INTRODUCTION

Over the past 35 years, the state of California has built an impressive program of higher education. Anchored by its three-tiered public system, higher education has made immense contributions to the state's economy and the widespread opportunity (however imperfect) that has characterized California society. The state's commitment to higher education was codified in the 1960 Master Plan, which guaranteed that all individuals who could benefit from a college education would receive one. But whatever higher education has contributed to California in the past, it is likely to be even more important in the future. In our evolving information economy, a college degree is one of the key determinants of economic success. California's economy may become significantly poorer if the workforce does not become increasingly college educated. In addition, the state's social cohesion may suffer if restricted access to higher education widens income disparities among different ethnic groups in the state's population.

TRENDS AFFECTING HIGHER EDUCATION

Several decades-long trends suggest that California's ability to maintain, much less increase, high levels of college education may be in danger:

- Demand for higher education, which has grown sevenfold in California since World War II, is expected to continue growing over the next two decades as the current bulge of a million or more students in the elementary schools works its way through the system. This so-called Tidal Wave II could be smaller or

1

larger depending on whether the children of groups with traditionally low levels of education, particularly recent Hispanic immigrants, attend college at rates approaching those of whites and Asians.

•   The percentage of the state budget that supports higher education has declined over the past 20 years as state spending on health, welfare, and corrections has increased dramatically. Public resistance to increased taxes has largely capped total state spending. Thus, state resources per student in higher education have declined and, without a significant change in state spending priorities, may continue to do so into the future. Concurrently, federal funding for student loans and financial aid has grown slowly over recent years and may continue to do so given pressures on the federal budget.

•   The costs of higher education have risen consistently faster than inflation over the past 35 years. For instance, the Higher Education Price Index (HEPI), which measures the real increase in the prices of the goods and services used by higher education institutions, has outpaced the Consumer Price Index (CPI) by an annual average of one full percentage point. In other sectors of the economy, such sustained imbalances in the cost of inputs have led to either large changes in productivity, often accompanied by large organizational changes, or decline.

There is wide agreement about these basic trends, but there is a broad spectrum of opinion as to how deleterious they will be for the future of California higher education. For instance, the Research and Planning Department at the University of California predicts that state funding for higher education will show healthy growth over the next two decades, as the state economy grows and the fraction of state funding that goes to higher education remains constant (Copperud and Geiser, 1996). Conversely, Shires (1996) of the California Public Policy Institute of California predicts state support for higher education will drop precipitously as increased state spending on corrections cuts the fraction of the state general fund allocated to higher education in half. Similarly, there are many different projections of the precise number of students who will seek access to higher education.

TRADITIONAL ANALYTIC APPROACH

In the traditional approach, a policy study would assess each of these conflicting predictions and decide which are the most likely. Based on this "best estimate" of the future, the study would then recommend the policies most likely to succeed. This traditional approach sometimes works very well, but policies based on one best estimate can fail if another future comes to pass. Unfortunately, decision makers and policy analysts, like most people, have a strong tendency to underestimate their uncertainty about the future.[1] They focus on some single best estimate, often the one they think most likely or most supportive of the case they wish to make.

The dangers for California higher education are clear. Policies predicated on high levels of state funding that never materialize or on overambitious estimates of productivity improvements could deny large numbers of potential students a higher education. However, policies predicated on overly pessimistic assumptions could waste resources and disrupt lives, overfixing institutions that are not broken. In addition, decision makers can spend too much time debating the most likely future rather than developing flexible, robust strategies that can take advantage of fortuitous opportunities and avoid unexpected difficulties.

We believe that the differing predictions of the trends facing California higher education represent real uncertainty about the future that is difficult if not impossible to resolve. In some cases—such as the sensitivity of student demand to changes in tuition—there currently is not enough information to predict well. In other cases—such as the budget priorities of future legislatures and the impact of information technology on the classroom—the phenomena involved are inherently unpredictable. Thus, the different predictions for the future of California higher education do not reflect faulty analysis by one party or another so much as the fact that such factors as future funding and demand for education result from an inherently unpredictable set of future political and individual decisions.

––––––––––––––

[1]See, for instance, Chapter 6, "Human Judgment about and with Uncertainty," in Morgan and Henrion, 1990.

NEW ANALYTIC APPROACH

Our study used a new approach to make a quantitative assessment of the various trends facing California higher education and to suggest the implications they have for current policy choices. Rather than projecting the most likely trends, we examined a large number of plausible scenarios for the future. We made visual representations of these scenarios and used these "landscapes of plausible futures" to clarify the key uncertainties facing decision makers, to provide a framework that different stakeholders can use to debate differing views of the future, and to compare the effects of different policy choices.

Our approach combines two previously distinct strands of strategic planning methodology. Traditional forecasting employs sophisticated models and available quantitative data to project likely trends. This type of approach provides much rigor but has difficulty coping with the uncertainty inherent in most decisions. Recently, many public and private sector organizations have begun to use scenario planning techniques, such as those developed by Royal Dutch Shell and the Global Business Network.[2] These approaches help decision makers bring uncertainty into their planning and help different stakeholders agree on a framework for discussion. However, scenario planning as currently practiced cannot make use of available quantitative information.

Our new approach, called *exploratory modeling* (Bankes, 1993, 1994), combines quantitative forecasts with scenario planning. We exploit the new capabilities provided by wedding information technology (primarily networked computer workstations and powerful desktop graphics) to new concepts of decision making under extreme uncertainty.[3] In this study, we used computer models to describe future

_____

[2]Wack (1985) describes Royal Dutch Shell's developments in scenario planning. Schwartz (1991) provides one of the classic descriptions of scenario planning methodologies; his Global Business Network can be found at www.gbn.org. Dewar, et al. (1993) describe assumption-based planning, the RAND-developed version of these methods.

[3]The field of decision analysis largely deals with uncertainty about the future that can be characterized by well-known probability distributions. Exploratory modeling can address cases of extreme uncertainty for which the probability distributions are un-

enrollments in the three public California systems of higher education—University of California (UC), California State University (CSU), and the community colleges (CCs); the revenues available for undergraduate education; the effects of potential productivity improvements; and the impact of potential fee increases. The quantitative data and mathematical representations we used are similar to and in many instances identical to those used by other analysts. But rather than use these models to make best-estimate projections, we used them as constraints on the range of plausible futures for California higher education.

One reason our approach is useful is that there is often a great deal of information about a problem that, although insufficient for making accurate predictions, is nonetheless useful for making decisions. For instance, simple accounting relationships among the flows of students and money through the higher education system impose important constraints on the future. While it may seem that abandoning a best estimate for a large set of plausible futures complicates the decision-making problem, the large set of plausible scenarios represents real and very useful information. Perhaps surprisingly, when we trade the question "What is most likely to happen in the future?" for "Which policy choice deals best with the uncertainty we face?" the complexity posed by an unpredictable future often falls away and reveals a small set of clear choices.[4]

This report focuses on the first step in an exploratory modeling analysis: creating landscapes of plausible futures for California higher education and using these landscapes to identify those uncertainties and trends most salient to decision makers' choices. In the future, we hope to address the second step: comparing the performance of a large number of potential policy choices against these landscapes to help policymakers choose the best policy consistent with their risk profile and their own expectations about the future.

---

known. Some concepts similar to exploratory modeling can be found in the policy region analysis of Watson and Buede (1987).

[4]See, for instance, Lempert, Schlesinger, and Bankes, 1996, which uses exploratory modeling to show that an adaptive strategy dominates the other policy options currently proposed to address the problem of global climate change.

ORGANIZATION OF THIS REPORT

The next chapter of this report summarizes the data and models we used to describe the California higher education system. Chapter 3 presents our landscapes of plausible futures for California higher education; Chapter 4 presents our conclusions. Five appendices describe the details of our calculations and provide additional results to support the arguments laid out in the main body of this report.