9

Saudi Arabia's Industrialization Strategy: A Question of Comparative Advantage

Robert E. Looney

INTRODUCTION

In almost every country, industry is the glamour sector of economic development. People look to industrial development to provide much needed employment, to generate higher individual and national income, to relieve balance of payments constraints through import substitution, to open up markets for primary products such as those from the mining and fishing sectors, to give the country greater economic independence, to generate new tax revenues, and to furnish an important source of national pride.[1] By and large, these hoped for benefits of industrialization are realistic – provided a country makes sensible choices.

Until recently, investment in Saudi Arabia has concentrated on infrastructure, light manufacturing and construction materials. Most of the major products in transportation, communications, health, education, electricity, and water that were initiated in the 1970s are completed or nearing completion. Since the mid-1970s, attention has centred on industrial development, primarily in the downstream activities of the petroleum sector and on import substitution.

In fact, one of the most intriguing question marks concerning the kingdom's development strategy centres precisely around the government's selection of industries. A steel plant, fertilizer plants, domestic and export-oriented refineries, and a series of major petrochemical complexes form the basis of the government's attempt to diversify the economy. What is the rationalization for this strategy and is all this too ambitious for a country with virtually no previous industrial experience?[2]

As Yannis Stournaras[3] has recently noted, the whole rationality of this policy has been seriously questioned. The main purpose of this paper is to examine in some detail the basic arguments for and against the

industrial strategy adopted by Saudi Arabia. The aim is to provide some general explanations rather than a detailed cost–benefit analysis of specific projects.

COMPARATIVE ADVANTAGE

The existence of under-exploited gas reserves in the kingdom has been one of the strongest arguments for developing gas-based heavy industries. Gas – especially the dry gases, methane and ethane – is an expensive product to transport, thus making it sensible to look for more productive uses for its exploitation.

International trade theory is capable of rationalizing a gas-based industrialization strategy. For example, according to the Heckscher–Ohlin theory of international trade, a country tends to have lower comparative costs in the commodity that uses the largest amount of the relatively cheapest factor in its economy. These considerations provide the fundamental rationale for specialization.[4] In general terms, the theory indicates that Saudi Arabia should establish and promote industries primarily based on natural gas and/or oil. These are the industries, everything else aside, that are most likely to be efficient and successful. Fortunately for the Saudis, these industries are not only energy intensive but also capital intensive. Thus, they tend to utilize its abundant financial surplus as well as gas and oil.

Once oil has been produced at an optimal rate, there is an excellent theoretical argument for developing gas intensive industries around it.[5] These can either be chemical industries, which use the gas as a feedstock for conversion into higher value and more easily transportable chemical products, or they can be energy intensive industries such as steel or aluminium production, where the gas can be used as a reasonably cheap source of energy.

Few observers would quibble with these general observations. The planners' task in identifying precisely those industries best suited for the kingdom has not been as easy as it might appear at first sight, however.

Because the country had virtually no heavy industry or industrial experience to speak of in the early 1970s, the Heckscher–Ohlin predicted pattern of trade had not been established and the price system had not developed to the point where it was capable of giving the planners the correct signals as to the best areas of investment. In addition, a number of less obvious considerations surrounding the introduction of heavy industry into the country have made it extremely difficult to design procedures capable of identifying the most effective methods of

allocating the country's resources. Although financial capital may not be a constraint, especially in the short term, the kingdom has to face other constraints to industrial development. Physical bottlenecks, manpower shortages and inflation have proved to be real impediments to the absorptive capacity of the economy. In particular, the impact of these negative factors has often been most severe in the very developmental activities intrinsic to a successful diversification policy.

GOVERNMENT INVESTMENT IN INDUSTRY

A number of potentially profitable projects have been identified by the government for its investment programme. These are industries which conform to the Heckscher–Ohlin theory of trade by using relatively large amounts of the kingdom's relatively abundant factors of production, oil, natural gas and capital. These industries appear attractive because not only do they mesh into the present structure of the economy, but also should logically fit the next phase of development by providing competitive exports with which to pay for future imports.

Because the capital cost of these industries is immense, the private sector is unable to undertake investment in them at this time. Instead, the Saudi Basic Industries Corporation (SABIC) was founded by the government to initiate development of the kingdom's heavy industries.

The Saudi Basic Industries Corporation was set up in 1976 with a capital of SR10 billion to undertake investments in operation and marketing of products in the basic industries, using local hydrocarbon and mineral resources and other complementary and supporting industries.[6] SABIC has so far set up and developed 14 industrial companies in Jubail, Yanbu, Heddah and Dammam and work is progressing on the establishment of two new companies. By the first quarter of 1986, all of these companies were in operation except for one of the new companies, which is expected to begin production in 1988[7] (Table 1). With these facilities, Saudi Arabia is capable of producing between four and five per cent of the world's primary petrochemical output.[8]

The features of these industrial operations and planned industrial development have emerged sufficiently to allow us to characterize the future industrial structure and industrial employment of Saudi Arabia.

In August 1985, the government announced that more than SR16,000 ($4,384 million) is to be spent on expansion of SABIC during the current development plan (1985–90). According to SABIC, more than half the new investment will be channelled into building more downstream petrochemical plants and just over 20 per cent of the total will be devoted to further plastics and rubber industries.[9]

TABLE 1
SABIC: DOMESTIC HEAVY INDUSTRY PROJECTS

Project	Joint-venture partner(s)	Signature date	Production start-up date	Location	Feedstock	Products	Annual capacity (tonnes)
Saudi Arabian Fertilizer Company (Safco)	Saudi private sector (including Safco employees — 59%)	1965	1970	Dammam	Methane	Urea	330,000
						Sulphuric acid	100,000
						Melamine	20,000
Saudi Iron & Steel Company (Hadeed)	DEG (West Germany — 5%)	March 1979	1983	Jubail	Iron ores, limestone, natural gas, scrap iron	Steel rods and bars	800,000
Jeddah Steel Rolling Mill Company (Sulb)	Hadeed subsidiary (100%)	May 1979	1981	Jeddah	Steel billets	Steel rods and bars	140,000
Saudi Methanol Company (Ar-Razi)	Japanese consortium led by Mitsubishi Gas Chemical Corporation (50%)	November 1979	1983	Jubail	Methane	Chemical-grade methanol	600,000
Al-Jubail Fertilizer Company (Samad)	Taiwan Fertilizer Company (50%)	December 1979	1983	Jubail	Methane	Urea	500,000
Saudi Yanbu Petrochemical Company (Yanpet)	Mobil Oil Corporation (US — 50%)	April 1980	1984	Yanbu	Ethane	Ethylene	455,000
						Linear low-density polyethylene	205,000
						High-density polyethylene	91,000
						Ethylene glycol	220,000
Al-Jubail Petrochemical Company (Kemya)	Exxon Chemical Company (US — 50%)	April 1980	1984	Jubail	Ethylene	Linear low-density poly ethylene	260,000
Saudi Petrochemical Company (Sadaf)	Pecten Arabia (subsidiary of Shell Oil Company — 50%)	September 1980	First unit ethylene, 1984	Jubail	Ethane	Ethylene	656,000
			Last unit styrene, 1985		Salt	Ethylene dichloride	454,000
					Benzene	Styrene monomer	295,000
						Crude industrial ethanol	281,000
						Caustic soda	377,000

National Methanol Company (Ibn Sina)	Celanese Corporation (US — 25%), Texas Eastern Corporation (US — 25%), None	February 1981	1984	Jubail	Methane	Chemical-grade methanol	650,000
Arabian Petrochemical Company (Petrokemya)		May 1981	1985	Jubail	Ethane	Ethylene	500,000
Eastern Petrochemical Company (Sharq)	Mitsubishi-led Japanese consortium (50%)	May 1981	1985	Jubail	Ethylene	Linear low-density polyethylene Ethylene glycol	130,000 300,000
National Industrial Gases Company (Gasi)	Saudi gas companies (30%)	February 1983	1984	Jubail	Air	Oxygen Nitrogen	438,000 146,000
National Plastic Company (Ibn Hayyan)	Lucky group, (South Korea — 15%)	December 1983	1986	Jubail	Ethylene Ethylene dichloride	Vinyl chloride monomer Polyvinyl chloride	300,000 200,000
Saudi European Petrochemical Company (Ibn Zahr)	Arab Petroleum Investments Corporation (Apicorp — pan-Arab — 10%), Neste (Finland — 10%), ENI (Italy — 10%)	December 1984	1988	Jubail	Butane Chemical-grade methanol	Methyl tertiary-butyl ether Butadiene Butene-1	500,000 125,000 80,000

Source: Sabic

As noted, most of these plants are sited at Jubail and Yanbu, located respectively on the East and West coasts of Saudi Arabia. Both are new industrial cities that represent enormous undertakings. Jubail is expected to grow to a city of 280,000 by the year 2010, and Yanbu will have a population of 100,000–200,000 persons. All infrastructure had to be planned and provided. Much of the new industrial investment in petrochemicals will be located in these two cities.[10]

The private sector is strongly encouraged to participate in the country's industrialization, through utilizing the output of the SABIC industries, this being one of the major objectives behind the kingdom's industrial development strategy. Among the incentives provided to the private sector are:[11]

1. Exemption from import taxes on imported machinery, spare parts and raw materials;
2. Protective tariffs or quotas against competing imports;
3. Financial assistance on very easy terms (primarily through SIDF financing);
4. Long-term leasing of industrial sites at nominal rents ($0.03/sq.m. for building lands);
5. Electricity at heavily subsidized rates ($0.02 per KWH, although it appears likely that the cost will have to be increased in line with 'rationalization' policies;
6. Preferential treatment for locally manufactured goods in government procurements;
7. Assistance in the identification of viable projects through cheap feedstock and guaranteed supplies of crude for 15–20 years (500 b/d for every $1 billion in investment, although the government is reported to be reneging on some agreements, and in some cases, the 'cheap' price was set when oil prices were at a peak, making the terms far less tempting in today's market).

In sum, the government has tried vigorously over the last decade to expand the industrial base of the country. This has been undertaken through encouraging and subsidizing private sector industrial projects and by initiating the development of large-scale industrial projects in the public sector. The government's motives for promoting industrial expansion include:[12]

1. The desire to exploit Saudi Arabia's natural resources in as efficient (and profitable) a way as possible. Thus, large public sector projects and joint ventures draw on crude petroleum and natural gas (much of which used to be flared) as raw materials.

An added advantage of this form of industrial development is that it increases the vertical integration of the newly Saudized domestic oil industry, giving it more influence in world markets.

2. The desire to diversify the economy. It is recognized that petrochemical and other energy-related projects contribute little in this respect, insofar as their performance is strongly related to demand conditions in the international energy markets. Light industries which are the domain of the private sector are more useful in increasing the level of economic diversification, although the scope for their expansion is limited.
3. The desire to ensure a greater degree of regional balance by positioning industries in a number of different locales, so as to provide employment for underemployed labour, distribute the kingdom's wealth more widely, and consolidate the kingdom's physical structure.
4. The desire to enhance the role of the private sector, especially as the public sector continues to expand. Light industries are regarded as an eminently suitable avenue for the utilization of private capital.
5. The desire to offer local banks the opportunity to assume a greater degree of oversight risk, to ensure the integration of the financial sector into the mainstream of domestic economic activity.

Despite the massive amounts of investment in Saudi Arabian industry – $10 billion in refinery projects and another $10 billion in plants using ethane and methane as feedstock to produce products such as ethylene, polyethylene, ethylene glycol and methanol – the contribution of the industrial sector to GDP, although growing, has been fairly limited. The contribution of manufacturing to GDP was 5.0 per cent in 1980, but by 1985 this had increased to 8.1 per cent. This pattern is fairly typical of the Gulf Cooperation Council (GCC) countries (Table 2).

Saudi Arabia's development plans for the Fourth Plan period (1985–90) place great emphasis on continued industrialization, human resources development and increased use of local products and services.[13] Associated with these goals is the development of a more appropriate financial system that would facilitate channelling private capital to productive projects. Emphasis is moving from infrastructure building to production. There are priority shifts as well within the infrastructure from construction and transportation to operations and maintenance and from physical to social and educational infrastructure. These are being paralleled by directional changes in the

TABLE 2
CONTRIBUTION OF MANUFACTURING SECTORS TO GDP IN THE GCC COUNTRIES, 1980–1985

	1980	1982	1983	1984	1985
Saudi Arabia	5.0	4.3	5.8	7.5	8.1
Kuwait	5.9	6.6	6.4	6.3	6.6
UAE	3.8	8.2	8.7	8.7	n.a.
Oman	0.7	1.4	2.3	2.8	n.a.
Bahrain	11.5	11.3	11.5	11.8	n.a.
Qatar	3.3	5.0	6.0	6.0	n.a.

Sources: Various National and Regional Sources Including: *Unified Arab Economic Report*, 1985, edited by The Arab Monetary Fund

area of production from construction materials to basic industries and manufacturing.[14]

In sum, the Saudi government hopes that the development of heavy industry in the petrochemical sector will spawn a wide range of manufacturing activities. There are two major reasons why the kingdom can rationalize reversing the more typical experience of developing light manufacturing first and heavy industry second. With 40 per cent of world crude oil reserves, Saudi Arabia has the resource endowment to support an efficient petrochemical sector, and it is natural that petrochemical facilities be established to process this crude. Initially, Saudi Arabia will export most of its primary petrochemical output, but over time chemical and plastics enterprises can be established locally to process increasing proportions of primary petrochemical output. Second, with a relatively small labour force and relatively large amounts of capital (government foreign exchange assets exceeded $150 million in 1983), capital intensive operations are consistent with relative factor endowments in Saudi Arabia.[15]

THE CASE FOR PETROCHEMICALS

In addition to the availability of gas, several additional characteristics associated with petrochemicals have made investment in this industry especially attractive to the Saudi government.[16]

Capital Intensity

This industry enjoys one of the highest capital/labour ratios in the world. In fact, investment per new job created is estimated at $20,000 to

$100,000. Also, larger amounts of investment are required as the stage of production advances from basic products to intermediaries to finished products and finally to the consumer stage. In fact, the investment required for the transformation of finished products into consumer or industrial products (third manufacturing phase) is two or three times higher than that necessary for the production of intermediate products (second manufacturing phase) and five times higher than that necessary for the production of basic products (first manufacturing phase).

Economies of Sale

Investments do not vary in proportion to the capacity, but rather according to a power factor generally lying between 0.6 and 0.85. This is the reason why it is advantageous to build large capacity units which cost proportionately less than small or medium capacity units. Manpower as well as general and plant overhead also appear to have proportionately lower expenditures with larger plant size.

Given Saudi Arabia's abundant endowments of both the raw materials and capital needed to finance large-scale investments, petrochemicals seem to be an ideal sector around which the country could build its industrialization programme.

SOME POLICY ISSUES

There are at least two main issues[17] related to industrialization in Saudi Arabia. One is that the existing and anticipated expansion of industrial activity implies considerable strain on the government and private enterprise. It also means accentuating the disadvantages in factor proportions that are critically vital for self-sustained industrial growth, namely, skills and markets.

The second important issue relates to the diseconomies of competition. There is little doubt that the lack of coordination in the Gulf, until the recent past, over industrial projects had led to wasteful duplication and lowered the returns on investments. In these cases, the problems are the same: short production runs, high fixed costs in relation to total costs and diseconomies of scale.[18]

More specifically, the problems and constraints facing the kingdom's industrial development schemes can be detailed as follows:

1. The kingdom's most ambitious industrial objective, to become an international force in the production and marketing of petrochemicals, has involved it in disputes with its trade partners in Western Europe and the United States. The market

for petrochemicals is currently depressed and the current (1987) potential for producing $3 billion (or more) worth of petrochemicals requires that the kingdom continue to fight for a major share of the international market. The EEC and the United States are likely to intensify the degree of protectionism currently in effect to protect their petrochemical industries, citing as pretext the heavy subsidization of feedstock in Saudi Arabia (where the government charges producers $0.50 per million BTU, compared with $4.50–5.00 in Western Europe and $3.30–3.50 in the United States).[19]

2. Regardless of how emphatic Saudi Arabia planners are about promoting private sector participation, the Saudi economy is largely driven by government expenditure,[20] the level of which is to some extent (not totally) dependent on the level of oil revenues, which fluctuate as oil prices vary and as world markets continue to be depressed. This results in complications for the industrial sector inasmuch as:

   (a) The heavy petrochemical industrial projects require considerable capital allocations, and their scale cannot be easily adjusted up or down. As fiscal pressures intensified with the recent oil revenue declines and planners became aware that they could not count on nearly infinite supplies of capital, they became more reluctant to invest in 'mega-projects', cancelling some which had already been planned and slowing down payments to others. This tends to shake the confidence of foreign partners and has complicated marketing plans.

   (b) Private sector (mostly light) industries are sensitive to the level of government spending, since government-funded or supported projects provide the basis for demand for many light industrial projects. By the end of 1984, for instance, over ten private sector factories had closed and some 40 enterprises were reporting serious problems in meeting financial obligations or launching marketing campaigns.[21] One major manufacturer estimates that his total sales declined by over 50 per cent during 1984 and 1985. One of his responses has been to cut employment by over one-third.[22]

   (c) Government subsidized loans by the Saudi Industrial Development Fund (SIDF) have decreased significantly. SIDF was a major source of industrial investment funds during the 1970s and early 1980s. Private investors have

been more reluctant to commit funds as domestic spending has slowed. Domestic investors are accustomed to the high rates of return on investment realized during the period of rapid growth from 1974 to 1982. Foreign investors too made highly profitable investments during this period. Some foreign investments were made to ensure supplies of crude and this incentive no longer applies. As a result, some investments in secondary and light industries have been postponed or cancelled. These are the industries associated with lower capital/labour ratios.[23]

3. As in nearly all sectors of the economy, the manpower shortage is a serious constraint. Not only does the scarcity of skilled and unskilled workers translate into higher labour costs, but the adoption and implementation of proper management and marketing techniques in the industrial sector is sometimes hampered by the lack of adequate expertise. University education at home and abroad is slowly filling the upper echelons of management with well-trained Saudis, but the prospects for filling middle management positions with qualified Saudis are problematic.
4. Despite modest success in building industrial estates outside the major industrial centres of Jeddah, Riyadh, Damman, Yanbu and Jubail (with partially completed industrial centres in Qassim province northwest of Riyadh, at Hassa in the Eastern Province and at Mecca), the prospects for additional industrial expansion in the provinces are limited. The need for budgetary austerity necessitates the rethinking of spending priorities, a process likely to penalize projected investment in localities distant from major market outlets and requiring substantial infrastructural investment. While additional estates are planned at Asir, Medina, Hail and Tabuk, earlier projections of provincial industrial growth are being scaled down in size and geographic scope.
5. The domestic market is too small to absorb enough production to make economies of scale a factor in most cases. The prospects for foreign markets for Saudi products are limited, and the possibility of GCC integration expanding the scope for Saudi industrial output is circumscribed by the lack of coordination and duplication in industrial effort among GCC members. In this regard, Saudi Arabia is favoured. Crude (a primary factor of industrial production) is produced more cheaply and on a larger scale in Saudi Arabia than elsewhere. At the same time,

Saudi Arabia has a far larger population than other GCC countries. Gains from integration (in terms of generating demand for locally produced goods) may accrue to other GCC countries – initially at least.

Concentrated efforts at regional cooperation and coordination appear absolutely essential for Saudi Arabia, given the fact that the kingdom's neighbours have similar resources and industrial aptitudes. Unless development is coordinated, it is likely that there will be major duplication between states in the energy-based industries. Awareness of these problems has led to a good deal of consultation and contact in the region, as is illustrated by the following examples:[24]

1. One of the recommendations approved by the Arab Gulf Co-operation Council called for the establishment of an industrial cooperation committee with a view to promoting greater co-ordination and interaction;
2. Steps are being taken to constitute institutional apparatus for coordination of petrochemicals industry so as to (a) achieve product specialization, (b) prevent harmful duplications, and (c) evolve a regional strategy;
3. Institutions, such as the Gulf Organization for Industrial Consulting, have been created to encourage coordination between and among the states of the region in their respective plans for economic and industrial development. Here again, the intent was to avoid unnecessary duplication of projects;
4. At the project level, Saudi Arabia has acquisitioned 20 per cent of equity holding in the ALBA (Aluminium Bahrain), and has dropped its plans of having its own aluminium smelter.

LESSONS LEARNED

Several general lessons have emerged from Saudi Arabia's initial attempts at industrialization.[25] The most important is that there is no industrial option open, even including petrochemicals, to the country which gives anywhere near the kind of returns provided by successful investments in the oil sector. This implies that while the country may be choosing to restrict production levels for the benefit of future generations, it is still not absolved from the responsibility of ensuring that oil is produced as efficiently as possible. That means ensuring that existing oil fields are exploited with the best techniques, with growing attention to enhanced recovery and to the exploration necessary to replace declining production in existing fields.

In countries like Saudi Arabia, prudence may dictate the building of pipelines designed to give greater commercial flexibility. With oil prices still far above oil production costs, the country's planners would be extremely unwise not to start by ensuring they are getting the optimal returns from the oil sector before turning their attention to diversification strategies.[26]

Second, it appears that there is not a very strong case for investing in export-oriented refining capacity. The bulk transportation of crude oil will always remain cheaper than transporting oil products, so the best the kingdom can do is maximize the efficiency of its refineries. However, the comparatively greater cost of transporting oil products rather than crude is still very small in comparison to the final market price of oil. It is, therefore, perhaps at least possible to defend the decision to increase refining capacity.

Third, before utilizing gas in industry, Saudi planners should first ensure that they have used it as productively as possible in prolonging the life of oil fields (through gas ejection) or in substitution for oil in the domestic economy (thus releasing high value crude for export). The returns from exporting oil are so much more than exporting gas or its derivatives that there is an overwhelming logic in substituting gas for oil in such areas as electricity generation, oil refinery powering and desalinization.

Fourth, simple generalizations about the comparative economics of petrochemicals are difficult to make since a project which may make economic sense in a tight market may be unjustifiable if its products are in global oversupply. However, it appears that the creation of gas-based industries in the kingdom makes sense if the relative cheapness of the country's gas can be used to overcome some comparative disadvantages which the country currently faces:

1. Construction costs are high in Saudi Arabia for the current generation of plants under construction. Costs may be at least a quarter more expensive than in the United States or Western Europe.
2. The country is a long way from the richest world markets (North America, Japan and Western Europe). Its export-oriented industries will have to be particularly competitive if they are to break into these established markets. The alternative strategy is to aim for markets in Africa and Asia where the country may be closer as a supplier than the established competition in the advanced industrial countries. However, there are limits to how far the country can concentrate solely on Third World

markets, which are by definition relatively poor and unsuitable for the more sophisticated chemical products.[27]

Fifth, it must be emphasized that regional cooperation is essential, not only as a means for securing access to the wider regional market for the growing petrochemical industries, but also as a vehicle for coordination and harmonization with the other oil producers' plans for the development of petrochemicals and various energy and capital intensive industries. This type of cooperation is particularly necessary to prevent duplication, waste and harmful competition.[28]

Finally, a number of different factors have combined to form a bias against the conversion of oil revenues into productive industrial output and employment. It has been much easier to create direct government employment than industrial employment. To develop public sector jobs it is only necessary to build a room and put a desk in it; to develop a job in the modern industrial sector involves importing machinery and finding a skilled work force. The easiest activity for the government to promote has been construction, and the authorities have been notably successful in this area. Most of the jobs in this sector, however, have gone to foreigners.

The underlying reasons accounting for so few Saudis employed in modern industries are, in addition to those mentioned above, numerous, complex and interwoven. They include:

1. The great distances between regions and the poor communications connecting many parts of the kingdom;
2. Many government loans and grants to small farmers with the objective of aiding their mechanization and modernization are not spent on farming activity, but instead are considered additional income by recipients and spent on consumer goods – the result is to raise the opportunity cost of leaving the rural sector;[29]
3. The high value that rural men in Saudi Arabia place on leisure reinforced by the utilization of women in activities not permissible in urban areas;
4. Various government payments for social welfare contribute significantly to rural incomes;
5. Supplemental incomes earned by many in agriculture from patronage, traditional obligations and loyalties, and rents from family properties and land;
6. The high financial and social costs of moving into cities; rents are high, properties difficult to acquire.
7. Conditions in towns are relatively poor, meaning that the

standard of life in the cities for lower and middle income Saudis is lower than in rural areas;

8. Even at unskilled manual levels at which Saudi nationals are unwilling to work, foreign labour which is most cost effective is easily available.

Given the virtually unlimited amount of financial resources, the existence of large amounts of low or underemployment in Saudi Arabia is somewhat surprising. It has been shown, however, that this condition is the direct result of a complex mix of economic and social factors. One additional factor is the phenomenon of socially induced voluntary underemployment because Saudi workers are biased against types of work which they consider socially inferior.[30]

Labour theory suggests that the unwillingness to accept socially undesirable employment can be overcome by payment of a premium over the wages in the more desirable occupations. The market equilibrium wage would then be established by the simultaneous interaction between the strength of demand and the distribution of tastes. It appears, however, that in Saudi Arabia the social factors are so strong that, given the limited size of internal markets and the inefficiency of labour and capital in the modern industrial sector, the wage gap is not large enough to draw Saudi workers into the formal sector. The extended family, subsidized loans, and the existence of the informal sector enabling occasional work to supplement other income allow Saudi workers to set a high reservation wage.[31]

There should be a large enough positive compensating wage differential to overcome the reluctance to accept socially inferior jobs. It appears, however, that in Saudi Arabia, because the income incentive is so weak, even excessively high wages are not sufficient to entice Saudi workers into the industrial work force.

As a result of this interaction of economic and social factors, numerous Saudi workers have not gained appreciably from economic development. In most cases, their move from country to city involves a horizontal move from one low productivity job to another. Underemployment continues to exist because the planners have failed to provide the right types of government opportunities given the existing cultural environment. Again, in time this problem may be overcome. It is hard to predict at this point, however, whether Saudis will eventually be more inclined to join the industrial work force. The outcome may depend on how successful technology transfer to the kingdom is during the next decade or so.

TRANSFER OF TECHNOLOGY

Within the framework of Saudi Arabia's industrial strategy, attention is being closely paid to the selection of new technology and the means of innovating the existing technology. The concept of technology transfer used here is expanded to apply to the transfer of technological know-how internally between various industries and scientific R & D organizations and also internationally from similar institutions in other countries.

True industrialization is achieved not only through production but also through the development of national design and application capability so that an increasing number of products can be conceptualized and realized in Saudi Arabia. There are at present many areas where such capability has already been developed: progress is being made with acquired maturity.

It may be opportune to point out that the course of the transfer of technology has never been a smooth one. Among the major obstacles that the Saudis have had to overcome in their attempt to absorb new technology are:

1. Lack of industrial infrastructure and an industrial tradition;
2. Lack of skilled manpower, particularly on operational levels (e.g., skilled workers and technicians), and
3. The reluctance of many foreign companies to cooperate sincerely in the transfer of technology.

In the past decade, the Saudis have begun to adopt a cohesive effort to tackle the issue of technology transfer. The most important measures which have been taken are:[32]

1. Introducing advanced technical subjects in vocational schools and universities;
2. Establishing contact with technical and scientific organizations of international repute, and
3. Sending many students and researchers to institutions of higher education abroad in the various branches of science and technology.

It is recognized that sustained growth of the technological base is almost directly correlated to the quantity and quality of research and development work being carried out. Therefore, the Saudi Arabian government has been investing heavily in its institutions of higher learning, and at the same time establishing the real data base which indigenous research requires.[33]

CONCLUSIONS

It is still too early to say with much certainty what success the kingdom will have in its industrialization effort. The country is still going through an experimental period in which it is finding out exactly what future its oil and gas sector has and which kinds of industrial diversification make the most sense for its society. One lesson which will probably emerge is that it is pointless to push ahead too fast wtih such a diversification.[34] It takes time to build up an industrial culture, and there may be no point in developing industries which have to be run by more expatriates than the indigenous society can tolerate. At the same time, we really do not know if the Saudi workers will choose to dedicate themselves to mastering manufacturing skills. It may well be that they will prefer to continue settling for desk jobs, in which case the kingdom's strategy should continue to be to develop a limited range of capital intensive hydrocarbon processing industries, firmly leaving the labour intensive operations for other countries.

Based on its factor endowments, the private sector in conjunction with government guidance has been wise in selecting techniques of production which make maximum use of available energy and/or capital resources. Government investment in petrochemicals, cement, and steel are examples of energy and capital intensive industries. In other industries catering primarily to the local markets, such as the building materials industry, capital intensive techniques of production must be chosen to combat acute labour shortages prevalent in most of these countries. Unlike labour surplus economies unable to draw extensively on existing modern foreign technology because it is labour saving, Western technology is particularly suited to the factor endowment of the kingdom. The employment of capital intensive and sophisticated techniques of production requires, however, skilled and scientifically trained manpower. Thus, the upgrading of human resources will become a critical factor in expanding the capital absorptive capacity of the economy.

Few other countries would consider or could afford to consider the industrial programme taking place in Saudi Arabia. There is a genuine concern for the educational, social, and ethical development of the Saudi citizen, from a current low base. Much has been accomplished in the last ten years, but standards are still not high. Much more will be done in the coming decade, but without satisfying employment prospects, a contradiction between talents and expectations on the one hand and opportunities on the other must inevitably arise.

NOTES

1 Cf. Sharif S. Elmusa, 'Dependency and Industrialization in the Arab World', *Arab Studies Quarterly* (Summer 1986), pp. 253–67.
2 A question also asked by Louis Terner, 'Industrial Development Strategies in the Arab Gulf States', in May Ziwar-Daftari, ed., *Issues in Development: The Arab Gulf Strategy* (London, M.D. Research Services Limited, 1980), pp. 210–11.
3 Yannis Stournaras, 'Is the Industrialization of the Arab Gulf a Rational Policy?', *The Arab Gulf Journal* (April 1985), pp. 21–8.
4 J. L. Ford, *The Ohlin–Heckscher Theory of the Basis and Effects of Commodity Trade* (New York: Asia Publishing House, 1965), Ch. 1.
5 Cf. the argument given in B. I. Mohyuddin and R. Z. Karam, 'Arab Petrochemicals – Supply and Demand', *Arab Gulf Industries* (Dec. 1986), pp. 8–38.
6 Saudi Consulting House, *A Guide to Industrial Investment, 7th Edition* (Riyadh: Saudi Consulting House, 1986), p. 42. This is an excellent source of information on the Saudi government's industrial policies.
7 'Proposals for Expansion Reflect SABIC's Confidence', *Middle East Economic Digest Special Report: Saudi Industry* (Nov. 1985), pp. 7–8.
8 Donald Wells, 'The Effects of Saudi Industrialization on Employment', *The Journal of Energy and Development* (Spring 1986), p. 274.
9 'Proposals for Expansion Reflect SABIC's Confidence', op. cit., p. 7.
10 Wells, op. cit., p. 274.
11 Middle East Research Institute, University of Pennsylvania, *MERI Report, Saudi Arabia* (London: Croom Helm, 1985), pp. 80–9.
12 Ibid., pp. 85–6.
13 Cf. Kingdom of Saudi Arabia, Ministry of Planning, *Fourth Development Plan, 1985–1990* (Riyadh, Ministry of Planning, 1985), especially pp. 196–213.
14 Henry Azzam, 'Investment Climate in the Gulf: Opportunities and Constraints', *The Arab Gulf Journal* (Oct. 1986), p. 26.
15 Wells, op. cit., pp. 274–5.
16 Cf. Louis Turner and James M. Bedore, *Middle East Industrialization* (Farnborough: Saxon House, 1979), Ch. 6, for an excellent elaboration of these and other related issues.
17 For an analysis of the Gulf as a whole, see Nasif Dabdab and Badr Mohyuddin, 'Industrialization in the Arab Gulf', in M. S. El Azhary, *The Impact of Oil Revenues on Arab Gulf Development* (London: Croom Helm, 1984), pp. 91–106.
18 Ibid., p. 102.
19 Arab–British Chamber of Commerce, 'Saudi Arabian Petrochemicals Exports', *The Arab Gulf Journal* (April 1985), pp. 9–20.
20 Cf. Robert Looney, 'The Impact of Petroleum Exports on the Saudi Arabian Economy', in Robert W. Stookey, ed., *The Arabian Peninsula* (Stanford, Ca.: Hoover Institution Press, 1984), pp. 37–64.
21 Michael Field, 'Weathering the Storm', *Financial Times* (21 April 1986), p. 1.
22 *Wall Street Journal*, 28 April 1986, p. 1.
23 Wells, op. cit., p. 282.
24 Dabdab and Mohyuddin, op. cit., pp. 103–4.
25 Cf. Robert Looney and P. C. Frederiksen, 'The Evolution and Evaluation of Saudi Arabian Economic Planning', *Journal of South Asian and Middle Eastern Studies* (Winter 1985), pp. 3–19.
26 Louis Turner, 'Industrial Development Strategies in the Arab Gulf States', op. cit., pp. 215–19.
27 Ibid.
28 Based on questions of economies of scale and efficiency of plant size, cf. M. M. Metwally, 'Market Limitation and Industrialization in Arab Countries' (mimeo), 1979.
29 J. S. Birks and C. A. Sinclair, 'The Domestic Political Economy of Development in Saudi Arabia', in Centre for Arab Gulf Studies, University of Exeter, *State, Economy and Power in Saudi Arabia* (Symposium, 4–7 July 1980), p. 7.

30 See Ramon Knaverhase, 'Social Factors and Labor Market Structure in Saudi Arabia', Yale University Economic Growth Center, *Discussion Paper No. 247* (May 1976) for an elaboration of this thesis.
31 Ibid.
32 See Joseph Szyliowicz, 'The Prospects for Scientific and Technological Development in Saudi Arabia', *International Journal of Middle East Studies* (Aug. 1979), pp. 355–72, for a discussion of these issues.
33 Ibid.
34 Turner, op. cit., p. 219.