

The Role Of Universities In Building A Knowledge-Based Economy In Saudi Arabia

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ABSTRACT

A knowledge-based economy is one of the vital components of modern economies. Growth in most of the economies of the world, and most developed economies in particular, are increasingly based on knowledge. In a knowledge-based economy, economic development is dependent on investments in education, learning and training, among others. Universities are today becoming aware of the essential role that higher education plays in the construction of knowledge-based economies.

The kingdom of Saudi Arabia (KSA) has adopted the drive toward a knowledge-based economy through focusing on the higher education sector. Saudi Universities are playing a pivotal role toward the Kingdom's transition into a knowledge-based economy and hence achieving economic growth and development.

The purpose of this paper is to critically examine the important role that universities play in building a knowledge-based economy through innovation, research commercialization, and technology transfer as economic development policies. The role of universities in building a knowledge-based economy in Saudi Arabia is also investigated. The paper confirms that Saudi universities are considered as a very important entity in the aim for the Saudi economy to achieve sustainable growth and development.

Keywords: Knowledge-Based Economy; Universities; Saudi Arabia; Economic Development; Economic Growth; Innovation; Technology Transfer

INTRODUCTION

*K*nowledge is the foundation of the renaissance of all countries. The source of economic growth and value-added activities increasingly relies on knowledge (Stehr, 1994). A knowledge-based economy refers to one that focuses on production and management of knowledge (Cooke & Leydesdorff, 2006). The Organization for Economic Co-operation and Development (OECD) defines a country with a knowledge-based economy as one where “the production, diffusion and use of technology and information are keys to economic activity and sustainable growth” (OECD, 1999). Such an economy depends on the adaptive and creative thinking skills of individuals to come up with solutions for problems prevalent in their society. This shows that a “knowledge-based economy” and a “knowledge-society” are mutually interactive and positively correlated. Furthermore, it means that a knowledge-based economy depends on the human capital as the major source of new and innovative ideas, which is enabled by the Information and Communications Technology (ICT). It is thus an open source economy of ideas intended to invent a future state for a better society and, ultimately, a more sustainable world than the present state (OECD, 1996).

Knowledge is produced, transmitted and applied in all activities, including in the creation of goods and information services. The resultant products are then referred to as “knowledge products.” Demand for such products is increasingly on the rise, causing considerable change in the structure of the global economy as well. In this case, management in all sectors of the economy needs to use knowledge to achieve competitive advantage. Accordingly, a knowledge-based economy utilizes knowledge as a major tool in amassing wealth, raising

efficiencies, enhancing economic growth, and creating jobs. Besides the development of knowledge products, some countries relate a knowledge-based economy to higher education and research (Powell & Snellman, 2004). According to the World Bank (2007, 2012), education and training represent one of the four fundamental pillars of a knowledge economy.

Initially, many of the leading countries depend on the traditional resources, such as labor and capital, to create wealth and fuel economic growth. However, with globalization, emerging trends, and technological advancements in the present highly dynamic economic environment, most of them have gradually shifted into the new economy. They capitalize on creating new knowledge and innovation and adapting new technology to drive their progress in economic growth. Basically, they have changed into knowledge-based economies (Godin, 2006). Knowledge is their greatest asset that places them in the lead, compared to other countries that are still in the transition stage or are lagging behind. Notwithstanding, in the past two decades, most of the latter have witnessed the benefits and have been convinced to accept change. The Kingdom of Saudi Arabia is one of those countries that is enthusiastically transitioning to a knowledge-based economy, especially through university education and research.

Present international practices, theory, and experience have proven the fact that the contemporary drivers of economic development have changed. More specifically, they ascertain that knowledge is now a key factor in economic growth. Research findings have also enabled researchers to advise that for a country to enhance its national economy's competitive advantage and achieve the benefits that come with the aforementioned developments, economic policies – including science, technology, and industry policies – need to take the different aspects of knowledge into consideration. Such aspects include the new role of technology, innovation, and its utilization in all sectors, education, lifelong learning, entrepreneurship, and sharpening the skills of the workforce.

Countries that have switched into the new economy are reaping the enormous benefits that result from using knowledge to generate both tangible and intangible products and values. A knowledge-based economy gives the economy of a country a forward thrust and places it at a strategic competitive advantage. Furthermore, it results in increased income and revenue. Emerging trends, globalization, and international trade require economies to adapt effectively in order to grow in an increasingly competitive world. Thus, countries invest in research and development, and education and training to maximize benefits and maintain a competitive advantage. This means that the basic need for a knowledge-based economy triggers such investments that are key to economic growth.

A knowledge-based economy results in new and increased employment opportunities. This is because it requires a workforce that can run the highly dynamic trends efficiently. People with the required skills thus get jobs in the new high-technology industries and new sectors. Thus, a knowledge-based economy results in investment to develop a highly-skilled labor force (Fernandez, 2001). Research, technological advancement, and a highly skilled workforce translate to productivity gains and, in turn, boost economic growth and development.

A knowledge-based economy also triggers knowledge distribution. This occurs through formal and informal networks and results in increased economic performance. The emergence of new media and social networks has increased the codification of knowledge through computer and communications networks. Skills and tacit knowledge are required to fit in. It is also required in a knowledge-based economy where innovation has changed from the traditional linear model to entail interaction between producers and users (Godin, 2003). Another determinant of economic growth is the national innovation systems that have been configured to encompass interaction among government, academia and industry in development of science and technology. Evidently, knowledge-based economies have triggered, fostered, and accelerated economic growth in both developing and developed countries.

UNIVERSITIES AND KNOWLEDGE ECONOMIES: OPPORTUNITIES AND CHALLENGES

Developing countries face significant new trends in the global environment, such as the increasing importance of knowledge, the main driver of growth within this information and communication revolution. The positive role of higher education sector in building the knowledge-based economies is highly promoted by international organizations such as the World Bank. Investment in quality training and higher education generates major external benefits that are critical for knowledge-driven economic and social development (Ramady, 2010).

Universities are a key facet that plays a central role in a knowledge-based economy. Today, the role of the contemporary university goes beyond teaching and conducting primary research. It incorporates the high demand for science, technology, and innovation as the foundations of a knowledge-based economy. Universities do so to align their ambitions to lead nationally and be recognized internationally with the global agenda of their respective countries to establish a sustainable economy (Godin, 2004). Thus, universities strategically collaborate with the business sector and/or the public sector with the main aim of exchanging knowledge for developing and using research findings and research-based education to increase the competitiveness and maintain the competitive advantage of the county's trade and industry.

Universities are the source of strength in the knowledge-based economy of the twenty-first century. They are increasingly viewed as key drivers of innovation and "major agents of economic growth." Consequently, many policymakers view research universities as "knowledge factories" for the new economy with largely untapped reservoirs of potentially commercializable knowledge waiting to be taken up by firms (Wolfe & Bramwell, 2008). However, this overly mechanistic view of the process by which basic scientific research is transformed into economically viable products demonstrates not only a misconception of the commercialization process itself, but also of what universities can and should be expected to do. When knowledge flows, it drives innovation, but knowledge transfer and knowledge spillover in the national economy are a complex, repetitive and fluid process that is influenced by many factors. According to Wolfe and Gertler (2004), universities are more of followers of technological innovation than leaders; that is, "catalysts" rather than "drivers." The fact that a leading research university is situated in a certain community in itself is not sufficient to stimulate strong regional economic growth, although it can make significant contributions to the process (Wolfe, 2005).

Evidence has been established confirming that universities are powerful institutions for commercializing knowledge and key drivers of regional innovation systems. This is largely reliant on empirical work produced in some of the world's most dynamic regional economies, such as Route 128 in Massachusetts and Silicon Valley in California (Huggin & Johnston, 2009). These argue that companies in other regions may lack the levels of 'absorptive capacity' required to fully benefit and make use of university research. Owing to this, it is important not to generalize the findings from a few select or 'exemplar' regions to much more traditional regional economies (Torre, 2008).

With regard to the economic advantages of research commercialization, recent studies have also slightly challenged some of the perceived benefits. Spin-offs were originally seen as a key form of knowledge spillover from universities (Shane & Ulrich, 2004), especially owing to the fact they tend to locate in the same location as their 'host' university (Wolfe & Bramwell, 2008). However, recent empirical research on university spin-outs (USOs) has started to question the scale of impacts. A major research study of 200 USOs in Scotland found that 30% were no longer trading and 55% employed less than 10 people. These findings were echoed by Harrison, Leitch, & McMullan (2013) who find that USOs tend to start small and remain small, claiming that these are lifestyle businesses and not dynamic high-growth potential businesses. Similarly, recent comparative research of USOs and company spin-offs (CSOs) finds that the performances of CSOs, in terms of sales growth and survival rates, are considerably higher (Wennberg, Wiklund, & Wright, 2011). These findings have led some to claim that the prominence given to spin-offs in the analysis of technology transfer and in discussions of the economic impacts of universities is 'misplaced' (Harrison, Leitch, & McMullan, 2013). It is also important to note that there is little research of the impacts of licensing technology from universities to existing companies and whether this is a more successful form of commercialization.

Some researchers argue that the mere presence of leading research universities in the region does not mean that they will definitely trigger economic growth in the region despite being critical assets for such regional or urban economies (Wolfe, 2005). However, some policymakers hold to the notion that universities are potential drivers of the new economy (Abel & Deitz, 2010), with untapped reservoirs of commercialized knowledge waiting to be 'taken up' and applied by businesses (Wolfe & Bramwell, 2008). Linear models of innovation assume that universities and government laboratories 'make' and industry 'takes' (Bozeman, 2000). Arguably, this mechanistic (and highly linear) view of the way in which basic scientific research is transformed into commercial products is a crude misconception of the commercialization process. The flow of knowledge does drive innovation, but knowledge transfer from universities to industry is a fluid, complex, and iterative process involving many different

actors (Wolfe & Bramwell, 2008). As a consequence, the role of universities in technology transfer and commercialization is much more nuanced than traditional linear conceptions of the innovation process assume (Godin, 2006). Knowledge transfer between universities and businesses is not a simple or linear process.

One of the main benefits of universities and a key form of research commercialization is the human capital produced by universities. While more indirect than the commercialization process, students who become employed within local businesses and those who start up their own businesses are key signs of this knowledge transfer. In addition, increasing recognition is now being given to the role of graduates as generators of start-ups. Recent research has found that graduate start-ups are now at least of the order of magnitude as academic start-ups. Graduate start-ups across the UK were growing very rapidly and between 2000 and 2009, the number had risen from 179 to 2,045, an 11-fold increase in nine years (Gallarotti, 2013). These, however, are not necessarily start-ups that exploit or commercialize research like a traditional USO.

Research shows that universities are not just trainers of highly qualified scientists and researchers; they are also attractors of talent from elsewhere to the local community (Wolfe & Gertler, 2004). Universities do not only generate new knowledge through primary research, they also provide technical support and specialized expertise and facilities for on-going firm-based R&D activities (Wolfe & Bramwell, 2008). University activity is not confined to the process of knowledge transfer on a local basis, but also acts as a conduit of new knowledge through the “global pipelines” of international academic research networks (OECD, 1996). Finally, rather than acting as “ivory towers” insulated from their community, they act as “good community players” that facilitate local linkages and networks and create “anchors of creativity” that underpin the virtuous cycle of talent attraction and retention (Wolfe, 2005). In relation to this framework of knowledge transfer mechanisms, the University of Waterloo in Canada emerges as a strong example of an “entrepreneurial research university” that is actively engaged with the process of economic development in the local community (Abel & Deitz, 2010).

The Post-World War II science and technology policy saw enormous investments in scientific research for commercialization, with the aim of achieving the associated long-term and durable benefits. Universities were in favor of this move, retaining their autonomy to judge the merits and applications of findings. The linear model of innovation underlay this ‘social contract for science’ by assuming that investments in basic science would directly translate to economic growth through technological development applied science and marketing (Godin, 2006). In a stylized linear model, the innovation process begins with basic research that leads to new discoveries, without consideration of potential future applications. These basic discoveries launch potential applications that are pursued and taken-up by firms through further applied research, development, design, production, and marketing. The later stages of this process lead to the successful commercialization of new products and processes (Wolfe, 2005).

In the recent past, governments have put pressure on universities by requiring them to conduct more applied research than the traditional basic research. These changes that have affected the university system are characterized by three major trends: 1) the linking of government funding for academic research with economic policy, 2) the development of more long-term relationships between firms and academic researchers, and 3) the direct participation of universities in commercializing research (Harrison, Leitch, & McMullan, 2013). As a result, while universities continue to fulfill their traditional roles of performing primary research and training highly qualified people, they have come under increasing pressure in recent years to expand their basic research activities to include more applied research of greater relevance to industry and to diffuse technical knowledge and provide technical support to industry. This shift reflects changing government expectations that public investments in basic research should produce a measurable economic return (Wolfe, 2005).

The said shift in the policy perspective was partly stimulated by a re-evaluation of the linear model; it has not yet been replaced with a more realistic understanding of the processes by which knowledge flows between universities and industry. Influential work on the process of knowledge transfer affords some guidance. The theoretical shift toward an emphasis on interactive learning in the production and application of knowledge has critical implications for the process of knowledge transfer and regional economic development in general, and for universities in particular. In contrast to earlier linear models of scientific research and knowledge transfer, based on a conception of knowledge as codified information, innovation is now seen as an interactive process.

Innovation is considered to be a social process in which producers and users can actively learn from each other through consistent ‘learning-through-interacting’ (Cooke & Leydesdorff, 2006). In this context, learning refers primarily to the building of new competencies and the acquisition of new skills rather than simply accessing information of codified scientific knowledge. However, successful learning through interaction involves a capacity for localized learning within and between firms and supporting institutions in a region. In this sense, the capacity for learning of firms in a region – the ability to develop and assess both person-embodied, tacit knowledge, and easily accessible and reproducible codified knowledge - is a critical variable in successful innovation. This form of learning often occurs at the regional level because firms within a region often share common networks that facilitate learning among them and are supported by a common set of regional institutions, including universities (Wolfe, 2005).

Linking public research institutes with universities enables the former to access university-generated knowledge, which is critical to the innovative capabilities of firms. Powell & Snellman (2004) argue that the success of knowledge transfer between universities and firms is strongly conditioned by the internal knowledge base and research capacity of firms themselves. Absorptive capacity refers to the notion of knowledge as the capacity of the firm to acquire and apply research results, rather than as an end in itself where “the overlap between the firm’s internal knowledge base and external research allows firms to recognize potentially useful outside knowledge and to use it to augment its existing knowledge base” (Wolfe, 2005). This argument mainly implies that for firms to develop their ability to assess and absorb scientific knowledge successfully, they need to have a fortified commission of research engineers and scientists with exemplary qualifications, sourced primarily from universities. The latter will be the firm’s source of outstanding research skills and strong knowledge base, along with a network of both informal and informal academic contacts, for reference in the course of training.

UNIVERSITIES AND A KNOWLEDGE-BASED ECONOMY IN SAUDI ARABIA

Several developing countries are in the lead toward diversification of their economies beyond natural resources, including the Kingdom of Saudi Arabia (KSA), and in quest for a stable and vibrant economy, as well as rapid economic development. In the recent past, the Kingdom has transitioned to a knowledge-based economy as an optimal development strategy. The demands of the economy have encouraged more emphasis on scientific and technological subjects than before. As the technological requirements of the global economy grow, there is increasing pressure on the educational system to produce graduates who have the skills to be productive in that economy (Rugh, 2002). This is shown elaborately in the Kingdom’s Ninth Five-Year Development Plan (2010-2014) that follows the Eighth Development Plan (2005-2009). By these, the KSA seeks to end the dependency on oil for economic growth.

The Eighth Development Plan focused on fundamental developments that laid the basis for heading toward a knowledge-based economy. These included starting implementation of the first five-year plan of the National Science, Technology, and Innovation Policy; adopting the National ICT Plan, the National Industrial Strategy, and the Strategy and Plan for Giftedness, Creativity and Supporting Innovation; establishing the Knowledge Economic City in Madina, and the Technology Zone of the Saudi Organization for Industrial Estate and Technology Zones in Dammam (Shane & Ulrich, 2004).

The Ninth Development Plan adopts the drive towards a knowledge-based economy through focusing on education, which disseminates knowledge, paving the way for knowledge transfer and accumulation and thereafter knowledge generation and utilization of knowledge in various economic and social sectors, particularly in production and service activities. Through these endeavors, the Ninth Plan aims at enhancing the economy’s comparative advantage, increasing the new competitive advantages, diversifying the economy, increasing its competitiveness and productivity and creating new, suitable employment opportunities for citizens (Gallarotti, 2013).

Basically, the Ninth Development Plan was developed to emphasize that knowledge is central to increased economic growth and development. Through the Plan, \$240 million are provided annually as grants for research to encourage innovation in research and technology, the cornerstone of a knowledge-based economy. Furthermore, the Plan entails other initiatives, such as the establishment of fifteen university-technological innovation centers in

collaboration with King Abdullah City for Science and Technology (KACST), ten research centers, and at least ten incubators of technology at KACST and other universities. The government of Saudi is also continually promoting collaboration between universities and international companies for commercialization and transfer of knowledge (SBC, 2012).

The Ministry of Higher Education in the Kingdom has been seen to advance the innovation agenda since it has launched several scientific and technological initiatives so that innovation potentials can be fostered and thus make the Saudi economy to be highly competitive. The Ministry has launched several initiatives that aid in the development of human resources to encourage the occurrence of innovations and discoveries in the field of science and technology. The Ministry also strengthened the role of the university in scientific research by establishing scientific research centers, science parks, and technology incubators at various universities (Onsman, 2010). In addition, the Saudi government has expanded the establishment of new public and private universities and colleges to widen the knowledge net and foster proper education to the citizens.

Universities in the KSA create a network of research centers in the country where the students are the think tanks and thus facilitate the tapping into the growing stock of global knowledge. Once this global knowledge is tapped by the researchers and/or innovators, they assimilate knowledge that has been acquired to the local needs of the country. This helps to create knowledge, diffuse technology and, in the end, aid the technological development of the country. The institutions of higher learning have changed the way wealth is perceived in the country from just being a superpower in industrial and energy products to being a country where wealth is also measured through the value created via resourceful application of knowledge. This has been achieved through the universities' ambition to build capacity in order to access, create, and use knowledge so that the competitiveness and economic incentives can be strengthened.

Universities in Saudi Arabia are playing a fundamental role toward the Kingdom's transition into a knowledge-based economy and hence toward economic growth and development. This has been achieved through production, spreading, transfer, and utilization of knowledge; through research, scholarships as at KAUST, partnerships with other international universities, and collaboration with local and international businesses. It is universally known that the principal means of disseminating knowledge in society is education, from the lowest level to post-university level. General education constitutes the foundation for the capacity building required by the drive toward a knowledge-based economy (Wolfe & Gertler, 2004). King Abdullah's program for education development (Tatweer) has been launched with the aim of addressing issues at all levels of education needing further attention, such as quality of education, teacher training, and curriculum development. The program aims at focusing on science; technology and mathematics; expansion of skill-development activities, particularly analytical thinking and hands-on skills, initiative, innovation, and entrepreneurship; languages; and future and emerging sciences.

However, higher education is one of the most important stages of the build-up toward a knowledge-based economy. The Kingdom of Saudi Arabia's initiative of establishing universities was so that these could serve the purpose of building a high value human capital compatible with the knowledge age. This plan for the future of university education was commissioned by the Saudi Ministry of Higher Education in 2004 to advance the components of higher learning and to enable it to respond to the needs of the sustained development of the country (SBC, 2012). Institutions of higher learning in Saudi Arabia have put tremendous efforts into the development of knowledge centers (Huggin & Johnston, 2009). The major research centers and institutes at the Saudi universities are directing a substantial part of their Research and Development (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 at 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 (KSU) in building a partnership with the public and private sectors in the area of knowledge economics. King Saud University 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 (RTVKSU),” 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. The Rector of KSU stated, "Now world economies have evolved from industrial production to knowledge production. Investment now focuses on minds, not machines. It is the worthiest investment in the present era" (Pavan, 2013).

Also, the King Fahd University of Petroleum and Minerals (KFUPM) has recently established Dhahran Techno-Valley (DTV), a business cluster located in Dhahran, 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 (Harrison, Leitch, & McMullan, 2013).

The Saudi government has put enormous efforts in drawing new knowledge into its universities, mainly aiming to create new sectors in the national economy and transform the country into a knowledge-based-economy. The way in which The King Abdullah University of Science and Technology (KAUST) was established was a prime example of such efforts. As an independent institution, KAUST aimed to employ many of the best practices from leading foreign research universities and enable ‘top’ researchers from around the globe to work together to solve challenging scientific and technological issues.

In May 2008, Cornell University was awarded a grant by the King Abdullah University of Science and Technology to fund the KAUST-Cornell Center for Energy and Sustainability. The grant was mainly aimed at learning from the US research experience and establishing international research cooperation in scientific areas. Moreover, a partnership was established between KAUST and the University of California to develop joint research in training facilities and virtual reality for the purpose of positioning KAUST campus among the most advanced visualization centers in the world. Moreover, in July 2008, King Saud University signed a research agreement with the University of Leeds in UK, under which both partners jointly organized staff exchanges and joint research and PhD projects in the areas of Nanotechnology, technology and engineering. Following its establishment, the King Abdullah University of Science and Technology also entered into numerous ground-breaking research contracts with ‘world-class’ universities overseas, such as the collaboration for research in water, soil and coastal resources with Netherlands’ Utrecht University and in research on solar energy with the National Taiwan University.

The government of Saudi Arabia seeks to lure Western universities and their scientific know-how and expertise through networks and partnerships and offering scholarships to researchers globally. These partnerships seem to signal a new direction for Saudi’s higher education policies and are increasing the interests of foreign institutions in the country as a potential niche market with regard to science cooperation and research. The Saudi government is currently championing for international research and science partnerships with the primary aim of developing a national knowledge-based economy. A significant number of countries in the world are interested in building and expanding partnerships in Saudi Arabia and the Middle East at large. The European Commission, for instance, launched a new project with the aim of encouraging cooperation between universities in the Middle East, such as Saudi Arabia, and those in the European Union, providing partnership opportunities among the interested universities.

In recent years, Saudi Arabia has upgraded many of its degree-granting institutions and established a significant number of universities to respond to the large demand for expansion in higher education opportunities and enhance the aforementioned contribution of the universities toward a knowledge-based economy. Saudi Arabia has developed a new model of international cooperation through science and research networks that allowed foreign researchers to collaborate with researchers in the kingdom. This new model of cooperation seems to offer favorable and mutually beneficial opportunities for partnering with the foreign universities, which – if sustained – can potentially result in economic (and possibly social) advancement in the long term.

CONCLUSION AND POLICY IMPLICATIONS

In conclusion, it is clear that most developing countries are increasingly transitioning into knowledge-based economies from the traditional resource-based economies. Unlike the latter where capital and natural resources form the core of economic development, the former is built upon knowledge as the foundation where science, technology, and innovation are its pillars (Wolfe, 2005).

Evidently, universities play a pivotal role in the achievement of a knowledge-based economy in any country. Their role goes beyond teaching and conducting primary research to include commercialization and transfer of knowledge in line with the governmental requirements to promote R&D and innovation to increase the country's global competitiveness. In this regard, Saudi Arabia has made tremendous efforts to transition into a knowledge-based economy from dependency on oil (SBC, 2012). This has been evident in their investment in education and promotion of technology, science and innovation in universities like King Abdullah University of Science and Technology, King Saud University, and other institutions of higher learning.

Universities in Saudi Arabia should invest more in science, technology, and innovation to keep up with the dynamic economic environment. They should also protect their Intellectual Property (IP) by ensuring that it is not exported in partnerships with other international universities or businesses. The government should not only lay down policies requiring universities to incorporate innovation into their curricula, but also follow the implementation process closely. It should increase research grants and subsidies, especially to the new universities to foster their contribution. It should also protect the knowledge commercialization and transfer process through governing policies and regulations. This will help the Kingdom of Saudi Arabia transition into a knowledge-based economy smoothly and swiftly, hence achieving economic growth and development.

AUTHOR INFORMATION

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