Chapter 1: Introduction

Abstract

Background

Economic transformation is a popular theme around the world today. In the context of modern high-tech society, economic transformation is manifested through technology and innovation in entities ranging from the smallest business entrepreneur to national governments. The leadershipin theKingdom of Saudi Arabia has taken unique initiative to develop a clear vision for the country's economic transformation through a comprehensive strategic plan. The National transformation Program of the Kingdom of Saudi Arabia under the overarching Vision 2030 initiative has several objectives one of which is to position the kingdom of Saudi Arabia in the top ten of the Global Competitive Index published by the World Economic Forum (Al-Helayyil, Rajan, Claps, & Schaller, 2016)

In 2016, the Saudi Deputy Crown Prince Mohamed bin Salman visited the Silicon Valley and highlighted the role of digital technology, technology entrepreneurs and technology start-ups in economic growth. This trip underscored the potential of leveraging on technology to increase the contribution of Saudi small and medium enterprises (SMEs) to the GDP and employment (Aswad & McDowall, 2016). Saudi Arabia like the other Gulf Cooperation Countries (Bahrain, Qatar, Kuwait, Oman and UAE)has vast reserves of petroleum resources that make them important global economies. However, the economies of the Gulf Cooperation Countries (GCC) are vulnerable to reduction in oil prices and high volatility in demand, production, and consumption. It has been established that the uncertain economic environment created by mono-sector economies can be mitigated through diversification of the economy (Hesse, 2008). This being the case this paper argues that technology, innovation, and entrepreneurship are the key drivers to the diversification of the Saudi economy and are critical to the degree of economic competitiveness and overall economic growth. The government plays an important stakeholder role in boosting innovation as innovation is intimately connected to the structure of the economy. Global economic competition has become increasingly dependent on knowledge, innovation, and technological advances than resources.

Statement of Problem and Research Questions

The Diversification problem in the GCC

The Gulf Cooperation Council (GCC) is a region with vast economic potential. The region has the largest proven crude oil reserves representing 36% of the global total oil reserves. The region is the largest producer and exporter of petroleum and in 2015 oil exports accounted for 46% of the GDP of the six GCC countries. Oil and Gas exports make up over three quarters of exports from GCC countries. Economic situations of low and volatile oil prices have the effect of widening fiscal deficits, dampening economic growth and weakening the ability of economies to fund investments and infrastructure. Consequently, GCC countries still experience high youth unemployment despite controlling a significant share of the world's energy supply (IMF, 2015). Oil price declines are forecasted in the medium term due to weakening global demand and higher oil supply. A decline in oil revenue meansthat resulting fiscal deficits will require cuts in government spending and are

expected to slow down GCC economies (IMF, 2015). In their world economic outlook, the International monetary fund expected the GCC economies to grow at 1.8% a reduction from 3.3% in 2015 and 3.4% in 2014 (IMF, 2016). The effect of declining oil revenues have spurred new thought in economic restructuring and rethinking huge spending on subsidies in Saudi Arabia and other GCC countries. Besides price volatility, oil revenue has crowded out non-oil tradable commodities in Saudi Arabia. Production of non-oil tradable goods and services has proved less convenient to firms because need to benefit from rapidly expanding government expenditure in the oil sector. In addition, availability of public sector jobs has discouraged Saudi national from pursuing entrepreneurship and private sector employment. It is thus clear that declining oil prices have spill over effects that should be mitigated by diversification into high values of exports of goods and services (Schiliro, 2013).

Innovation and technology would help create more high-value added jobs for Saudi nationals through diversification into sophisticated, quality and differentiated export markets. Saudi Arabia is a high-incomecountry and needs to highly paying employment opportunities in the private sector of the economy. The strategies that the kingdom of Saudi Arabia can follow to reach this goal, essentially favour innovation and technology entrepreneurship (Callen, Cherif, Hasanov, Hegazy, & Khandelwal, 2014). The government of the kingdom of Saudi Arabia has a duty to aid diversification through appropriate incentives that drive Saudi nationals towards improving their skills and making them more relevant to an innovation and technology based economy. The government also needs to re-orient public spending to facilitate development and linkage of private sector competition (Callen, Cherif, Hasanov, Hegazy, & Khandelwal, 2014).

Innovation and competitiveness

Innovation is a basic and essential factor of economic diversification as a key element for boosting growth. Innovation is also critical in addressing societal problems such as health issues, unemploymentand environmental problems such as pollution. Innovation is more than just a meeting of science and technology but a meeting point of a multiplicity of disciplines to discern and meet the needs of customers. Thus, innovation is a tool in the hands of entrepreneurs to exploit opportunities in change (Drucker, 1985), any improvement in marketing, distribution of service is no less an innovation than those that are generated from R&D processes. However, the role of a government especially in one in an economy that seeks to become knowledge or economy lead must involve risky and expensive investment (Schiliro, 2013). Where the private sector my shy from risky investment in innovations, the government of the Kingdom of Saudi Arabia has an obligation to demonstrate the potential returns of investing in innovation. A well designed innovation and productivity strategy that is based on coherent strategies for education, scientific research, commercialisation, intellectual property, trade and technology management would go a long way in optimising an economy for innovation (Furnam, Porter, & Stern, 2002). Innovative capacity of a nation depends on strengths along multiple dimensions such as effective public policy and the quality of human resources. Since private businesses are the principal drivers of innovation, an innovation oriented corporate culture and the clusters in which businesses compete are important determinants of global innovation. In particular, involvement of universities in generation and transfer of knowledge is essential in determining the innovation capacity of a cluster (Furnam, Porter, & Stern, 2002). Governments' role in developing national innovation capacity through specific policies and institutions and facilitating complex interactions between innovation actors,

policies and institutions is referred to as innovation systems approach (Furnam, Porter, & Stern, 2002).

Models of innovation

National innovation system (NIS) is commonly described as a group of institutions working together to innovate within the borders of a nation (Freeman, The national system of innovation in historical perspectiv, 1995). The pioneers of systems approach to innovation investigated the social interactions between customers and suppliers as well as their effect on innovation at the national level. Innovation systems have been credited with emergence of technology hubs in Japan and elsewhere in the world (Freeman, The national system of innovation in historical perspectiv, 1995). According to Christopher Freeman, Japan, one of the eastern pioneers of innovation system policies relies heavily on innovation at the national level to support innovation at lower levels (Freeman, The national system of innovation in historical perspectiv, 1995). A precise definition of innovation systems is still not agreed, although any definition tends to emphasize on private-public partnership to support and nurture technological innovation. The appropriate definition of innovation system for this work emphasises a continuous interaction of people and different institutions using technology and information leading to continual development of products and services (Patel & Pavitt, 1994). National Innovation systems (NIS) operate within national boundaries while regional Innovation Systems (RIS) operate within regions.

The most visible example of a regional innovation system is the Silicon Valley. The Silicon Valley is a region in northern California, USA. The area also synonymous with San Francisco is renowned for the remarkable culture of creating and supporting start-ups based on technology. The emergence of the Silicon Valley as a regional innovation system can be traced t to the late 50s when venture capitalists emerged. Encouraged by the growth of start-up companies, venture capitalists aggressively sort new ideas to invest in. In turn, the availability of venture capital encouraged entrepreneurs to come up with new ideas for funding. Consequently,entrepreneurs and venture capitalists congregated in the Silicon Valley as all sort an opportunity. Soon a culture of exchange of benefits between entrepreneurs and venture capitalists created a culture of innovation for which the Silicon Valley is renowned (Saxenian, 2006).

The name Silicon Valley is derived from the material that makes semi-conductors on which the Silicon Valley is founded. Fairchild Semiconductors an early spinoff from Shockley Semiconductors benefited from the funds of a pioneer venture capitalist. The same venture capitalist went on to support the creation of 70 additionalstart-ups. The lucrative interactions between entrepreneurs went on to spur the development of rapidly growing software and hardware firms in the Silicon Valley (Maclowry, 2014). The regional as opposed to national focus of innovation systems inspired M.E Porter to develop the term Regional Innovation Cluster (RIC) which he defined as geographical concentration of interconnected businesses and institutions in a particular field important for competition (Porter, 1998). Regional innovation cluster (RIC) is therefore by definition narrower than a Regional Innovation System because the membership of RIC is limited to a common value chain such as the Semiconductor value chain in the Silicon Valley. An RIS on the other hand transcends Industry clusters.

Realising the importance of innovation clusters the government of the Kingdom of Saudi Arabia begun investing billions of dollars in developing technological and traditional infrastructure to

replicate the Silicon Valley (Aswad & McDowall, 2016; Al-Helayyil, Rajan, Claps, & Schaller, 2016). Although many government attempts at seeding regional innovation systems or regional innovation clusters have failed, some successful innovation clusters have emerged such as Bangalore in India and Jiangsu in China (Parayil & D'Costa, 2009). The common characteristic of successfully innovation clusters besides massive investment in infrastructure and generous incentives to real estate is what has come to be known as the Triple Helix Model (THM). THM involves strategic leadership and cooperation between universities, governments and entrepreneurs. This combination has been found to create a supportive innovation ecosystem (Saxenian, 2006).

Innovation Status of Kingdom of Saudi

The leadership of the Kingdom of Saudi Arabia has ventured into this model as evidenced by the creation of the King Abdul-Aziz City for Science and Technology with the express purpose spearheading the Kingdom's science and technology plans (Al-Swailem, 2014). Although has managed to build relationships with technological and educational institutions such as Intel, NASA, MIT and Stanford University it has not been successfully in nurturing an innovation cluster. However, it has been successful in the main mission of establishing the Saudi industrial property rights regime (KACST, 2017). The number of patents applications are a good indicator of national innovation and patent data could contribute to an understanding of innovation system (Eaton & Kortum, 1999). The World Intellectual Property Organisation Ranks the Kingdom of Saudi Arabia 41st in Country Statistical Profiles (WIPO, 2018). Although patent data is an imperfect indicator of innovative output, it provides uniquely detailed information on innovation activity (Eaton & Kortum, 1999). Below we will use data from WIPO to evaluate the rate of observable innovation in the Kingdom of Saudi Arabia in comparison to the republic of Korea. The rationale for using the Kingdom of Korea is the closeness of the size of the economies of the two countries and the success of Korean innovation.

Korea, which has been ranked the second most innovative country by Bloomberg Businessweek in 2012, is the 15th largest economy and 9th largest trading nation globally. With a trade volume excess of 1 trillion US dollars, Korea is the World leader in mobile phones, displays, semiconductors and shipbuilding. The major exports from Korea are machinery, automotive, semiconductors and petroleum products. 3.74% of the GDP of Korea went into research and development making the country the fifth largest in R&D spending. In addition, Korea's labour productivity is ranked second in the OECD. The well-known Korean electronics giant, Samsung Electronics is ranked sixth on R&D spending in the world in 2012 (Science and Technology Office in South Korea, 2018).

Table 1

Comparative IP Filings (Resident + Abroad, Including Regional) and Economy (Source: WIPO)
(Kingdom Of Saudi Arabia Vs Republic of Korea)

Year	Patent (KSA)	Patent (Korea)	Trademark (KSA)	Trademark (Korea)	Industrial Design (KSA)	Industrial Design (Korea)	KSA GDP (Base 2011 US$)	Korea GDP (Base 2011 US$)
2010	1,108	178,654		142,669		70,100	1,246	1,504
2011	1,242	187,747		150,682	251	70,826	1,370	1,559
2012		203,836		162,500		83,555	1,444	1,595
2013	3,124	223,527		190,983	230	95,719	1,483	1,641

2014	4,122	230,553	10,949	198,184	360	87,479	1,538	1,696
2015	3,538	238,045	11,882	241,106	334	97,999	1,601	1,744
2016	4,735	233,625		230,035	501	104,842	1,629	1,793

Table I highlights how the technological strength of the Kingdom of Saudi Arabia compares with that of the Republic of Korea. Although the economies of both the Republic of Korea and the Kingdom of Saudi Arabia are almost equal, there is a huge disparity in the number of intellectual property fillings for both countries. The Republic of Korea innovative activity overwhelmingly overshadows that of Kingdom of Saudi Arabia. To further drill down into the details of innovative activities of both countries Table 2 compares patent applications by field of technology.

Table 2

Kingdom of Saudi Arabia Patent Applications by Top Fields of Technology (2002 - 2016)

Field of Technology	Share
Basic materials chemistry	12.45
Chemical engineering	10.62
Organic fine chemistry	9.25
Civil engineering	8.33
Measurement	8.01
Macromolecular chemistry, polymers	7.73
Computer technology	6.11
Materials, metallurgy	3.8
Environmental technology	3.7
Medical technology	2.72
Others	27.28

Republic of Korea Patent Applications by Top Fields of Technology (2002 - 2016)

Field of Technology	Share
Semiconductors	8.6
Electrical machinery, apparatus, energy	8.09
Computer technology	7.8
Audio-visual technology	7.27
Digital communication	5.4
Telecommunications	5.22
Optics	4.78
Transport	4.67
Civil engineering	3.87
Other consumer goods	3.03
Others	41.27

Table 2 clearly shows that the area in which Saudi innovation is most active has to do with Chemical and engineering. In contrast, the most active area of innovation in the Republic of Korea is high-tech. The Kingdom of Saudi Arabia needs to support both the volume and nature of patent activity and innovation through appropriate policies.

Research Questions

Although the triple helix approach has been cited as having achieved a measure of success, we believe there is no single appropriate model of innovation policy that suits all circumstances. Like most policies, Innovation policies must be context specific and reflective of the trajectory of the specific country. Many countries pursuing the idea of creating high-tech industries often imitate well-organised models like Silicon Valley, but policy makers and researchers are beginning to question whether Silicon Valley can be replicated (Feldman M. P., 2014).Many researchers view the Silicon Valley as a unique case that is based on a culture and reputation for innovation (Feldman M. P., 2014). This therefore justifies the need to clarify the linkage and relationship between models of innovation. This research will examine the role of Saudi government in driving innovation and success in emerging innovation clusters. The thesis will investigate how government policies aid or hinder innovation systems.

Specifically the dissertation will answer the primary research question Do emerging innovation clusters need to retain connections withthe three Models of Innovation? Related to this are a number of relevant sub questions

1. What are the Ethical practices of technology management? And
2. How did some developing countries succeed in building technology based economies?

I have particular interest in comparing the application of innovation systems/innovation cluster case study to draw lessons that would help Saudi leadership approach technological diversification of the economy of the Kingdom of Saudi Arabia.

Rationale for Study

Many countries including the Kingdom of Saudi Arabia are investing billions of dollars in innovation systems. Scholars have attributed the existence and success of innovation systems to strategic investment and cooperation between governments, universities and entrepreneurs. This study will help clarify the process of creating innovation systems on the national, regional and industry cluster level. In the process, this dissertation will bridge the gap in knowledge about the relationship between national, regional and industry cluster innovation systems.

Secondly, the findings of this study will help Saudi policy makers implement policies that support identified relationship variables between public and private players in innovation. Third, the case studies will result in a comparative analysis that can identify and analyse factors and conditions that lead to successful innovation systems or innovation clusters.

Research Design

The research design for this study will be comparative, qualitative and exploratory case study method. Comparative research design essentially compares two or more groups in an attempt to draw a conclusion about them. The researchers attempts to identify, categorises and analyse similarities and differences between the groups. Comparative studies can be used to increase understanding of similarities and differences between groups and create a foundation for compromise and collaboration. Comparative research design is compatible with both quantitative and qualitative research methods. Quantitative research methods emphasise on transforming research data into quantities and measures on which statistical models can be applied.Researchers using quantitative approach to research have a good idea of what they want to measure and

therefore focus on collecting statistical information. Qualitative research methods on the other hand is focused on gaining a better understanding of the research phenomena through detailed information of the phenomena. An important objective of qualitative research methods is to gather complete and detailed information on the research topic through application of reasoning. By nature, qualitative research methods do not involve quantitative data obtained through formal measurements. Qualitative data involves observations, descriptions and other qualities obtained through interviews and observations (Quinn & Keough, 2002). An exploratory study seeks to explore and find more information on a phenomenon on which much is not already known. An exploratory study requires extensive preliminary work to gain a better understanding of the subject. Exploratory studies also help in generating hypothesis and suggesting direction for further studies. Exploratory studies are not to be confused with explanatory studies, which are undertaken to explain the nature of certain relationships (Quinn & Keough, 2002).

Research strategy

Five major research strategies have been identified. They are experiments, surveys, archival analysis, history and case studies. Each of the five research strategies has advantages and disadvantages. The most appropriate strategy is decided by the type of research question, the extent of control the researcher has over the behavioural events and the degree of focus on contemporary as opposed to historical events.

Since this research is to gain in-depth information about development of innovation cluster in the Kingdom of Saudi Arabia, case study research strategy is found most appropriate.

Data Collection

It is important to choose the right data collection method in order to get accurate information for research. The data collection method that a researcher chooses is significantly influenced by the research design. Some data collection methods include interviews, questionnaires, documentation, observations, and archival records. Data may be categorised into two categories. Primary data is data collected by the researcher in person for a specific purpose or study. Secondary data is data collected by others for different purposes. Secondary data is therefore easier to acquire than primary data. However, secondary data is less trustworthy and less reliable than primary data, which is more expensive to obtain. Secondary data has therefore to be treated with caution (Quinn & Keough, 2002). In this study, data will be collected from reliable and prestigious journals. Examples of these journals areAcademy of Management Journal,International Economic Review, Economics of innovation and new technology, Journal of Applied Economic Sciences, Journal of Management,and Research Policy.

Overview of origins and existing works

An appropriate point to start the review of literature on the geography of innovation is in the work of Joseph Schumpeter who is a pioneering researcher on innovation. Joseph Schumpeter led the first thread of research that focused on entrepreneurs and entrepreneurial innovation. In his definition innovation is ‘ Setting up of a new production function… it breaks off any physical return ‘curve’ and replaces it by another’ (Schumpeter, 1939). According to this thread of research, entrepreneurs are key conveyors of radical and incremental innovations. Entrepreneurs look for and seize technological and or market opportunities and bring the applicable inventions to the market (Schumpeter, 1939). Schumpeter did not delve into the origin of the entrepreneurial effort.

However, Feldman (2005) provided tentative answers. The entreprenurial spark is created by the risk-reward balance between the 'entrepreneurship opportunity cost' which is the expected potential cost for an entrepreneur to start their own company. This school of thought assumes that entreprenuers are evenly distributed over geographical regions nd lie dormant waiting for unique shocks and historical events to break the risk-reward balance. This thread of research seems inadequate as it makes matters unpredictable and leaves little speace for external intervention.

The second and perharps more influential thread of research approaches innovation activities from an organisational perspective. Researcher in this school of thought are concerned with identification of both internal and external organisational factors that influence innvation decisions and outcomes. A company's age, size, R&D activities and technological segmentation are some of the Internal factors that would influence the company's innovation (Bottazzi, Dosi, & Fagiolo, 2005). Input-output linkage, market sophistication and agglomeration effect are some of the external factors that would influence a company's innovation (Carter, 2007). The most outstanding and promising feature of the organisational innovation school is its account of innovation across an organisations lifecycle (Alvarez & Busenitz, 2001). Businesses pursue different innovation strategies in different stages of the product and industy's life. The dynamisn requires to be complemented by differing skills and knwledge, most of which are outsourced to other companies. The process of outsourcing knoWledge and skills is assumed by many scholars to follow a linear process progressing from basic research, through applied research and development and ending with production and diffusion (Goldin, 2006). Although other ideas such as 'learning by doing' and 'Learning by using' have revealed the interactive nature of inovation companies remain the dominant concerns of the organisational school of innovation. Other intagible factors such as cultue, behaviour, norms and trust are left our because they are difficult to incorporate into economic analysis.

The third thread of research is the evolutionary institutional theory founded on a broad literature base. This school pays much attention to the intagible assets within a company and the interdependecies between innovation actors. The concept of an innovation network made up of private and ublic sectors is a product of evolutionary thinking (Dacin, Goodstein, & Scott, 2002). The dynamics of any local industry can be understood through an interactive and co-evolutionary process (Martin, 2010). This means that a regions unique characteristics and institutional development trajectory are relevant factors nd have been identified in emerging literature on innovation system theory. Leading scholars within this thread of research including Nelson & Winter, (1982) and Freeman, (1987) argue that an understanding of the development, diffusion and utilization of innovations requires attention to institutional factors and their co-evolutionary economic activities. Knowledge sharing and networking that evolves with time nourish systematic synergy and position the whole innovative systen in a competitive position (Castells & Hall, 1994).

The fourth thread of research is the science park model. This school of thought argues that the practical way of building an innovation system from scratch is concrete planning. A more detailed study of the genesis and growth of the science park model of innovation will be covered in another chapter.

Outline of Dissertation

The first chapter will introduce an overview of the background of the research, statement of the problem, the research question as well as a summary of primary methods.

Literature Review

Theoretical background

Friedrich List is the acknowledged ancestor or originator of the idea of innovation systems(Freeman, 1987; Nelson, 1993). When criticising Adam Smith for his narrow definition of national wealth Friedrich List noted that "the property of a nation does not depend…on the quantity of riches and of exchangeable values it possesses, but upon the degree in which the productive power is developed"(List & Colwell, 1856, pp. 222-3). The 'productive power' of a nation is the crystallised knowledgestored in techno- institutional spheres and in the nation's learning capabilities. A nation's 'productive power' is derives from the overall productivity of its industrial systems and is influenced by the dynamic and accumulative broader institutional environment (List & Colwell, 1856). In this work,Friedrich List implied many essential elements of the innovation system theory including the institutional environment, role of the state and the significance of considering the economy as a whole and its unique culture, political, and civil status (Freeman, 1995; Lundvall, 2010).

The modern concept of innovation system was first proposed by Lundvall (1985) and was soon picked up by Freeman (1988) and Richard Nelson (1988). Since then innovation systems has been catchphrase in both politics and the academic world. Innovation system theory has found a place at the confluence of institutional and evolutionary economics because it emphasises the role of institutions,economic actors and their interactions in the process of technological development. The key elements inthe modern concept of innovation system are knowledge, learning, and networking. Innovation system theory focuses on knowledge accumulation and circulation as the linkage of the various actors in the process of achieving long-term competitive advantages.

Three models of Innovation

Case study Silicon Valley

The Silicon Valley established in the 1950s is one of the earliest regional innovation system and this still holds a leading position in the quantity and quality innovations (Saxenian, 1985)The genesis of the Silicon Valley which is the undisputed pioneer in regional innovation systems (RIS)can be traced back to the beginning of the Second World War. Thanks to Stanford University's reputation for excellence in electronic engineering, huge amount of government spending was allocated to the Palo Alto area for research and development in aeroplane and electronic technologies (Castells & Hall, 1994).

The efforts of Professor Frederick Terman in his quest to promote the construction of his 'secret weapon' gave rise to the Stanford Industrial Park(later Stanford Research Park) which has been acknowledged as the first innovation park in the world (Koepp, 2002). The development of Stanford Industrial Park followed private sector demand rather being led by a Master Plan. However,government contributed to the development of the innovation parkby arranging annexation andcooperatingwith private sector to influence policy favourably towards benefit of the innovation park (Luger & Goldstein, 1991).

The role of Stanford Research Park in the Silicon Valley innovation cluster has now been dwarfed the huge number of companies located outside the park. Nevertheless, the importance Stanford Research Park as the cradle of the Silicon valleyhigh-tech innovation hub has not diminished. Stanford Research Park is still the best example of an endogenous innovation system, characterised by dynamic private sector initiatives and co- evolution within an institutional environment. It is evident that Silicon Valley innovation cluster fed on the leadership of Stanford University and its entrepreneurialacademics. Professor Frederick Terman played a critical role in positively cultivating a vibrant business atmosphere that intimately intertwined industry and academic networks. Beyond the leadership of Stanford University, the dynamism of private sector and spontaneity of enterprises led the growth of Silicon Valleyafter the embryonic stage (Koepp, 2002). The role of private enterprise in the development of an innovation system is captured in the case of HP and Intel. The case of HP illustrates the importance of innovation and strategic management for company survival, without which an IS would collapse. HP diversified and transformed every time it faced a crisis. It is easy to conclude in retrospect that odd and unusual occurrences occurred at HP that enabled the company anticipate and prevail over new markets. Motivation for improved performance by individual companies by 'thinking out of the box to develop transformative solutions are fundamental to the progress of the IS. In the case of HP it has been noted that Bill Hewlettresisted three transformations while Dave Packard at some point opposed all transformation. This point buttresses the idea that innovation that brought about corporate transformation for HP came from the internal ecology of HP before being sanctioned and embraced by the founders. This is evidence for a button-up innovation process through internal experimentation and selection process. (House & Price, 2009).Another aspect of the role of private enterprise in development of Silicon Valleyisrobust entrepreneurial culture based on competitionand cooperation. According to Saxenian(1994) the entrepreneurial culture in Silicon Valley is the engine sustaining innovation and competitiveness. The entrepreneurial spirit of Silicon Valley thrives on an ecosystem of entrepreneurs, politicians, academics, spin-offs, and venture capitalists.

As can be observed the Silicon Valley followed the endogenous development theory. In the Silicon Valley model, knowledge is especially productive for two reasons. First once knowledge is developed, ant member of the IS can use it without cost. Secondly, the creation of knowledge often opens new avenues for further increases in knowledge. In contrast to other resources where, each firm must pay for use and use by one companyexcludes their use in another company, knowledge allows separate different companies to use the same piece of knowledge simultaneously at no extra cost. Thus allowing additional members of the IS to use innovation does for reduce availability of the resource. Consequently where innovation lowers the cost of production, it can lower the cost of production across all similar firms in the IS at the same time.

The second lesson from the Silicon Valley model is the role of government. The role of government comes in whereInnovation accrues benefit to everyone in the IS. In this case an individual company may shy away from investing resources in research and development (R&D) to produce innovation. The role of government is to subsidizeinvestment in R&D up to the right level. In the case of the Silicon Valley, the subsidy is through University contribution to research. The secondary role of government is to establish and enforce intellectual property rights through patent and copyright laws. Industrial property rules give the innovator of new knowledge a short-term

monopoly, which acts as an incentive for private businesses to undertake research. The innovation is then disseminated to other members of the IS through licensing and fee agreements.

To develop a better understanding we look at different models of innovation models in the United Kingdom and France.

Case study Saudi Innovation System

Case study South Korea Innovation System

Conclusion and roadmap for success in innovation

Innovation system in Saudi Arabia

Recommendations for government innovation systems

Limitations of research

Future Research

Conclusion

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