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# Smart Development: The Quest for a Knowledge Economy in Saudi Arabia

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## *Introduction*

Nations that have sought to overcome the resource curse and other barriers to economic growth have for some time sought greater development through a number of strategies: from import substitution in the 1950s to current strategies based on microfinance and human-capabilities approaches. Needless to say, the international community is still searching for the elusive Holy Grail of the optimal development strategy. One strategy that is gaining greater attention and adherents is that of promoting a transition to a knowledge economy. This paper is about one such nation: Saudi Arabia. In analyzing the Kingdom's quest for a knowledge economy, this article hopes to shed light on the anatomy of the strategy itself, as well as identify important preconditions for and barriers to the strategy's success. The case study of Saudi Arabia's quest for a knowledge economy carries important implications and lessons for other nations, especially those with resource economies, that are seeking effective economic plans of economic development and transition.

As one of the richest countries in the world and G20 economies, the Kingdom of Saudi Arabia has, for more than a decade, been taking aggressive steps to break the long-established link between the fate of the Saudi economy and conditions in the global market for oil. But even within the few highpoints of the oil age, and with revenues abundant, the Kingdom has found life in the oil age anything but trouble free. Accordingly, the Kingdom has taken wide strides towards economic diversification. In fact, abundant revenues often found a way to cause political and economic problems. Many economies dependent on natural resources have also found oil to be a "curse" rather than a source of wealth that propels the country's economy forward. The Kingdom has come to look beyond oil for the answers to a stable and vibrant economy, notwithstanding forecasts about the longevity of the oil age. The nation has firmly set its sights

on transitioning to a knowledge economy, as reflected in the spending pattern of the Ninth Five-Year Development Plan that concludes by the end of 2014. The foundations of such a technological society are the benchmarks of the leading economies of the modern age. Saudi Arabia sees its economic future as unfolding squarely within such a development plan. It is this new age that the Saudi's embrace as a means of escaping the instabilities of oil dependence, and arriving at a more prosperous and sustainable economic future. This article analyzes the prospects for success in Saudi Arabia's quest for this objective. It describes the nature of a knowledge economy, identifies the conditions within Saudi Arabia that favor the development of a knowledge economy, and finally it identifies existing obstacles to such a development while proposing suggestions for overcoming these obstacles. In marshaling these analyses, the article hopes to generate important implications and lessons on the greater issue of economic development and transition.

### *The End of the Oil Age?*

Daniel Yergin (2009 and 2011) has issued the most celebrated retort to the Neo-Malthusian chorus of naysayers who have been proclaiming the end of the oil age. With the price of a barrel of oil reaching \$147.00 in June of 2008, the chorus gained greater volume with a cacophony of warnings about trends in the supply, demand, and investment in the oil market. Yergin underscores the idea of an oil shortage as misguided, given that the Earth was sitting on 1.5 trillion barrels of reserves in 2009. Even more misguided, for Yergin, was the idea of "peak oil" (i.e., that the Earth has now arrived at its maximum potential in oil production). He avers that innovative technologies are not only finding substitutes for oil, but also creating the potential for greater discoveries, hence we should see increasing production of oil well into the future. While he acknowledges that "innovation" is leading the world toward a path of alternative energies, he does insist that we are not yet at a point where such sources are widely available, and hence "oil is still the one." Yergin insists that we can still comfortably rely on oil for some time without having to drastically adapt to new energy sources whose feasibility is problematic for wide scale use. But while Yergin appears Cornucopian about the Earth's short-term energy situation, he has continued to underscore the great uncertainty in the market for energy and the technologies that produce that energy.<sup>1</sup> In some cases, he has identified possibilities for "disruptive innovations," which have the potential to bring significant changes to the market for energy. So just like the scale and affordability of jet travel fundamentally altered the market for private and commercial transportation, the development of new and feasible technologies for energy have the potential to drastically change conditions in the market for oil. Moreover, many of Yergin's arguments about the wisdom of depending on oil are founded on speculation. Using Yergin's (2009, p. 93) own words when describing the likelihood of potential developments in alternative-energy technologies and their impact on the oil market: "in truth, we don't know, and we won't know

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<sup>1</sup> Saudi decision makers are expected to be Cornucopian in their outlook to the future of energy resources since they are affected by the Islamic tradition that assures that the wealth of every new born is predetermined by God.

until we do know.” Yergin in fact has not denied the potential for instabilities in the oil market, instabilities that would create a critical need to move toward alternatives. There is a consistent growing demand for automobiles in nations with populations of over one billion people (China and India). Oil companies have continued to be frustrated in the search for the holy grail of the next great ocean of crude. The environmental assault on the use of coal and oil has been pervasive and left a strong imprint on laws and economic regulation, so as to create increasing limits to the viability of their use. Both China and the US have staked an important economic wager on the profitability of alternative energy technologies, each competing to be the leading entrepôt for environmental innovation. Oil companies have been reluctant to build new refineries because of the size of the start-up costs and the uncertainty in the market for refined fuels (especially those companies whose refineries use more expensive grades of crude oil). Furthermore, oil companies themselves are working in tandem with automobile manufactures to develop alternative fuels for the greater integration between the markets for oil and transportation. These joint initiatives increase the corporate momentum toward the development of feasible alternatives in automobiles and complementary fuels. Finally, the integration of the markets for oil and investment has created the potential for greater instabilities in the price of oil, thus endangering prospects for long-term reliance on oil as a primary energy source. These instabilities hit both producer and consumer nations hard, as sharper variations in both oil revenues (for the producers) and energy costs (for the consumers) have had a crucial impact on the state of the economies and public finances for both sets of nations (Yergin 2009 and 2011).

Realizing that life in the oil age and extensive reliance on oil-revenue is anything but trouble free, Saudi Arabia founded as early as 1975 the Royal Commission for Jubail and Yanbu to oversee the construction of two major industrial cities, Jubail (a port on the Arabian Gulf) and Yanbu (a major port on the Red Sea). The modern infrastructure of the two cities was built to support petrochemical industries and oil-intensive heavy manufacturing industries through private investments. Yanbu is the site of the first world-wide and only Saudi-US dual purpose all-solar powered desalination plant, while Jubail gained worldwide fame during the Second Gulf War. A year later, the Saudi Arabian Basic Industries Corporation SABIC was established to produce chemicals, polymers and fertilizers.<sup>2</sup> Yet, the economy has remained fairly undiversified, with oil continuing to dominate in a nation sitting on one-quarter of global reserves in a world still dependent on fossil fuels. Even in recent years, oil has still been “the one” for the Saudi economy: accounting for up to 90% of Saudi exports, 75% of public revenues, and over one-quarter of GDP. Saudi Arabia is the largest free market economy in the MENA region, holding a 25% share of the total Arab GDP, yet the Saudi economy itself is still under-diversified relative to other economies, even MENA nations. Dependence on a commodity with

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<sup>2</sup> In 2008, SABIC was Asia's largest (in terms of market capitalization) and most profitable publicly listed non-oil company, the world's 4<sup>th</sup> largest petrochemical company, ranked 186<sup>th</sup> as the world's largest corporation on the Fortune Global 500 for 2009, the second largest producer of ethylene glycol and methanol in the world, the third largest producer of polyethylene, and overall the fourth largest producer of polypropylene and polyolefin. Standard and Poor's and Fitch Ratings identified SABIC as the world's largest producer of polymers and the Arabian Gulf region's largest steel producer for 2005 and assigned SABIC an 'A' corporate credit rating.

such unstable prices has left its mark on the Saudi economy and public finances, with greater swings in the economic and fiscal standing of the nation relative to nations with more complex economies. In terms of the energy sector, there are also foreboding developments on the horizon. While oil sales have increased, the price of oil has declined in the first half of 2012 from over 100 dollars a barrel to under 85 dollars. Like many oil economies, the Saudi's are plagued by some of the unfortunate effects of the resource curse. It will be difficult for an undiversified economy to pick up the slack caused by declining revenues from resource exportation. But even here, trends in Saudi energy use forebode a declining capacity to export oil even if production is stable. Energy use in Saudi Arabia has been increasing by 7% a year. The Saudi's presently consume 4 out of the 9 million barrels of oil that they produce daily. Extrapolating from these numbers, if nothing changes, then Saudi Arabia will be a net oil importer by 2035. It is therefore not surprising that the Saudi's have been vigorously pursuing the development of alternative energies for the Kingdom itself, including nuclear energy through the relatively recent establishment of King Abdullah Atomic & Renewable Energy City.

The Saudi economy has endured an ongoing malaise, even in the face of fairly stable oil production over recent years and the windfalls from the price of oil which reached 147 d/b in June of 2010, and has remained over 100 dollars until 2012. Unemployment has remained over 10% in recent years (close to the US rate), but with a higher youth unemployment (ages 20-24) rate. Demographic trends promise to make this problem even more acute, unless addressed, as Saudi society is very young with 80% of the population under the age of 30, 60% under 20, and 40% under 13 (the Saudi median age is 22). Moreover, recent trends show the population doubling every 20 years, which would mean the need for a very high and consistent economic growth rate in order to keep per capita GDP rising over that period. Yet even with such unemployment figures for Saudi citizens, a great many of the jobs in the Kingdom are still being filled by foreign workers (Gallarotti and Al-Filali 2012, Ramady 2010; Gause and Jones 2012, Lippman 2012, Jones 2010, and "Saudi Economy" 2012).

Indeed, even if the oil age were far from over and Saudi Arabia enjoyed favorable conditions in the market for energy, life under such conditions would prove difficult, as the history of economic instability for oil producers has demonstrated. Hence the Saudi's have been vigorously pursuing a new economic age for the Kingdom. The long-term plan for economic reform in the Kingdom issued by the Ministry of Economy and Planning (Ministry of Economy 2005) encapsulates the vision and urgency of moving toward this new age of the knowledge worker, a knowledge society and a knowledge-based economy. The Ministry is pursuing an ambitious quest to double GDP by 2020 from the 2006 level through a transformation of the Saudi economy. The planners envision industrial diversification largely driven through education and private-sector investment. According to the (latest) Ninth Five-Year Plan, half of the government's spending will be dedicated to human resource development, which includes education and training – reinforcing the Kingdom's goal of creating a knowledge-based society (Ministry of Economy 2010). The important long-term report of 2005 (which maps out a development plan to 2025--Ministry of Economy 2005) stresses the central role of the service sector: "The services sector, is expected to be the

leading sector in the process of economic diversification during the strategy period due to international advancements in communications and information technology which will be applied in the service sector in the Kingdom. This role will be of more importance with the increasing attention to upgrading the innovative skills of scientific cadres in the Kingdom as well as enhancing the tourist sector and utilizing the geographic position of the Kingdom in providing services that enhance international trade and capital flows through international markets.”

While the latest Ninth Plan stresses the central role of knowledge:

“The plan also encourages innovation in science and technology by providing \$240 million in grants for research projects each year. Other initiatives include the establishment of 10 research centers, 15 university technological innovation centers in association with King Abdullah City for Science and Technology (KACST), and at least eight technology incubators at KACST and other universities. The government will also continue to promote university collaboration with international companies” (SBC 2012).

There is in fact a pervasive emphasis throughout the Eighth Five-Year Plan (Ministry of Economy 2005) on the crucial role of information and communication technologies (ICT), research, education, and innovation in all sectors of the economy. In short, the very lynchpin to the plan is the development of a vibrant knowledge economy in the Kingdom. The importance of a knowledge economy in the report is encapsulated in the following statement, which relates to planning for reform in the context of a global revolution in ICT: “The strategy will have to adjust not only its contents but also its speed to respond to this global information revolution”. In addition the Ninth Five-Year Plan emphasized diversification of the economy horizontally and vertically, and expanding the absorptive and productive capacity of the economy in addition to building a knowledge society (Ministry of Economy 2010).

### ***Saudi Arabia’s Next Economic Age: a Knowledge Economy***

According to the first five year plan published by the newly created (in 2003) Ministry of Communication and Information Technology (MCIT-2005, p. 4), the vision of the economic future of the Kingdom is based on

“a transformation into an information society and digital economy so as to increase productivity and provide Communication and IT services for all sectors of the society in all parts of the country and build a solid information industry that becomes a major source of income.”

The emphasis on this objective is founded on the faith in the potential for information technology and human development as forces that generate pervasive impacts on national economies. Indeed

the extensive empirical findings on the association between knowledge (i.e., education and ICT) and economic prosperity attest to the important role played by knowledge in economic growth and development (Ramady 2010, pps. 396-400 and 2005, p. 188, and World Bank 2007). A major report issued by the World Bank in 2007 titled *Building Knowledge Economies: Advanced Strategies for Development* concludes: “whatever their level of development, countries should consider embarking on a knowledge- and innovation-based development process. In these times of accelerated globalization, ‘grey matter’ is a country’s main durable resource. Its exploitation for economic and social well-being is increasingly at the center of development strategies.”<sup>3</sup> The government has embraced this philosophy and has hence made it a priority to steer its economic evolution in that direction. The ambitiousness of the MCIT plan reflects the priority with which the government views a transition to a knowledge economy in its economic reform plans for Kingdom: it has seven general objectives, 62 implementation policies, 26 specific goals, and 98 projects. The seven general objectives are:

- Raising the productivity of all sectors through the optimal utilization of information and communications technology (ICT)
- Effective government regulation of ITC so as to assure is vigorous growth
- Building an internationally competitive information industry that becomes a major source of income for the Kingdom
- The optimum use of ICT in all levels of education and training
- Bridging the digital divide by enabling all of Saudi society to effectively use ICT
- The optimal use of ICT consistent with the civilizational mission of the Arabic language, patriotism and Islam
- The provision of individuals highly skilled in ICT through both training and attraction of foreign expertise

The idea of a knowledge economy goes back at least to the 1960s and the work of Peter Drucker. Drucker first introduced the concepts of knowledge workers and knowledge organizations in *The Effective Executive* (1966). Such workers and organizations produced “knowledge, ideas and information.” This identification of knowledge as a specific factor of production introduced a new input into the theory of the firm, which until this time emphasized the value of only tangible inputs such as physical labor and non-human capital. Drucker went on to underscore and generate greater interest in the subject of the knowledge economy in *The Age of Discontinuity* (1969), where he devoted an entire chapter to the subject. His ideas would go on to create an impressive legacy as the knowledge economy became a fixture in the pantheon of economic science’s central issues. The knowledge economy (also called the information economy, knowledge-based economy, and knowledge society) represents what some consider the fourth stage in the history of economic development: from the agrarian or pre-industrial age (pre-19<sup>th</sup> century--agricultural sector), to the industrial age (19<sup>th</sup> to mid 20<sup>th</sup> century--

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<sup>3</sup> Studies suggest that the demand for expert thinking and complex communication are growing far greater than the demand for more conventional skills in the market for labor in industrial nations (World Bank 2007, p. 12).

manufacturing), to the post-industrial (mid-20<sup>th</sup> century-present--service sector), and finally to the information age (late 20<sup>th</sup>-21<sup>st</sup> century—knowledge, information technology, innovation, and human capital). In reality, our present age is an amalgam of all four ages, as the global economy features all four basic models of economic relations. The knowledge economy in the fourth stage has an especially strong potential for interaction effects with production models of the first three stages in that its components can have a pronounced impact on the state of the other modes of economic organization. Hence the knowledge age may be a culmination in economic evolution in that it has introduced the principal means of guiding and coordinating all other forms of economic activity. As outputs, knowledge and information technologies have created entirely new markets. The products themselves serve multifaceted and pervasive uses in modern society. As inputs they are the foundation for improved management, product and scientific innovations, increased efficiency in the production of goods and services, and economic growth (Powell and Snellman 2004).

There is much debate on the issue of the knowledge economy, from its nature (is knowledge most important as an input or as an output?) to its effectiveness as a means of economic growth and employment-creation (which sectors are more knowledge-based than others? how much do knowledge-based sectors contribute to productivity?). This article seeks to analyze the potential for the emergence of a knowledge economy in Saudi Arabia rather than resolve these debates about the knowledge economy per se.<sup>4</sup> Powell and Snellman's (2004, p. 201) insightful analysis of the nature of the knowledge economy defines it as,

“ production and services based on knowledge-intensive activities that contribute to an accelerated pace of technological and scientific advance as well as equally rapid obsolescence. The key components of a knowledge economy include a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements in every stage of the production process, from the R&D lab to the factory floor to the interface with customers. These changes are reflected in the increasing relative share of the gross domestic product that is attributable to ‘intangible’ capital.

The knowledge economy features a number of qualities that suggest a fundamental difference from the three economic systems that preceded it, hence it is indeed a paradigm shift in economic evolution. First, it is far less influenced by time and space. Since the products and inputs are often intangible (information, skills), they can be created and used in most any locations at any time. Unlike tangible products, the components of a knowledge economy have no geographic or temporal restrictions. Second, the foundations of the knowledge economy are neither bound up in the application of human labor nor in that of non-human capital. Rather they are driven by human capital formation. In essence, the principal chariot of production and value is neither physical toil nor machines, but human knowledge and ingenuity. Third, in preceding

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<sup>4</sup> The literature is large and growing. For an excellent review of the literature and a fairly concise analysis of the prevalent debates regarding the knowledge economy, see Powell and Snellman (2004). For more recent and extensive analyses, see Dolgin (2012) and Ward (2012).



economic systems, education was bound up in the application of knowledge to specific modes of producing existing tangible products and services. In a knowledge economy, education is largely geared toward generating innovation, inventions, new products, and new modes of managing economic activity. Fourth, the knowledge economy is pervaded by non-rivalries in consumption. Since many of the inputs and products of the economy are intangible, they are subject to infinite and simultaneous use without depletion, hence economic relations are much less plagued with problems of limited resources. This in effect changes the very nature of economic relations: economics is no longer about the production, distribution and consumption of goods and services in the face of limited resources. In many cases the resources in a knowledge economy are unlimited. Fifth, this non-rivalrous quality introduces another difference in the knowledge economy: there is a far greater production of public goods relative to the previous three stages of evolution because knowledge is difficult to privatize. Once new ideas are born, they can be applied virtually everywhere.<sup>5</sup> This would amount to a new kind of positive externality from economic activity: products and inputs which become public domain. Sixth, unlike the three systems that preceded it, shocks in the knowledge economy are endogenous rather than exogenous. The system is designed to generate shocks, while shocks occurred as a by-product in the previous systems. These shocks have significant impacts on existing markets: they produce a faster pace of creative destruction, i.e., new ideas, products, and management systems make existing ones obsolete in a faster and more comprehensive manner (think of how quickly mass air travel made other forms of transportation obsolete). The process of globalization has compounded this speed and destructive fallout of innovations. So there is the possibility for very large rewards in the short-run with innovation, but the speed of dissemination often compromises the proprietary rewards from such innovation. Seventh, innovation is driven far more by supply relative to former ages where demand was the dominant stimulant for innovation. Moreover, demand in the knowledge age is much more a function of desire than need (unlike former ages where need played a greater role in encouraging innovation). Hence, demand for products and services in the knowledge economy tend to be somewhat more elastic relative to the demand for products in previous ages of economic development. The last two qualities create an economic system that is more dynamic and unstable relative to the economic systems of previous ages: change is inherent in the system; change generates fast and pervasive change in existing markets; and finally the rewards to innovation could be great, but could also be fleeting.

According to the World Bank (2007 and 2012), there are four fundamental pillars of a knowledge economy:

### *Education & Training*

“An educated and skilled population is needed to create, share and use knowledge.”

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<sup>5</sup> Even patents commonly expire after some designated period.

This is achieved through the development of a robust educational infrastructure: primary and secondary education, vocational training, higher education, and lifelong learning institutions. In terms of development, knowledge economies have turned comparative advantage on its head: uneducated workers that fed low-wage economies will become more of a liability than an asset in a world where more developed human capital reaps the greatest rewards. Globalization amplifies this tendency as the market for ideas has fewer boundaries in a growing world market.

### *Information Infrastructure*

“A dynamic information infrastructure [television, radio, telephone, internet] is required to facilitate the effective communication, dissemination and processing of information [and knowledge].”

A knowledge economy thrives on a robust network of ICT. The economic aspects of ICT are pervasive across sectors: as they represent a lucrative sector in themselves as well as an important input in the selling and marketing of other products and services. The potential for e-applications (i.e., e-business, e-government, e-learning) is great. In terms of development, ICT is the foundation for the construction of a modern industrial economy. It has the potential to produce fertile leading industries for economic take-off more easily because the requirements for acquisition and operationalization of ICT are modest compared to those of traditional brick-and mortar (i.e., high start-up cost) industrialization.

### *Economic Incentive & Institutional Regime*

“A regulatory and economic environment that enables the free flow of knowledge, supports investment in Information and Communications Technology ..., and encourages entrepreneurship is central to the knowledge economy.”

In this respect, governments must eliminate both political and market distortions that impede the efficient application of resources that are required for a knowledge economy to thrive. Through appropriate laws and procedures, a viable regulatory regime would encourage robust entrepreneurship and investment in ITC, as well as effective management of ITC enterprises. Fundamentally, it is overwhelmingly clear from the evidence on the correlates of development that better government produces more prosperous societies (World Bank 2007, p. 25).

### *Innovation Systems*

“A network of research centers, universities, think tanks, private enterprises and community groups is necessary to tap into the growing stock of global knowledge, assimilate and adapt it to local needs, and create new knowledge.”

A pervasive network of institutions that process and generate information, as well as institutions that produce innovations are a necessary condition for a viable knowledge economy.

Both public and private institutions will be the venues through which this clearinghouse of information and innovation operates: universities, laboratories, research centers, think tanks, private-sector R&D, government R&D. Public support for this clearinghouse will be especially crucial: first, because the government can sustain initiatives that are not immediately profitable; second, because government-sponsored innovation enters into the public domain more readily than innovation in the private sector; and finally, because government innovation is more closely targeted toward general social needs relative to the more restricted priorities of private-sector innovation. In terms of development, developing nations will be especially dependent on the government to be an engine of such clearinghouses because private investment in ICT and R&D are limited in those nations. Furthermore, such nations will also be far more dependent on information and technology that comes in through foreign direct investment. In this respect, developing nations with perspicacious governments that both invest in ICT and court FDI will find themselves in an advantageous position relative to nations that lack such governance.

### *Conditions Favoring a Knowledge Economy in Saudi Arabia*

Saudi Arabia is well situated politically, economically and socially to transition to a knowledge economy. In terms of the four pillars of a knowledge economy established by the World Bank (2012), it scores moderately high on the Knowledge Economy Index at 5.93, which places it 50<sup>th</sup> in the world.<sup>6</sup> But the most glaring statistical testament to its progress toward a knowledge economy is the fact that it has the best improvement in ranking of the 145 nations on the index. From 200 to the present it has moved up in the ranking 26 spots. The next biggest improvement is 18 years by Oman. Of the 145 nations ranked, fewer than ten nations had double-digit improvements in their rankings from 2000. Moreover, Saudi Arabia ranks fairly high specifically on the ICT score, which is especially important because it represents the information-technology infrastructure of a country. Its ICT score of 8.33 places it 21st in the world. In this respect, Saudi Arabia is one of the hardest-wired nations in the world in terms of information and telecommunications. It requires mainly an improvement in human capital to complement the technology: a more skilled and educated populace that is more capable of innovating, and more perspicacious bureaucrats to create laws and regulations that encourage the development of the other three pillars.

Nevertheless, the Kingdom is deliberately taking predetermined steps in the right direction towards building a high value human capital compatible with the knowledge age. This is exemplified in several initiatives, including but not limited to: the preparation and implementation of a plan for the future of university education commissioned by the Saudi Ministry of Higher Education in 2004 to advance the level all the components of higher learning and to enable it to respond to the needs of the sustained development of the country. Commensurate with this initiative, the Ministry established a set of concepts and the steps for

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<sup>6</sup> The World Bank's (2012) Knowledge Economy Index (KEI) is a weighted average of the measures on all four of the above pillars of the knowledge economy defined by the World Bank: education, innovation, ICT, and economic incentive regimes.

implementation of a program called “Afaq” or horizons. The program strives to provide the necessary information and analysis to develop a long term future plan for the university educational system across the next twenty five years (i.e., Afaq and the future of higher education 2005 – 2030) and to provide the principle milestones for developing staged plans for implementation during five years period. The process for implementation of this vital program at the national level comprises two important initiatives: developing theoretical capability and developing the implementation capabilities that involve application and training. The specific objectives of this project include: assessment of the scientific research needs in knowledge-based society; assessment of the realistic requirements of scientific research at universities; identification of the actual needs of active scientific research, including tools for performance of high level scientific research at Saudi universities; estimation of the level, effectiveness and productivity of scientific research at universities in a knowledge-based society.

Furthermore, a government scholarship program, implemented by King Abdullah in 2005, was instituted to provide an estimated 5,000 young Saudis opportunities for undergraduate and postgraduate studies at universities abroad for the 2007/2008 academic year. Saudi students received government scholarships funds for tuition and living expenses for up to four years. Students have mostly studied at universities in Canada, the United States of America, the United Kingdom, Australia, New Zealand, Switzerland, France, and Germany. According to the World Bank (2007a) Saudi Arabia provides female students with one of the world's largest scholarship programs. By this program, thousands of women have earned doctorates from Western universities. These efforts culminated in founding King Abdullah University of Science and Technology (KAUST) in 2009 as a public research university located in Thuwal, Saudi Arabia. KAUST focuses exclusively on graduate education and research, using English as the official language of instruction. It offers programs in life sciences, engineering, computer sciences, and physical sciences. On lower levels of the education system, the King Abdullah Project for General Education Development was funded in 2009 to the tune of \$2.4 billion over the budget of the Ministry of Education for six years to fund transformation of selected public schools into a model of excellence in education similar to the magnet schools in the USA, wherein the curriculum places great emphasis on excellence in science and mathematics. Extracurricular activities are directed towards developing intellectual, creative and communicative skills to create a skilled workforce for the future to build a knowledge society and economy. More than 400,000 teachers are being trained for the new program.

To accelerate the transition to a knowledge economy, the Saudi Government created the Saudi Arabian General Investment Authority (SAGIA) on April 10, 2000, an institution intended to promote and formalize the process of economic liberalization in the Kingdom. SAGIA plans involve launching six "economic cities" to be completed by 2020 to achieve the objectives of rapid and sustainable economic growth through creation of a pro-business environment, the provision of comprehensive services to investors, and the fostering of investment opportunities in key sectors of the economy, with emphasis on ICT and knowledge-based industries. These six new industrialized cities are intended to diversify the economy of Saudi Arabia, and in doing so are expected to make a significant contribution to increasing per capita income. The cities will be spread around Saudi Arabia to promote diversification for each region and their economy, and the cities are projected to contribute \$150

billion to the GDP, compared to a contribution of \$287 billion dollars by the urban areas of Riyadh and Jeddah by the year 2020. Over sixty billion dollars are allocated for the ongoing construction in four "economic cities": King Abdullah Economic City, Prince Abdul Aziz bin Mousaed City, Knowledge Economic City, and Jazan Economic City; all of which will have free-trade zones, research centers and higher education institutions and advanced IT and media centers. A key component of the King Abdullah Economic City, for example, is the Educational Zone which is intended to bring the Saudi capabilities and aspirations in technology to globally competitive levels. The Educational Zone consists of a multi-university campus flanked by two research & development parks. The multi-university campus houses a Science and Research Complex associated with Columbia and Thunderbird Universities and is designed to accommodate 18,000 students and a 7,500 cadre of faculty and staff members. Similarly, the Knowledge Economic City (KEC), situated to the east of Al-Madinah (the second Islamic Holy city) will be a cultural landmark for visitors and a national center for knowledge-based industries. Among the other zones are Taiba Complex for Technology and Knowledge-Based Economy, Technological and Administrative Colleges, Theme Parks, Islamic Civilization Studies Centre, Complex for Medical Studies, and Biological Sciences and Health Services.

Saudi institutions of higher learning have done much to enhance the development knowledge centers. The major research centers and institutes at the Saudi universities are directing a substantial part of their R&D activities on issues related to building a Saudi knowledge society and providing the foundation of a strong Saudi knowledge-based economy with the academic institutions as the prime motivators and managers. An example is the comprehensive research conducted by the Center of Strategic Studies, King Abdulaziz University with the results published in over 44 documents in its "Knowledge Series." King Abdulaziz University has also become noted for establishing the Wadi Jeddah Company, a university-owned organization focused on knowledge-based investments. Similarly, the Riyadh Techno Valley (RTV) is one of the contributions of King Saud University in building a partnership with the public and private sectors in the area of knowledge economics. King Saud University (KSU) is seeking to play a full part in this strategy through the development of a substantial science and technology park, "Riyadh Techno Valley - King Saud University (RTV-KSU)", on its Riyadh campus. Through this project, KSU aims to satisfy the demands of the knowledge-based industries, and to commercialize its research findings, in addition to enhancing the research environment and encouraging researchers and graduates to participate in the incubation program and to establish spin-off knowledge-based companies. Also, the King Fahd University of Petroleum and Minerals (KFUPM) recently established Dhahran Techno-Valley (DTV), a business cluster located in Dhahran, Saudi Arabia to attract research and development centers of local and international companies and to promote new businesses. It is envisaged as a leading research and technology development nucleus with comprehensive business support. DTV includes the King Abdullah Science Park (KASP), an innovation center at KFUPM, a liaison office, business incubator, industrial consulting office and a science and technology exhibition Scitech (Tayeb 2007, El-Saqqaf 2006a, Abulfaraj 2006).

The pattern of economic development programs and concomitant spending clearly indicates that the government is committed to an economic transformation that will create a more fertile environment for the growth of innovation, technology, and human capital. Since the

beginning of the 5-year economic planning system undertaken by the government, we see a significant shift from infrastructural and economic resource development in the first two plans (1970's) to a greater emphasis on industrialization, diversification, social and health services, human capital development through education and training, and private investment over the next seven plans. If we look at government expenditures on economic development over the nine plans, we see expenditures on infrastructure declining from 41% during the third plan (1980-84) to 14.7% in the current plan (2010-14). Over the same period, expenditures on resource development declined from 30.7 to 15.7. Conversely, expenditures on human resource development increased from 18.4% to 50.7% and expenditure on social and health development increased from 9.8% to 18.9%. The present government of King Abdullah has embraced this development strategy over the longer run with its *Long-Term Strategy 2025*: to transition over twenty years from a homogeneous economy founded on resource extraction to a modern industrial and knowledge economy (Ministry of Economy 2005). This modernization is being stewarded by King Abdullah's ambitious economic reform of the Saudi economy. In the *Long-Term Strategy 2025*, the Saudi Government has proclaimed the following targets: a doubling of GDP as noted; raising the investment component of GDP from 20.5% to 33.9%; decreasing the consumption component of GDP from 69.6% to 55.1%; increasing the private investment component of GDP from 15.4% to 30.7%, while reducing the public component; the share of both imports and exports as a share of GDP is expected to decline slightly as higher growth in GDP is expected to outpace the increase in trade (which suggests greater domestic sources of economic growth); oil and gas exports are expected to decrease by about half, from 71.7% to 36.7% of total exports; concomitantly the share of non-oil and gas exports are expected to increase from 20.7% to 53.7%; increasing industry's share of GDP from 19.6% to 24.9%; decreasing the oil sector's share of GDP from 27.5% to 17.9%, while increasing the non-oil sector from 72.5% to 81.1% of GDP; increasing the service sector from 27.4% to 41.9% of GDP; increasing the private sector from 52.3% to 69.3% of GDP; increasing the ratio of savings to GDP from 39.8% to 45.6%; increasing the labor participation rate from 36.9% to 56.3% of the population (this reflects an increase in the participation rate of women from 10.3% to 30% of the Saudi workforce); increasing the workforce from 8.55 million to 15 million, while decreasing the foreign workforce from 4.7 million to 3.2 million (i.e., Saudization); and increasing university graduates from 27.5% to 44% of the workforce. These targets clearly convey a strong desire to move out of early stages of economic development based on the harvesting of raw materials to more advanced stages. A prevalent theme in the language of the Ministry of Economy development plan (2005) is that success in achieving these targets, and thus transforming the Saudi economy, lies in establishing the foundations of a knowledge economy. Such references in the report are pervasive: "high skilled and well qualified labor," "scientific cadres," "advancements in communications and information technology," "economic diversification," "educational attainment," "high degrees of skill and specialization," and "human development sectors," (Ramady 2010 and Ministry of Economy 2005).

The economy of Saudi Arabia is strong and favorably situated to achieve such goals. While growth has been uneven due to changes in the price of crude oil, still it has been sufficiently robust, with consistent positive growth rates over the past several decades. The nominal GDP of the Kingdom has roughly doubled since 2005. King Abdullah has announced that the per capita income is forecast to rise from \$15,000 in 2006 to \$33,500 in 2020. Saudi

Arabia is one of only a few fast-growing countries in the world with a relatively high per capita income of \$24,200 (2010). Over the past five years: consumer spending has more than doubled; bank deposits have almost doubled to 1.1 trillion SR; inflation is down from 9.9% to 4.9%; non-oil exports and total imports have both grown by about 40%; the fiscal state of the Kingdom has been robust with yearly budget surpluses greater than 12% of GDP in three of the last five years; in the non-oil sectors, the service sector has increased by about 30%, while the manufacturing sectors have increased by 25%. In the first decade of the new century (2002-2010): crude oil production has remained strong and consistent, with the world share of production staying consistently about 10% and total production averaging over 3 billion barrels per year; crude reserves have remained steady at about 294 billion barrels, while world demand for oil (at about 85 million b/d on average) has risen slightly. Even with the current decline in the price of crude in 2012, still the price of crude in current dollars is four times greater today than it was in 1999, so oil revenues have been quite robust over that period. The current account surplus has been strong and consistent, averaging about 20% of GDP, while the capital account deficit declined from 22.4% to 9.4% of GDP from 2006 to 2010. Bank lending to the private sector has increased strongly and consistently over the past two years, reaching a yearly increase of 13.5% in April of 2012. The Tadawul All Share Index (TASI) increased from 5,500 in March 2011 to 7,900 in March 2012. The number of factories increased from 3484 in 2004 to 4878 in 2011.<sup>7</sup> And unemployment is down from 12% in 2006 to 10.5% in 2012 (Gamble 2012 and Ministry of Economy 2011).

Infrastructurally, the Kingdom has also shown promising outcomes in the first decade of the new century (2002-2010) that are conducive to the advent of a knowledge economy. The demand for electricity has approximately doubled; the area of paved roads has increased from 43,000 to 58,000 kilometers; railway track has been expanded with significant increases in passengers carried (from 714,000 to 1,124,000 people) and freight transported (from 165,000 to 4,005,000 tons); the activity at both commercial and industrial sea ports has shown large increases, from 43,526,000 to 80,252,000 tons at commercial ports and from 60,710,000 to 73,773,000 tons at industrial ports. In civil aviation the number of flights increased from 261,900 (in 2002) to 430,500 (in 2009); air passengers increased from 31,707,000 to 48,022,000 in the same period. In telecommunications the number of fixed telephone lines increased from 33,170,000 (in 2002) to 41,061,000 (in 2010); the number of mobile phone connections increased tenfold from 5,008,000 to 51,600,000 in the same period (which is equivalent to two connections per person in the Kingdom); the number of internet users increased from 2,360,000 (in 2004) to 11,400,000. In terms of manufacturing these products, the number of factories that produce electronic machinery and apparatus increased from 86 (in 2004) to 135 (in 2011). (in 2010) and the number of broadband subscribers increased from 35,000 (in 2004) to 4,400,000 (in 2010--Gamble 2012 and Ministry of Economy 2011).

Socially, the Saudi population is large and very young (figures cited above). While the youth of the nation presents a challenge for the economic future of the Kingdom, it also carries significant advantages for ushering in the advent of a knowledge economy. Young Saudis are

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<sup>7</sup> Tadawul is the Saudi Arabia Stock Exchange.

better adapted to the highly-educated and cosmopolitan world that serves as a breeding ground for the skills and technologies upon which information-based economies are founded. The government plan to enhance human capital development in Saudi Arabia goes back at least to the 1990s. Saudi youth are very well educated with almost full enrollment rates at the primary and secondary levels of education (with 93 % females enrollment at the secondary level as of 2010). Enrollment in higher education is strong with 36.6% of males and 37.3% of women enrolled at institutions of higher learning. While total enrollments in primary education remained fairly steady in the first decade of the new century (2002 to 2010) from 2,316,200 to 2,493,100, the enrollments at the secondary level and in higher education increased dramatically: from 842,200 to 1,146,600 and from 448,800 to 903,000 respectively. The number of graduates from institutions of higher education increased from 76,300 (in 2002) to 115,800 (in 2009). In terms of the quality of education, we see a decline in student/teacher ratios across all three levels in the same period: from 11.6 to 11.2 in primary education, from 11.6 to 10.1 in secondary education, and from 12.9 to 11.0 in higher education. Enrollments in the Institute of Public Administration increased from 21,884 to 50,503, while graduates of the Institute rose from 19,715 to 49,440. Enrollments in technical training increased from 30,060 to 84,737, while graduates increased from 5,074 to 20,415. Enrollments in vocational schools declined from 22,647 to 16,262, but graduates of vocational training rose from 4,818 to 8,387. A stronger educational system may be the most important means of promoting Saudization, since Saudi citizens qualified for high-skilled positions will have a competitive edge over foreign candidates in both domestic and foreign firms. Moreover, the Saudi government continues its generous funding of free higher education and by sending Saudi students abroad (Ministry of Economy 2011 and Bremmer 2004).

In essence, the demographics of education are testament to the success of an ongoing initiative on the part of the government to address a historic shortfall in the development of human capital. The manifestation of this shortfall has shown a dearth of Saudi youth filling high-skill jobs, hence the need to bring in foreign labor to fill the jobs. While the education system of the past promoted a preparation for “luxury” rather than high-skilled jobs, Saudi citizens have faced a situation in which foreign nationals have been displacing Saudi youth in the market for jobs requiring high levels of human capital development. Saudi Arabia is not unique in this aspect. Most countries including highly industrialized countries import the needed specialized skills as long as the domestic labor market suffers from shortage in supplying such skills. This is not different from importing the materials or equipment needed to boost production. In reality many countries entice highly qualified individuals to join their work forces whether because the human development of their specialized skills will take a long time or the cost will be prohibitively high. Although some institutions tend to resort to hire foreign nationals as a low-cost alternative to citizens with the same skill level, the gap in skills may be also manifested in higher wages for foreign-high-skilled labor. Furthermore, Saudi Arabia as a member of the World Trade Organization (WTO) and signatory of the General Agreement on Trade in Services (GATS) has a competitive labor market. Within this prevailing environment the Ministry’s (2005) twenty year plan seeks to vigorously encourage human development so as to enhance the process of Saudization. Furthermore, the increased successes in vocational and technical training have helped to mitigate a major distortion in the market for labor that has plagued the Kingdom: skill mismatches, i.e., too many advanced degrees and too few artisans or technicians with trade



skills. The evidence from across nations regarding differences between high and low skilled employments suggests that there is a significant “education” premium earned in high skill jobs. But there is also more job security in high skilled jobs with respect to redundancy: technology is more likely to replace low-skilled workers than high-skilled labor. Moreover, the findings on fast-growing small and medium enterprises (SMEs) suggest that it is these economic “gazelles” that provide one of the major solutions to problems of employment in MENA nations. Not surprisingly, these gazelles tend to reflect a strong knowledge-based profile: more high-skilled positions, more employees with advanced degrees, innovators, offer more training programs, use more multimedia technology. In light of this association, Stone and Badawy (2011, p. 4) proclaim that:” These findings direct policy attention towards education, training, quality systems, telecommunications systems and computer literacy, and competition policy (understood broadly) as key focal points for a strategy to promote SME-based employment growth” (Ramady 2010, Stone and Badawy 2011, Powell and Snellman 2004, Looney 1991, and Ministry of Economy 2011).

Politically, the most recent thinking on development, which is founded on a “human capabilities” approach, stresses the importance for political agency as a necessary condition for economic transition to higher stages in the ladder of economic evolution. The type of knowledge and industrial economy that the Kingdom is seeking will indeed require such agency to enhance the process of human capital formation and the growth of a private sector. Just on the issue of women’s employment alone, success in Saudization will in great part be driven by greater participation of women in the workforce. To circumvent some the social impediments and logistics of women’s participation in the Saudi workforce, the Center for Strategic Studies at King Abdulaziz University conducted in-depth analysis of the situation and have developed of means to facilitate the transition of university graduates to the labor force. Also, extensive studies were conducted on the provision of job opportunities particularly suited for young women within the prevailing traditions and social norms (i.e., designed to have limited impact on the women’s role as wives and mothers. A case in point is taking advantage of the advancement in technology that support telework: a spreading mode of work performance that saves energy and space which is being adapted around the world by major companies and organizations. Telework allows young mothers in their child-bearing years and home makers to use their education and training in contributing to the economy while being able to care for and nurture their young children. Further job opportunities are likely to develop with the advent of e-universities, e-learning and e-commerce as presented in a comprehensive study of “the role of e-commerce in the placement of graduates of women’s colleges in the Kingdom of Saudi Arabia”<sup>8</sup>. The present ruling regime of King Abdullah has embraced this association between agency and economic development in pushing for historic reforms in the Kingdom. His creation of a National Dialogue; his human rights commissions; his fight against corruption; and his educational, legal, political, and social reforms have gone beyond the nominal institutions of political agency embodied in such things as the Consultative Council ~~and the~~ (*Majlis Al-Shura*) system (i.e., political venues through which people can marshal a political voice) and have

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<sup>8</sup> El-Saqqaf (2006b).

demonstrated a commitment to modernization in a more liberal direction.<sup>9</sup> Furthermore, there is much generational momentum in compounding this reform movement, as many of the King's grandsons are themselves products of modernity, and a number of their spouses have even taken up social causes. Saudi society, like those of Arab Spring nations, is seeing increasing manifestations of political agency at both the grass-roots and organizational levels.<sup>10</sup> Lippman (2012, p. 36) cites an extensive study on reform in the Kingdom undertaken by a group of experts on Saudi Arabia, and highlights their finding that Saudi Arabia is indeed moving toward a "liberalized autocracy" (Lippman 2012; Riedel 2011; Deneulin and Shahani 2009; Ramady 2010; Gallarotti, and Al-Filali 2012; and Gause and Jones 2012).<sup>11</sup>

In terms of the social conditions for a knowledge economy, the principal issue revolves around interfacing a modern knowledge economy with a traditional religious culture. The Arab Spring has suggested that indeed the two are not as diametrically opposed as some might think. But it was certainly also the case that the Spring was to a large extent the result of the lack of economic opportunities for highly educated segments of the respective populations. Can a traditional culture co-exist with a modern society, and accommodate its economic needs? In effect, the modern Kingdom of Saudi Arabia has throughout its history proved that in fact such can indeed be the case. Many have cited the important role played by vast oil revenues as a means of purchasing political and social stability in the face of modernization. But in fact the Kingdom's most important asset in bringing these often conflicting forces into a peaceful co-existence has been its domestic "soft power" deriving from its religious status and the ruling family's political support.<sup>12</sup> In fact, the duration of the golden age of the Saudi distributive state has been all too brief and intermittent. The highpoint of oil wealth was in the 1970s, but since then (up until the oil-price boom in recent years), the Kingdom has been anything but an infinitely rich nation that was capable of spending itself out of political, social, and economic difficulty. The Al Saud have in fact been the principal sources of modernization in the Kingdom. Such success in modernization owes much to both the veneration of the ruling family itself as well as

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<sup>9</sup> Even the Council has progressed to a more publically accountable institution with greater dialogue between it and government ministers (Ramady 2010).

<sup>10</sup> There have been a number of popular provocations on political issues reminiscent of the Arab Spring process (i.e., networking and communication through modern media) that have gotten the attention of, and in some cases even responses from, the ruling family. To note a few, there was controversy over the floods in Jeddah in 2009, caused by government incompetence that was amplified by video clips transmitted on the internet. .

<sup>11</sup> The reforms are much more than just perfunctory window dressing. There has been much debate on the significance of the changes. Measured from a baseline of past political history, the reforms are significant. Measured by Western standards, they are still considered relatively small (The Long Day Closes 2012). But stable change can only occur incrementally, and there is no doubt that the trajectory of change is significant.

<sup>12</sup> Gallarotti and Al-Filali (2012) have analyzed the role of soft power (i.e., the cultivation of popular and elite support generated by perceptions of political legitimacy and cultural exceptionalism) in the history of the modern Kingdom.

the sanctity of the religious connections which the family has drawn between the Kingdom's progress/reforms and Islam.

### *There is Much Work to be Done*

Saudi Arabia is well on its way toward a knowledge economy, as the track record bears out. Already the Kingdom has made significant achievements in economic diversity, quality of life, and education. This success has been the outcome of, as articulated above, a number of favorable conditions in the Kingdom that have created a nurturing environment for economic transition. But there is still much work to do and many hurdles to overcome economically, politically, and socially ("The Long Day Closes" 2012). The ambitious goals of the plan of the Ministry of Communications and Information Technology (2005) are still far from realization. While economic diversification toward a knowledge economy is presently underway, the emphasis in government policy needs to continue to be on developing internationally competitive industries. It is within these industries that the market for innovation and technology flourishes. The failure to invest in such industries, both from private and public sources, has created one of the most significant barriers to economic transition in the Kingdom. To a large extent, Saudi Arabia is still being victimized by the resources curse.<sup>13</sup> Notwithstanding the major goal of developing the private sector in the Kingdom, the public sector is still large. Government ownership of industry in the Kingdom is still significantly high in comparison to the OECD average. Foreign direct investment is still relatively moderate, having remained on average under 8% over the past decade (and actually experienced a significant decline after 2008). Financial markets in the Kingdom still remain moderate in depth and size compared to other economies, hence indirect investment has also lagged behind the hopes of economic planners. An important precondition for growth in investment and private industry is structural reform: a stable economy, strong regulatory system, and a competitive environment (World Bank 2007, p. 52). But such reform has not progressed at the desired pace. Other more specific conditions like the absence of a reliable value system for the sale of public assets, rigid wage structures, and unfavorable corporate tax structures have held back the growth of the private sector. The government has also historically emphasized the localization of labor, which cuts against efficiency as well as producing regional gaps in filling high-skilled labor. The government has to continue to reduce distortions in the market for labor. One major problem has been a rapid urbanization which has denuded rural areas of sufficient human capital. It has in part has been caused by greater government spending on urban bureaucratization relative to rural bureaucratization. Another major problem is the still large number of government workers in the Kingdom, a historic means of reducing unemployment in an undiversified economy (Ramady 2010, Looney 1991, and Lippman 2012).

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<sup>13</sup> Comparative studies of national economies from 1960-90 demonstrate that resource poor economies outperformed economies of resources-rich countries, including the Kingdom, by a factor of 2 to 3 times in terms of growth (Ramady 2005, p. 194).

In terms of regional development, the present emphasis on urban and sub-urban development must continue, but not at the expense of neglecting rural development. A developed rural sector goes hand in hand with modernization and economic development. Rural industries are also prime candidates for knowledge economies: technical expertise in agriculture, rural-based telecommunication and information ventures, etc. Saudi Arabian rural areas have historically been the victim of a vicious cycle of deprivation and exodus. This is no different than the case in most of the developing countries wherein the onrush in industrialization has led to neglect of the rural sector which supports the national economy. In fact isolated and scattered rural areas in some of the major industrial countries suffer from migration to industrial cities whenever there is an imbalance between job opportunities in urban and rural areas. Accordingly the ministries of agriculture in many developing countries seek innovative ways to create job opportunities in rural societies and encourage SME's formed to vitalize the rural economy. Since public and private investment has concentrated on urban areas, the rewards to educated youth in rural areas has been limited, hence the large exodus to cities. Reversing this cycle through a vigorous investment program in rural areas would create a more even economic development geographically, thus abating migratory flows that are economically and socially destabilizing. One model for regional development, which has been implemented on a wide scale in Saudi Arabia, is establishing special economic zones (SEZs) with few bureaucratic entanglements, few tax burdens, and limited transaction costs (e.g., technology parks). As entry points for ICT ventures, these economic start-up projects are important catalysts for integrating national ICT markets and promoting general growth (World Bank 2007, p. 52).

As is being realized by Saudi scholars and educators alike, education is the catalyst to generating the change that will provide a fertile ground for an economic transition to higher stages of development in the Kingdom. To quote Bremmer (2004, p. 29) "The long-term success of reforms in the Kingdom depends on the emergence of a citizenry capable of playing an informed and active role in their society." Education must continue to be expanded and rationalized. Greater emphasis on innovative and critical thinking relative to memorization of texts must be the underlying pedagogical objective of Saudi education across differing levels of learning. There is still a gap between the demand for labor and the system of education in the Kingdom, the latter still promoting non-technical higher-education degrees that are best suited for government employment. The gap between the job market demand and the educational institutions supply can be eliminated through coordination of admission to different colleges, whether this is done nationwide as in Saudi Arabia or selectively by the different academic institutions through restricting the admission to specific specialties as in the USA and European Union countries. However, often times the time lapse between admission and graduation is enough to change the priorities of the job market resulting in a mismatch between demand and supply of the work force. In order to affect this reform, curricula in secondary and higher

education require an expansion of engineering, sciences, IT, and medical training. The expansion of vocational training should also be a priority, as should the expansion of distance learning.<sup>14</sup>

The creation of applied research institutions should be another major goal of education reform. The Kingdom has taken several leaps towards achievement of this goal by transformation of the major Saudi universities to research universities, in addition to the establishment of university-based research centers.<sup>15</sup> Since private institutions are more internationally competitive and likely to promote knowledge-based learning than public institutions, Saudi Arabia ought to encourage establishment of private learning institutions at all levels of education. Nevertheless this move may not be possible at this time since the current public education system is free for all. However, being a member of the WTO and by signing the GATS, Saudi Arabia will allow foreign universities to have branches in the Kingdom and open the doors as well for investment universities.<sup>16</sup> Furthermore, the economic cities under construction, such as King Abdullah Economic City, will be fertile sites for foreign universities. Moreover, in lieu of privatization, public institutions should become more independent in management and staffing practices. Academic independence is critical especially for research universities and associated research centers. Such an objective will also promote a more efficient educational system at all levels. This requires initiatives that create incentives for highly qualified individuals to become and remain teachers. It is also important to enhance the availability of and enrollments in rural educational institutions, an environment that has historically failed to generate high participation rates in primary and secondary education. Effective primary and secondary education has proved to be a foundation for creating a vibrant middle class, which itself is a necessary condition for a modern industrial economy. In some cases, this means a greater reliance on Westernization strategies, but also a more efficient re-allocation of indigenous resources (Al-Filali 2012, Ramady 2005 and 2010, Bremmer 2004, and Looney 1991).

With respect to specific sources of the knowledge economy, Saudi performance has been somewhat uneven. In terms of developing communications networks, the accomplishments have been commendable. Saudi investment has reached global media sources such as Fox News and Twitter. Moreover, the government has created science parks that collaborate with universities, and has created technology parks and industrial cities in Jeddah, Riyadh, and Dhahran. In addition, the establishment of King Abdullah University of Science and Technology stands as a landmark testament to the government's commitment to a new technological society in the Kingdom. However, in other areas, the performance has not been up to par. This is the case with respect to think tanks, patents and the publishing industries; also principal foundations for a knowledge economy. The findings of the *Global Think Tank Report of 2011* show Saudi Arabia as having just 4 think tanks in a world with over 3,000. Only 3 MENA nations actually have

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<sup>14</sup> An important institution for financing educational reform that has helped enhance the goal of Saudization by making the training and education of Saudi citizens "fit the job" is the Human Resources Development Fund, which was founded in 2001 (Ramady 2005).

<sup>15</sup> Research Universities (2006).

<sup>16</sup> Comparative Study of Education Universities (2006).

fewer: Libya with 1, Oman with 2, and Bahrain with 3. MENA nations as a whole boast 329 think tanks. Moreover, Saudi Arabia has no think tank among the MENA top 30.<sup>17</sup> In terms of patents, from 1977 to 2011 Saudi Arabia ranks 45<sup>th</sup> globally in the number of total patents acquired with 443; behind Greece, Bulgaria, Malaysia, and the Philippines. This is excluding patent applications filed in the Saudi Patent Office (established 1990) under the administration of the King Abdulaziz City for Science and Technology and the GCC Patent Office (which became operational in 1998), wherein applications are filed and issued in Arabic. The United States, by comparison, has 2,433,535. Every individual state in the United States, in fact, has more patents to its credit than the entire nation of Saudi Arabia. The American state with the fewest number of patents is Alaska with 1,327, three times the number of Saudi patents. Also, in terms of the percentage of population having achieved a tertiary education and national investment in knowledge as a share of GDP, Saudi Arabia still ranks outside the top 20. Accordingly the Kingdom launched an extensive campaign to encourage the Saudis to register their innovations. The Saudi government and the universities provide financial and status-based incentives to inventors and facilitate submission of patent applications. For example, the King honors those who obtain patents. In the area of publishing and printing, we have seen only a modest increase in the number of factories from 108 to 117 in the last 7 years. Traditional publishers in the Arab world tend to congregate in one of the major cities. Cairo, Egypt maintained its status as the publishing capitol of the Arab countries and the Muslim world until the sixties at which time Beirut, Lebanon became the flagship of publishing in the Arab World. Such concentration of publishers in one place is gradually dismantled. As much as the Kingdom has become more hard-wired in both industry and among the public, it still lags behind even some Gulf States in the use of information technology. The Kingdom lags behind the UAE and Bahrain in mobile phone and internet users, as well as in computers per household. To accelerate the correction of such a shortfall, the universities are examining the situation and providing solutions to bridge the digital divide, and the Saudi Government is promoting programs to spread the use of internet and computers. One such effort in that direction is the expansion of e-government in the Kingdom (World Bank 2007, Global Go To 2011, Ministry of Economy 2011, Ramady 2010, Hammond

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<sup>17</sup> Think tanks are in reality alien to the MENA region, since some of those existing in MENA countries could be financed to work for a foreign country other than the host country. Such practice is well known in the case of Egypt since think tanks financed by the USA, Germany, UK and other countries are not unfamiliar. In the same time, the governments in MENA countries as well as the political, economical and social organizations rely mostly in semi-permanent consultant groups in lieu of think tanks. Furthermore, the opinions and findings of those groups in their service to the establishment or to other concerns are often out of circulation. Such is not the case in the USA for example wherein think tanks working for the government or political parties are in the habit of publishing or releasing their stand on national issues to the general public. On the other hand, the number of research centers and houses of expertise could easily exceed their number in the MENA countries all together. Case in point the number of the major research centers and laboratories in King Abdulaziz University alone is 23 centers, in areas of excellence of the university, some of which have gained international fame. This is in addition to deanship of scientific research and vice presidency of graduate studies and scientific research.

2007, Pintak 2006, U.S. Patent and Trademark Office 2012, E-government 2006, and The Digital Divide 2008).

An important gateway to a process of economic take-off into an information economy would be the energy sector. It is after all the sector in which the Kingdom has long enjoyed a strong competitive advantage. Over-diversification in the Saudi economy would be a mistake, since there are a plethora of platforms in the energy sector that have the potential to develop knowledge-based elements. In trying to get away from an energy economy, planners must be careful not to “throw the baby out with the bath water.” Needless to say, at present Saudi industry is best developed along all the differing phases of energy production, from upstream to downstream. All state-run energy-based companies are fully integrated internationally with foreign companies. It is here that the economy has amassed its greatest storehouse of knowledge-based capabilities. In this respect, oil itself can turn into gold in terms of the international demand for expertise in extracting and refining oil products. But there is a natural spin-off benefit based on integrated expertise with other energy industries such as natural gas, petrochemicals, power generation, water desalination, alternative energies, and mining. These other energy industries are indeed being increasingly developed, but the emphasis needs to be more on developing the informational and technical aspects of the industries, rather than on the value of the energy output to the Saudi economy. The opportunities are especially great now that Saudi Arabia is still a crucial international energy hub, and it can use its commercial influence to become the most important international entrepot for information and consulting services on all types of energy and resource extraction industries. Since the energy sector is pervasive in the Kingdom, its information-based growth promises to have the greatest impact in terms of positive externalities for other sectors, and hence has the greatest potential to be a catalyst industry for general economic development. There is significant spin-off potential in the Kingdom’s energy sector for clean energy technologies. Forecasts of global patterns in the use of energy suggest that clean energy technologies and expertise will be in great demand as this growing industry is foreseen as a principal economic driver in the near future. Moreover, clean energy technologies naturally open up subsequent spin-off opportunities in new environmental industries, which are also among the most promising future industries. Even Obama has embraced clean energy as critical component of the future US economy.

The rich history of Saudi Arabia’s involvement in renewable and clean energy research, technology and industry goes back to close to a half century. It culminated with launching the joint Saudi-USA SOLERAS program in 1977, wherein scientists and experts in renewable energy technology from both sides participated in research and development and US and Saudi joint ventures and large and small companies carried out competitive projects from design to operation. The program was administered by the Solar Energy Research Institute (SERI)<sup>18</sup> of the US Department of Energy and the King Abdulaziz City of Science and Technology. The administration of the program transferred after the end of the Carter administration to the bMidwest Research Institute (MRI), Kansas City, Missouri. The SOLERAS program brought to the forefront commercially viable renewable energy equipment, devices and systems which

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<sup>18</sup> Currently, the National Renewable Energy Laboratory (NREL), Golden, Colorado.

existed in the past as concepts only. Among the projects completed by the program: a passive solar greenhouse, an active solar desalination plant, solar powered traffic signals, cooling laboratory, solar powered city in Saudi Arabia, solar electric power generation in the USA. The Saudi energy sector is primed to expand into the specific growth areas comprising clean energy: end-use energy efficiency, emerging technologies, demonstration and deployment programs, and commercial technologies. Other Middle Eastern countries have already embraced the spin-off potential of resource extraction as spending on clean energy in the region has increased dramatically in the past decade (Shihab-Eldin 2009 and Ramady 2010).

Politically, King Abdullah's political reforms have embarked the Kingdom on a path to greater political and economic agency for all of Saudi society. As noted, there is a very strong association with such agency and economic development. Both interact to reinforce one another, but a strong necessary condition for a modern economy with a prosperous middle class is indeed a society that has been empowered both politically and economically. The empowerment of women is especially important. Women in the workforce will enhance Saudization at all skill levels, but they are especially poised to fill knowledge-based jobs that the economic reforms promise to create. Women in the Kingdom own large amounts of wealth, enjoy extensive commercial proprietorship, and their enrollment in higher education is greater than that of men.<sup>19</sup> A total of 636,245 (268,080 male and 368,165 female) students were enrolled in higher education in 2006: 528,146 students (187,489 male and 340,657 female) were in Bachelor programs, 9,768 students (5,551 male and 4,217 female) were in Master Programs, and 2,410 students (1,293 male and 1,117 female) were in Ph.D. programs (Ministry of Economics and Planning 2008). Furthermore, in 2006 the gross enrollment ratio for females was 36.1 percent, the gross enrollment ratio for males was 24.7 percent, and the total gross enrollment ratio was 30.2 percent (World Bank 2008). Much is presently changing to give women greater social, economic, and political power. We see an increase in female employment across a cross-section of the labor market which has traditionally only been filled by men, women having historically worked either for the government or in education. Special institutions for the technical training of women have been constructed. But even under the present restrictions on the agency of women, information services are well adapted to their employment. Such types of jobs allow women to work from home and they are also unaffected by workforce demographics, i.e., women can effectively do their jobs without having to share offices with men. Empirical studies on the effects of economically empowering women definitively attest to the great potential such economic and political agency has for growth and development within their greater economies (El-Saqqaf 2006b); Jacobsen 2011; King, Klasen, and Porter; and Ramady 2005).

With the abundant soft power enjoyed by the Al Saud family from both its political and religious status, the royal family maintains significant support from Saudi society to carry on its reforms in the long and short terms. And this requires the continuation of conceptualizing and articulating its reform strategies in the context of Arab culture and Islamic values. The most venerated scriptures of Islam contain a significant amount of content that is consistent with the

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<sup>19</sup> We also see the creation and growth of women's organizations in the Kingdom. Such organizations are a boon creating support networks that empower women.



acquisition, the spread of knowledge, modernization, economic growth, and economic agency for all groups and both genders. Indeed, modernization is most compatible with the national culture and religion. Ultimately, the royal family should continue doing what it has done best: promote modernization within the Kingdom's prevailing religious and cultural principles (Gallarotti and Al-Filali 2012, Nehme 1994 and Ramady 2010).

### ***In Lieu of Conclusions: The Need for Speed and Resolve in Economic Reform, and the Promise of a Knowledge Bourse***

The Saudi government is strongly committed to a transition away from a resource economy founded on oil. Even if the oil age continues and oil nations continue to prosper, life in the oil age has proved difficult even when revenues were abundant. Indeed, the Kingdom has set its sights squarely on joining the ranks of nations that embrace the potential of a knowledge economy. Ultimately, however, it behooves the Saudi government, as well as other governments that are seeking a similar economic transition, to spare no expense nor delay in bringing this transition about. The transition cannot be fast enough, as early government spending on developing a knowledge economy will diminish the need for later spending as the transition becomes self-perpetuating. The greater the upfront investment, the fewer will be total expenditures over the long run. Also there is a competitive element involved, as the early knowledge economies become international hubs whose growth is more self-reinforcing, while the laggards fall further behind.<sup>20</sup> Hence the rich get richer and the poor get poorer in the international market place for information and technology. In this respect, there is a strong *first-mover benefit* in transitioning to a knowledge economy. As Powell and Snellman (2004, p. 214) note:

“Technological advance, like many aspects of economic and social life, is often characterized by a feedback process in which early success is heavily rewarded. Just as more educated workers are garnering the lion's share of gains from the knowledge economy, both specific institutions and regions that were ‘present at the founding’ capture increasing returns from the knowledge economy....In the intensely competitive realms of basic science and technology transfer, positive feedback and increasing returns are enjoyed by early entrants, while institutions and regions that did not have a hand in the initial discoveries struggle to catch up.”

To accomplish this, economic planners must move beyond the conventional liberalization and modernization strategy to a new strategy of development. This will take four strong attitudinal characteristics that nurture knowledge: determination, vision, openness, and pragmatism.

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<sup>20</sup> The World Bank (2007, pp. 15-18) report on *Building Knowledge Economies* stresses the burgeoning competition among nations to transition toward knowledge economies, and that the competition is especially fierce among developing nations that are using knowledge capital as a basis of their development strategies.

Effectively this translates into going beyond freedom and modernity and becoming: an innovator, a challenger, forward-looking, an opportunist, a global competitor, and ultimately a “winner” in the quest for knowledge and technology (World Bank 2007, p. 49).

One very promising new idea in accelerating the development of a knowledge economy in nations is that of establishing a knowledge bourse. A knowledge bourse would provide avenues for participation of a large base of knowledge workers and experts on the local, regional and international levels in the process of building a knowledge society and thus facilitating the transition to a knowledge economy. The concept of trading in knowledge stocks and knowledge futures was conceived in Saudi Arabia and developed by pioneers who have been working for over a decade on R&D in different facets of knowledge investment. This financial innovation provides for systems and methods to establish a bourse specialized in trading in various forms of knowledge encompassing inventions, intellectual properties and any type of explicit knowledge that have tangible value in the marketplace. The creation of a knowledge bourse would provide a market for trading in knowledge stocks and commodities of different types. In Saudi Arabia, a road map was designed and drawn to implement a Saudi Knowledge Bourse both as part of the Saudi Exchange “Tadawl” or as an independent entity specialized in knowledge trading (Tayeb, Al-Filali, and Gallarott 2012; Tayeb and Al-Filali 2011 and 2012).

The knowledge economy carries great potential for nations that want to insert themselves at the cutting edge of economic innovation and development, but the lion’s share of spoils will go to the nations of those planners perspicacious enough to embrace the need to be committed and to be at the international forefront of implementation.

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