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Industrializing the Arab world: a speculative case study

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Some of the challenges facing Arab countries could be solved if their economies were industrialized. They have made much progress in some fields, but have failed so far to industrialize. While this is obviously a complicated issue, there are, at the same time, many countries that have been very successful in doing so. Speculating about such complex issues is nothing new. A reader of Western literature is daily confronted with speculative articles on the rise or fall of American power. A number of writers appear to be concerned that China will soon displace the United States as the number 1 superpower. (For a review of three books by Edward Luce on this subject, see *Financial Times* February 2, 2014.) Some thoughtful writers propose various possibilities on some countries' readiness to assume roles that may lead to a new political world order. Other writers frequently speculate on China possibly lacking sufficient creativity to displace the United States from its privileged position. There are no simple answers to such complex issues. Concern for the rise and fall of nations is of constant interest in Western literature, but by contrast concern in the Arab world is limited in scope and depth to the ultimate development of their own region. What is surprising in the Arab world is that despite the prevailing conditions the Arabs enjoy through their enormous assets, they seem oblivious to the rich possibilities that these resources provide. Arab countries are confronted with expanding populations, education, emigration and unemployment. It seems that unless they adopt a more serious interest in the challenges they face, they will be unable to escape from a state of permanent crisis. The purpose of this article is to speculate on the feasibility of utilizing the Gulf Cooperation Council's (GCC) railway system – estimated at approximately US$200 billion – as a tool for achieving industrialization. The railway system will be 1940 km long and include all GCC countries.

Keywords: Arab industrialization; Arab development; Gulf Cooperation Council (GCC) railway system

The challenge

There are certain political facts that are obvious. For example, there is a high rate in demographic growth of the Arab population. It is expected that the approximate population of the Arab world will grow from 300 million in 2000 to 750 million in 2050 and to more than 1 billion in 2100. There is a surprising propensity in Arab governments (without exception) to sustain limited interest in either employment or demography.

The prevailing paralysis of the Arab economies places a high pressure on Arab youth to seek employment abroad. Emigration is of two types: university graduates

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and unskilled labour. There is already a high density of Arab emigration to Europe, combined with an increasingly hostile welcome to emigrants with limited skills. Despite the relatively small population of the Arab world compared with China and India, their emigration record is as large as that of these much larger nations.

If underdevelopment stems from a shortage of human capital, the answer to the problem is clear: to expand and improve the system of education. If underdevelopment arises from the weakness of an enabling environment, then this factor should be attended to as a first priority.

Fortunately, there are many ways of studying this challenging question. One notes, for example, that China and India are now recognized as having well-functioning economic systems. Yet, on the basis of available statistics, Arab countries were doing better up to 1999 than either China or India in terms of education on a per capita basis. It is unlikely that there has been a dramatic change.

Both China and India are large countries and each is politically united under one government. This may well be the reason for their success. Some small countries are also doing as well as large ones. Seven of the leading 10 countries in socio-economic performance are small, with Norway and Iceland often in the first two positions. Therefore, size does not seem to be a sufficient explanation for the difference between Arabs, Chinese and Indians in economic performance.

In addition, until 1999, the Arab world contributed to the brain drain to Organisation for Economic Co-operation and Development (OECD) countries with as many high-level personnel as China and 30% more than India. Interestingly, the total number of emigrants (unskilled, dependents and skilled) from the Arab world is greater than the sum of Chinese and Indians.

The Arabs lose four to five times as many high-level personnel per capita as China or India. In other words, the latter two countries can retain more of their professionals than can the Arabs. This makes sense since China now devotes US$155 billion to research and development (R&D), representing 35 times more than the Arab world on a per capita basis.

All three regions – the Arab world, China and India – are roughly at the same level in terms of education. However, when it comes to the brain drain, Arabs lose many more people than the Chinese or Indians. China and India are doing much better in establishing a knowledge-based society.

If we look more closely at the relationship between the emigrants and their home country, both China and India make considerable efforts at benefiting from their emigrant human capital. If it were not for the Gulf Cooperation Council (GCC) countries, the number of Arab emigrants to OECD countries would have been much larger. This paper does not count Arab expatriates in the GCC as emigrants. In other words, Arab countries do not suffer from a shortage of human capital. It seems self-evident that the factors creating the difference in performance between these countries need serious consideration.

Arab countries are investing heavily in educating their human resources. However, the 100,000 engineers graduating annually from Arab universities, the tens of thousands of medical doctors, the scientists and other highly skilled people are subject to unemployment and to emigration. When such skills emigrate, society fails to organize training and employment for lesser qualified labour. The degree of how limited is the interest in the Arab countries in the employment of its labour is quite simply astonishing.

Arab labour also lacks training with the objective of constantly raising labour productivity. Such training is essential to reduce labour costs and improve earnings.

There does not appear to be any European concern in the employment of educated Arab emigrants. Educated Arabs do not appear to have any serious problems in living in Western countries. However, limited concern with the living conditions of unskilled labour inevitably leads to social problems. It does not require much reflection to expect such a situation to lead to conflict between residents of slums and host populations. To prevent a crisis, one would expect both Arab and European governments to be concerned by the current situation, and to adopt urgent measures to upgrade the technical skills of emigrant labour, and to improve their living conditions.

It can be readily established by anyone delving into the matter that European countries have the economic and political capabilities to address such weighty issues, while Arab governments have shown considerable incompetence in dealing with them.

It is suspected that some European countries wish to maintain slum living conditions for undesired unskilled emigrants in order to slow the inflow of new emigrants. Obviously, if European countries apply themselves to skill improvement and upgrading slum areas, there will follow an increase of emigration. On the other hand, if Europeans governments apply their extensive expertise in skill formation and employment to Arab emigrants, they would make a double contribution: first, to their own economy and, second, to facilitate the return home of some of the Arab emigrants, where they could apply their new skills. Yet, all indications show that neither the Arab nor the European sides appear concerned with this potential source of conflict.

The motivation for presenting this paper is to indicate that it is possible to undertake mutually useful measures that can overcome not only any potential crisis, but also ones that may resolve a major developmental crisis afflicting Arab countries. The proposed measures are likely to improve economic relations between European and Arab countries, as well as increase Euro-Arab trading.

This paper proposes to illustrate that these problems are resolvable, that jobs can be created within the Arab world and the pressure on youth to emigrate can be considerably reduced.

Origins of the crisis

Arab countries, as well as Iran and Turkey, suffer from similar failures: they have so far found it difficult to enter the industrial age which started 250 years ago. During the 19th century, and before colonialism dominated the region, leaders and governments of a number of these countries (the Ottomans, Egypt, Iran, Oman, Emir Abdel Kader of Algeria) exerted efforts to adopt industrial technologies. To all intents and purposes, Muhammad Ali in Egypt made the most sustained and serious efforts to do so (Zahlan 1978). Yet, they all failed to make the transition. Their efforts were inadequate. The worst aspect in this was that their failure to acquire technological competencies led them to be colonized, and this colonization, in turn, aborted all further efforts and deepened their underdevelopment. It was not until they regained their independence in the mid-20th century that they resumed an unsatisfactory process of development.

Moreover, by 1950 the accumulation of the political problems generated by the uprooting of the people of Palestine and the deprivation of their ancestral rights had transformed the priorities of the region. Arab countries, emerging from centuries of underdevelopment, were incapable of understanding the dramatic developments that had been occurring since the mid eighteenth century, and the imperial policies of Anglo-Saxon powers.

Most of the Arab countries adopted vigorous policies in the educational fields. In 1950, there were probably only some 30,000 Arabs who held a university degree, and there were barely 10 universities in the region. Since then there has been a dramatic expansion in university teaching, and millions of graduates have qualified from universities in the Arab countries. Some 100,000 engineers per year graduate from their universities. Today, the number of engineers may have reached more than 3 million.

Despite this, Arab writers remain pessimistic and wonder whether Arab thinkers and decision-makers can find the way forward (e.g. Hashem 2014).[1] Most interesting is that although massive youth unemployment, poverty and total dependence are the issues that are primarily afflicting Arab society, most of the debates going on there are about ethnic and religious issues. There is practically no serious public discussion on how it is that with more than 3 million engineers, Arabs import all their products, import 60% of their food needs, and have not learnt the technologies that would enable them to grow their own food, or to manufacture their own cars and other devices they want to acquire. In other words, why are the educated Arabs not employed in manufacturing the products they consume? They already have the basic skills, and it is now only a matter of policies for investment and the management of human resources.

The Arab world has a large supply of oil and gas. Arabs are unable to take full charge of a single facet of this industry independently. They have been exporting Arab oil for over a century now, and to date, vigorous national programmes to take full charge of this resource have yet to be implemented. By contrast, all European countries were able to copy the British early successes of industrialization.

By the 11th century, thanks to the great Arab physicist Hasan Bin al-Haytham, the Arabs were already at the door of modern science. Al-Haytham had demonstrated the critical concept that science is based on experimentation and not on speculation. This simple concept was the foundation of modern science.

Today, both Iran and Turkey appear to have made some advances by comparison with the leading Arab countries (such as Egypt and Saudi Arabia). Both countries may be able to make the transition to industrialization within the next decade. This is not, however, a foregone conclusion. Both Iran and Turkey still need to increase dramatically their support of scientific research, industrialize, establish comprehensive statistical services, encourage the formation of scientific societies, promote quality control, and promote national consulting and contracting technical services in all major disciplines of technologies. The progress underway, though positive, is still modest.

I have shown in a recent study that among the Arab countries Egypt was the only one that had a significant (though small) R&D output in the 1960s and 1970s. During the 1960s, Lebanon, Sudan and Iraq had a small R&D output. After 1975, the GCC countries, thanks to the increase in their oil revenue, rapidly caught up with Egypt and since 1988 the output of GCC countries equalled or exceeded all other Arab countries on a per capita basis. Furthermore, the GCC countries combined equalled the output of R&D from Egypt. R&D in the Maghreb countries started moving forward in the 1980s. Amongst the Maghreb countries, Tunisia is in the lead. The combined output of three Maghreb countries, Algeria, Morocco and Tunisia, exceeded the output of Egypt in 2006 (Zahlan 2012).

What is striking is the near total lack of cooperation in the scientific fields among Arab countries. Yet, there is considerable collaboration amongst Arab, European and American scientists. However, because Arab scientists are not party to Arab economic development, such collaboration does not make a significant contribution to national or regional development.

The efforts of Arab countries in R&D are severely limited by this lack of pan-Arab collaboration. If they had sponsored scientific collaboration amongst themselves, they automatically would be able to benefit from the collective pool of scientific capabilities. There is a considerable pool of scientific know-how in the Arab world which is not tapped.

The difficulty facing the Arab countries is that they cannot benefit from their R&D and human capital before they put in place national policies to overcome their technological dependence. This means they have to learn to develop their agriculture, since they now produce only 40% of their food consumption. Similarly, they have to learn how to mobilize their human capital to support the development of a scientific base to sustain their:

- oil and gas sector;
- transport sector;
- construction industry; and
- transform underdeveloped phosphate industries, and others.

All this immense chemical wealth is of vital importance to the Arab world. If Arab engineers and scientists were fully engaged in the development of these resources, they would create millions of jobs at home. The economic return to building a factory, or exploiting a natural resource, would have an impact on the Arab economy instead of on foreign economies.

Although Arab countries have developed competence in consulting and contracting, they are still dependent on foreign civil engineering. In all other fields they are still heavily dependent. To date they have insignificant capabilities in designing and manufacturing the industrial structures needed to extract and process their own oil and gas. Inevitably, this means they cannot employ fruitfully their human capital, and they are plagued with high unemployment.

Iran appears to be the most likely country in the Middle East and North African (MENA) region to industrialize first. No Arab country is close to entering the industrial age, but several (such as Tunisia, Lebanon, Syria, United Arab Emirates (UAE), Kuwait, Egypt and Saudi Arabia) may be able to combine their resources to do so.

Some expertise may be gained by attracting back some of the considerable number of distinguished emigrants, and there is always the possibility of attracting foreign expertise to train and manage the initial steps. Asian countries have experimented with a wide variety of patterns. The Koreans have been very successful in entering into joint ventures with prominent international firms on condition that they train their Korean partners and guarantee the quality of the services performed by their national manufacturing, consulting and contracting firms.

The challenge is to learn how to combine assets of human capital, markets, financial and material resources. Arab countries have to learn to open their labour market to talent and creative individuals, while, at the same time, upgrading local skills and standards.

The key element is to create a home for entrepreneurs. What is needed is an understanding of the nature of industrialization, and the processes of establishing friendly and supportive infrastructures. This means the rapid establishment of local manufacturing in several of the key areas of the local economy; the development of advanced chemical, mechanical and electrical engineering industries, which are heavily reliant on national human capital.

The GCC railway system and the creation of employment

The breakdown of the economic unity of the Arab world, which was initiated in the 17th century by the invasion and dismantling of Arab–Asian trade by Western powers, still persists. The Arabs have been unable to reconstruct any significant measure of economic, social and political cooperation amongst themselves. This is partly due to Western colonial policies over the past two centuries.

Yet, the Arabs today possess an enormous variety of capabilities to overcome these difficulties. First of all, they enjoy considerable complementary opportunities and challenges that they can easily exploit to their advantage. In addition to this, the opportunities available to them can contribute to positive international relations with Western powers. Needless to say, Arab development can play a dramatic role in the development of Africa, as well as in stabilizing the world economy.

The GCC market for the proposed railway system attracts 68,700 entries via Google. These entries discuss the virtue and usefulness of the railway projects. These entries extol the merits of the project, and some even elaborate on the entire cost of implementing it. Apparently, the estimated cost is of the order of US$200 billion. Nevertheless, there is not a single paper on the internet related to it devoted to the benefits of collaboration amongst Arab countries in constructing the system and its components. One would imagine that numerous Arab countries already possess mechanical engineering capabilities to contribute to the construction of some parts of the systems. In other words, the project will not only benefit the region through the services it is expected to provide, but also will contribute to the development of local skills and local industries. Clearly, developing these railway-related industries will enrich the countries of the region and internalize the technology.

The multiplier factor associated with this technology is probably around four or more, and thus the investment of US$200 billion in the region would generate US $800 billion through the multiplier factor. This would represent considerable employment opportunities from Morocco to Egypt and Yemen. Each Arab country could identify the type of activities that appeal to it, train its labour force and prepare their organizations to compete for a share of the work.

Evidently, the opportunities that are generated by the scale and type of such complex projects are enormous and would require considerable planning and cooperation. Good statistical services would, of course, be greatly needed to assist planners to generate realistic plans. The Arab countries that take the matter seriously will secure a greater share of the project. The development of mechanical engineering in the Arab world has been very slow, and such a project can give it a dramatic push. Furthermore, this activity would complement the services called for by the petroleum and petrochemical sectors.

Can the Arab countries indulge in development?

The fact is that many of the Arab countries have been able to participate in marginal industrial and economic development. What is lacking is a serious interest in industrialization. Many of the essential tools to do so are available in rudimentary form.

Nothing prevents Arab governments from expanding their capabilities in industrialization.[2] As a first step they need to expand and improve their statistical services. It is very difficult to develop when one does not have an accurate idea of what one possesses. The Arab countries possess not only considerable material resources, but also considerable human resources which can be readily improved and deployed more effectively to accelerate industrial development.

What one finds lacking are commitments to upgrading the skills of workers in a systematic and steady manner. The efficiency of Arab labour is very low, and they need large-scale training programmes. Some estimate the efficiency of Arab labour at some 10% of the labour force in industrialized countries. Steady improvement of labour productivity is one of the most critical tools of development.

What is stunning is to note the limited progress made throughout the region in a number of industries that are central to Arab countries. The largest industry in the Arab world is that of oil and gas. Yet we find very limited national capabilities despite the fact that large numbers of engineers and scientists have graduated from Arab universities. This local educational contribution is in addition to hundreds of thousands of Arab students who received their education abroad, some obtaining a doctorate degree.

The amazing feature of the Arab energy sector is the limited national capabilities in design and construction of all petroleum industrial installation, whether of refining or manufacturing petrochemical products.

The construction sector is also a vital and considerable industrial sector. It is probably the largest sector of the Arab economy. Though the Arab countries already possess a large range of expertise in both consulting and contracting, they still lag in technology, skills and standards. Considerable effort is needed to upgrade industrial capabilities, testing facilities and skill training. Much effort is needed to improve urban planning, architecture and local production of materials of construction. The failure of the Arab countries to penetrate this vast and vital industry certainly merits serious investigation.

Another important industry located in the Arab world is that of phosphates. The Arab world exports crude phosphate and phosphoric acid. Yet there are vast numbers of simple phosphate products that are vital for industrial applications. Unlike the petroleum industry, the phosphate industry should have been easier to penetrate. But there are no signs that significant efforts have been made to produce the vast range of phosphate by-products. Such efforts would have created jobs, and produced value-added products for export.

Most of the key industries needed are essentially based on mechanical, chemical and electrical engineering. Competent specialists are available to transform the management, efficiency and productivity of activities in all these sectors.

Can Arab countries industrialize?

Industrialization of the Arab world does not mean that every country has to learn to manufacture everything. It means that the various Arab countries could each select activity in sectors of business and industry that they would seek to develop in a competitive international market. This would, obviously, imply lower production costs of goods manufactured locally or regionally.

The issue of whether it is advantageous to GCC countries to adopt self-reliance and cooperate with other Arab countries to construct its railway systems needs to be addressed.

Serious cooperation of the Arab states in all the major sectors of the economy is both feasible and constructive. All states can benefit in different ways, depending on their resources and skills. Sooner or later, all Arab states will have to develop their transport systems. Thus, the expertise learnt from constructing the GCC railway system could be applied repeatedly in building railway systems in the rest of the Arab countries. Such models could also be exported to neighbouring African countries.

Industrialization is a complex process and involves a range of expertise, including:

- *Financial and insurance services*. Modern engineering depends on a wide range of financial services. Most consulting and contracting firms require financing to undertake substantial projects. Such services are in a rudimentary state in the Arab world. All countries wishing to industrialize will have to establish such services. Those that do not have such services can readily sponsor training programmes managed by their central bank to train bankers to deal with such issues. Furthermore, the companies working in this domain will need insurance services. Both workers and the equipment need insurance. Insurance services exist in Arab countries, but they may not be sufficiently comprehensive and need to be expanded to cover industrial installations. In addition, employees of these industries need protection from accidents. All these services would contribute to the expansion of the insurance industries in the region. They could be provided by firms in Egypt, Saudi Arabia or Qatar. None of these services would be offered free of charge; they are all commercial services, the cost of which would ultimately be covered by the project owner.
- *Civil engineering*. Constructing a railway calls for extensive civil engineering to determine the routes, design bridges and tunnels, build stations and repair yards. There are already extensive numbers of both consulting and contracting civil engineers in the Arab world. Given this fact, this will, most likely, be the easiest service to provide locally.
- *Manufacturing rails and other items to construct the railway*. The amount of rails needed would not be very big, and most probably existing Arab iron and steel manufacturers could upgrade their installations and produce the rails to the required specifications.
- *Quality control of all components*. A careful study would have to be undertaken to determine whether there are adequate testing services to verify the quality of the components produced locally.
- Local manufacturing of all railway carriages and locomotives.

Why the Arab world has so far failed to industrialize

Interestingly, up to now there have been limited efforts to overcome hurdles in the way of industrialization. Arab countries have frequently adopted measures that did not promote the acquisition of technological and industrial capabilities. For example, the great nationalist leader Ta'lat Harb who established Bank Misr sought to focus on ownership of the industry rather than ownership of the technology (Zahlan 2002, 347–368). The net result was that Egypt failed to secure control of the needed technologies.

A number of objectives need to be pursued simultaneously for a country to secure ownership of the technologies it needs. Korea was able to develop a systematic strategy through which it succeeded in acquiring control of the technologies it sought by building national policies, institutions and capabilities. I have reviewed in some detail the evolution of Korean contractors, and shown the complexity and continuity of their approach, and how the Korean government utilized the construction of a subway system in a manner to develop a comprehensive Korean industry for constructing and manufacturing the system. The project was executed through a joint venture between international and Korean firms (Zahlan 1991, 165–192).

GCC railway system serves as an integrative factor

Most Arab countries have been involved in planning the expansion of their railway systems. The process has been relatively slow and dependent on purchasing the service from abroad. Each national railway system was too small to justify building a national industry. However, building a technology base to serve the entire GCC as well as non-GCC clients should be adequate, with a reasonable amount of competition and ingenuity, to support the development of a comprehensive industry. Attention may have to be paid to merging existing industries as well as developing high-quality testing services. Some Arab countries already possess the capabilities for manufacturing railway subsystems. Korea was able to develop its policies on its own; but in the case of Arab countries they will have to establish a minimum level of mutual collaboration and cooperation.

During the 19th century, railway systems were diffused worldwide. This led to a revolutionary impact on the industrialization of Britain – the inventor of the technology – and in those countries that took active part in the process, such as the United States and several European countries.

Arab countries consume an enormous range of mechanical devices, from cars, to oil refineries, to household devices. In other words, they import a huge range of industrial products that are manufactured in mechanical industries. The same fields of knowledge needed to manufacture rail systems would enable Arab countries to build refineries, and manufacture cars, household equipment and an extensive range of other products.

Constructing or importing a railway system

The construction of a railway system calls for a large range of mechanical, electrical, communication, metallurgical and engineering skills. Over the past 60 years, Arab countries have invested enormously in the education of precisely such skills, both at home and abroad. Unfortunately, reliable and detailed statistics on the population of this category of engineers are not available. Yet, we know from statistics on studies abroad, and the numbers who have graduated from some 400 Arab universities, that some 100,000 engineers graduate annually from these universities. This could bring the 'virtual' number of engineers to some 3 million. The number is a rough estimate because it is not known how many engineers emigrated, retired or changed jobs. Nonetheless, given the sizeable number, it should be enough to enable Arab countries to become seriously involved in manufacturing.

The question of whether Arab countries should import the railway systems as a turnkey project – as has been the custom – is worth raising. With some 3 million engineers and some 30% or more of the labour force unemployed, one may think that it is.

Unskilled Arab labour is not needed in the labour markets of Europe or elsewhere, although there is no taboo against scientific and engineering Arab human capital. It is obviously the political responsibility of Arab governments to promote job creation to absorb the high rate of population growth expected during this century.

Korea has pioneered its own development during the past 50 years. It is relatively a much smaller country with few resources. Yet, the Korean government has successfully been able to adopt policies that promoted joint ventures between international firms and Korean firms to promote the development of local skills and know-how. Korea wanted to build an underground railway system. But Koreans wanted to build it themselves. However, they were not confident of going it alone. So they invited companies who were interested in working with Korean firms to form a joint venture and be responsible for the design and construction of the system through developing Korean capabilities. The idea was that the foreign firms would train, supervise, design and participate to a limited extent. The bulk of the work was to be done by Korean firms. The objective was to create a self-contained industry. Most of the materials needed, including rails, carriages and locomotives, were to be manufactured in Korea. Korea was successful in achieving its ambition in this endeavour and in numerous other similar cases.

Building the industrial base

Arab countries are half way along the road to industrialization. What remains to be done is to combine what has been achieved with new inputs, and the construction of genuine and committed engineering organizations.

A country need not undertake such a complex project on its own. There is, fortunately, a very large and significant international market that could be tapped. When the government of Korea decided to develop this same type of capability, it invited major consulting and industrial firms to enter into joint ventures with Korean firms to transfer the know-how to Korea. It wanted international firms to train and supervise and guarantee the quality of the work. At the same time it wanted Korean firms to manufacture most of components of the system and did not want to import more than one-third of the equipment.

It is interesting to note that several firms competed for the role and the project was very successful. There is little doubt that the Arab market is substantially larger than that of Korea and it should attract considerable international interest, if such an initiative were launched.

The industrial base to build a railway system overlaps with the same base needed to service the oil and gas sector, or the phosphate or construction industries. In fact, the same industrial base can service shipbuilding, food industries, the energy sector etc.

It is an indisputable fact that all countries observe, learn and copy from each other. There are infinite ways to implement these transformations. Once a region has 400 universities and millions of engineers and scientists, the process of development should be a simple one.

Conclusions

Designing and constructing the railway systems of the GCC countries could be achieved in many ways. The success of the recommended process could be guaranteed in a manner similar to that adopted by the Korean government when it sponsored the construction of the Korean subway system. If the GCC sought to use the railway system as a major instrument of industrialization of Arab countries, there would be numerous developmental by-products. The proposed approach could be repeatedly applied to all major programmes of Arab development. The major requirement for success is a unified vision of all concerned parties.

The benefits for European countries from an industrializing Arab world are multiple. Arab industrialization would call for the importation of a vast range of products and services to support its efforts. European countries would be able to trade with larger, more complex and sophisticated economic systems than at present. It would also considerably stem the migration of unskilled workers.

As the industrialization process advances, the scientific and technological needs of Arab countries would grow and provide considerable opportunities for collaboration with European industries. The spread of Arab know-how in industrialization to African countries would also contribute to regional development and collaboration with other parties. The considerable pool of active scientific and engineering human resources in the Arab world would provide partners capable of cooperation with European organizations.

Notes

1. Hashem questions the ability of the Arabs to develop autonomously, while the UAE sponsors a conference on the reasons for the intellectual and sectarian conflicts afflicting Muslim societies (*Ashark Al-Awsat* October 3, 2014).
2. A Google search under railway system for GCC reveals thousands of articles on various aspects of the GCC railways programme. One such reference is Lowe and Altrairi (2013). All aspects of the project are well documented except aspects of the design and construction of the system, and the relationship of these activities to the technological resources of the Arab countries. It should not be forgotten that many Arab countries had utilized similar engineering services during the mid-19th century and had not sought to acquire the know-how to build such systems. There is no discussion in these Google articles of the possibility of the Arab states being involved in the design and construction of the railway systems. The history of railway systems, since their inception in Britain, is well documented in the literature. What is proposed here is that individual Arab countries would develop their engineering capabilities to construct either parts, or all, of these proposed systems. This approach has been successfully achieved by a number of countries. A successful and consistent player in the acquisition of technology over several decades is Korea. Their efforts are discussed by Zahlan (1991, ch. 10) and more briefly by Zahlan (2002).

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