
CHAPTER 14

**Future Prospects for
Technology Trade**

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Future Prospects for Technology Trade

Will technology trade with the Middle East continue to grow rapidly for the next decade, has it reached a plateau, or will it decline in the remainder of the 1980's and in the 1990's? OTA's analysis indicates that much slower growth of real exports to the Middle East in the period 1985-90 appears likely. This will be on the order of 2 to 5 percent per annum if Middle Eastern countries keep their imports within the bounds of their export earnings. For the decade 1990-2000, it is more difficult to predict trends, but stagnation in real exports seems likely.

In this chapter, OTA assesses prospects for future Middle East technology trade. Two scenarios, involving high and low U.S. export shares, are constructed. While the high export share scenario is theoretically possible, OTA concludes that it is much less plausible than a lower U.S. export share. In light of anticipated slow growth in the volume of overall exports to the Middle East, it is likely that the U.S. export share will decline from the roughly 18 percent share of industrial country exports held by U.S. firms in the past decade.

Politically, the Middle East has been the scene of much international conflict and rev-

olutionary ferment, and political factors will continue to exert strong influence over Middle Eastern technology trade. The potential exists for conflicts that could affect trade as catastrophically as the Iranian revolution or the Iran-Iraq War; such conflicts have generally reduced civilian technology trade. The Arab-Israeli conflict, internal revolutions, great-power tensions, and local wars all have the potential for trade disruption.

The rapidly developing economies of the region have already achieved substantial economic complexity and will continue to develop in the future for two basic reasons: 1) the process under way has already built up a certain momentum, and 2) resources will continue to be provided by the oil sector. On these points economists generally agree, although they disagree about how difficult it will be to make a variety of adjustments which are being forced on Middle Eastern economies by events in the international oil economy and by structural changes in their domestic economies.'

¹For example, Wharton Econometric Forecasting Associates, *Middle East Economic Outlook*, April 1983; Jahangir Amuzegar, *Oil Exporter's Economic Development in an Interdependent World*, International Monetary Fund, April 1983.

THE VOLUME OF TECHNOLOGY TRADE

In assessing prospects for technology trade, the principal uncertainties concern: 1) what the growth of real oil revenues will be in the coming decade for each of the producers; 2) how much drawdown of foreign investment and use of trade deficits there will be; 3) how the nonoil sector in the Gulf countries will manage the transition from infrastructure development to a more diversified manufacturing economy (or, indeed, if such a transition will be made); and 4) how effective the industrial rationalization programs of Egypt and Algeria and the post-

war industrial reconstruction programs of Iraq and Iran may be.

FORECASTING OIL EXPORT REVENUES

The level of Middle Eastern oil revenues will be one of the key determinants of technology trade during the next decade. Forecasting developments in world oil markets and their effects on Middle Eastern oil revenues is an enterprise subject to great error, and OTA does

not undertake it in this report. Instead, we review several of the basic forces that drive the oil market in order to provide a rough approximation of the likely range of oil revenues of the Middle East.

The oil-exporting countries of the Middle East must determine individually and as part of OPEC how much of their depletable oil resource to ship during any given period to meet national objectives of current consumption and future income growth. Oil left in the ground constitutes a speculation on its future price. Keeping it there does not earn current income, in contrast to selling it and investing the proceeds in interest-bearing bonds or in economic development projects. There is a "capital gain" from leaving the oil in inventory if it will command a higher price when sold in the future. At any point in time, the expected capital gain may constitute an attractive enough return to make keeping the oil in the ground a rational investment decision.

Increases in the real price of oil are, in fact, to be expected in the long run because of the way oil owners attempt to manage their exhaustible asset.¹ The removal of any barrel from the ground increases the value of each barrel remaining there, everything else being equal. From the narrow investment point of view, the production rate of oil should be set so as to increase its value in the ground at the rate that would maximize the expected present value of future returns. When the production rate is optimized in this way, everything else equal the real price rises, as withdrawals from reserves add value to the remaining reserves. Most actual projections of oil prices, in fact, take this into account and project rising real prices at least in the longer term.

The world is more complicated than the abstract investment model in many different ways, however. Governments must make deci-

sions about what fraction of oil revenues to allocate among current consumption, foreign investment, and domestic capital formation. How the benefits are distributed among various groups of the population is invariably a key element in domestic politics and therefore enters the decision process. The international political dimensions are also important because countries use their oil wealth to gain international power and prestige and to develop military strength.

At least for particular member countries, OPEC production decisions are also an important determinant of production rates. Such production rates are the subject of negotiation within the cartel and governments take them very seriously. Iran, for instance, despite the bitter war, continues to participate fully in OPEC along with Iraq and its Arab allies. How much impact OPEC has on overall production and prices in the long run, however, is subject to debate, since actual production rates differ substantially from those agreed on.

On the demand side, important factors that must be taken into account in making forecasts of prices and production rates in the next decade are: first, the delayed effects of the 1979 oil price rise on the miles-per-gallon characteristics of the stock of transportation vehicles and the efficiency of stationary industrial energy uses (in other words, conservation); and second, the rate of economic growth in the industrial countries.³

A number of forecasting groups have recently attempted to take all these elements into account and make medium- and long-term oil price and production forecasts. Table 113 lists a selection of forecasts made in 1983 by various energy forecasting groups and compiled by the Department of Energy (DOE).⁴ Most

¹For classic references on the economics of exhaustible resources, see Harold Hotelling, "The Economics of Exhaustible Resources," *Journal of Political Economy*, vol. 39, April 1931, pp. 137-175; and Robert M. Solow, "The Economics of Resources and the Resources of Economics," *American Economic Review*, vol. 64, May 1974, pp. 1-14.

³Estimates of the changes in transportation energy use efficiency and price and income elasticities of transportation energy demand for the United States are presented in Douglas L. Adkins, "Forecasting Transportation Demand for Petroleum: A New Generation of Econometric Models of Highway and Airline Industry Fuel Use," paper presented to the Transportation Research Board, National Research Council, January 1983.

⁴Department of Energy, Office of Policy, Planning, and Analysis, *Energy Projections to the Year 2010*, October 1983, tables 7-10, 7-11.

Table 11 3.—1983 Projections of the International Oil Price and OPEC Oil Production
(1982 dollars per barrel or million barrels per day)

Date forecast published	Forecasting group	1990		2000	
		Price	OPEC production	Price	OPEC production
6/83	Department of Energy, National Energy Policy Plan Scenario B	\$32	26	\$57	28
4/83	Energy Information Administration, Annual Energy Outlook Middle Scenario	37	27	59	—
2/83	Data Resources Inc.	36	26	51	—
6/83	Marine and Preckel, Stanford .,	36	23	58	25
2/83	Oil Company B	—	26	—	30
6/83	Oil Company C	—	21	—	27
2/83	Oil Company D	—	23	—	28
4/83	Chase Econometrics	34	—	42	—
4/83	Wharton Econometric Forecasting Associates	—	—	35	—
4/83	American Gas Association	37	—	45	—
1/83	Energy Study Centre	53	—	64	—

SOURCE Department of Energy Office of Policy Planning and Analysis Energy Projections to the Year 2010 October 1983 tables 710 and 711 See this source for a listing of the publications in which the above forecasts appeared

of the projected 1990 price forecasts fall in a narrow region of around \$35 per barrel (1982 dollars), and most of the 1990 OPEC production forecasts are approximately 25 million barrels per day (b/d), ± 2 million b/d. This range of forecasts is consistent with those of the International Energy Agency (IEA), which we used to make forecasts of Middle Eastern oil export revenues (table 114).

The record of the past 12 years leads us to be skeptical about all oil market forecasts. They are based on stated and unstated assumptions that are subject to change. For instance, the 1982 price forecasts for 1990, which are cited in the DOE report referenced above, are generally considerably higher than those published in 1983. The 1982 price softness in the oil market was the occasion for

Table 114.—Projected Middle East Oil Export Revenue^a

	1980	1983-	1985	1990	1995	2000
Real Oil price (1982 dollars):						
High revenue scenario ^b	\$36 ^c	\$28 ^c	\$32 ^d	\$37	\$43 ^e	\$49
Low revenue scenario ^f	36 ^g	28 ^c	30 ^d	30	30 ^e	30
Middle East oil exports (million barrels/day): ^g						
High revenue scenario .,	19C	10 ^c	16 ^d	18	16 ^e	14
Low revenue scenario	19C	10 ^c	18 ^d	20	21 ^e	22
Middle East oil export revenues (1982 dollars, billions):						
High revenue scenario	\$250	\$102	\$187	\$243	\$250	\$250
Low revenue scenario	250	102	197	219	230	241
Change in real revenues (percent per annum, average)	80-83%	83-85%	85-90%	90-95%	95-2000%	
High revenue scenario.	-29.9%	+ 30.3%	+ 5.2%	+ .6%	0%	
Low revenue scenario	-29.9%	+ 32.9%	+ 2.1%	+ 1.0%	+ 0.9%	

a ^{Source} East members of OPEC Saudi Arabia Iraq Iran Algeria, Kuwait, United Arab Emirates, Qatar and Libya The IEA projections of Middle East OPEC's share of total OPEC production were in the 78 to 81. percent range for the period

b OTA's high oil revenue scenario is the same as IEA's 'low demand scenario' combines low world economic growth and high oil price assumptions that in combination result in relatively low demand world economic growth —2.4 percent to 1985, 27 percent thereafter, real oil price — increase at 3.0% per annum after 1985

^c Actual price and output Dollar magnitudes converted to 1982 dollars using the GNP deflator (Source CIA, *International Energy Statistical Review* June 26 1984 pp 2-3, 19). Estimated exports of natural gas liquids added (Source *Middle East Economic Digest*, June 29 1984, p 15)

d IEA's 1985 Projections assume full European recovery from the recession. Since this may not characterize all of 1985, they may be better interpreted as indicating the rate of exports and the oil price when recovery is complete, rather than a forecast for calendar year 1985

e Interpolated

f OTA's low oil revenue scenario is the same as IEA's high demand scenario combines high world economic growth and low oil Price assumptions that in combination result in relatively high demand world economic growth—2.6 percent to 1985 32 percent thereafter, real oil price— constant after 1985

g Includes natural gas liquids. Inventory changes are not considered Derived from IEA projections of OPEC production under the low and high demand scenarios except that for 2000, IEA's estimate of the production under a 'maximum sustainable capacity' scenario (33 million b/d) is substituted for high demand estimate of 28 million b/d If OPEC production should be only 28 million b/d Middle East oil revenues would decline by 16 percent per annum in 1990-2000

SOURCE Based on International Energy Agency, *World Energy Outlook* Organization for Economic Cooperation and Development (Paris 1982) pp 23-26 80 460461 Dollar magnitudes converted to 1982 dollars using the GNP deflator (table B-3 Economic Report of the President March 1984)

forecasters to rethink their approaches to the forecasting problem, and they tended to move together in revising their forecasts downward.⁵ Although this tendency for forecasts to change as the current price of oil changes may stir skepticism, recent forecasts nevertheless represent the best current professional thinking.

With this caution in mind, OTA uses the IEA projections of world oil supply, demand, and price for 1985, 1990, and 2000 under two scenarios that combine plausible economic growth and oil price assumptions that would together produce high demand for oil, on the one hand, and low demand, on the other.

Table 114 contains historical data and presents projections of Middle Eastern oil export revenues based on IEA's two scenarios. After quintupling from 1973 to 1980,⁶ Middle Eastern real oil export revenues fell precipitously from 1980 to 1983 (at an annual average rate of 30 percent). Real 1983 revenues were only 41 percent of those of 1980.

OTA does not expect revenues to persist at this depressed level, however. Based on the IEA projections, OTA expects them to return to within the \$185 billion to \$197 billion per annum range by sometime in 1985, when the European economic recovery is complete. The rapid growth of revenues during this recovery period will reduce short-term pressure on the balances of payments of Middle Eastern countries. All forecasters expect rapidly increasing revenues to be only temporary, however—a reflection of the world economic recovery.

⁵For a worldwide survey of approximately 200 projections of the international oil price and of interregional oil and gas exports, see Alan S. Marine and Leo Schrattenholzer, "International Energy Workshop: A Summary of the 1983 Poll Responses," *The Energy Journal*, January 1984, pp. 45-54. Most of the projections reported in this article were done in the years 1981-83 and few are derived directly from formal models. Between the 1981 and 1983 polls, the median oil-price projection for the year 2000 declined 18 percent (p. 51). For a historical analysis of how U.S. energy projections made since 1950 for years in the 1980's have changed over the period, see DOE, op. cit., ch. 7.

⁶Derived from the sources cited in table 120. This growth in real revenues can be expressed as an average annual rate of 22.5 percent. The revenue increases, of course, occurred mainly in 1973 and 1979 and real declines occurred in other years.

A new era of slow growth or even slight decline of Middle Eastern oil revenues is expected to begin in the period beyond 1985 once recovery from the world recession has been completed. Even under the high revenue scenario, real export revenues in 1990 (\$243 billion) recover only to the 1980 level, staying roughly constant at that level through 2000.

Under the low revenue scenario, Middle Eastern oil export revenues never again reach the 1980 level. They increase slowly at 2 percent per annum during the 1985-90 period and even more slowly (at less than 1 percent per annum) during the 1990's.⁷

In summary, OTA's Middle Eastern oil revenue projections can be stated as follows:

- Vigorous near-term growth of revenues as economic recovery in the industrial countries takes place; real revenues, nonetheless, remain below the level of 1980.
- Slow growth in revenues from 1985 to 1990 at 2 to 5 percent per annum.
- Stagnation in the 1990-2000 period.

IMPACT ON TRADE

If exports of goods and services from the industrial countries to the Middle East grow relatively slowly, in the 2 to 5 percent per annum range that appears likely to be financed by oil exports from the Middle East, the new trade era will be completely different from that re-

⁷In IEA computer simulations, the economic growth and price assumptions are somewhat inconsistent in the 1990's. This is particularly evident in the high demand (low revenue) scenario, as the IEA points out, since the projections were based on the assumption that policies are unchanged. Changes in policies are, of course, difficult to forecast, but the IEA has also devised a reference set of plausible policy changes to promote inter-fuel substitution that would eliminate excess demand for oil in the 1990's at the scenario prices. An implicit assumption of the IEA high demand scenario, which OTA believes to be plausible enough to construct the scenario, is therefore that the prospect of higher oil prices will induce policy changes or conservation that, in absence of a serious supply disruption, will prevent prices from rising beyond the indicated levels. On the supply side, we use IEA's "maximum sustainable capacity" scenario in 2000 to indicate our belief that, given declining prospective oil revenues, Middle Eastern countries might attempt to increase production beyond the previously targeted levels and that this more plausibly sets an upper bound than IEA's low demand scenario for that year.

cently experienced. The contrast can be seen when one considers that Saudi Arabia's and Iraq's imports grew at over 25 percent per annum during the 1973-82 period (table 13, ch. 4), and that both Egypt's and Kuwait's grew at 17 percent per annum during the same period.

Certain Middle Eastern countries have the option of increasing trade at a rate much greater than the rate at which oil revenues increase because large trade deficits can be financed out of foreign investment earnings, by a drawdown of the investments themselves, or by credit based on investments. Nevertheless, in an era when Middle Eastern oil exports are growing slowly, it is unlikely that imports would grow at the phenomenal rates of the past,

The Middle Eastern oil exporters have recently demonstrated their ability to undergo massive current account deficits. The Middle East, as a whole, experienced a current account deficit of \$12 billion in 1983, and the International Monetary Fund forecasts a deficit of like amount in 1984.⁸

Whether or not the Middle Eastern oil exporters are "willing" to undergo such deficits is another question. Wharton Econometric Forecasting Associates expects the Saudi deficit to disappear in 1986.⁹ If so, it will be the combined effect of the world recovery and the determination of the Saudi Government to live within current resources.

Assuming that total imports of Middle Eastern countries over the next decade will be constrained by the growth of exports just as they are for most countries,¹⁰ annual imports

⁸International Monetary Fund, *World Economic Outlook*, Washington, D. C., 1984, table 17, p. 187.

⁹Wharton Econometric Forecasting Associates, *Middle East Economic Outlook*, April 1983, p. 111.

¹⁰"This is not to suggest a lock-step relationship between export earnings and the ability to import. Countries can finance trade deficits in a number of ways; nevertheless, for most countries export earnings are the principal source of ability to import. We should note that Egypt and Kuwait are partial exceptions to this. Egypt's import growth will also depend substantially on the growth of development assistance. For Kuwait, investment income will be of roughly equal magnitude to oil revenues, and growth in investment income will support growth in its imports.

will be likely to grow 2 to 5 percent per year until 1990 and then stagnate or possibly decline thereafter.

THE EFFECT OF OTHER SCENARIOS ON TRADE

OTA also considered the possibility of vastly different scenarios of oil prices and revenues and attempted to assess their impact on imports into the Middle East. A disruption scenario, such as the closing of the Strait of Hormuz or a revolution in Saudi Arabia, is a possibility. Since the world oil market is in a glut, and important non-Gulf producers, such as Nigeria, Mexico, and Libya, are standing by with excess capacity, such a disruption might have less of an impact on the price of oil than it would have had in earlier periods of market tightness.

Nevertheless, disruption in the flow of oil from the Gulf could lead to a substantial increase in the price of oil, which would depend on the size of the actual loss of supply.¹¹ This would reduce revenues of the disrupted countries but increase revenues of other Middle Eastern exporters.¹² What the net effect would be would depend on the characteristics of the disruption and the impact on the oil price, but a disruption in the Persian Gulf could negatively affect oil exports from four of the countries of major concern in this study—Iran, Iraq, Kuwait, and Saudi Arabia. "

¹¹"A major oil industry executive sees the political situation in the Middle East as the one thing that could have a dramatic effect on the world oil market. *New York Times*, Sept. 12, 1983, p. D1. See also, Congressional Research Service, "Western Vulnerability to a Disruption of Persian Gulf Oil Supplies: U.S. Interests and Options," Mar. 24, 1983; and J. S. Congress, office of Technology Assessment, *Strategic Responses to an Extended Oil Disruption*, forthcoming, 1984.

¹²We assume in the discussion that follows that both the short- and long-run price elasticities of demand are substantially less than one, so that an increase in price results in an increase in revenues and vice-versa.

¹³A disruption scenario involving non-Middle East developing-country producers, notably Mexico, Nigeria, Indonesia, and Venezuela, can also be constructed, but the potential impact of a disruption of any single country among them on the world oil economy during the next decade is limited. IEA expects all such countries together to produce only about one-fifth of world oil supply in 1990, of which about one-third would be produced by Mexico. A full disruption of Mexican supply would have sig-

A scenario of a fall in revenues owing to a large fall in the price of oil is also possible, although it is difficult to estimate how likely it is. This scenario would be based on the judgment that the current price of \$29 per barrel (1984 dollars), which is under market pressure at present, is not sustainable in the intermediate future, even with world economic recovery.¹⁴ Such a judgment depends in turn on other judgments about a number of fundamental questions, such as whether OPEC really has the power to effectively determine total world output and the international oil price and whether large new low-cost producers might appear on the scene.

If the \$29 price should fall significantly, because OPEC loses power or for another reason, oil revenues would fall substantially in the short run. If the inevitable long-run increase in the real price of oil from that level should also be held off by large new low-cost production being placed on the market at the lower price, the low price and revenues could persist through the next decade and beyond.

Neither of these widely divergent scenarios on the oil price would lead to total Middle Eastern oil revenues growing as rapidly in the future as they did in the 1970's. In the disruption scenario certain Middle Eastern countries would stand to increase revenues, but others would stand to lose. In the low-price scenario, all exporters would lose, and total Middle Eastern oil revenues would decline.¹⁵

Thus, one is left with a reasonably strong conclusion, taking into account the unlikely scenarios, that Middle Eastern oil revenues are unlikely to increase rapidly in the next decade. Such slower revenue growth is also likely to result in slowly growing Middle East imports from the industrial countries.

One implication of a new foreign exchange constraint on imports in capital-surplus countries is that Middle Eastern policymakers will have to face explicitly the tradeoffs between imports of consumer goods, raw materials, and capital goods for the first time in a decade. If machinery and equipment imports increase at a higher rate than total imports, imports of consumer goods and raw materials would have to increase at lower rates or might decrease.

The mechanisms for limiting imports in the face of limited oil revenues are basically two: a decline in the value of the currency, which makes imports more expensive and therefore less demanded, or a foreign exchange allocation scheme that politically and/or administratively determines who will be given the right to import. A marked reduction in imports of consumer goods, with or without large increases in their prices, would probably have unpleasant political ramifications that governments may not be prepared to shoulder. The unexpected slowdown in foreign exchange growth, therefore, brings a new and unpredictable politics of distribution among competing uses and groups.

THE IMPACT OF CHANGING ECONOMIC STRUCTURE ON TECHNOLOGY TRADE

The economic structure of the oil-exporting countries of the Middle East appears to be changing in several ways that will affect technology imports. The emphasis on investment in infrastructure¹⁶ projects that has characterized the economic development and technology transfer activities, particularly, of the capital-surplus countries is starting to give way to a new phase in which more official emphasis is being placed on the development of the

nificant impact on world oil prices and would increase Middle East oil export revenues, all else equal, but estimating this impact is beyond the scope of the present study.

¹⁴Significant real oil price declines in 1984 are indicated in an article on the international oil market (*New York Times*, July 7, 1984, p. 36) and add plausibility to this scenario.

¹⁵See footnote 12.

¹⁶Infrastructure refers to the type of economic activity that directly or indirectly provides generalized inputs, usually services, for other enterprises. Physical infrastructure is conventionally defined to include transportation, communications, power, water, and gas services. Social infrastructure, a looser term, is usually used to refer to education, health and the legal/regulatory apparatus of the society. Once defined as infrastructure, the service involved is usually measured in toto, whether or not it is provided to enterprises or to consumers directly.

manufacturing sector. In this transition, technology transfer will be increasingly important.

Continued Infrastructure Development

It would be a mistake to conclude that infrastructure development will not continue; the contracting emphasis may shift, however, to smaller and more specialized firms, with local firms playing a greater role.¹ Each of the countries OTA has examined now has a large domestic construction industry. In Saudi Arabia, for example, the construction industry (foreign and local firms participating) has been making a contribution to gross domestic product (GDP) more than four times the contribution of the manufacturing sector.

Kuwait continues to place heavy emphasis on telecommunications development. In Algeria and Egypt, considerable force seems to have developed behind continued airport expansion. In Iran and Iraq, destroyed or postponed infrastructure investments of all kinds may give rise to large new construction projects after the war. All countries continue to invest heavily in social infrastructure sectors such as medical services and education.

Considering the infrastructure projects already completed or under way in the region, operations and maintenance requirements for existing projects will also be a growing source of demand for technology imports. Thus, for many different reasons, including domestic politics, infrastructure development will continue to be a stimulus for large imports of machinery and technologies even if the manufacturing sector begins to grow more rapidly in many Middle Eastern countries.

¹ According to the *Middle East Economic Digest*, the share of contracts awarded to local and other Middle Eastern firms rose to a high of 22.9 percent of the total across all sectors in 1982 before declining to 15.6 percent in 1983. See *Contracts Awarded, Second Half, 1983*, p. 15. In March 1983, Saudi Arabia issued a royal decree requiring that foreign construction companies subcontract 30 percent of their work to Saudi firms.

² Wharton Econometric Forecasting Associates, *Middle East Economic outlook*, April 1983. The "manufacturing" sector includes a small nonpetroleum mining component.

The Expanding Manufacturing Sector

The expanding Middle East manufacturing sector will be a second important source of demand for technology imports in the next 15 years. All countries except Kuwait currently place substantial emphasis on official plans for the development of their manufacturing sectors, but they start from different positions.

In Saudi Arabia and the other capital-surplus countries of the Gulf the desired development of the manufacturing sector must expand from a small base. In Egypt, which already has a sizable, diversified, but inefficient, manufacturing sector dominated by public enterprises, the government seeks to rationalize and reinvigorate it. In Algeria, Iraq, and Iran, all of which have smaller, but also inefficient, manufacturing sectors, the empha-



Photo credit Middle East Economic Digest

Mercedes plant in Saudi Arabia

sis (post-Iraq-Iran War) will probably be on both renovation and expansion.

Despite the desires of planners, there is substantial uncertainty about how large machinery and technical services imports will be for Middle East manufacturing. The existing small manufacturing sectors of Saudi Arabia and Kuwait will probably maintain their current modest momentum of growth. (Real manufacturing output was growing at about 6 percent per annum in both countries in the early 1980's.¹⁹) But imports of technology to support continued growth at this rate would not result in a surge of technology trade in the next decade comparable to what infrastructure development produced in the last. Manufacturing growth would have to be much faster to boost the demand for technology imports in the manufacturing sector into a large fraction of the total.

Looking at the case of Saudi Arabia—by far the major U.S. trading partner in the region—a number of considerations are involved in whether Saudi Arabia will develop a manufacturing sector rapidly enough to generate a significant demand for equipment and technical service imports in the next decade.

The first consideration is technology absorption. Obstacles to absorption, discussed in chapters 2 through 10, are particularly pertinent to the development of the Saudi manufacturing sector. Manufacturing firms generally require greater adaptive technological capability than infrastructure enterprises do, and they also require marketing skills necessary to appeal to customers who usually have alternatives to any given company's manufacturing output. In relatively open economies, firms engaging in import substitution must be able to face competition from abroad. One critical area of uncertainty is whether technical and entrepreneurial skills will be adequate to meet these challenges.

A second consideration affecting how rapidly the Saudi manufacturing sector will grow

is whether other competing demands for foreign exchange will give way to demands from this new sector to finance technology and raw material imports. Perhaps the greatest unknown would be whether a primarily private nonoil manufacturing sector could compete successfully for scarce foreign exchange with government-led social and physical infrastructure projects.

Third, in an era of greater foreign exchange scarcity, the riyal exchange rate is likely to decline, and this would have a number of effects. The most powerful, perhaps, would be an increased incentive to manufacture import substitutes, since competing foreign goods would now be more expensive. To be sure, so would the imported inputs of the new manufacturing enterprises, but since the government currently subsidizes the local inputs of Saudi manufacturing enterprises—for instance, through subsidized credit and energy prices—a decrease in the exchange rate would undoubtedly still constitute a powerful incentive to expansion.

Fourth, import-substituting enterprises may be able to convince the government to protect them with tariffs and other trade barriers. Such measures might lure erstwhile foreign exporters to Saudi Arabia to set up local manufacturing enterprises. The relatively small Saudi domestic market for many commodities, however, would still limit investment opportunities.

Despite all the uncertainties, however, the Saudi manufacturing sector is likely to generate a growing, if initially moderate, demand for technology transfer and trade. By the end of the next decade, even a moderately fast-growing manufacturing sector (say, 7 percent per annum) would double its current size and probably its imports.

Many of these observations apply in somewhat different form to other Middle Eastern countries. In Egypt, a relatively large and diversified manufacturing sector has been generating significant technology trade. The question about Egypt's manufacturing sector is whether recent changes in economic policy will

¹⁹Wharton Econometric Forecasting Associates, *op. cit.*, tables 5.3 and 6.2.

allow it to continue to expand. Considering that Egypt's industry is primarily in the public sector and that foreign investors have yet to enter the "open door" in any numbers, the chances of continued rapid expansion of the manufacturing sector in the future would not seem bright. It cannot, be ruled out, however. Despite long-standing conditions of bureaucratic inefficiency, Egypt's manufacturing sector has been expanding relatively vigorously by world standards (10 percent per annum in real terms in the last few years).²⁰

Algeria, Iraq, and Iran have significant but not highly developed manufacturing sectors, which, however, are well behind Egypt's in size and diversification. They are likely to generate fairly rapidly growing technology imports in the next decade, if the war between Iran and Iraq is concluded, since manufacturing is being emphasized in current economic planning.

Wharton Econometric Forecasting Associates, op. cit.

It should be emphasized that even if the manufacturing sector does not develop as rapidly as it might, the Middle East will continue to constitute a large market for technology trade, as continuing investment is made in physical and social infrastructure and in other service sectors. A burgeoning demand for manufacturing technology²¹ is likely to be satisfied at the expense of infrastructure rather than at the expense of military or consumer imports, in the context of the relative foreign exchange scarcity that we have forecast, in light of the political sensitivity of military and consumer imports. In the conservative situation—low growth in manufacturing—imports for infrastructure investment will be likely to take up a good deal of the slack, and the Middle East will remain an important market for Western technology. While the substitutability between manufacturing and infrastructure demand for imported technology will tend to maintain the volume of technology imports, the composition will vary depending on the relative importance of manufacturing.

PROSPECTS FOR SUPPLIER SHARES

SHARE TRENDS

With the exception of a noticeable improvement in the Japanese share and a distinct fall in the French share, most supplier country export shares to the Middle East were relatively stable during the past decade. In the context of rapid economic expansion and political turbulence, this was somewhat surprising. Although there was some fluctuation, the shares of four of the six supplier countries were approximately the same in 1982 as they were in 1970 (see ch. 4, tables 26 to 31). With two-thirds of the U.S. share concentrated in Saudi Arabia and Egypt, however, there can be little confidence in mechanically projecting a constant U.S. share based on this trend.

Neither does it appear likely that the trends identified in the French and Japanese shares can confidently be projected into the future. The French share in Algerian exports has

reached the point where it is unlikely to drop as rapidly as in the past, or even drop at all. The worldwide share of Japanese exports in less developed countries (LDCs), which has generally been increasing for two decades, might now level off as the newly industrializing countries become more competitive in manufactured goods with standardized technologies.²² Thus, continued rapid increase in the export share of Japan over the long run is probably not to be expected, although it is by no means improbable.

In order to establish the range of possible variation in U.S. export shares to the Middle East market, OTA has organized the discussion around two scenarios. Based on an exam-

²⁰See Raymond F. Mikesell and Mark G. Farah, *U.S. Export Competitiveness in Third World Markets* (Washington, D.C.: Georgetown University, 1980). See table I.1, p. 7, for share data for Japanese exports to LDCs.

ination of past trends, quantitative high and low export scenarios are constructed. Underlying these are assumptions about the effect of politics (and other factors) on patterns of technology trade.

On the one hand, prospects for expansion of supplier shares are limited by the desire of Middle Eastern nations to diversify suppliers for economic as well as political reasons. As discussed in chapter 6, for example, Algeria consciously sought to reduce dependence on France during the past decade. While the upper bound to supplier shares in a particular Middle Eastern country market is difficult to quantify, the existence of such an implied upper bound even when political relations between supplier and recipient are strong leads to the conclusion that it is highly unlikely that the United States will expand its position very much in either Saudi Arabia or Egypt.

On the other hand, if political relations between supplier and recipient are severely strained, the supplier is unlikely to win or maintain an overwhelming share of the market. The sharp decline in trade between the United States and revolutionary Iran illustrates the negative effects of political disputes on trade. Persisting political hostility between supplier and recipient, it is hypothesized, will eventually preclude a large supplier share. However, the record of the past decade indicates that this assumption must not be interpreted too rigidly. The United States and Libya were major trading partners until the early 1980's. In addition, countries such as Iraq which have not always supported U.S. political and diplomatic positions have preferred Western, and in some instances U. S., technology. Over the course of a decade, however, overt political hostility between recipient and supplier can be expected to limit the supplier's shares.

HIGH U.S. EXPORT SHARE SCENARIO

The U.S. market share in exports to the Middle East is strongly dependent on high individual shares for Saudi Arabia and Egypt. In

both of these countries, the United States has a higher market share than Japan and West Germany, the two principal competitors of the United States in the region. In contrast to the United States, neither Japan nor West Germany has taken a strong political position in the region nor attempted to couple foreign policy with trade policy.

It is possible to quantify an illustrative high-share scenario for the United States based on an assumption that the United States share equals the 1982 share of Japan, West Germany, or the United States—whichever was highest in each Middle Eastern country. Thus, the United States keeps its (high) shares of the Saudi Arabian and Egyptian markets; takes on the German share in the Iran, Iraq, Libyan, and Algerian markets; and assumes the Japanese share in Kuwait and the Gulf kingdoms. (See table 32 for the 1982 country share data.)

Applying these assumptions to 1982 exports, the United States' overall Middle Eastern share would have been 32 percent of the total exports of the six major industrial countries rather than 22 percent.²² This would appear to set an upper bound to what the U.S. share might become in the next decade under greatly improved performance in all countries where the United States did not have the larger share. In 1982 this superior performance would have increased U.S. exports by \$7 billion over the \$19.8 billion actually realized, and U.S. exports to the Middle East would have increased from 16 to 22 percent of exports to all LDCs.

The question is whether there is a set of events that might make the high market share scenario come true. First and most important, the United States would have to maintain its preeminent share in Saudi Arabia and Egypt.

*Note that these supplier share percentages (and most others cited in this chapter) are based on calculations including only the six major Western suppliers, and do not include total industrial country exports. To be specific, the 22 percent U.S. share was derived from the data in table 26 as follows: the U.S. share of total industrial country exports to the Middle East—17.9 percent—is 22.2 percent of the 80.5 percent total for the six major industrial countries.

This, however, is somewhat unlikely. One reason for the U.S. preeminence in Saudi Arabia was the existence in the late 1970's and early 1980's of the "mega" construction projects, where the United States had a comparative advantage in technical and managerial services. In an era of foreign exchange limitation (by Saudi standards) and growing buyer sophistication, the proportion of smaller unbundled construction projects will probably increase and will probably result in a smaller share for U.S. contractors.

Furthermore, if it follows the general pattern in the Middle East, Saudi Arabia will lessen its dependence on a single supplier. In Egypt, a policy that explicitly links aid policy to commercial policy could theoretically result in an expanded U.S. market share, especially of machinery and equipment imports (see table 100 inch. 12). However, this seems unlikely in view of Egypt's steps toward rapprochement with the other Arab countries and concerns about dependence on the United States.

The high shares of Japan and West Germany in certain countries probably result in part from their ability to stay aloof from Middle Eastern politics. However, it seems unlikely that the United States could similarly disengage itself from Middle Eastern politics without suffering considerable political costs, even if it desired to do so for commercial policy reasons. Therefore, it is unrealistic to expect that the United States might obtain the "nonpolitical" maximum share in all countries.

If foreign economic policy were given more emphasis, however, it might be possible to increase the U.S. share slightly. Even if foreign policy disengagement is not vigorously pursued as an across-the-board policy, policymakers might decide to decouple trade from foreign policy in a few specific cases. For example, if a conscious decision were made to do so because of changed political or other circumstances, nations such as Iran, Iraq, Syria, and Libya, which have not been closely allied with U.S. diplomatic positions, could become stronger trading partners.

Since it is not clear how much effect controls and antiboycott/corrupt practices policies have had on the U.S. market share independently of broader foreign policy, the magnitude of any decoupling effect is uncertain. OTA's judgment, based on subjective evidence, is that decoupling would have a small but significantly favorable effect on U.S. market share. Likewise, expanded efforts to represent U.S. business in the Middle East, including high-level support, as well as improvements in the foreign commercial service, might improve U.S. export performance by a small amount.

An end to the Arab-Israel conflict would complicate the United States from the unhappy situation of trying to be friends with those at odds with one another. The effect on exports is hard to determine, however. Where exports from the United States have been reduced because of the conflict, the United States would gain; where a strong political position has resulted in a high export share and where this strong position would dissipate with Arab-Israeli peace, the United States might lose its share. On balance, there would probably be opportunity to expand the U.S. share.

The U.S. market share would also tend to increase if international trade agreements reduced "unfair" export competition by other countries. For instance, if the new interest-rate provisions of the Organization for Economic Cooperation and Development (OECD) arrangement on officially supported export credits lead to less subsidization of exports by other suppliers, as they appear to be doing,²³ all three of the major suppliers may benefit, since neither West Germany nor Japan use large amounts of subsidized export credit. Regarding Egypt and Algeria, all suppliers have used aid and mixed credits in connection with exports, so it is not clear what impact a possibly emerging international agreement on mixed credits would have on the U.S. share of Middle East trade.

²³The Export-Import Bank stated in its 1983 *Annual Report* that the new provisions "will phase out most remaining export credit subsidies by July 1986," p. 4.

All in all, the improved international trade rules that might be obtained would probably have only a minor effect on market share in the Middle East, because it seems unlikely that they could be tightened enough to fully hamstring those supplier governments intent on helping their exporters—and because the aid/trade connection will always exist.

Currency realignment would probably be relatively powerful over a period of time in changing the U.S. export share in the Middle East. If those who think that the dollar is substantially but temporarily overvalued compared to the yen and the mark are correct, U.S. exports in the Middle East and elsewhere could receive a significant price-effect stimulus in the future.

In the last analysis, basic changes in the comparative advantage of U.S. exports²⁴ and in the economic growth rate of the United States will probably be the most important economic factors determining the U.S. export share in the Middle East—as they will be in worldwide trade. Long-run changes in comparative advantage in the international economy are virtually impossible to predict, however. The leading industrial economies may become more similar, or the United States may keep its comparative advantage in exports that depend heavily on research and development and highly skilled professionals.

To sum up, the factors that could raise the U.S. export share, which are specific to the Middle East, appear to be either not very likely or not very powerful. Those which could raise the long-run worldwide U.S. export share, including its share of exports to the Middle East, exceptionally fast U.S. economic growth throughout the period or shifts in comparative advantage, are together unlikely to raise the U.S. share more than a few percentage points except possibly in the very long run. The fundamental change in the relation of the United States to the international economy that would have to occur for the United States to have a materially larger export share worldwide because of these two long-run fac-

tors is probably not likely to occur, and it is certainly not predictable with any confidence. This leaves currency realignment as the factor most likely to give a material upward boost—on the order of a few percentage points—to the U.S. export share in the Middle East and elsewhere.²⁵ Taking all these factors together, it does not appear likely that there will be a large increase in U.S. market share in the Middle East.

LOW U.S. EXPORT SHARE SCENARIO

On a more pessimistic note, a low-export share scenario can be quantified on the arbitrary assumption that U.S. firms receive the lowest shares of the three major Western exporters. Under this assumption the United States would keep its 1982 share of exports to Iraq, Iran, Syria, and the Yemens; it would take Japan's share of Egypt, Algeria, Libya, Jordan, and Lebanon; and West Germany's share of Saudi Arabia, Kuwait, and the Gulf kingdoms. For 1982, the resulting U.S. Middle Eastern export share would have been only 10.8 percent of the six major industrial country total, rather than the 22 percent it actually was. This less satisfactory performance would have decreased U.S. exports by \$9 billion, and exports to the Middle East as a share of exports to all LDCs, all else remaining the same, would have decreased from 16 to 8 percent.

In fact, such a precipitous fall in market share could result simply from reducing the U.S. share of exports to Saudi Arabia and Egypt to the levels of the other two major competitors. To demonstrate how dependent the overall U.S. share is on its high shares of exports to its major Middle Eastern trading partners, the following possibility is considered: if the United States had the West German share of exports to Saudi Arabia and the Japanese share of exports to Egypt, and main-

²⁴As an indication of how much difference a decrease in the value of the dollar could make, if the long-run price elasticity of the U.S. six industrial country export share was in the range of 0.5 to 1.0 (moderate sensitivity), the increased export share that would be induced by a 10 percent drop in the value of the dollar would be 1 to 2 percent.

²⁵See ch. 2 for a brief discussion of this concept.

tained its export share at the actual share level it had in 1982 for the other 13 countries, its regional share would have been only 12.4 percent of the total for the six major industrial countries in 1982, which is comparable to its share under the low export share scenario, and far lower than its actual share of 22 percent.

Since such a high fraction of U.S. exports to the Middle East goes to Saudi Arabia, any factors that would lower either Saudi Arabia's total imports more than those of other countries in the region or would lower the U.S. share of Saudi imports would be likely to reduce the U.S. regional share. Slower growing Middle East oil revenues in the 1980's and 1990's, and hence slower growing exports to the region, are, in fact, likely to affect Saudi Arabia disproportionately in absolute magnitude, since its import growth was so rapid in the 1970's. If exports to Saudi Arabia become a smaller fraction of total exports to the Middle East, all else equal, a smaller U.S. share will result.

It is not unlikely, furthermore, that the U.S. share of the Saudi market will decline, for a number of reasons. With the passing of the "mega" project era, an area of particular U.S. comparative advantage may also have passed. If it wasn't comparative advantage but politics or established position in the Saudi market that resulted in a U.S. export share 36 percent higher than Japan's in 1982, any dissipation in these latter factors would also be likely to result in a regression of the U.S. market share toward those of its major competitors. An active policy by the Saudi Arabian Government to reduce its dependence on any one supplier could have the same effect.

Diversification could result from either dissatisfaction with U.S. policy in the region, or the desire to improve bargaining position by increasing competition among potential suppliers. Saudi use of trade as a weapon against the United States, during a period of rough bilateral relations, could be even more damaging to the U.S. share. On the U.S. side, a widening of national security controls to limit the export of technologies having both civil-

ian and military uses would tend to reduce the U.S. share.

Finally, regime change or political instability would raise the possibility of a full break in relations similar to the break with Iran (and for the same reasons), which in the latter case resulted in a current U.S. market share one-tenth that of its share of the Saudi Arabian market.

Considering all these possibilities, together with the competition from other firms for Saudi Arabian sales, OTA judges it to be more likely than not that the United States will have a smaller share of a Saudi market, which would result in a significant decline in the U.S. share of Middle Eastern exports.

Likewise, analysis of the Egyptian market leads to similar conclusions, although the United States is in a stronger position to influence events there through its economic assistance policy. A decline in the U.S. export share to Egypt, though, would have less of an effect on the overall U.S. export share, since Egypt is a smaller market.

An end to the Iran-Iraq War would probably increase the Middle Eastern market, but it is not clear that U.S. firms would necessarily benefit disproportionately from this trade opportunity. Dramatic political as well as economic changes would have to occur in order to expand U.S. export shares to the two countries—3 percent of exports to Iran and 7 percent of exports to Iraq from the six major industrial countries in 1982—sufficiently to soon bring them up to the 1982 regional figure of 22 percent. Furthermore, if U.S. exports remained a relatively small share of expanded Iranian and Iraqi markets, the U.S. regional market share would drop. In any case, it is difficult to anticipate events in these countries, and trade data are distorted by sales of U.S. products through third countries.²⁶

²⁶Direct and indirect U.S. trade with Iran might have been two to three times higher than the direct trade recorded in 1982, if indirect transactions of U.S. products through agents or other intermediaries had been reflected as U.S. sales. Kenneth N. Gilpin, "Iran-U.S. Trade Up From 1980 Plunge," *New York Times*, Dec. 26, 1983, p. D1.

A sharp increase in unfair export competition from the other leading industrial countries might result in a decrease in the U.S. export share if U.S. policies were not changed to provide matching subsidies. Other important factors that could possibly reduce the U.S. share of exports to the Middle East are the fundamental ones that would affect the level of U.S. exports everywhere; for instance, low relative economic growth in the United States or disadvantageous shifts in comparative advantage that could result in perhaps lengthy adjustment periods.

Thus, there appears to be a set of plausible factors that could easily result in a significant

decrease in the U.S. export share in the Middle East. These principally involve the potential for a fall in the U.S. position in Saudi Arabia and Egypt and the possibility of a continuing low U.S. share in post-war Iran and Iraq, which together could occupy a larger fraction of the region's imports. Other factors mentioned could also lead to a diminished U.S. share of exports. On a more optimistic note, only a decline in the value of the dollar holds clear promise for increasing the U.S. export share. OTA judges the low U.S. export scenario, therefore, to be more plausible overall than the high export scenario given the events underlying both.

CONCLUSION: PROSPECTS FOR THE 1990's

Because a significant decline in U.S. market share seems considerably more likely than an increase, and because maintenance of the current share depends primarily on maintenance of the U.S. export share with Saudi Arabia, where it may be difficult for U.S. exporters to maintain their 35 percent 1982 share of exports from the six top exporters, we come to the overall conclusion that the U.S. export share in the Middle East vis-a-vis the other major industrial countries will probably decline in the 1980's. A not completely, improbable low-share scenario could see the U.S. portion drop by half. Instead of securing 22 percent of the exports from the top six industrial countries exporting to the Middle East (18 percent of total industrial country exports) the U.S. share might very well drop significantly.

We also conclude that after a resurgence in 1984 and 1985, total industrial country exports to the Middle East will grow much more slowly in the 1985-2000 period than in the last decade because of very far-reaching changes in the oil economy. It seems plausible that over this 15-year period, exports to the Middle East will grow no faster than oil exports from the region. In the 1985-90 period this would mean a growth of imports of 2 to 5 per-

cent per annum, if we use the range defined by our low and high revenue scenarios, followed by stagnating demand for imports in the 1990-2000 period.

There are important implications of this pessimistic trade outlook for the likely nature of future technology transfer to the Middle East and the role of U.S. firms and organizations in it. Technology transfers may increasingly take the form of the provision by Western firms of more specialized technical services in smaller contracts (more often with local joint venture firms). As a result of slowly growing revenues and because of past experience, Middle Eastern buyers may become more selective in their purchases of foreign technology, and local government intervention may help them to negotiate favorable terms. The emphasis that Middle Eastern countries have placed on diversification of suppliers, for political as well as economic reasons, can be expected to persist. To the extent that financing terms are also important considerations for buyers, mixed credits and other extraordinary supports for exports may be utilized more extensively by suppliers, despite the fact that the subsidy element has been greatly reduced in standard official export credits. These various trends suggest that technology trans-

fers will involve more two-way interaction, in which suppliers are required to tailor transfers to the specific needs of Middle Eastern buyers.

While none of these trends identified above promises by itself to materially alter the volume of trade, they do point to changes in its nature and in the mechanisms for technology transfer. OTA's analysis in this chapter indicates that U.S. firms and organizations will probably not be able to substantially expand their positions in this changing Middle East market context, and that they will be chal-

lenged to maintain their shares. While there is no question that the United States will remain an important supplier country, the issue is whether the apparent comparative advantage that U.S. firms had in large-scale technical service exports during the past decade can be converted into a continuing advantage in smaller and more specialized exports of technical know-how, training and management that will contribute to a growth of indigenous technological capability in the region.