number of industries in the southern U.S. using robots
- Number of four-year colleges in the U.S. offering technical programs at the baccalaureate level

Representative events on this questionnaire were as follows:

- A national opinion poll reveals that over 40% of the public believe that a general/liberal arts education is the best preparation for entering the job market.

- The Federal government requires an 800 SAT or comparable ACT score for persons to be eligible to receive Federal student aid.
- The state legislature mandates articulation policies and procedures among two-year colleges and four-year colleges.
- A major depression occurs in the U.S. (Unemployment exceeds 15% for two consecutive years).

Panel members forecasted the level of each trend at two points in the future, 1992 and 1997, and estimated the probability that each event would occur at some time between 1987 and 1997. In order to relieve their anxiety about forecasting, they were instructed to provide their "best guess," and to indicate their first impressions. The purpose of requesting their forecasts as opposed to relying solely on forecasts of experts was to obtain the thinking of the chief decision-makers of the college as to their version of the "most likely" future. It is entirely possible that when faced with making these forecasts they may turn to the information initially provided, or may seek other information. The assumption is that by having the decision-makers participate in the analysis, they "own" the analysis and, therefore, will find it creditable for developing policy options on the basis of the analysis.

In addition, panel members assessed the positive and negative consequences of each trend and event. This latter information was used to reduce the size of the trend and event set by eliminating those variables with lesser impact upon the institution.

Refining the Forecast

The forecasts of trends represented the panel's view of the "most likely" future of the college. In order to develop alternative scenarios to this future, it was necessary to conduct a third round (R3) Delphi, which focused on refining the probability estimates from the previous round (R2). This refinement was conducted using small groups from the Delphi panel. Initially, it was planned to use the Delphi panel to make these estimates as well as those estimates required to develop the cross-impact model (see below). This required each member of the Delphi panel to potentially make an enormous number of estimates. Although having the entire membership of the Delphi panel make all the estimates would have resulted in a single vision of the future of the group, it was decided that this task would be overwhelming to the individuals on the panel and lead to panel "drop-outs," a recurring problem in a large Delphi.

Therefore, to refine the forecast of events, the panel was divided into smaller groups, each being assigned a set of events and required to complete several estimates for each event: the earliest year the event's probability would first exceed zero, and the event's probability of occurring by 1990 and by 1994. The procedure was for team members to: (a) review R2 estimates for the median and interquartile range; (b) make a decision if, on the bases of earlier discussion, these estimates need revision; (c) discuss the rationale for reestimation with other members of the group; and (d) make individual reestimations.

Developing the Cross-Impact Model

These groups were used to develop a cross-impact model that defined the interrelationships of events-on-trends and events-on-events. The events-on-trends model required the group to determine the impact of an event on the level of each trend. This was accomplished by the group providing both estimates of the magnitude of the event's maximum and "steady-state" impact on the trend's forecasted level (i.e., how long the maximum impact would remain to affect the trend level). In addition, group members estimated the number of years it took from the initial occurrence of the event until it affected the trend, how long it would take for the effect of the event to reach its maximum effect, how long the maximum effect would last, and how long it would take for the impact of the event to decline until the trend reached a "steady state." For example, one event in the set was "voice-activated microcomputers available in the U.S." The impact of this event on the level of automation in U.S. offices was as follows: it would be one year before voice-activated microcomputers would begin to influence the level of office automation, and another two years before the maximum impact of a 40% increase in office automation would be reached. It was estimated that the maximum impact would continue for four years after which the impact would decrease over a three year period to 30% steady-state impact.

The process of making these estimates was initially slow. After panel members grasped the concept of cross-impact analysis, however, the process proceeded at a smooth pace. The estimates from all teams were then reviewed by selected panel members. This step was necessary to ensure that there was consistency in the vision of the future represented by the cross-impact model's estimates.

Development of Alternative Scenarios

Once the cross-impact model was complete, a series of scenarios showing possible alternative future environments of the college were developed. The first scenario developed represented the college's "most likely" future. It described the content of the "expected futures" as defined by those trends identified as critical to the college's future. The specific character of this future was represented by the forecasted level of the trend based upon the implicit assumptions of each member of the panel. In this sense, the "most likely" future was a compilation of the planning assumptions used in most planning models, written in the form of a scenario.

Three other scenarios were created showing the alternative futures that could occur, should specific events happen in the future. Each of these scenarios described the changes in the level of the trends resulting from the impacts of a particular sequence of events over the period of the future which defined the strategic planning horizon for the college (10 years). In essence the alternative futures depicted in these scenarios represented a variation of the external environment described in the "most likely" scenario. The alternative scenarios were generated using PASS, an event-to-event and event-to-trend cross-impact model implemented on a personal computer. Within PASS, the "hits" for the event-to-event and event-on-trend sections of the model were determined from the cross-impact estimates made by the analysis teams. These estimates represented how the probability of a particular event would change, given the prior occurrence of an impacting event and how the level of a trend would change given the impact of a particular sequence of events. The result outlined a single path of development over time. Such paths were instructive to the planning teams, not only because they integrated the input estimates of the cross-impact model, but also because they described the alternative paths of developments that were in fact possible and redefined the context of the "most likley" future as represented by the changes in the levels of the impacted trends.

Conducting the Policy Analysis

The analysis of the implications of the four scenarios represented the policy analysis phase of the process. The planning team first evaluated the scenarios using the criteria previously mentioned in this chapter for judging forecasts. These criteria allowed the team to maintain the perspective that no scenario was to be viewed as a prediction of a

future state of affairs of the college. Instead, there were an infinite number of possible alternative futures, each varying because of interactions among human choice, institutional forces, natural processes, and unknowable chance events. Each scenario, therefore, represented a probabilistic statement about some element of a possible future (i.e., forecast).

After the group had rigorously examined the scenarios, they assessed how the institution would be affected if the particular future described by the scenario materialized. This step was a critical part of the team's strategic planning process, because forecasts are of little or no value unless decision-makers estimate the degree and nature of the impact of change on the organization (Halal, 1984). Team members assessed the consequences of the scenario to the current and future mission of the organization. Also explored was the impact of the scenario on the institution's key indicators--factors that were perceived to make the difference between institutional success or failure (Rockart, 1979).

Once all scenarios had been reviewed, a list of implications was developed. These implications, common to all scenarios, represented those of critical importance to the establishment of institutional strategy (e.g., the demand for the college to develop more and varied outreach services, to provide both technical education and technology transfer activities, to adapt a core approach to its engineering curriculum, to demonstrate quality and excellence, and to operate in a context of more centralized governance at the state level). Those implications unique to a particular scenario represented possible conditions for which contingency strategies might have to be developed should the future described in the particular scenario emerge.

From these implications the planning team developed a list of institutional strategies. To ensure that strategies were appropriately focused, team members were directed to think of strategy as defining the relationship of the college to its external environment and as providing guidance to the institution's staff in carrying out their administrative and operational activities in six key decision areas: (a) basic mission (b) array of programs and services; (c) types of students served; (d) geographic area served; (e) educational goals and objectives, and (f) competitive advantage(s) over competitors (e.g., low tuition, location). A strategy that affected one or more of these decision areas or the relationship between the college and the environment was considered a good candidate for adoption by the planning team. The potential of each strategy was assessed

as to the degree it enhanced or inhibited institutional strengths and weaknesses previously identified by the planning team.

Those strategies estimated to enhance strengths or reduce weaknesses were examined as to their effectiveness across scenarios and then categorized with respect to the external implications they address. For example, a number of strategies focussed on the issue of educational excellence. Members of the team believed this issue would continue to grow as a public concern based upon the analysis of several of the scenarios; consequently, it was deemed important to make the college's community and staff perceive "quality" and "excellence" as important institutional values. Specific strategies identified by the planning team to accomplish this included:

- publicizing institutional and faculty awards, honors, and innovative projects
- publicizing student achievements
- establishing a task force on institutional excellence to examine and make appropriate recommendations for improving any aspect of those educational programs and operation deemed "less than excellent"
- expanding the number of major national conferences and meetings annually hosted by the college
- encouraging greater faculty participation in regional and national professional associations
- improving the quality of the college's adjunct faculty through increased salaries and involvement in the college's activities
- establishing an endowment fund to expand professional development opportunities available to the college's faculty and staff to insure that all personnel remain current in their field of specialization
- establishing an instructional resource center in the college to provide support and training for all part-time and full-time faculty to maintain their instructional skills.

Another category of strategies was intended to reaffirm the institution's role as a catalyst for regional economic development. Strategies included:

- expanding the capability of the college's continuing education program to provide startup and on-going job training and technical assistance for small business and service industries
- establishing a technology transfer consortium to assist businesses and industries in the region to improve their productivity through the application of new technologies for existing production processes
- establishing an on-going program of conferences and workshops for local and community groups to foster regional economic and community activities
- establishing an advanced technology education center for the "factory of the future" to provide technical training and technology transfer services to industries in the region.

Incorporating the Strategies into the College's On-Going Activities

The planning team was asked to discuss these strategies with members of their staffs. The vice president for planning circulated this list of strategies and their corresponding objectives to all members of the planning team. At a half-day meeting, the team reviewed suggested objectives for each strategy and selected those objectives they believed the college should emphasize in its annual operational plan, allocating appropriate resources. Periodically during the year the president and the vice presidents reviewed the progress made in accomplishing the objectives.

Benefits and Limitations

An evaluation of the process by the members of the planning team indicated that the planning process was successful in producing information describing changes in the external environment relevant to the future of the college and in stimulating strategies that would not have been developed without going through the process. More specifically, team members felt that the process provided a systematic approach to the identification and analysis of external information. This viewpoint was best summarized by several members of the team who said that the process caused the team "to look at the future in an organized manner," and it "gave order to all the dat. that is out there" by helping the

college's planning team to "structure the data so it can be matched with what we are about [and] what we are trying to do."

Overall the team members thought that this planning approach increased their awareness and ability to assess the implications of external changes for the institution's future. Several members of the team said that it, "forces members [i.e., the planning team] to look at issues which would be overlooked and. . .aids in broadening the participant's perspective." Members of the planning team also indicated that the alternative scenarios were useful in developing a number of strategies and that the process provided a systematic approach for identifying those strategies that were to be given priority for implementation.

The incorporation of the strategies selected for implementation into the college's on-going management activities, however, did not go smoothly. This was not surprising in that Gray (1986) found that the difficulties encountered in the implementation of strategic plans were the source of the greatest discontent among corporate executives (p. 90). In this case, planning team members felt that there was a gap between the college's strategic planning process and its operational planning. The perception of a number of members was that the results of the process were not used in their entirety. Members also noted that the strategies were added to previously determined priority assignments of staff, thus increasing work loads and resulting in incompatible demands. In other words, the new strategies were implemented without work assignments being "uncoupled" from strategies previously developed by the administration (Hobbs and Heany, 1977).

The problem of implementation was also related to what team members viewed as another problem--the lack of wider participation in the process among other members of the faculty and staff. While team members believed that the process facilitated the development of a consensus regarding the strategic directions of the institution among members of the planning team, they generally did not perceive this consensus reaching other members of the faculty and staff. Consequently, the results of the strategic planning process were perceived to be mandated by some staff. The importance of this problem is supported by the conclusion that Cleland and King (1974) draw that an organization's success in strategic planning is more sensitive to the overall organizational culture within which the planning is accomplished than the planning techniques and processes used (p. 70).

Some planning team members were critical about the techniques and procedures used during the process. Several individuals believed that the scope of the environmental scan was too narrow and concentrated too heavily on technological and economic changes in the environment. There was far from unanimity on this point. One team member's sole criticism of the process was that the information from the scan was of little value and should rather have concentrated on the economic and employment data reflective of the local economy of the college's service area. Most team members thought, however, that the environmental scan and the trend and event statements contained on the Delphi's R2 questionnaire reflected changes in all sectors of the environment affecting the college.

Lastly, team members thought the procedures followed for evaluating the robustness and probable effectiveness of the strategies needed to be strengthened. More specifically, it was pointed out that short of a subjective assessment of the impact on college expenditures, the complete financial implications of implementing a particular strategy would not be known until after it was selected. Also, several individuals believed that in addition to assessing the strategies' impact on the institution's strengths and weaknesses, it would have been useful if the strategies had also been assessed as to their impact on the college's key indicators. With the availability of the PASS model such an assessment was technically feasible, as it allows the user to incorporate policies (i.e., strategies) and trend data for each indicator into the cross-impact model of the institution's future environment.

Problems, Issues, and Needed Research

This approach to planning and associated research methods and techniques is derived from the development of technological forecasting by military planners in the years that followed World War II in an attempt to avoid being unprepared for future wars. Technological forecasting differed from traditional planning methods in that findings were based upon judgments about the future, and were used to develop complex scenarios as opposed to identifying only the next generation of military-related breakthroughs. However, according to Enzer (1983), it was not until the mid-sixties that technological forecasting was placed into an analytical framework with such supporting methods as the Delphi, scenario writing, cross-impact analysis, and system dynamics, through the

work of Gabor (1964), Jantsch (1967), Kahn and Wiener (1967), and de Jouvenel (1967).

As one might expect with such a newly developing field, there are a variety of problems and issues associated with external analysis and forecasting. Indeed, Boucher (1975) identified some 300 unique problems and issues in this emerging area in a survey of the literature and of leading researchers in the futures field; Coates (1985) identified almost as many in a survey of issues managers. Space permits only a limited description of the most pressing issues for further research in this area.

Methodological Issues

Forecasting the "most likely" and alternative futures using the approach described here is based on soft, judgmental data, data based upon intuitive, often theoretically unstructured insights into real world phenomena. Indeed, one of the major problems in this area of inquiry is the inadequacy of current theories of social change. Boucher (1977) found that none of the competing theories existing then or now (personal communication, August, 1988) had predictive value. If our understanding of social change were more highly developed, forecasting the future would be much less problematic.

Improving methods of forecasting involves the question of how the validity of results obtained by the construction of a simulation model about the future can be measured. Of course, the concept of validity is difficult to apply to the study of the future. For this reason, many forecasters emphasize that accuracy is not a criterion for evaluating forecasts, for it is impossible to identify and assess the impact of all of the future events that could affect the future. Therefore, the best criteria we can develop at present is that forecasts be credible, plausible, and internally consistent given the information we have as a result of our scan and given our state of knowledge vis-a-vis social change.

Reliability is also a problem in judgmental forecasting. There has been some research on the extent to which the same methods produce the same results when used by different forecasters. Sackman (1974) reviewed a variety of Delphi studies comparing forecasts of experts with nonexperts and found that there was no difference. Studies by Campbell (1966) and Salancik (1971) came to essentially the same conclusion. There has been little recent research on this subject.

Moreover, there has been little research on the relative advantages of different methods of eliciting forecasts from a group (e.g., questionnaires, interviews, computer terminals, face-to-face discussion, etc.), and the extent to which forecasts derived through the use of these different techniques differ (Boucher, personal communication, August, 1988). Perhaps one reason for the lack of research on these questions is the paucity of university based programs that incorporate a responsibility for developing the concepts and methodology of forecasting. Another reason may be due to the pragmatic use of this approach to planning. That is, a major function of this approach to planning is to involve decision-makers in thinking about the future in ways that they have not done previously. Ideally, they should be involved in all forecasting activities so that they "own" the products of the analysis and, therefore, are comfortable in using this analysis to stimulate the development of policy options that can be implemented in action plans. They use forecasts by experts (as reported in the literature or through personal communications) to assist them in making their own forecasts. In so-doing, they become "smart" about current and forecasted changes and use this increasing alertness to conduct their managerial and planning responsibilities. The process of scanning, forecasting, and planning, therefore, may be more important to the future of the organization than the product of any particular round of forecasting or planning. Consequently, the validity of the analysis is not as crucial as it would be in other research activity.[3]

There are a number of questions related to one of the major tools used by forecasters--the Delphi. Olaf Helmer, one of the developers of the Delphi technique, has posed the following research questions: What degree of anonymity is most helpful to the performance of a panel? How should the questioning process be structured? How can information from a variety of individuals from a variety of disciplines be best used? How stable is a panel's judgment over time? What is the optimal panel size? How can the performance of forecasters be calibrated? Be enhanced? What data, data processing facilities, simulations, communication devices or models would be most helpful to forecasters? How can control for the systematic bias of forecasters be obtained (Helmer, 1983, p. 118)?

There are also a number of issues related to a tool essential to forecasting alternative scenarios--cross-impact analysis. For example, the cross-impact matrix is constructed in a bivariate, first-order impact, fashion. (If Event A occurs, does it affect

the probability of Event B occurring and, if so, to what extent?) It is too unwieldy and complex for this technique to handle the possibility of two or more events jointly affecting the probability of another event. Too, Helmer (1983) notes the problem of "double-accounting," i.e., "if event A has a direct impact on event C but also has an indirect impact on it via another event, B, how can we make sure that this indirect impact is not also reflected in the direct impact of A on C and thus counted twice?" (p. 120).

Implementation Issues

Most educational leaders can readily identify pressing concerns and issues facing colleges and universities on the basis of their reading, experience in managing issues, and discussions with colleagues, both at home and around the world. Frequently, however, this identification is limited without the benefit of a comprehensive environmental scan of critical trends and potential events in the social, technological, economic, or political environments from the local to the global levels. Moreover, a systematic and continuous scanning process is crucial to the successful implementation of an external analysis/forecasting approach to planning in order to reevaluate the forecasts to determine if they need to be reestimated on the basis of new information generated in the scan.

Developing and institutionalizing a systematic, comprehensive environmental scanning function requires a commitment of time and resources that at present only major corporations (e.g., General Motors), trade associations (e.g., The American Council of Life Insurance), think tanks (e.g., SRI) and some philanthropic organizations (e.g., United Way of America) have been willing to do. A number of colleges (e.g., St. Catherine) and universities (e.g., Arizona State, Colorado and Minnesota) have conducted periodic scans , but the only comprehensive, on-going system reported in the literature is at the Georgia Center for Continuing Education (Simpson, McGinty and Morrison, 1987). There may be several reasons for this state of affairs. One is the resource commitment required in (a) obtaining sufficient readers to regularly scan a variety of information sources, (b) maintaining the files manually and electronically, and (c) obtaining time of busy administrators and faculty members to review, discuss, and use the pertinent information developed in the process. Pflaum (1985) argues, for example, that many scanning processes do not survive because of the time and energy required to sustain them by volunteers. Ptaszynski, in applying the ED QUEST model in

the School of Management at Wake Forest University, reported that their planning team thought that they were wasting valuable professional time scanning irrelevant material, time that detracted from the more important analysis phase (personal communication, May 28, 1988).

There are attempts underway to develop environmental scanning consortia. United Way of America, for example, encourages colleges and universities to participate in their electronic environmental scanning network, although they have not yet established a separate subnet for higher education (Morrison, 1987). Even with such assistance in maintaining a shared data base, however, the question of how to best use the scarce time available for the major decision-makers remains an issue.

Studies Needed

In addition to the research implications of the discussion above to advance this important area of inquiry, there are a number of specific studies needed. For example, the general approach to external analysis and forecasting advanced here has been applied only in a small two-year technical college. How applicable is this model to other types of educational organizations and units (e.g., academic departments, four-year colleges, research universities, state systems of higher education)? A number of case studies are underway that apply this approach to a learning resources center in a dental school (Raney, personal communication, August 1988), to the admissions program of a school of management (Ptaszynski, 1988), to a department of training and development in a university hospital (Clay, personal communication, August 1988), to a consortium of church related colleges (May, 1988), and to a doctoral degree granting university (Porter, personal communication, May, 1988). More are needed. Such studies could include a focus on actual decision-making behaviors of educational leaders engaged in formal analysis, forecasting, and planning activities. Others could focus on comparisons of effectiveness (as measured by outcomes) of those institutions using this approach to those not using the approach, controlling on relevant third variables (e.g., selectivity, type of control, institutional size, financial support).

Winkler (1982) identified several promising research directions when considering modeling decision-making problems under uncertainty that are relevant to the approach described in this chapter. First, the link between the creative process and the model-formulation stage of decision-making under uncertainty has not been explored, although

Mendell (1985a) has developed a set of rules for improving an individual's ability to create mental scenarios of the future and a framework of questions designed to stimulate consciousness of the future implications of current phenomena (1985b).

Winkler (1982) also suggested the development of decision-aids involving user-friendly computer software for modeling decision-making problems under uncertainty, preferably in an interactive mode. The cross-impact models noted in this chapter (INTERAX, PASS, and BRAVOI) are all designed to enable users to generate outlines of scenarios of future environments and of organizational performance simultaneously. It is possible to examine each alternative scenario for developments that give the future its special character and, thereby, identify those events that are particularly "bad" or "good." Policy options may then be designed to increase the probability of "good" events and decrease the probability of "bad" events. By including these policies in the cross-impact model, it is possible to treat them analytically in the same manner as events (i.e., estimate their effects on the events and trends in the model), and rerun the computer simulation to create alternative scenarios that contain policies as well as events and trends. This is known as policy-impact analysis (Renfro, 1980). Although such decision-aids are available, there is no evidence in the literature that they are being used in external analysis and forecasting in colleges and universities. As Norris and Poulton (1987) note, there is a dire need for case studies to illuminate the applicability of this aporoach to educational planning.

The applicability of catastrophe theory to socio-political forecasting is another direction for possible research. Catastrophe theory defines sudden changes and discontinuities in the behavior of natural and social systems (Woodcock and Davis, 1978). Zeeman (cited in Smith, 1980) points out that catastrophe theory "can be applied with particular effectiveness in those situations where gradually changing forces or motivations lead to abrupt changes in behavior" (p. 26). Although a relatively young science, catastrophe theory is beginning to be applied in planning. For example, analysts at a major corporation adapted the approach for modeling alternative "catastrophies" of discontinuous and divergent change in the motivational forces of growth and profit that control business behavior (Smith, 1980). One can only speculate as to the value in the decision-making process of alternative scenarios generated by computerized cross-impact models incorporating the mathematical modeling approach of catastrophe theory.

There are dozens of other research possibilities to improve this approach to academic planning, of which only two additional ones will be mentioned here. First, there is a need for a current handbook on external analysis and forecasting that can guide college and university institutional researchers and planners in this promising methodology. The only published guides (Fowles, 1978; Henckley and Yates, 1974), although good, are dated. Second, there is a need for a national research effort on the future of higher education, with corresponding implications for academic planning in America's diversified system of colleges and universities. This effort should include an environmental scanning/forecasting data base, housed either with the U.S. Department of Education or at one of the major professional associations (American Association for Higher Education, American Council on Education, Association for Institutional Research, or the Society for College and University Planning). This data base should be electronically accessible to the higher education research and planning community. Moreover, portions of the annual meetings of professional associations could focus on the implications of this evolving data base for academic planning and provide professional development opportunities in current techniques of external analysis and forecasting.

Conclusion

The purpose of environmental analysis/forecasting in academic planning is to provide college and university administrators information that can facilitate better decision-making, particularly in making decisions affecting the long-range future of their institutions. Given that we live in an age of "future shock" where changes in the external environment occur with ever-increasing rapidity, educational leaders are faced with a future that most assuredly will be different from the present. This chapter has reviewed the salient literature describing a basic approach used to manage this uncertainty--identifying issues/concerns based upon experience and upon environmental scanning, structuring issues in the form of trends and events, forecasting the "most likely" future of these trends and events, assessing the interrelationships of these trends and events through cross-impact analysis, and producing alternative scenarios of plausible futures that stimulate the development of viable and robust strategic options that can be incorporated in specific institutional plans. This approach varies from a traditional long-range planning approach based upon a single set of environmental assumptions about the future in that it recognizes that although the future is a continuation of existing trends, it is subject to modification by events that have some probability of occurrence. Indeed, environmental uncertainty is caused by

potential events. We cannot predict the future, because uncertainty is a product of our incomplete understanding of trends, potential events and their interrelationships. However, by using the best available information we have, we can anticipate plausible alternative futures and, thereby, limit the number of unanticipated possibilities to the smallest possible set.

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Footnotes

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[2]The following sketch of the history of cross-impact analysis was prepared by Boucher (1984) as reported in Boucher and Morrison (in press).

[3]This view is not shared by everyone, however. Ptaszynski (personal communication, May 28, 1988) argues that college and university planning teams should not engage in forecasting, but rely solely on forecasts produced by experts.