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# Scenarios: Uncharted Waters Ahead

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*It is fashionable to downplay and even denigrate the usefulness of economic forecasting. The reason is obvious: forecasters seem to be more often wrong than right. Yet most U.S. companies continue to use a variety of forecasting techniques because no one has apparently developed a better way to deal with the future's economic uncertainty.*

*Still, there are exceptions, like Royal Dutch/Shell. Beginning in the late 1960s and early 1970s, Shell developed a technique known as "scenario planning." By listening to planners' analysis of the global business environment, Shell's management was prepared for the eventuality—if not the timing—of the 1973 oil crisis. And again in 1981, when other oil companies stockpiled reserves in the aftermath of the outbreak of the Iran-Iraq war, Shell sold off its excess before the glut became a reality and prices collapsed.*

*Undoubtedly, many readers believe they are familiar with scenarios. But the decision scenarios developed by Shell in Europe are a far cry from their usual U.S. counterparts. In this article and a sequel to come, the author describes their evolution and ultimate impact on Shell's management.*

Few companies today would say they are happy with the way they plan for an increasingly fluid and turbulent business environment. Traditional plan-

ning was based on forecasts, which worked reasonably well in the relatively stable 1950s and 1960s. Since the early 1970s, however, forecasting errors have become more frequent and occasionally of dramatic and unprecedented magnitude.

Forecasts are not always wrong; more often than not, they can be reasonably accurate. And that is what makes them so dangerous. They are usually constructed on the assumption that tomorrow's world will be much like today's. They often work because the world does not always change. But sooner or later forecasts will fail when they are needed most: in anticipating major shifts in the business environment that make whole strategies obsolete (see the insert, "Wrong When It Hurts Most").

Most managers know from experience how inaccurate forecasts can be. On this point, there is probably a large consensus.

My thesis—on which agreement may be less general—is this: the way to solve this problem is not to look for better forecasts by perfecting techniques or hiring more or better forecasters. Too many forces work against the possibility of getting *the* right forecast. The future is no longer stable; it has become a moving target. No single "right" projection can be deduced from past behavior.

The better approach, I believe, is to accept uncertainty, try to understand it, and make it part of our reasoning. Uncertainty today is not just an occasional, temporary deviation from a reasonable predictability; it is a basic structural feature of the business environment. The method used to think

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## A note on names

Throughout this article, I use "Royal Dutch/Shell" and "Shell" to refer to the Royal Dutch/Shell group of companies. The terms also serve as a convenient shorthand to describe the management and planning functions within the central service companies of that group in London and The Hague. I am generally excluding Shell Oil Company of the United States, which—as a majority-owned public company—had undertaken its own operations planning. I use words like "company" as a shorthand for what is a complex group of organizations with varying degrees of self-sufficiency and operational independence. Most are obliged to plan for a future in their own national economic and political environments and to be integral parts of the Royal Dutch/Shell group of which they are members. I would not like to mislead anyone into thinking that any single person, manager, or planner is able to have a clear view of it all.

about and plan for the future must be made appropriate to a changed business environment.

Royal Dutch/Shell believes that decision scenarios are such a method. As Shell's former group managing director, André Bénard, commented: "Experience has taught us that the scenario technique is much more conducive to forcing people to think about the future than the forecasting techniques we formerly used."<sup>1</sup>

Many strategic planners may claim they know all about scenarios: they have tried but do not like them. I would respond to their skepticism with two points:

- Most scenarios merely quantify alternative outcomes of obvious uncertainties (for example, the price of oil may be \$20 or \$40 per barrel in 1995). Such scenarios are not helpful to decision makers. We call them "first-generation" scenarios. Shell's decision scenarios are quite different, as we shall see.
- Even good scenarios are not enough. To be effective, they must involve top and middle managers in understanding the changing business environment more intimately than they would in the traditional planning process. Scenarios help managers structure uncertainty when (1) they are based on a sound analysis of reality, and (2) they change the decision makers' assumptions about how the world works and compel them to reorganize their mental model of reality. This process entails much more than simply design-

<sup>1</sup>André Bénard, "World Oil and Cold Reality," HBR November–December 1980, p. 91.

ing good scenarios. A willingness to face uncertainty and to understand the forces driving it requires an almost revolutionary transformation in a large organization. This transformation process is as important as the development of the scenarios themselves.

My discussion will be in two parts. In this first article I will describe the development of scenarios in the early 1970s as they evolved out of the more traditional planning process. As you will see, the concept and the technique we arrived at is very different from that with which we began—mainly because there were some highly instructive surprises along the way for all concerned. The art of scenarios is not mechanistic but organic; whatever we had learned after one step advanced us to the next.

In a forthcoming article, I will examine a short-term application of the technique and conclude by discussing key aspects that make the discipline creative.

## The First Steps

For ten years after World War II, Shell concentrated on physical planning: the company had to expand its production capacity and build tankers, depots, pipelines, and refineries. Its biggest challenge, like that of many companies, was to coordinate the scheduling of new facilities. Then from 1955 to 1965, financial considerations became more important but primarily on a project basis.

In 1965, Shell introduced a new system called "Unified Planning Machinery" (UPM) to provide planning details for the whole chain of activity—from moving oil from the ground, to the tanker, to the refinery, all the way to the gas station on the corner. UPM was a sophisticated, worldwide system that looked ahead six years: the first year in detail, the next five in broader lines. Unconsciously, managers designed the system to develop Shell's businesses in a familiar, predictable world of "more of the same."

Given the long lead times for new projects in an oil company, however, it was soon decided that the six-year horizon was too limited. Shell therefore undertook experimental studies to explore the business environment of the year 2000. One of them revealed that expansion simply could not continue and predicted that the oil market would switch from a buyers' to a sellers' market, with major discontinuities in the price of oil and changing interfuel competition. The study also signaled that major oil companies could become huge, heavily committed, and much less flexible—almost like dinosaurs. And dinosaurs,

## Wrong when it hurts most

In few fields has the concentration of the best techniques and the best brains been as high as that in short-term macroeconomic forecasting for the United States. Stephen McNees of the Federal Reserve Bank of Boston has been analyzing the track record of the best-known economic forecasters since 1970. For more than half of this period, they were quite successful. But on four occasions, the magnitude of error was large. McNees observes that:

"Forecasts made from 1973 through early 1974 initially did not foresee the recession and later misinterpreted the severe recession as an 'energy spasm.'"

"Forecasts made from mid-1977 through early 1978 did not capture the acceleration of the inflation rate in 1978 and 1979."

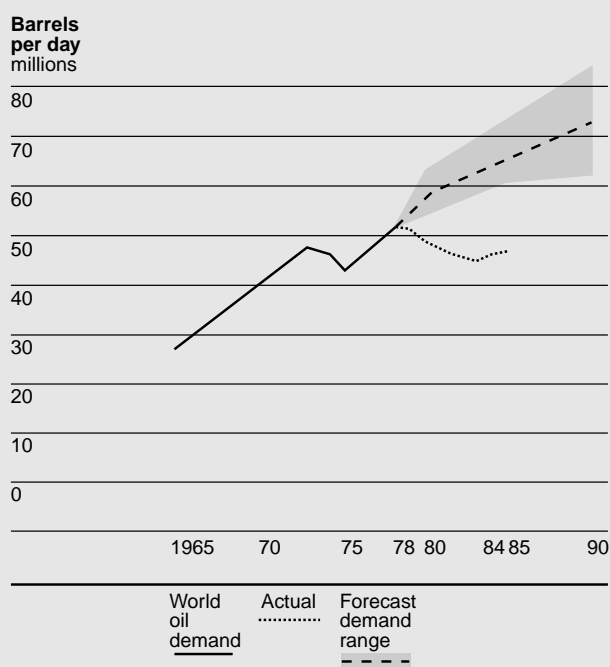
"Forecasts made during the 1980 recession underestimated the strength of the early recovery."

"Forecasts made in 1981 and early 1982 underestimated the severity of the 1982 recession and the deceleration of inflation that accompanied it."<sup>1</sup>

In the summer of 1981, the median one-year-ahead forecast of five prominent forecasters had predicted 2.1% growth in U.S. GNP for 1982. Instead, the economy plunged into a deep recession, with a GNP decline of 1.8%. As journalist Warren Brookes commented, "This is like forecasting partly cloudy and getting a ten-inch snowstorm instead. After all, in economics as in meteorology, it's the ability to predict stormy change that makes forecasting useful."

Many business cases illustrate a similar phenomenon. The oil industry—which before 1973 enjoyed the steady growth of all major industries—is still living with its failure to anticipate the turbulent changes that have occurred since then. Here is one major oil company's forecast of oil demand, made as late as 1978. This company allocates more resources to analyzing the future environment than do most companies and is well respected for its professionalism. Yet note how far outside the forecast demand range reality proved to be in 1984.

<sup>1</sup>Stephen K. McNees and John Ries, "The Track Record of Macroeconomic Forecasts," *New England Economic Review*, November–December 1983, p. 5.



as we all know, did not adjust well to sudden environmental changes.

In view of the study's findings, Shell believed it had to find a new way to plan. It asked a dozen of its largest operating companies and business sectors to experiment and look ahead 15 years in an exercise called "Horizon Year Planning."

At the time, I worked for Shell Française. We were

familiar with the late Herman Kahn's scenario approach and were intrigued by its possibilities for corporate planning.

Two important uncertainties made France a perfect testing ground for a corporate experiment with the technique: the availability of natural gas (then recently developed in France and the Netherlands), the only fuel that could compete with oil, and the

political uncertainty surrounding the way France would manage energy. France's oil regime of that time favored national companies and severely limited Shell's market share.

But France, as a member of the European Community, might have had to change its oil regime at some point to conform to EC policy. The two options—no change or liberalization—combined with two alternatives, large or small availability of gas, gave us four potential scenarios, as illustrated in *Exhibit I*.

How far to go in describing each? We discovered quickly that we would almost quadruple our work load if we made each scenario as detailed as a normal plan under the UPM system. Just as the logistics of supply for an army have to be adapted to the type of war being fought, the logistics of scenario planning require a capacity to deal easily and quickly with alternatives. Without it, the whole process can be paralyzed by a bottleneck. In practice, this realization led later to our developing flexible simulation models and having a number of specialists in key areas who could rapidly assess the consequences of different alternatives.

More important, we realized that simply combining obvious uncertainties did not help much with decision making. That exercise brought us only to a set of obvious, simplistic, and conflicting strategic solutions. In fact, many companies are doing just that in their approach to scenarios—quantifying the obvious and not gaining any help in making decisions. Yet this negative realization led to discovery of a positive search tool. By carefully studying some uncertainties, we gained a deeper understanding of their interplay, which, paradoxically, led us to learn what was certain and inevitable and what was not.

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**Exhibit I 1970 scenarios**

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		Liberalized	Same
Natural gas availability	Large		
	Small		

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We began to appreciate the importance of sorting out “predetermined elements” and “uncertainties” (see the insert, “What Is Predetermined and What Is Uncertain”). In emphasizing only uncertainties, and obvious ones at that, the scenarios we had developed were merely first-generation scenarios. They were useful in gaining a better understanding of the situation in order to ask better questions and develop better second-generation scenarios—that is, decision scenarios. This dawning intuition—confirmed by all later experience—was an awareness of the critical importance of design. Scenarios will either help decision makers or be of little use to them, depending on how they are constructed and presented, not just on the outcome they focus on. In the same way, two architects can create a well- or a poorly designed building, even though they both use the same construction materials.

The results of the horizon study across the company confirmed the conclusions of the year 2000 study. The most important findings were:

- The oil market—long characterized by oversupply—was due to switch to a sellers’ market.
- Soon there would be virtually no spare crude oil supply capacity.
- Inevitably, the Middle East and, in particular, the Arabian Gulf would be the balancing source of oil supply.
- The great demand on Middle East production would bring a sharp reduction in the Middle East reserve-production ratio, if met.
- The sharp peak in Middle East production would not be allowed to occur. Intervening factors would include a desire by Arab countries to extend the lifetime of their one valuable resource and a cornering of the world energy market by Gulf producers for perhaps 10 to 15 years by limiting production.
- Only something approaching a sustained worldwide depression could reduce the growth of demand for Middle East oil to levels where the anticipated sellers’ market would be too weak to command substantially higher oil prices.

The magnitude of the changes anticipated cast doubt on the ability of the UPM system to provide realistic planning assumptions. How could it provide the right answer if the forecasts on which it was based were likely to be wrong? In 1971, Shell therefore decided to try scenario planning as a potentially better framework for thinking about the future than forecasts—which were now perceived as a dangerous substitute for real thinking in times of uncertainty and potential discontinuity. But Shell, like many large organizations, is cautious. During the first year, when scenario analysis was done on an experimental basis, the company continued to employ the UPM

system. In 1972, scenario planning was extended to central offices and certain large Shell national operating companies. In the following year, it was finally recommended throughout the group and UPM was then phased out.

## The Next Step

The scenario process started with the construction of a set of exploratory first-generation scenarios. As we have learned, it is almost impossible to jump directly to proper decision scenarios.

□ Scenario I was surprise-free, virtually lifted whole from the work done under the old UPM system. The surprise-free scenario is one that rarely comes to pass but, in my experience, is essential in the package. It

### What is predetermined and what is uncertain

Strictly speaking, you can forecast the future only when all of its elements are predetermined. By predetermined elements, I mean those events that have already occurred (or that almost certainly will occur) but whose consequences have not yet unfolded.

Suppose, for example, heavy monsoon rains hit the upper part of the Ganges River basin. With little doubt you know that something extraordinary will happen within two days at Rishikesh at the foothills of the Himalayas; in Allahabad, three or four days later; and at Benares, two days after that. You derive that knowledge not from gazing into a crystal ball but from simply recognizing the future implications of a rainfall that has already occurred.

Identifying predetermined elements is fundamental to serious planning. You must be careful, however. Paul Valéry, the twentieth-century French philosopher, said, "Un fait mal observé est plus pernicieux qu'un mauvais raisonnement." (A fact poorly observed is more treacherous than faulty reasoning.) Errors in futures studies usually result from poor observation rather than poor reasoning.

There are always elements of the future that are predetermined. But there are seldom enough of them to permit a single-line forecast that encompasses residual uncertainties. Decision makers facing uncertain situations have a right to know just how uncertain they are. Accordingly, it is essential to try to put as much light on critical uncertainties as on the predetermined elements. They should not be swept under the carpet.

builds on the implicit views of the future shared by most managers, making it possible for them to recognize their outlook in the scenario package. If the package only contains possibilities that appear alien to the participants, they will likely find the scenario process threatening and reject it out of hand.

□ Scenario II postulated a tripling of host-government tax take in view of the 1975 renegotiation of the Teheran Agreement (which set the take for OPEC) and anticipated lower economic growth and depressed energy and oil demand as a consequence.

□ Scenario III treated the other obvious uncertainty: low growth. Based on the 1970–1971 recession model, a proliferation of "me-first" values, and a growing emphasis on leisure, it assumed an economic growth rate only half of that projected under Scenario I, with a slowdown in international trade, economic nationalism, and protective tariffs. Low oil demand would limit oil price rises and lower producer government take.

□ Scenario IV assumed increased demand for coal and nuclear energy—at the expense of oil.

All four scenarios assumed that the tax take of the producer governments would be increased at the 1975 Teheran renegotiation (see *Exhibit II*).

### OK as numbers but—

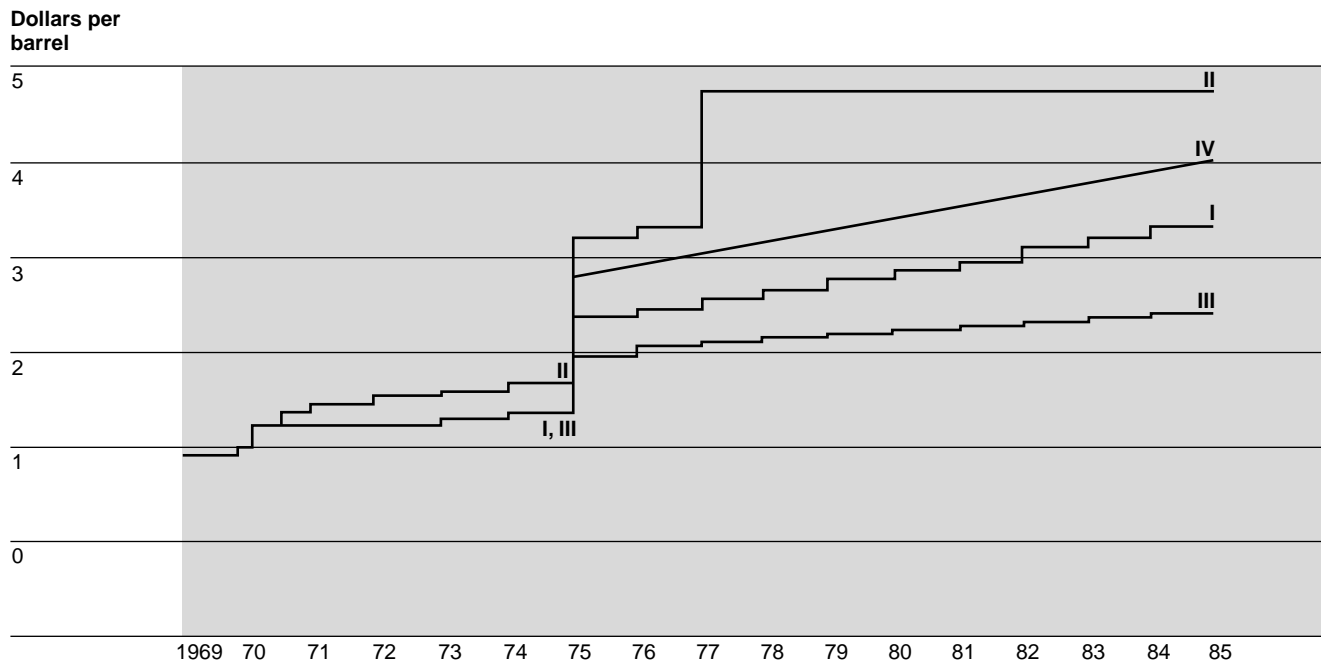
This set of scenarios seemed reasonably well designed and would fit most definitions of what scenarios should be. It covered a wide span of possible futures, and each scenario was internally consistent.

When the set was presented to Shell's top management, the problem was the same as in the French scenarios: no strategic thinking or action could be taken from considering this material.

Many companies reach this same point in planning scenarios. Management reaction? "So what! What do I do with scenarios?" And planners abandon the effort, often because they believe the problem is, in part, management's inability to deal with uncertainty.

Yet this group of Shell managers was highly experienced in dealing with risk and uncertainty. For example, many of the decisions they make deal with exploratory drilling, a true uncertainty since you never know what you'll find until you drill. They must often decide whether to risk \$5 million or \$50 million on exploration projects and distinguish the risks, say, in Brazil or the North Sea. What was so different about the uncertainties of scenarios? Quite simply, they needed structuring. In oil exploration, there were theories to call on, concepts to use, an organized body of geological and geophysical analyses, comparisons with similar geological structures, and ways to spread the risk that were familiar to

## Exhibit II    Producer government take\* 1970–1985



\*Constant 1970 dollars

the decision maker. The first-generation scenarios presented the raw uncertainties but they offered no basis on which managers could exercise their judgment. Our next task was to provide that basis so that executives could understand the nature of these uncertainties and come to grips with them.

The goal of these exploratory first-generation scenarios is not action but understanding. Their purpose is to give insight into the system, to identify the predetermined elements, and to perceive connections among various forces and events driving the system. As the system's interrelatedness became clear, we realized that what may appear in some cases to be uncertain might actually be predetermined—that many outcomes were simply *not* possible.

These exploratory scenarios were not effective planning devices. Without them, however, we could not have developed the next generation of scenarios.

### What Will Happen—What Cannot

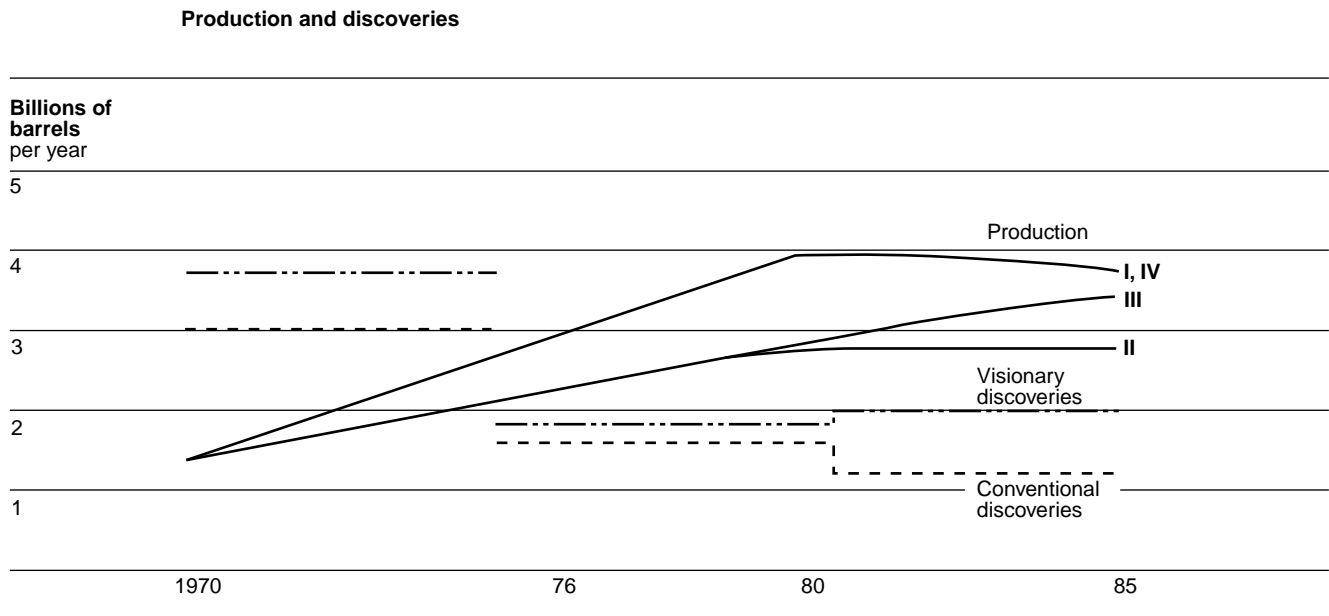
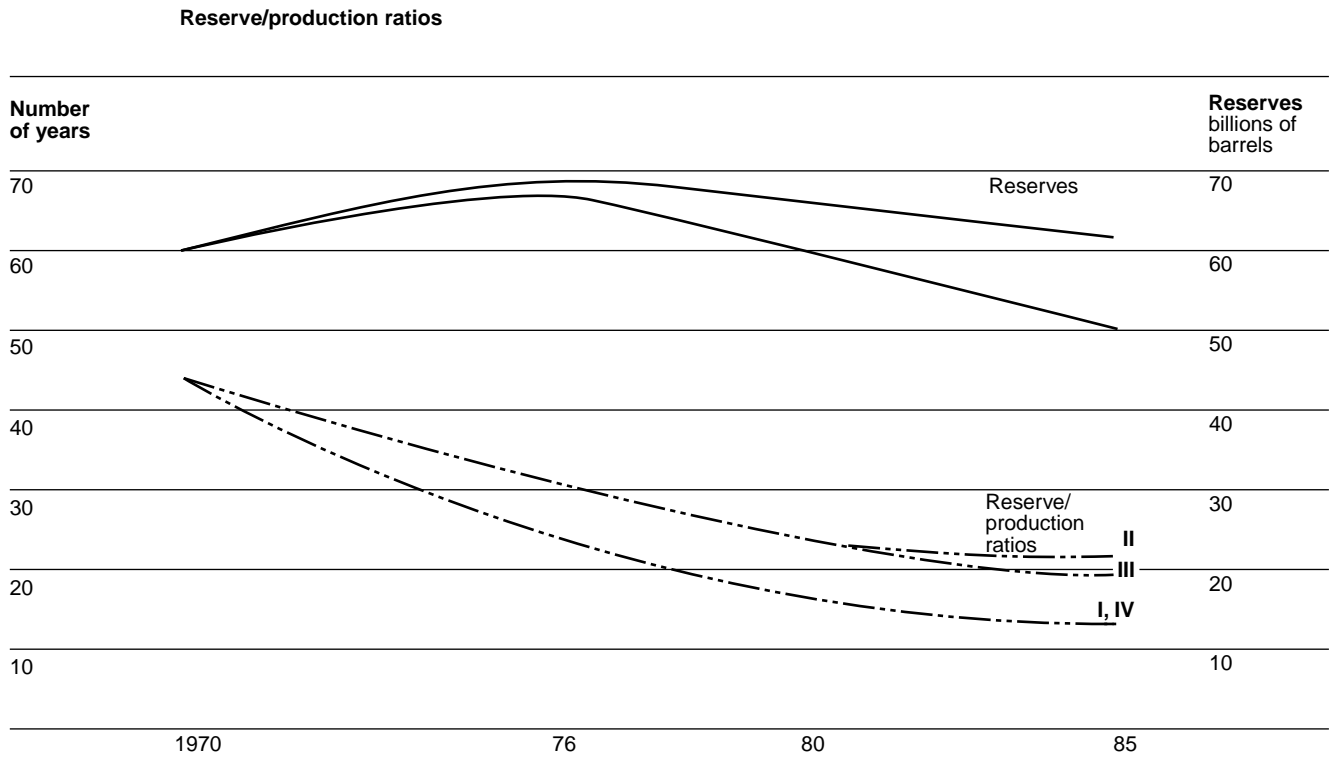
To understand the fluctuations that give the oil system its character and determine its future, we had to understand the forces that drive it. Work on

the next set of scenarios began with a closer look at the principal actors in Shell's business environment: oil producers, consumers, and companies. Because self-interest determined the fundamental concerns of these groups, significant behavioral differences existed. So we began to study the characters on the stage and how they would behave as the drama unfolded.

In analyzing the major oil-producing countries one by one, for example, it was clear that Iran's interests differed from Saudi Arabia's or Nigeria's and that their strategies would reflect these differences. The lower panel of *Exhibit III* shows Iran's oil production as its share of projected oil demand under each of the 1971 scenarios, as well as discovery rates and additions to reserves. For the first five years, we expected that Iran's reserves would grow as the industry found more new oil than it would produce. For the second five years, we expected the situation to reverse and reserves to fall.

As the upper panel of *Exhibit III* shows, reserve-production ratios would drop rapidly under all scenarios. Our conclusion was that Iran would then strive to change its oil policy from one of expanding production to one of increasing prices and possibly

### Exhibit III Iran's production scenarios



Note: The conventional and visionary discoveries shown represent the average discovery rate for each of the three periods.

curbing production. Such a policy change would stem not from an anti-Western attitude but simply from the logic of national interest. If we were Iranian, we would behave the same way.

Saudi Arabia's situation was different. Except in the low-growth scenario, production would generate more revenue than the government could purposefully spend, even allowing for some "manageable"



surplus. We concluded that even though oil company logic would have the Saudis producing 20 million barrels per day by 1985, the government could not do so in good political conscience. It was no surprise when Sheikh Zhaki Ahmed Yamani, Saudi Arabia's minister for oil affairs, later remarked: "We should find that leaving our crude in the ground is by far more profitable than depositing our money in the banks, particularly if we take into account the periodic devaluation of many of the currencies. This reassessment would lead us to adopt a production program that ensures that we get revenues which are only adequate for our real needs."<sup>2</sup>

We analyzed each of the producer countries according to their oil reserves and their need and ability to spend oil income productively (Exhibit IV). When arrayed in the simple matrix shown in *Exhibit V*, the power that was to become OPEC emerged clearly: no nation had both ample reserves and ample absorptive capacity, that is, the motivation to produce these reserves. If Indonesia, with its large population and enormous need for funds, had Saudi Arabia's reserves, then the growth of demand foreseen under the first scenario might have developed. But such was not the case.

We then analyzed the oil-consuming countries and saw their annual increments in import requirements (see *Exhibit VI*). For many years, oil imports had increased at a rate of about one million barrels per day; then for a long time the rate was about two million barrels per day.

Suddenly, in the mid-1970s, oil imports were expected to increase annually at much higher rates. This change can be understood by looking at *Exhibit VII*, which shows the sources of energy supply in the United States, Western Europe, and Japan. In the United States, oil supply had peaked early, and the incremental demand for energy had been satisfied by natural gas. Because of its regulated price, however, natural gas production plateaued in 1972. Coal production might have increased, but in light of the forecasts of future nuclear power generation, coal resources were not being developed. Nuclear plants, however, were not functioning in sufficient numbers to meet the demand, which was increasing annually at a rapid pace. Since the base was so large to begin with, even a 3% or 4% increase in the U.S. energy demand would in turn demand a great deal of the only available incremental energy source—imported oil.

In Japan—then like a new continent emerging on the world economic map—circumstances were different. In 1953, as the U.S. occupation ended, Japanese industrial production was 40% of the United Kingdom's; in 1970, it was more than double. With

the economy growing by 11% or 12% a year, annual demand for oil increased by some 20%. The result: huge increases in oil imports.

Beyond the need to view each participant individually and as part of a group, we discovered that "soft" data were as important to us as "hard" data in analyzing outcomes. For example, because the Japanese become anxious when faced with a possible denial of imports, any tension over oil supply would be especially trying. Furthermore, they would project on multinational oil companies the type of behavior they expect from their own companies in a crisis: giving loyalty to the home country and ignoring the rest of the world. This attitude would add to the probable tension over oil supplies.

Having collected and analyzed hard and soft data, and in order to expand the number of predetermined elements and get at the core of what remained uncertain, we looked at:

- Oil demand by market class and at different rates of growth.
- The implications of high oil prices for each nation's balance of payments and inflation.
- The possible reactions of consumer governments to higher oil prices.
- Interfuel competition and the impact of higher oil prices.
- The changing "cut of the barrel."
- Construction of refinery, marine, and market facilities.

## The 1972 Scenarios

Having all these building blocks, we could begin to understand the forces driving the system. In response, we presented the revamped scenarios to Shell's top management as an array of possible futures, gathered in two families, A and B, in September 1972.\* The A-group timed an oil supply disruption to coincide with the scheduled renegotiation of the Teheran price agreement in 1975. (In reality, it came, of course, in the fall of 1973—after the imposition of the oil embargo.)

Most oil-producing countries would be reaching the technical limit of their capacities by 1976, while others would be reluctant to increase output further because of their inability to absorb the additional revenues. Accordingly, producer countries' oil prices would increase substantially by the end of 1975. Confronted with possible energy supply shortages and

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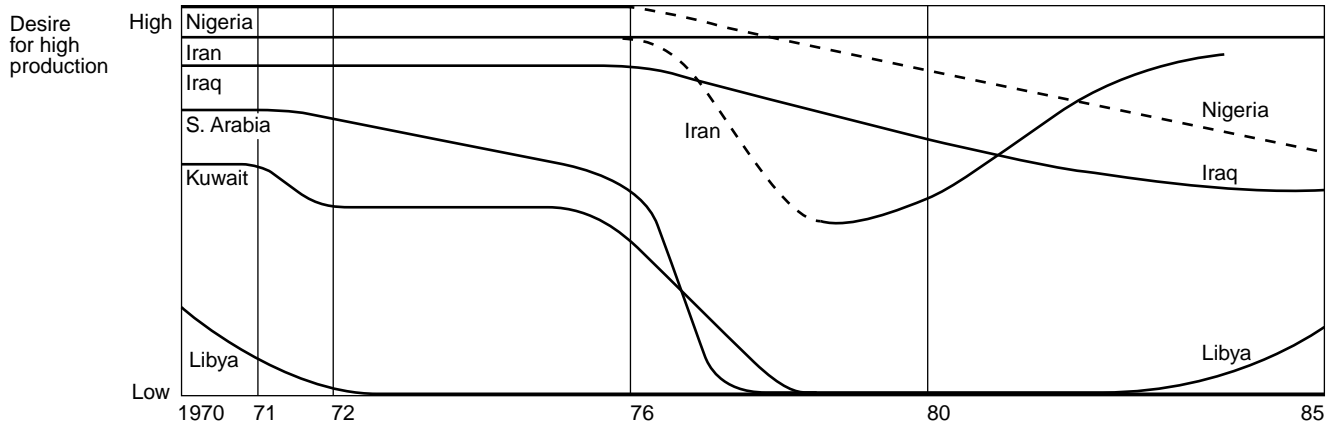
\**Author's note:* With hindsight, this set of scenarios was still clumsily designed. Six are far too many; they had no proper names to convey the essence of what drives each scenario. The sequel to this article will include a discussion of design.

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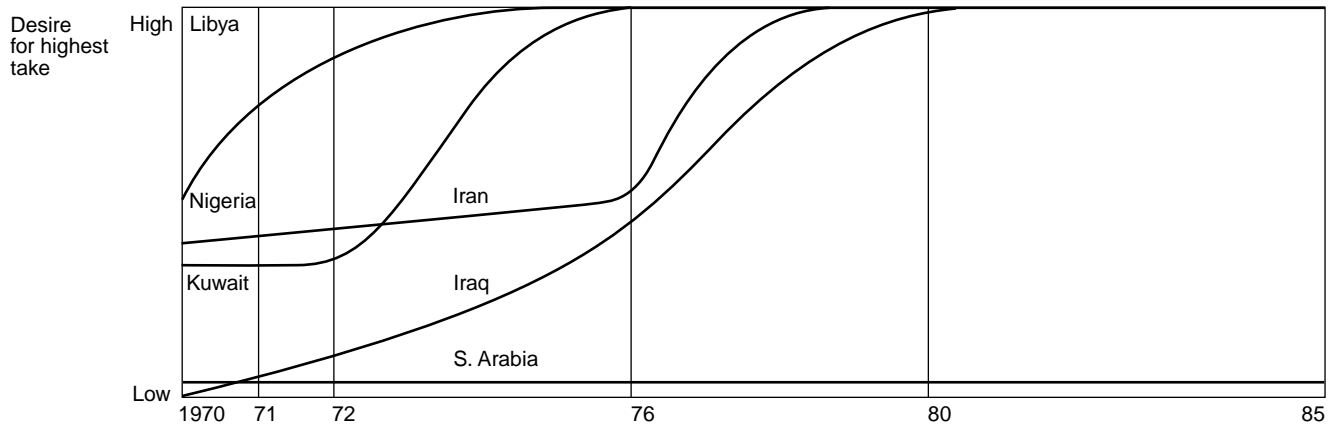
<sup>2</sup>Quoted in *Platt's Oilgram*, February 10, 1972.

## Exhibit IV How oil producers were motivated

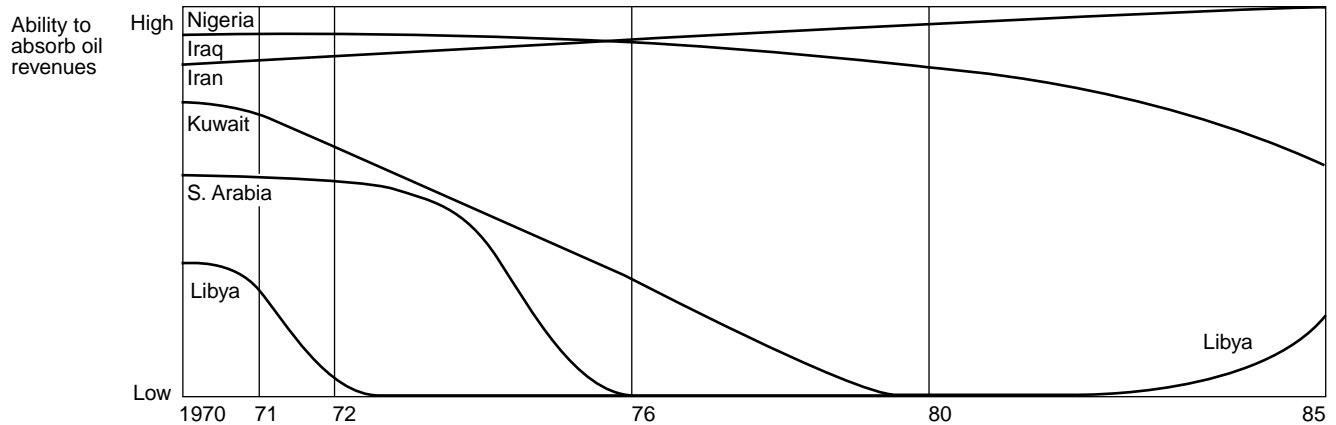
### Production motivation



### Take motivation



### Absorptive capacity



Note: The dotted lines show how a low take would affect Iran's production motivation and how low discoveries would affect Nigeria's production motivation.

## Exhibit V The major oil exporters

		Reserves	
		Limited	Ample
Absorptive capacity	Limited	<b>Group I</b> Libya Qatar	<b>Group III</b> Saudi Arabia Abu Dhabi Kuwait
	Ample	<b>Group II</b> Algeria Nigeria Venezuela Iraq Indonesia Iran	<b>Group IV</b>

increased oil import bills, consuming countries would feel economic shock waves.

Because we had identified a predetermined element, we used the A-family of scenarios to examine three potential solutions to the problems it presented: private enterprise (A1); government intervention, or *dirigiste* (A2); or none (A3), resulting in an energy crisis.

The A-family of scenarios emerged as the most likely outcome, but it varied sharply from the implicit worldview then prevailing at Shell. That view can be characterized loosely as “explore and drill, build refineries, order tankers, and expand markets.” Because it was so different, how could our view be heard? In response, we created a set of “challenge scenarios,” the B-family. Here the basic premise was that somehow, a sufficient energy supply would be available. The B-family scenarios would not only challenge the assumptions underlying the A-family but also destroy many of the business-as-usual aspects of the worldview held by so many at Shell (like their counterparts in other companies).

Under the B1 scenario, for example, some ten years of low economic growth were required to fit demand to the oil supply presumed available. While such low growth seemed plausible in the 1971 downturn, by 1972 signs of a coming economic boom began to show. B1 was also implausible since governments and citizens of industrialized countries viewed rising unemployment as unacceptable and would consciously seek growth no matter what. The implausibilities under B1 made the inevitability of a major disruption more plain to managers.

B3 was also an important educational tool because it postulated a very high supply of oil as a way to avoid major change. We called it the “three-miracles” scenario because it required the simultaneous occurrence of three extremely unlikely situations. The first was a miracle in exploration and production. The Shell exploration and production staff estimated a 30% chance that the reserves necessary to meet 1985 demand would be found in each of the oil provinces individually, but only a very small chance that these high reserves would be found in all areas simultaneously. Meeting the forecast 1985 demand under B3 would require not only 24 million barrels daily from Saudi Arabia, but also 13 million barrels from Africa and 6 million barrels from Alaska and Canada—clearly an impossibility.

The second miracle was sociopolitical: B3 foresaw that all major producing countries would happily deplete their resources at the will of the consumer. Countries with low capacities to absorb the excess revenue would agree to produce huge amounts of oil and put their money in the bank, exposed to the erosion of inflation, rather than keep it in the ground. That miracle projected the values of consuming countries onto oil producers—a kind of Western cultural imperialism that was extremely unconvincing, even to the most expansion-minded manager.

The final miracle started with the recognition that no capacity would be left above projected demand. Previously, when minor crises developed, additional oil was always available to meet sudden short-term needs. Under B3, however, there would be no spare production capacity. The miracle then was that there would be no need for it—no wars in the region, no acts of God, no cyclical peaks of demand higher than anticipated. Again, this was nothing short of miraculous. The improbability of B3 forced Shell management to realize how disruptive the change in their world would be.

B2 was a totally artificial construct. It premised that—despite all the problems—the world would muddle through. This reflects the sentiment that, as William Ogburn said, “There is much stability in society. . . . Social trends seldom change their directions quickly and sharply. . . . Revolutions are rare and evolution is the rule.” We couldn’t rationally justify this scenario, but we realized that the worst outcome does not always develop. So we imagined a B2 scenario in which everything positive was possible. Oil producers would live and let live to obtain concessions from the consumers who, in turn and with great foresight, would immediately curb oil consumption.

We quantified both the A- and B-family scenarios in terms of volume, price, impact on individual oil producers and consumers, and interfuel competition.

## Exhibit VI Annual growth in import requirements

Barrels  
per day  
millions

5

4

3

2

1

0

1957-60

61-63

64-66

67-69

70

71

72

73

74

75

76

77

78-80

North America



Japan



Rest



Western Europe



Note: The import requirements shown for 1957 through 1972 are actual; requirements shown for 1973 through 1980 represent the surprise-free consensus forecast. Data for the years 1957-1960, 1961-1963, 1964-1966, 1967-1969, and 1978-1980 represent averages.

Our presentation gained the attention of top management principally because the B-family of scenarios destroyed the ground many of them had chosen to stand on. Management then made two decisions: to use scenario planning in the central offices and the larger operating companies and to informally advise governments of the major oil-consuming countries about what we saw coming.

We made a series of presentations to the governments of the major consuming countries and stressed the coming disruption by tracing its impact on their balance of payments, rates of inflation, and resource allocation.

### Banging the drum quickly

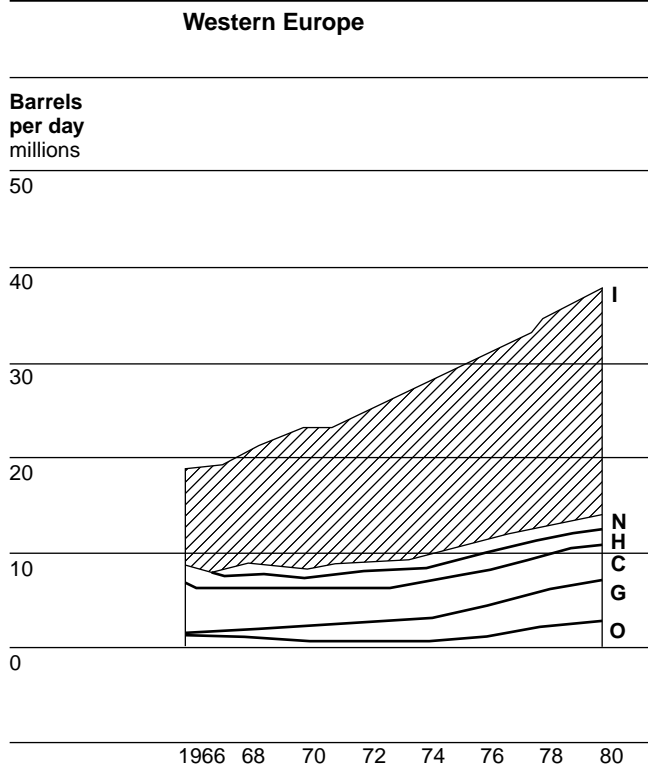
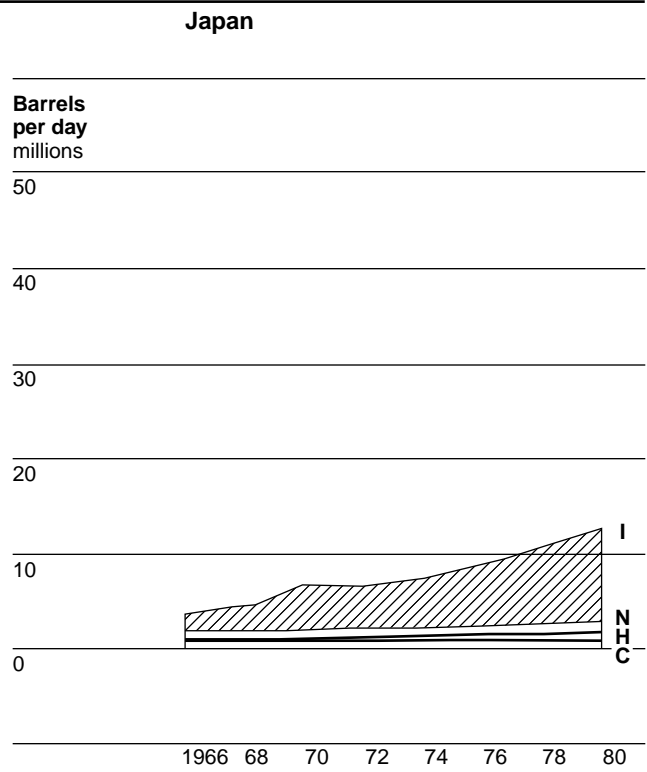
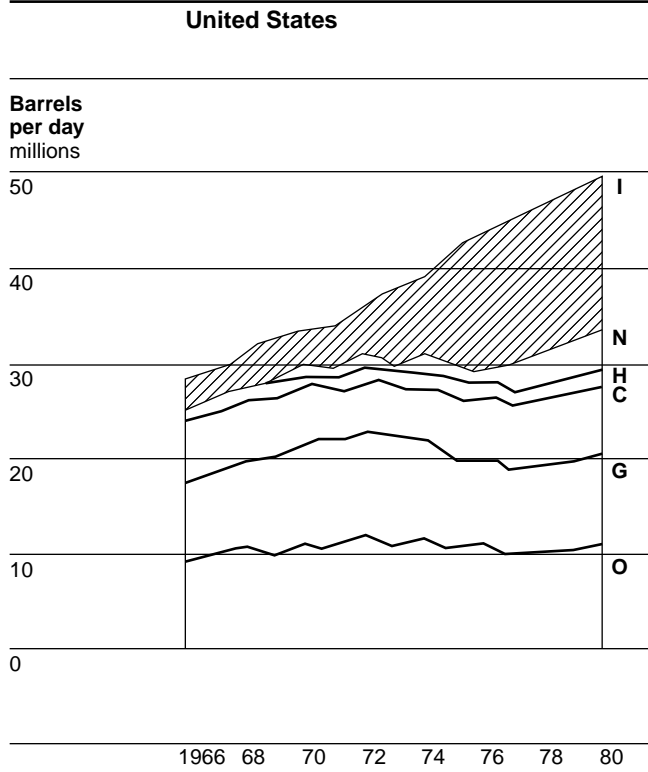
Shell first asked its major downstream operating companies to evaluate current strategies against two A-type scenarios, using the B2 scenario as a sensitiv-

ity check. By asking "what if," the B2 checked strategies already conceived in another conceptual framework (the A-family).

To this intent, we presented the A and B scenarios to the second echelon of Shell's management—its first exposure to scenarios. The meetings stood in stark contrast to traditional UPM planning sessions, which dealt out forecasts, trends, and premises—all under an avalanche of numbers. The scenarios focused less on predicting outcomes and more on understanding the forces that would eventually compel an outcome; less on figures and more on insight. The meetings were unusually lengthy and the audience clearly appreciative. We thought we had won over a large share of these managers.

The following months would show, however, that no more than a third of Shell's critical decision centers were really acting on the insights gained through the scenarios and actively preparing for the A-family

## Exhibit VII Energy demand by sources



I = Imported energy

Indigenous

N = nuclear

H = hydroelectricity

C = coal

G = natural gas

O = oil

Note: The energy demand shown for 1966 through 1972 is actual; demand shown for 1974 through 1980 represents the surprise-free consensus forecast.

of outcomes. The scenario package had sparked some intellectual interest but had failed to change behavior in much of the Shell organization. This reaction came as a shock and compelled us to rethink how to design scenarios geared for decision making.

Reality was painful: most studies dealing with the future business environment, including these first scenarios, have a low "existential effectiveness." (We can define existential effectiveness as single-mindedness, but the Japanese express it much better: "When there is no break, not even the thickness of a hair, between a man's vision and his action.") A vacuum cleaner is mostly heat and noise; its actual effectiveness is only around 40%. Studies of the future, particularly when they point to an economic disruption, are less effective than a vacuum cleaner.

If your role is to be a corporate lookout and you clearly see a discontinuity on the horizon, you had better learn what makes the difference between a more or a less effective study. One of the differences involves the basic psychology of decision making.

Every manager has a mental model of the world in which he or she acts based on experience and knowledge. When a manager must make a decision, he or she thinks of behavior alternatives within this mental model. When a decision is good, others will say the manager has good judgment. In fact, what has really happened is that his or her mental map matches the fundamentals of the real world. We call this mental model the decision maker's "microcosm"; the real world is the "macrocosm."

There is also a corporate view of the world, a corporate microcosm. During a sabbatical year in Japan, for example, I found that Nippon Steel did not "see" the steel market in the same way as Usinor, the French steel giant. As a result, there were marked differences in the behavior and priorities of the two corporations. Each acted rationally, given its worldview. A company's perception of its business environment is as important as its investment infrastructure because its strategy comes from this perception. I cannot overemphasize this point: unless the corporate microcosm changes, managerial behavior will not change; the internal compass must be recalibrated.

From the moment of this realization, we no longer saw our task as producing a documented view of the future business environment five or ten years ahead. Our real target was the microcosms of our decision makers: unless we influenced the mental image, the picture of reality held by critical decision makers, our scenarios would be like water on a stone. This was a different and much more demanding task than producing a relevant scenario package.

We had first tried to produce scenarios that we would not be ashamed of when we subsequently

compared them with reality. After our initiation with these first sets of scenarios, we changed our goal. We now wanted to design scenarios so that managers would question their own model of reality and change it when necessary, so as to come up with strategic insights beyond their minds' previous reach. This change in perspective—from producing a "good" document to changing the image of reality in the heads of critical decision makers—is as fundamental as that experienced when an organization switches from selling to marketing.

## The 1973 Scenarios—The Rapids

More than 20 centuries ago, Cicero noted, "It was ordained at the beginning of the world that certain signs should prefigure certain events." As we prepared the 1973 scenarios, all economic signs pointed to a major disruption in oil supply. New analyses foretold a tight supply-demand relationship in the coming years.

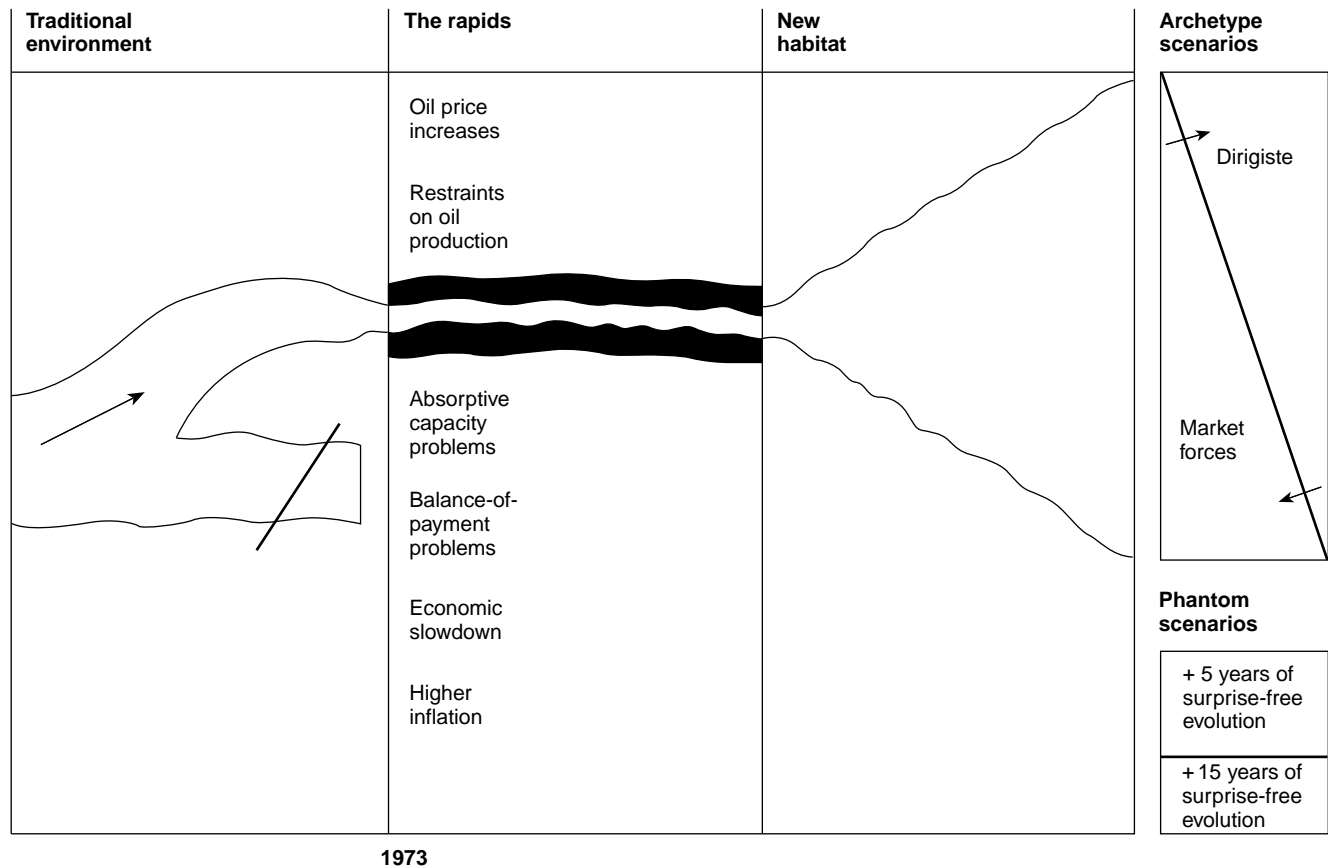
Now we saw the discontinuity as predetermined. No matter what happened in particular, prices would rise rapidly in the 1970s, and oil production would be constrained—not because of a real shortage of oil but for political reasons, with producers taking advantage of the very tight supply-demand relationship. Our next step was to make the disruption into our surprise-free scenario. We did not know how soon it would occur, how high the price increase would be, and how the various players would react. But we knew it would happen. Shell was like a canoeist who hears white water around the bend and must prepare to negotiate the rapids.

To help reframe our managers' outlook, we charted the 1973 scenarios (*Exhibit VIII*). From the calm upriver of the traditional environment, the company would plunge into the turbulence of the rapids and have to learn to live in a new habitat.

We could eliminate some of the original scenarios. We could dam off the alternate branch of the river (the B-family scenarios of 1972). The no-growth-no-problem scenario (B1) was clearly implausible as economies, fully recovered from the 1971 recession, boomed. The three-miracles scenario (B3) remained just that—three supply miracles. Finally, our discussions with governments about the impending crisis had allowed us to conclude that their reaction would occur only after the fact. (Obviously, we hadn't yet learned how to affect governmental microcosms.)

Because the B-branch of the river was dammed, we needed to explore other potential streams that dovetailed with management's current optimism, an optimism based on the booming economy of late

## Exhibit VIII 1973 scenarios



1972 and early 1973—in which growth exceeded that of any period since the Korean War. In an oil company having an affair with expansion, many executives were naturally reluctant to slow or suspend the expansion of refineries, the building of tankers, and so forth. In response, we created two “phantom” scenarios—alternatives to our main scenarios but ones we considered illusions. In Phantom Scenario I, we assumed a delay of 5 years in the onset of the disruption; in Phantom II, 15 years. (These represented typical times needed to first, bring a new oil facility into service and second, amortize it.) These phantom scenarios were used to measure the “regret” Shell would feel if it planned for a discontinuity that never occurred for 5 or even 15 more years.

Only two developments could delay the inevitable and both were ruled out: (1) the discovery of new Middle East-sized oil reserves in an area that would have no problem in absorbing revenues, or (2) political or military seizure and control of producers by consuming countries.

### More than water on a stone

On the surface, the 1973 scenarios seemed much like the A-scenarios constructed in 1972. Driven by a new sense of urgency, however, we saw them in a different light. The time we had to anticipate, prepare for, and respond to the new environment had shrunk greatly.

More important, we wanted the 1973 scenarios to be more than water on a stone: we wanted to change our managers’ view of reality. The first step was to question and destroy their existing view of the world in which oil demand expanded in orderly and predictable fashion, and Shell routinely could add oil fields, refineries, tankers, and marketing outlets. In fact, we had been at this job of destruction now for several years.

But exposing and invalidating an obsolete worldview is not where scenario analysis stops. Reconstructing a new model is the most important job and is the responsibility of the managers themselves.

The planners' job is to engage the decision makers' interest and participation in this reconstruction. We listen carefully to their needs and give them the highest quality materials to use in making decisions. The planners will succeed, however, only if they can securely link the new realities of the outside world—the unfolding business environment—to the managers' microcosm. Good scenarios supply this vital "bridge"; they must encompass both managers' concerns and external reality. Otherwise, no one will bother to cross the bridge.

If the planners design the package well, managers will use scenarios to construct a new model of reality by selecting from them those elements they believe relevant to their business world. Because they have been making decisions—and have a long track record to show that they're good at it—they may, of course, not see any relevant elements. Or they may go with what their "gut" tells them. But that should not discourage the planner who is drawing up the scenario.

Just as managers had to change their worldview, so planners had to change the way they viewed the planning process. So often, planning is divorced from the managers for whom it is intended. We came to understand that making the scenarios relevant required a keener knowledge of decision makers and their microcosm than we had ever imagined. In later years, we built some bridges that did not get used. The reason for this failure was always that we did not design scenarios that responded to managers' deepest concerns.

### Building blocks for new microcosms

In developing the 1973 scenarios, we realized that if managers were to reframe their view of reality, they would need a clear overview of a new model. *Exhibit IX*, one way to portray that model, summarizes the anticipated business environment and its key elements: the predetermined events, which are shown on the left, and the major discontinuities, which are shown in the center.

We focused attention on the following features of the business environment (shown in *Exhibit IX*):

□ Alternative fuels, which we could develop only very slowly. Even under a wartime crash development program, none could be available before the 1980s. We analyzed the cost in three stages. First, even though other fuels might replace oil for generating power and steam in large industrial settings, the oil-producing nations would not be impressed. On the contrary, they welcomed the alternative of coal and nuclear power in what they considered low-value

markets. Second, oil used for heating was a different story. Burning coal was not a satisfactory alternative. You would have to gasify or transform coal into electricity, with accompanying thermodynamic loss. The price for this alternative was high; the price for oil would not exceed this threshold in the near future. The third possibility, oil used in transport, had an even higher fuel cost than oil used for heating and was obviously irrelevant.

□ Accidents, which included both political and internal and physical incidents, are events that any oil executive considers a matter of course. In the same way, a Filipino knows that a roof must be built carefully; even though the weather in the Philippines is usually balmy, typhoons are frequent enough that the only uncertainty is when the roof's strength will be tested.

□ Negative supply elasticity, which means that unlike other commodities the supply of oil does not increase with increases in its price, at least for a number of years. On the contrary, the higher the price, the lower the volume of oil it would be in the interest of the major exporting countries to produce.

As planners at the center of a diverse group of companies, we faced a special problem beyond the construction of a new worldview. We had to make its message useful not only to managing directors but also to operating companies from Canada to Germany, Japan to Australia. And yet the dramatic changes we anticipated would affect each differently. What basic message could we convey to all of them?

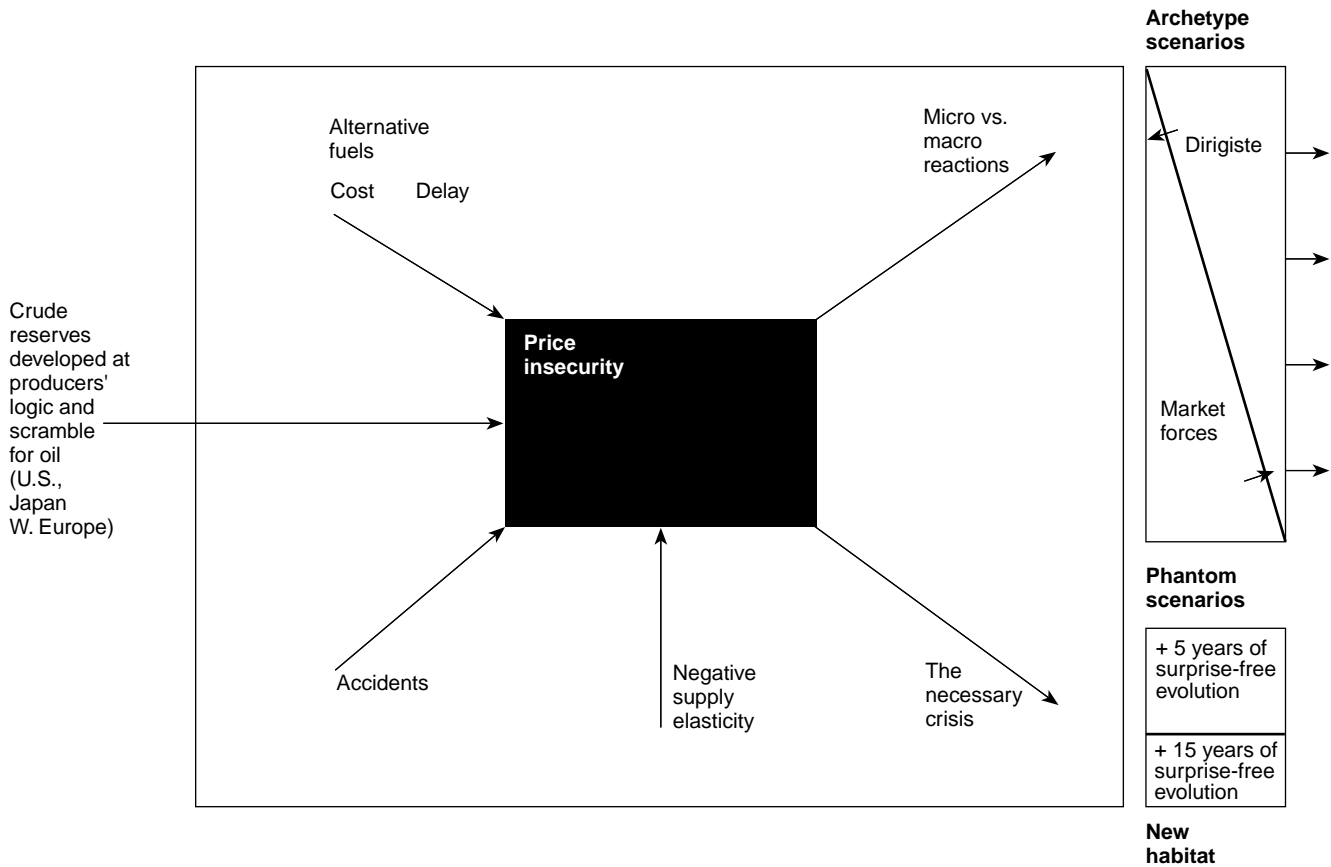
To construct a framework for the message, we borrowed the concept of archetypes from psychology. Just as we often view individuals as composites of archetypes (for example, part introvert and part extrovert), so we developed governmental archetypes to help us examine differing national responses. In our view, nations would favor either a market-force or government-intervention (*dirigiste*) approach. No country would follow one path exclusively. We expected, for example, that West Germany's response would be more market oriented, whereas France's would be more *dirigiste*. We analyzed the actions anticipated under each archetypal response in terms of price increases, taxes, alternative fuel development, and regulations by market class.

### We Led the Managers to Water . . .

While we didn't fully comprehend that influencing managers required a tailor-made fit between the scenarios and their deepest concerns, we knew intu-



**Exhibit IX A new worldview**



itively that events in 1973 gave us this fit in several ways. The arrows on the right side of *Exhibit IX* symbolize four of the implications stressed.

We told our upstream managers, engaged in exploration and production, that the unthinkable was going to happen: "Be careful! You are about to lose the major part of your concessions and mining rents." The traditional profit base in the upstream world would be lost and new relationships would have to be developed between the company and producing nations.

To the downstream world of refiners, transporters, and marketers, we said something equally alarming: "Prepare! You are about to become a low-growth industry." Oil demand had always grown more rapidly than GNP, something Shell's management took for granted. In the past, we did not have to consider the consequences of overinvestment; one or two years of normal market growth would cure any premature moves. Now oil consumption in industrial countries would increase at rates less than the increase in GNP,

and Shell would have to develop new instincts and reflexes to function in a low-growth world.

A third serious implication was the need to further decentralize the decision-making and strategic process. One basic strategy would no longer be valid for operating companies in most parts of the world. Shell companies had generally—and successfully—aimed for a higher share of conversion in refineries than did the competition. Now we understood that the energy shock would affect each nation so differently that each would have to respond independently. Shell, which was already decentralized compared with other oil majors, did in fact decentralize further, enabling it to adjust faster to the turbulence experienced later. (For some time now, it has been the most decentralized of all the major oil companies.)

Finally, we made managers see that because we didn't know when the disruption would come, they should prepare for it in different phases of the business cycle. We developed three simulations. In the first, the oil shock occurred before the cyclical down-

turn; in the second, the events were simultaneous; and in the third, the oil shock followed the downturn. These simulations led us to prepare for a far more serious economic decline than might otherwise have been expected.

### . . . and most finally drank

We hit planning pay dirt with the 1973 scenarios because they met the deepest concerns of managers. If any managers were not fully convinced, the events of October soon made them believers. We had set out to produce not a scenario booklet simply summarizing views but a change in the way managers view their world. Only when the oil embargo began could we appreciate the power of scenarios—power that becomes apparent when the world overturns, power that has immense and immediate value in a large, decentralized organization.

Strategies are the product of a worldview. When the world changes, managers need to share some common view of the new world. Otherwise, decentralized strategic decisions will result in management anarchy. Scenarios express and communicate this common view, a shared understanding of the new realities to all parts of the organization.

Decentralized management in worldwide operating companies can adapt and use that view for strategic decisions appropriate to its varied circumstances. Its initiative is not limited by instructions dictated from the center but facilitated and freed by a broad framework; all will speak the same language in adapting their operations to a new business environment. Companies from Finland to New Zealand now knew what “the rapids” meant, were alert to the implications of producer logic, and recognized the need to prepare for a new environment.

From studying evolution, we learn how an animal suited to one environment must become a new animal to survive when the environment undergoes severe change. We believed that Shell would have to become a new animal to function in a new world. Business-as-usual decisions would no longer suffice.

In the next installment, I will discuss how we adapted the technique to develop scenarios for the short term. As the time span between decisions steadily became shorter, this refinement became necessary.

## What executives expected from the 1970s

National income in current dollars will increase at roughly the same rate in the 1970s as in the 1960s.

Industrial production will grow more slowly in the 1970s. . . the service sector will continue to outpace the rest of the economy and industrial production will shrink from the 60% growth of the last decade to 55% in this decade.

Government spending will continue to increase both absolutely and relatively, despite slower growth in the defense sector. Government's share of national output will grow from its current 25% to 30% in the 1970s, and, by 1980, purchases of goods and services at federal, state, and local levels should reach \$500 billion in a \$1,700 billion economy.

Inflation will not be any worse than it is right now. But it will remain a problem throughout the decade . . . with an average annual rate of nearly 4½%. This rate is slightly more pessimistic than economists' projections and is roughly 50% higher than the 3% average during the 1960s.

Unemployment may be somewhat more of a problem in the 1970s than it was in the past decade. While the average rate was about 5% in the 1960s, the average for this decade may be closer to the present 5½% rate. However, businessmen still expect cyclical recurrences of labor shortages similar to those which prevailed in 1968–1969.

Corporate profits may not keep pace with national income. Profits are the most volatile component of national income accounts, and the HBR panel's overall profit pessimism is consistent with its predictions of national income and inflation.

Recessions will continue to be relatively mild. It seems unlikely that we will experience a downturn any more severe than that of 1960–1961, when industrial production dropped 9%. The economy has apparently become more “recession-proof” owing to increased government spending and the rapid growth of comparatively stable service industries.

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From Dean S. Ammer, “What Businessmen Expect from the 1970s,” HBR January–February 1971, p. 41.