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Policies, Innovation and Transition in the Arab countries of the Gulf

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Abstract

This paper examines the changes in innovation and sectoral labour productivity that materialise through the influence of intermediate outputs of active policy measures. We use an eclectic qualitative approach incorporating descriptive statistics from Oman, Saudi Arabia (KSA) and United Arab Emirates (UAE) for the period 1990 to 2016. The analysis is guided by the ?Innovation Policy Conditions Framework?. Oman within its natural resource-limited scenario has focused on developing basic education and followed the sequential development of the components of its innovation system. KSA has approached education, research and development (R&D), and industrialisation in parallel. It has also engaged in a pull strategy for the setup of R&D units from multinational organisations. Meanwhile, UAE has created a welcoming business environment with clusters and free zones. Oman exhibits slightly positive progress in the diversification arena. KSA, despite troubles in the education and governance arena, is engaged in basic research with relatively high patent and design activity. Meanwhile, UAE with education as a weaker element of its innovation system has relied on foreign labour and a clusters strategy for market development to fast-pace and diversify its innovation output. Overall, the state of the ultimate outputs of innovation activity and diversification for the three countries are far from their full potential owing to the moderate performance of the enablers and relevant policy areas. We observe that the ultimate outputs appear to be constrained by the lowest performing policy area that may be termed as the ?limiting? enabler.

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Keywords: Innovation policy, innovation, technological change, structural change, government effectiveness, developing countries, Arabian Gulf countries.

JEL Classification: O2, O3, O38, O57

1. Introduction

The countries of the Gulf Cooperation Council (GCC)[1] have long been considered as mainly oil and gas based economies. As such, not much work has been carried out to analyse their unique economic structure. We delve into this economic black box in order to study the effects of education, research and development (R&D), business environment, and governance. We aim to understand the variations in development and innovation with a different set of policies from each country. The work offers insights from individual countries and is a first of its kind cross-country comparative narrative for the GCC.

What defines a country's innovative capacity is based not only on its resources and other endowments that offer a natural comparative advantage but also the policies and decision that the country takes to create a comparative advantage (Nelson, 1993). It is observed that the effect of higher education and R&D policy on innovation is dependent on the interaction with the quality of governance (Al Raee, et al., 2017). The governments in GCC have a broad sphere of influence in economic structure and workings of their countries. Oman has a reputation as a young oil-based economy and makes it an ideal case in trying to understand what path countries in early stages of development and limited resources can take to develop a sustainable, diversified and innovation based economy. Saudi Arabia is an oil rich country with a relatively conservative socio-political setup in comparison to its GCC neighbours. The UAE's also has vast oil and natural gas reserves. Still, the result of the efforts of the federal government and the constituent emirates to diversify is that the UAE's economy is considered as the most diversified among the six countries of the GCC. Its most populous city of Dubai occupies the position of an important global city and an international trade, shipping, and aviation hub. Nevertheless, exports of petroleum remain key to all the three countries' Oman,

[1] Also referred to as the countries of the Arabian Gulf, countries of the Arabian Peninsula and countries of Persian Gulf and Arab countries of the Gulf. Our preferred terminology in this work is the countries of the Gulf Cooperation Council (GCC) which is colloquial term used to refer to the Cooperation Council of the Arab States of the Gulf (GCC). Geographically, Iraq is also an Arab country on the Arabian/Persian Gulf, Iran is also a country on the Arabian/Persian Gulf. Jordan and Yemen are countries on the Arabian Peninsula that have both been in talks to join the GCC. Finally, Morocco despite being geographically distant from the peninsula and the Gulf has also been in accession talks since 2011. In order to avoid any confusion, we use the term GCC to refer to the GCC members as of 2017 – Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates.

Saudi Arabia and UAE. With threats such as oil price volatility, depletion of oil resources, climate change and the emerging international consensus to move away from fossil fuels, and a youth bulge in their respective populations, it has become important for theses fossil fuel dependent GCC countries to drive the diversification process and develop highly productive and innovative economies.

In the following, we present a review of the relevant literature in Section 2, "Perspectives on innovation". Section 3 discusses our framework under the title, "Innovation in practice – A framework from the policy side". In Section 2 the state of policies and innovation in the GCC countries is explored in depth. Section 4.1. addresses the development of the education systems, 4.2. focuses on literacy, primary education, secondary education, education reforms and performance, 4.3 on tertiary education and vocational training. Section 4.4, 4.5. and 4.6. cover the condition of R&D policy, business and entrepreneurship, and governance and infrastructure, respectively. While in section 5.1 and 5.2 we present the innovation outputs, share of individual sectors in the economy and sectoral labour productivity in the GCC countries. Finally, we present the summary, discussion and conclusion of our work in Section 6.

2. Perspectives on innovation

Fagerberg and Srholec (2008) show that "Innovation System" and "Governance" – as understood in the context of the factor analysis carried out in their work – are important for economic development. In another work, governance, business policy, education, R&D and infrastructure are brought within the policy sphere of innovation systems. Using this framework, it is observed that the effect of higher education and R&D policy on labour productivity growth in non-traditional sector of the economy is dependent on the interaction with the quality of governance (Al Raee, et al., 2017). The concept of capabilities is discussed in conjunction with structural change policies in Rodrik's (2013b) work where slow growth is explained as an outcome of high level of capabilities and fundamentals, accompanied with slow structural change.

One of the most influential studies for understanding the characteristics of innovation systems looks at innovation systems in the context of technological innovation through fifteen country case-studies (Nelson, 1993). The work illustrates that across the countries there was a variation amongst the most important feature of the country's innovation system. What defines a country's innovative capacity is based not only on its resource and other endowments that provide a comparative advantage but also the policies and decision that the country implements to create a comparative advantage (Nelson, 1993). In our case, we compare three GCC countries – Oman, United Arab Emirates and Saudi Arabia. We expand the conceptual scope of innovation beyond technological innovation to include management, process, service, product and marketing innovation as well. The GCC countries offer a setting where the government influence spans across more spheres than the countries that have previously been discussed in the innovation policy literature. In addition to that, the GCC countries being relatively young oil-based economies, offer ideal grounds for comparing the pathways that countries in early stages of development may take to develop a sustainable, diversified and innovative economy. The literature offers very little in way of understanding the variation in policies between the GCC countries. In our best understanding, none of the works discusses the effect of policy inputs on innovation through intermediate outputs and the governments' ability to implement the policies. A number of works discuss selected specific policy measures in individual GCC countries and a smaller subset offers a comparative narrative.

Education policies are perhaps one of the most discussed in context of the GCC countries. The literature discussing primary education policies in the GCC countries, points out that Oman offers a story of success in terms of expanding primary education opportunities and rapid rise in literacy levels, Saudi Arabia appears to have a problem of low enrolment in primary education, whereas UAE's primary education system has been plagued with inefficiencies and faces challenges on the supply of teaching staff (Watkins, 2000; Gonzalez, et al., 2008; McMinn, et al., 2015). The secondary education system in GCC is plagued with the middle-child syndrome with secondary school sector being much smaller than primary school, and the majority of secondary school graduates from Oman, Saudi Arabia and UAE facing a

skills and knowledge set mismatch for entering and adjusting to the standards of the job market and tertiary education system (Abouchakra, et al., 2008; Issan & Gomaa, 2010; McGlennon, 2015). The secondary education in GCC also lacks in early transfer of practical skills and knowledge useful for smooth transition into vocational education programs. Moreover, there is a shortage of adequate vocational and technical training beyond the secondary level (Gonzalez, et al., 2008). Tertiary Education in the GCC countries under discussion, has a gap in inputs including the quality of high school graduates and funding (Alyahmadi, 2006; McGlennon, 2015). The quality of both primary and secondary education is not par with international standard (Gonzalez, et al., 2008). While tertiary education standards in both Oman and Saudi Arabia are assured by internal as well as external accreditation, UAE has inadequate higher education management systems and inefficient governance that have led to a quality deficit in higher education outputs in UAE (Darandari & Cardew, 2013; McGlennon, 2015). McGlennon (2006) points out that UAE has an open-door policy for universities, leading to the universities offering programs that require minimum investment on their part. The programs have demand mostly from foreign inhabitants in the country. Thus, majority of tertiary education programs in the UAE are business and IT related and the actual needs of UAE nationals, local job market alignment and development targets are ignored. The GCC countries' governments acknowledge the challenges facing the education system and have initiated reforms at various levels. The reforms include; a move from teacher centred to student oriented education in the primary and secondary education sector, efforts to match resources to desired outputs, enhancing skills and knowledge at secondary, post-secondary and tertiary level so as to diminish job market mismatch, enhancing linkages, and targeting education design geared towards developing a globalized knowledge economy (The Ministry fo Education, Saudi Arabia, et al., 2004; Alyahmadi, 2006; Abouchakra, et al., 2008; Gonzalez, et al., 2008).

Oman, UAE and Saudi Arabia have faced varied challenges in their pursuit of setting up a world class R&D system. Lack of coordination within the country and lack of collaboration with foreign researchers is an issue of concern for the Omani R&D system (Thomson Reuters,

2011; UNCTAD, 2014). The literature points towards a lack of a central science and research institute for coordination of research policy up until recently for both Oman and UAE (McGlennon, 2006; Al-Balushi, 2016). Insufficient investment in R&D and the R&D systems being relatively young are often discussed in the context of GCC countries, however UAE has a greater problem of limited availability of tertiary education graduates, and quality issues. While the main problem in Oman is that there is a limited number of researchers (Al-Balushi, 2016). In contrast to Oman and UAE, the academic research into the R&D arena reveals a relatively positive picture in Saudi Arabia. The Saudi government began investing in knowledge basis from the early 2000s and its results are noticeable in strong government support and alignment of government policy. Shin, et al. (2012) report that research collaboration in Saudi Arabia was stable while scientific productivity was increasing dramatically since the late 2000s. They also find that technological development in Saudi Arabia relies on prior technology i.e. patent references. It is reported that the investments into developing a knowledge base in Saudi Arabia are paying off as they are attracting graduates from around the world and Saudi Arabia has been able to establish PhD education with the number of PhDs doubling from 2006 to 2010. The countries are overall aggressively pushing for stronger R&D systems for transition to a knowledge and innovation based economy (Al-Hammadi, et al., 2010).

In a work relating foreign direct investment (FDI) and various factors affecting FDI in the GCC countries, Mina (2007) finds that higher trade openness, infrastructure development, and institutional quality have a positive influence on FDI. The study uses trade inflows and outflows to represent trade openness, penetration of telephone and mobile services for representing infrastructure, and rule of law as a proxy for institutional quality. As such it is not clear if the results would hold if alternative definitions for the explanatory variables are used. The GCC countries offer economic stability, political stability, low taxes, legal stability and protection for foreign investor, intellectual property rights, and robust physical infrastructure. Boparikar (2015) argues that the Oman government has pushed entrepreneurship in its development agenda. Shachmurov (2009) also points out that Oman's

economy is one of the most open in the region. In addition to that Al-Ghassani (2010) finds that the education system in Oman has made significant strides to include entrepreneurship education at all levels. While UAE has a strong focus on Free Trade Zones that contribute 80% of the UAE non-oil exports. The free trade zones have been identified in studies as one of the strongest pillar of the countries diversification strategy and put UAE on the world map as the third most important re-export centre in the world (Shayah & Qifeng, 2015). In "Mapping Entrepreneurship ecosystems of Saudi Arabia" (2010) Khan finds that the business environment in Saudi Arabia is in early stages of development and does not provide a complete range of support services, financing instruments, institutions and policy actions that have been discussed in the literature to have a positive influence pertaining to big and small businesses, start-ups, and entrepreneurs. The governments of Saudi Arabia and other GCC countries have taken many steps to develop the SME regime and the institutionalization of policy sphere is expected to deliver positive results in the future (Khan, 2010).

The important question in the context of policy implementation is not only related with the policy itself but also the effectiveness and capacity of the government to implement the policies and providing the essential infrastructure to do so. The works done to study the effectiveness of governance in GCC countries are limited. The economic development in Oman has led to vast development of infrastructure in Oman. The spending has been focused to establish and improve institutional as well as physical infrastructures, transportation, competitively driven dynamic telecommunication service industry, and power and water sectors (Abdelal, et al., 2008; Rajasekar & Al Raee, 2012; Oxford Business Group, 2014; BMI, 2017). Abdelal et al. (2008) consider that Oman, owing to its geographical, political and economic position in GCC is pulling closer to the international financial system. This is accomplished through the development of free-trade zones for manufacturing and services, and recreational facilities that attract businesses, skilled knowledge workers, and tourists. Oman also has a strong public private partnership framework that is considered as one of the more robust ones in the GCC. This enables Oman to use the governance systems to attract private investment (BMI, 2017). Oman is considered to have paid special attention to

governance and regulatory quality in its development path and as such earned the benefits of development that come along improved institutional quality (Looney, 2013). The presence of good physical and communication infrastructure in Saudi Arabia complements the effectiveness of governance and the ability of the Saudi government to implement the policy design (Al Shehry, et al., 2006). However, Al Shehry, et al. (2006) also find that there is a need for enhancing efficiency in terms of cost reduction, fairness, streamlining procedures and reducing fraud and over-crowdedness in Saudi Arabian public services. The participants in the study clearly outline the presence of gap between planning and implementation. The work also points at "distance" challenges in Saudi Arabia. First, being the personal distance referring to the limitations in communication between men and women at workplace, public and private sector organisations. The second, owing to the size of the Saudi Arabia. This natural and social distance among the participant of the Saudi Arabian economy creates inefficiencies in the policy realm (Al Shehry, et al., 2006). Al-Yahya (2010) finds that governance in Oman is constrained not by lack of skills but underutilization of skills, as such effective utilization of talent is an important source of improvement in the quality of governance. The situation in UAE however is different with UAE and its constituent Emirates not having a clear government vision, limited technical and entrepreneurial talent, restricted R&D budgets, weak regulatory systems, and inefficiencies in the labour market among others (Byat & Sultan, 2014; Schiliro, 2013; Haouas & Heshmati, 2014).

In the limited works putting the policies that effect innovation, labour productivity in non-traditional sectors, or sectoral diversity together the literature finds the level of readiness of GCC countries in respect to key knowledge economy pillars low. Oman lies amongst the 10th percentile of countries for innovation pillar, Saudi Arabia lags behind in human resources development and the weakest knowledge economy pillar for UAE is the education pillar (Al-Rahbi, 2008; Ahmed & Alfaki, 2010; Bashehab & Buddhapriya, 2013). In a dedicated chapter on Saudi Arabia in the Global Innovation Index (GII) Report for 2012 the authors point out at the lack of indigenous engineers and scientists in Saudi Arabia (Sultan & Zaharnah, 2012). This is in contrast to the its GCC neighbour Oman that boasts the highest ratio of science

and engineering graduates per capita in the world (Cornell University, INSEAD, and WIPO, 2016). For UAE the literature point towards targeted R&D initiatives, Sovereign Wealth Funds, trust in UAE's Financial sector despite high exposure and the recent efforts to provide clear strategy for creating an innovation based economy as strengths of the system. Saudi Arabia with 40 years of diversification strategy under its belt has succeeded in establishing industrial competitiveness in petrochemicals and downstream products of oil (Seznec, 2011). However, Saudi Arabia suffers from a lack of entrepreneurial activity and the major source of transition and innovation in Saudi Arabia is dependent on large corporations that dominate the industrial landscape in Saudi Arabia. The discussion on Saudi Arabian innovation cannot be complete without discussing the science and technology clusters. Dahran technovalley, KAUST Research Park and Innovation Cluster, PetroRabigh offer examples of Saudi Arabia's efforts to boost R&D and innovation through creating clusters and pulling international organisations to setup their middle east research units in Saudi Arabia but the success of these units is yet to be observed (Sultan & Zaharnah, 2012).

An important observation therein is that the Gulf States have had economic diversification on their agenda for the last half a century (Hvidt, 2013). The work by Hvidt (2013) focuses on the history of diversification and current plans in the countries of the Gulf Cooperation Council. They find that the plans of the GCC countries are targeting a shift towards production-oriented model where the participants of the economy are encouraged to produce actual goods and services. In another work a comparison of cumulative data for GCC countries Saudi Arabia, Kuwait and UAE and BRICS region is carried out and the findings point that the development of an effective innovation based economy is not necessarily associated with expenditure on R&D but rather on efficient allocation of resources and rigorous implementation of a strong innovation policy (Gackstatter, et al., 2014).

With the literature discussed above providing a background to our work we find that the missing elements constitute two aspects. Firstly, an explicit empirical evidence of impact of the composition of education, R&D, business, and governance systems on intermediate and final outputs in the GCC countries is not covered. Secondly, the impact of the combination

of the policies that essentially drive the various components of a comprehensive innovation system is not discussed. These limitation in the literature are not without reason as until recently data from the countries of the GCC has been sparsely available.

In the work Al Raee et. al. (2017) it is found that the labour productivity growth in non-natural resource sector in the GCC group of countries for the year from 1998 to 2013 has be much slower than the group of countries in Western Europe, Northern Europe, European countries of the Mediterranean, USA, and Canada together. The relationship is scrutinised on country level and it is observed that the predicted labour productivity growth in non-traditional sectors in Oman and Saudi Arabia is corelated with the annual growth rate of oil prices. In the comparison no correlation of non-traditional sector labour productivity growth with oil prices in Netherlands and Norway – two countries from the reference group was observed (Al Raee, et al., 2017).

In the last four decades, the GCC countries have been able to provide a high standard of living for their citizens through economic development based on the exploitation of oil and gas resources. The results in Al Raee et. al. (2007) cast doubt on the success of the diversification and innovation promoting policies of these countries. This is an alarming trend in the face of threats facing the region including but not limited to oil price volatility, depletion of oil resources, climate change and the emerging international consensus against use of fossil fuels. In light of a failure of the policies to deliver sectoral diversification, development of highly productivity and innovative sectors the GCC countries will not be able to maintain economics stability and the standard of living for their citizens. This work provides a critical comparative study for Oman, Saudi Arabia and UAE on the policies, enablers, and the outcomes of these on the share of value added of individual sectors in the economy, sectoral labour productivity, and innovation indicators.

3. Innovation in theory – A framework from the policy side

The innovation literature is distributed between “narrow” and “broad” focus on innovation policies. In the “narrow” sense only formal R&D systems and organizations systematically

active in knowledge generation and diffusion are the focus. An example of application of the systems of innovation framework in the former sense is World Bank Knowledge Assessment Methodology (Chen & Dahlman, 2005). However, systems of innovation in a narrow sense "leave significant elements of innovation-based economic performance unexplained" (Lundvall, 2007). In the "broad" sense the core knowledge producing and disseminating institutions are embedded in a wider socio-economic system and the relative success of innovation policies is a function of influences and linkages beyond these core institutions (Freeman, 2002). Among the works that discuss new-to-the-world innovation in the latter sense Furman, Porter and Stern (2002) integrate ideas-driven growth theory, microeconomics-based models of national competitiveness and industrial clusters theory and considers R&D manpower, knowledge and technology base as important sources of innovation, and Archibugi & Coco (2004) define innovation system through patents, publications, ICT, electricity consumption, and education.

The common theme that emerges from the literature is that innovation policies work in coherence with each other and have a combined and complementary effect on growth. The translation of policy to growth must go through the governments' ability to effectively turn inputs of policy into growth. See "Innovation Policy and Labour Productivity Growth" for more details (Al Raee, et al., 2017).

Figure 1 below represents our interpretation of how the flows of knowledge enable growth in innovation through increase in productivity in an economy. The innovation eco-system is thus arranged into conditions, linkages, the firms and the market itself. The change in state of these conditions is determined through natural transformation and policy. The education condition is affected by government policies as government financing of the tertiary education system, policies determining graduate ratios in science and technology fields, alignment to labour demand from market, university autonomy, and others. Similarly, research and development conditions are impacted by government expenditure on research and development, type of research grants, targeted scientific field grants, competitiveness of grants, intellectual property regime, and private sector research funding, and so forth.

Business conditions are related to industrial policies, competition policy, entrepreneurship policy, taxation policy, financial policy, health of financial sector, availability of finance, and market access for firms that create new products or services. Infrastructure conditions include availability of ICTs, Transport, Energy, Standard-Setting, Metrology, Security, etcetera.

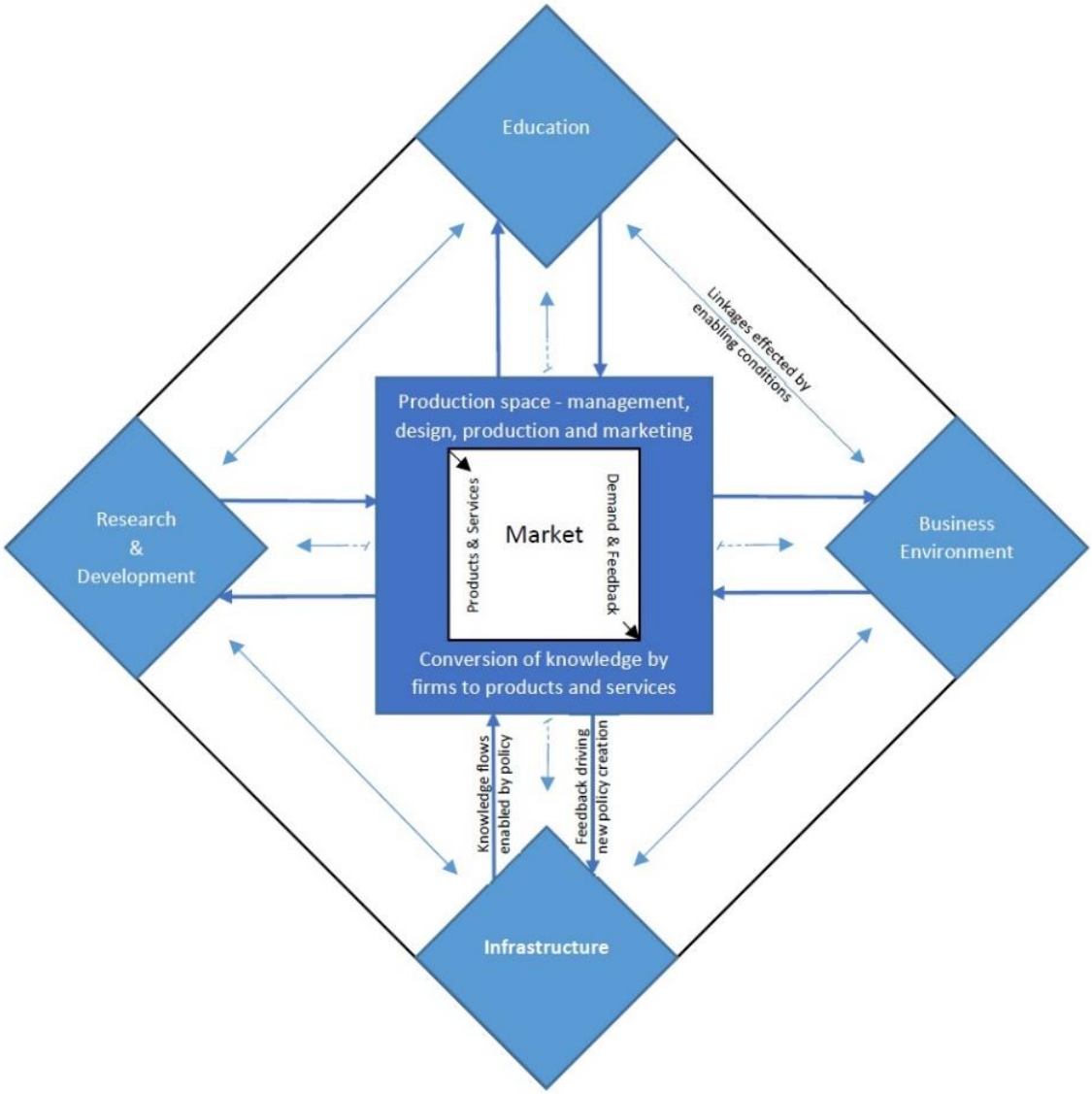

Figure 1 – Innovation Policy Framework Conditions

Finally, it is considered that without efficient and effective linkages the production of knowledge as well as transfer of knowledge for creation of new products and services would be hampered. For innovation to thrive in the production space it is important that the innovation environment conditions are healthy, governed by sound policy, with effective

linkages across various conditions as well as the production space and consequently the market that would consume the innovations and drive the productivity growth. In the following we study the innovation policies and their influence on innovation, labour productivity and diversification in the three GCC countries Oman, Saudi Arabia and UAE.

4. The Case of GCC – Policies and Enablers

Table 1 below highlights the overall strength of policy measures. In terms of education Oman and UAE perform equally well in the primary and secondary education policy and outcomes however overall government spending in primary education is comparatively lower than Saudi Arabia. Saudi Arabia with relatively higher spending in primary education has not been able to achieve positive outcomes in primary education students Math and Science results as well as in primary to secondary transition and secondary education students results. Oman faces shortcoming in vocational and technical education policy and outcomes, as well as R&D spending, number of scientific researchers and number of research staff. Saudi Arabia and UAE perform relatively well in vocational and technical education, and R&D spending and R&D staff, while facing challenges in term of total number of scientists active in research. Development of R&D clusters and enactment of R&D reforms and coordinated policy appear to be positive development in Oman's R&D policy element and relatively stronger in Saudi Arabia. While UAE lags behind in both of these element in terms of their R&D policy. Oman appears to be the only one out of the three countries providing targeted research funding programmes through a central R&D administration. In terms of business environment all three countries perform low on ease of resolving insolvency and ease of getting credit indicators. Saudi Arabia has been slower in the Free Zone implementation policy with it announced free-zones only reaching operational maturity from 2015 onwards. UAE has used the Free Zone model as a way to boost individual sectors through clustering, while Oman has three active and mature free trade zones focussed on industry, manufacturing and logistics with the first one established in 2002. While there is scope of improvement in governance in all three countries, the UAE scores relatively higher in government effectiveness and control

of corruption. Oman has all governance indicators positive, with voice and accountability at the mean value. Saudi Arabia performs positively only on the rule of law area of governance.

Table 1 – Comparing Innovation Policies and Enablers

Country → Innovation Enablers ↓	Oman	Saudi Arabia	UAE
Primary and Secondary Education			
Primary Education Spending	– –	+	– –
Primary Education Enrolment and Literacy	+++	+++	+++
Primary Education Results (TIMMS)	+	–	+
Secondary Education Enrolment (Primary to Secondary Transition)	++	– –	+
Secondary Education Results (TIMMS)	+	–	+
Teaching Quality	+++	+	+++
Primary & Secondary Education Reforms	++	+	++
Summary	++	–	+
Vocation, Technical and Tertiary Education			
Vocational and Technical Education	– – –	+	–
Tertiary Education Enrolment (Upper Secondary to Tertiary Transition)	+	++	+
Ratio of Science, Engineering and Technology Graduates	+++	+	o
Summary	o	+	o
Research and Development			
R&D Spending	– –	+	+
Number of Researchers	–	–	–
Total R&D Staff	–	++	+
Development of R&D Clusters	+	++	–
R&D Reforms & Coordinated Policy	+	++	o
Research Funding Programmes	+	–	–
Summary	–	+	–
Business Environment			
Starting a business	+++	++	+++
Getting credit	–	o	–
Paying Taxes	+++	+++	+++
Trading across borders	++	o	++
Enforcing contracts	+	o	+
Resolving insolvency	–	– – –	–
Free Trade Zones	+	o	+++
Summary	+	–	+
Governance and Infrastructure			
Government Effectiveness	+	o	++
Voice and Accountability	o	– –	–
Political Stability	–	–	+
Regulatory Quality	+	o	+
Rule of Law	+	+	+
Control of Corruption	+	o	++
Summary	+	–	++

Note: Description of the quality of or level of success in policy, enables or outcomes

– – – Extremely Negative – – Negative – Slightly Negative
o Moderate
+++ Highly Positive ++ Positive + Slightly Positive

4.1. Development of education systems

Oman: The first university in Oman was established in 1985. By early 1990s the baby-boom population following early development in Oman's economy was reaching post-secondary age. In 1995 providing education and job opportunities to the young became important part of the governments agenda. Oman developed its Vision 2020 that focussed on development of a diversified economy. However, there was no evidence of increased focus on tertiary education immediately after 1995. The changes in spending trends in tertiary education appear much later. Since 2001 Oman witnessed steady drops in primary education spending percent of GDP that went down from their peak of 2.0% in 2001 to 1.4% in 2011. Similarly, secondary education expenditures as a percent of GDP reduced from 2.1% in 1998 to 1.6% in 2013. We observe that a major portion of this spending was moved towards tertiary education expenditures. This was especially visible as, the expenditure percent of GDP on tertiary education was on a growth trajectory increasing from a dip of 0.25% in 2005 to 1.2% in 2009. There was an apparent move from investing in primary and secondary education towards development of higher education capacity. As basic education infrastructure reached stability and primary education needs of the population were being met, the government had a policy shift to spend more towards higher education. This was also in line with a stated effort to strengthen knowledge capabilities for a diversified and innovative economy.

Saudi Arabia has one of the most wide-ranging education systems in GCC countries, especially due to its early focus on vocational education in addition to tertiary education. It offers universal primary education, secondary education with tracking that includes, science, social and vocational education, and tertiary education. The social track is synonymous to the Islamic education track and occupies a similar position in the Saudi education system as the Secondary Modern Schools occupied in the Tripartite Education System in the United Kingdom from 1945 to 1970.

UAE: Data from UAE reveals that the expenditure on education as a percent of GDP in 1998 was 1.2% and was distributed between pre-primary, primary, lower-secondary and upper-secondary education in ratios of 6.6%, 47%, 24% and 21.6% respectively. Expenditure on tertiary education were not included in the overall expenditure. With primary and secondary education, both receiving close to 50% of the overall education spending it appears that the government has had the objective to ensure the development of both primary and secondary education. The tertiary education system in UAE however lacks a coordinated policy.

4.2. Literacy, primary education, secondary education, reforms and performance

Literacy and primary education: The three countries of the GCC Oman, Saudi Arabia and United Arab Emirates (UAE) have performed exceptionally well in terms of youth literacy despite not having compulsory basic education. Starting with modern education in 1970s Oman had achieved above 97% literacy by early 1990s. As such Oman was the earliest amongst the three while UAE and Saudi Arabia were below 95% till early 2000s. By 2015 the youth literacy rates for Oman, Saudi Arabia and UAE were 99.1%, 99.5% and 99.3% respectively, the gross primary school enrolment was above 100% for the three countries and the primary school enrolment gender parity index was 1.035, 0.995, and 1.03 respectively. The net enrolment rates were 94.5%, 97.6% and 93.4% respectively (see. The adult literacy at the same time was 93%, 94% and 93% respectively. In Oman, from 1997 to 2001 the education expenditures per primary student have stayed between USD 4000 and USD 5000 per student, thereon we see a marked increase from 2002 onwards the expenditures range between USD 6000 and USD 7000 per student.

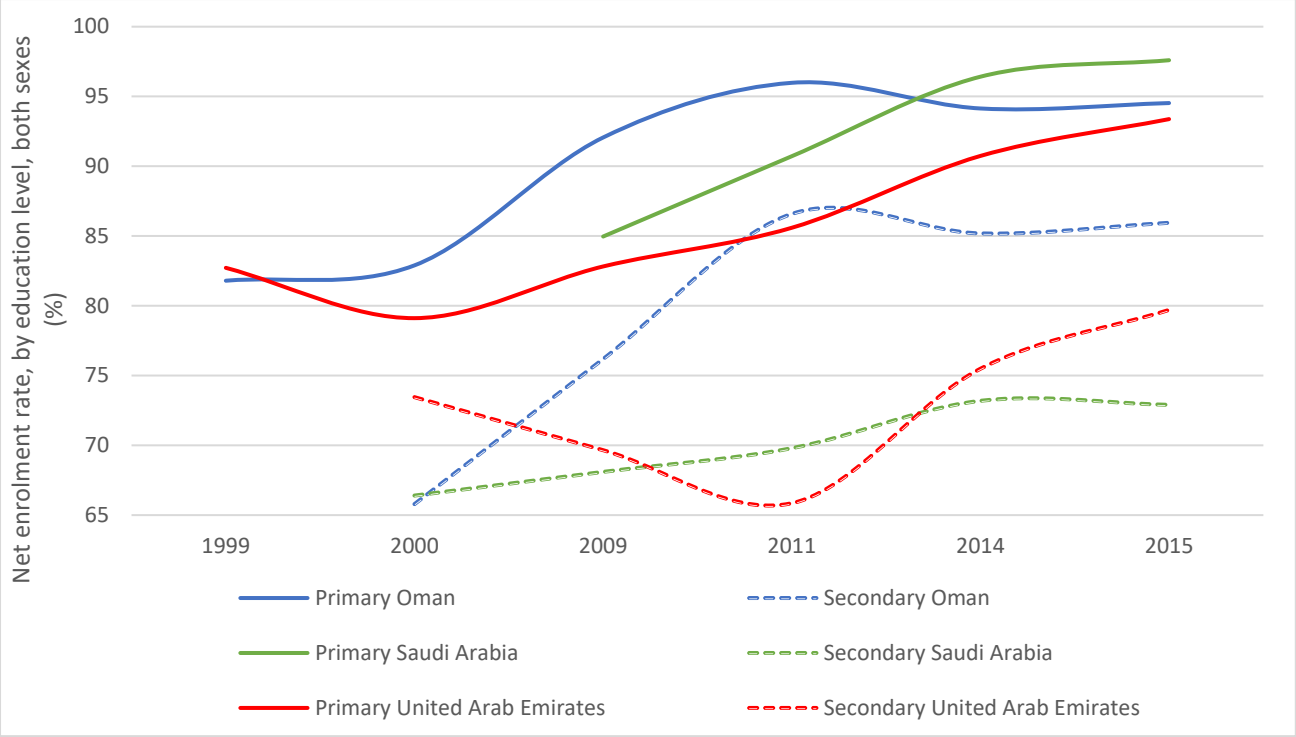

Figure 2 – Net enrolment rate, by education level, both sexes (%) – Primary and secondary education *(Selected years for which data for all three countries is available)*

Secondary education: In Oman, the secondary education expenditures have varied overall without any pattern that may be helpful in extracting any links to quality of education as well as economic development. The one thing that appears from the fluctuating finance at the secondary education level *(between USD 5,000 to 10,000 per student on average)* is that Oman lacks a clear coordinated secondary education strategy. From 2010 to 2014 we observe a drop-in enrolment at the secondary school level that follows a related drop in primary school enrolment and by 2015 Oman achieved 95% gross (85% net) enrolment in secondary education. For UAE, whereas primary education survival rates are as high as 100%, the completion situation in secondary education is of concern. Firstly, between 2008 and 2012 between 77% to 80% lower secondary school age children were enrolled for lower secondary school education. This ratio has improved to 88% and 92% in the years 2013 and 2014. Secondly, the gross intake ratio to the last grade of lower secondary school between 2008 and 2014 has been as low as 66% to 71% for both sexes. For Saudi Arabia, we notice that the enrolment in secondary education *(2015)* is roughly 20% lower than that of the enrolment in

primary school 6 years earlier *(2009)*. This is a daunting figure with no clear indication of how the children who drop out of education at the age of 12 contribute to their development, to the society and economy. Note that the same figure is 7% and 4% for Oman an UAE respectively *(See Figure 2 above).*

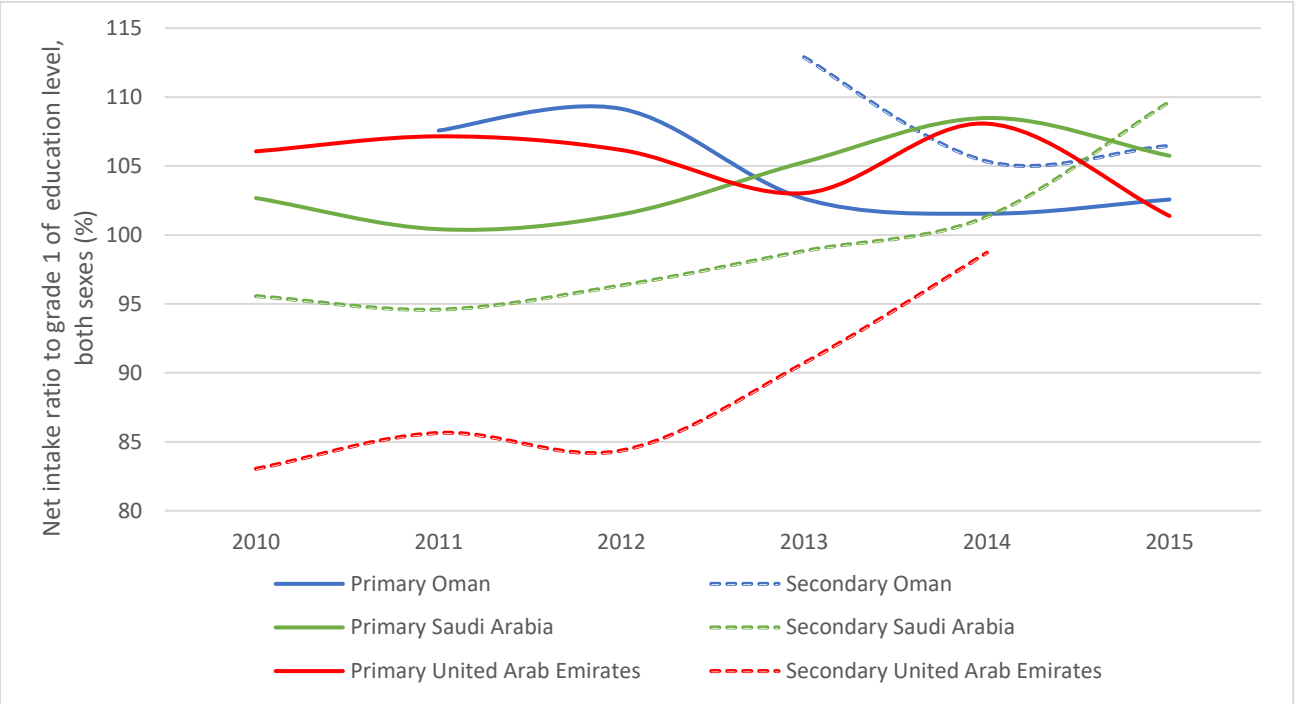

Figure 3 – Net intake ratio to grade 1 of education level, both sexes (%) – Primary and secondary education *(Selected years for which data for all three countries is available)*

Teachers: In Oman the pupil teacher ratio at primary and secondary level was 20 and 17, respectively. The same in Saudi Arabia was close to 10 for both primary and secondary school. While in UAE, the pupil teacher ratio at primary and secondary level of education stands at 23 and 16 respectively in 2015. The job satisfaction of science and math teachers at primary education level was very high with Oman ranked at number 3 for grade 4 and number 8 for grade 8 teachers with 73-74 % of grade 4 and 61-64% grade 8 student being taught by teacher who were very satisfied with their working job. Saudi Arabia performs a little lower in teachers' job satisfaction with between 55-61% students being taught by teachers who were very satisfied with their job. The job satisfaction of science and math teachers at primary education level in UAE is one of the top 5 in the world with 64-70% students taught by

teachers reporting that they were very satisfied and only between 3 to 5% *(depending on grade level and subject*) of students being taught by teachers who reported less than satisfied on job satisfaction in the year 2015. In Oman, for grade 4 between 58-64% of pupils are taught by math and science teachers who have majored in both the concerned subject and education. For the remaining students, around 33 % are taught by teacher who have majored only in the subject concerned or only in education. For grade 8 between 36-40% of pupils are taught by math and science teachers who have majored in both the concerned subject and education and around 50-60 % are taught by teacher who have majored only in the subject concerned or only in education. In Saudi Arabia the percentage of student taught by teachers with both the concerned subject *(Math or Science)* and Education qualification was lower and between 17-34%. In UAE, between 25 to 26% of students are taught by math and science teachers who have majored in both the concerned subject and education. For the remaining students, around 50 to 60 % are taught by teacher who have majored only in the subject concerned.

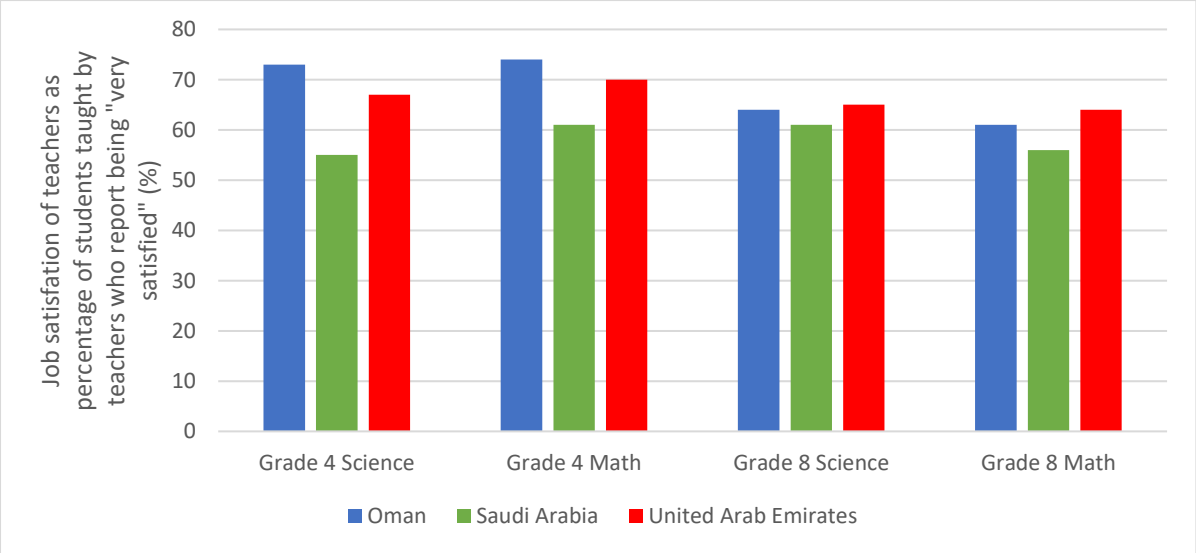

Figure 4 – Job satisfaction of school teachers as reported in TIMMS 2015

Reforms: In Oman, an important reform the Basic Education System was introduced in 1997. This was to gradually replace all the General Education System and the first schools started with Basic Education System in 1998. The degree of prevalence of Basic Education System in Oman is not determined at the time of writing this paper. The system promises to be

student-oriented rather than the previous teacher-oriented design. The Basic Education Reforms may be the second part of the story of the marked increase in results of Mathematics and Science by 2015. UAE has followed suit in both primary and secondary education. Whereas primary and secondary education reform have been recommended for Saudi Arabia for some time by experts, any concrete action toward comprehensive education reform has yet to be seen.

Performance: It is possible that it is the resource allocation changes and education reforms are partially responsible for the improved TIMMS results of primary education and secondary education in 2015 in Oman. In terms of translation of primary education spending to quality of education the scenario has been encouraging. The TIMMS Score for students of 4th Grade age were a low of 385 for Mathematics and 377 for Science in 2011. Similarly, the 8th Grade scores for Mathematics and science were 372 and 423 in 2007 respectively. The increase is visible from 2011 to 2015 where Oman made to the top of TIMMS greatest improvers list showing an increase of 4th Grade score from 385 to 425 for Mathematics and from 377 to 431 in Science. The 8th Grade scores in Mathematics increased from 366 to 403 and those in Science increased from 420 to 455 during the same period. Between 2011 and 2015 Saudi Arabia has witnessed a fall in the Trends in International Mathematics and Science Scores (TIMMS) Math and Science scores for 4th and 8th Grade students. The scores for 4th Grade Math results went from 410 to 383 and the science result dropped from 429 to 390 respectively. Similarly, the results for 8th Grade Math and Science dropped from 394 to 368 and 436 to 396. It is hard to say what forces are behind this drop as data related to total and per capita education expenditure for the years 2011 to 2015 was not available. However, the last data available shows that 2.2% of GDP was spent on primary education. It is also clear from the TIMMS analysis that roughly 90% of that student were taught in condition whereby they faced shortage in resources for Math and Science teaching for both 4th and 8th grade. The TIMMS scores in United Arab Emirates showed an improvement from 434 to 452 and 456 to 465 for 4th Grade and 8th Grade Maths scores between 2011 to 2015. Similarly, the science scores improved from 428 to 451 and 465 to 477 in the same period for grades 4th and 8th respectively. To put things in perspective the highest scoring countries have scores around

620 and European countries and Anglo-Saxon countries score around 500 to 550 level. One reason for lower scores may be that students were starting education in primary level later than their peers in other countries.

Table 2 – TIMMS Score for Grade 4 and 8 students in Science and Mathematics

Score	Country	2011	2015	Trend
Grade 4 Science	Oman	377	431	+
	Saudi Arabia	429	390	–
	United Arab Emirates	428	451	+
Grade 4 Math	Oman	385	425	+
	Saudi Arabia	410	383	–
	United Arab Emirates	434	483	+
Grade 8 Science	Oman	420	455	+
	Saudi Arabia	436	396	–
	United Arab Emirates	465	477	+
Grade 8 Math	Oman	366	403	+
	Saudi Arabia	394	368	–
	United Arab Emirates	456	465	+

4.3. Tertiary education and vocational education

Tertiary education: In 1997 the total number of students enrolled in tertiary education in and outside the Oman was hardly approaching 10,000. By 2005 the number of tertiary education students had increased to 48,500 with government spending a meagre 0.25% of the total GDP on tertiary education. This accounted for roughly 290 million USD constant 2011 PPP total expenditure on tertiary education or 6,000 USD constant 2011 PPP per student. This was a

drop from the 1997 per student expenditure of roughly 20,000 USD constant 2011 PPP. However, by 2005 onwards the spending increased to 25,000 USD constant 2011 PPP per student, with 127,000 students enrolled in tertiary education leading to a total expenditure of roughly 3.2 billion USD constant 2011 PPP per student or 2.0 % of total GDP. Tertiary education expenditures in Oman have been an average of USD 20,000 per from 1997 onwards. Even though the expenditures per student have remained somewhat constant on average the overall expenditure has increased since 2005 it being at 0.25% of the GDP to approaching the 2.0% of GDP mark by 2015. This is reflected in larger number of Omanis graduating from tertiary education institutes in Oman and foreign countries. As well as the marked increase in Natural Science, Mathematics, Information Technology, Statistics and Engineering graduates, increasing from 27% of total graduates in 2007 to 45% in 2015. The number of higher education graduates in sciences has been acknowledged as the greatest strength of Oman's young innovation system as Oman has the highest ratio of higher education science and engineering graduates when compared to any other country in the world. This is a rather recent phenomenon, yet it is one that is bound to reflect positively in building innovation capacity in Oman.

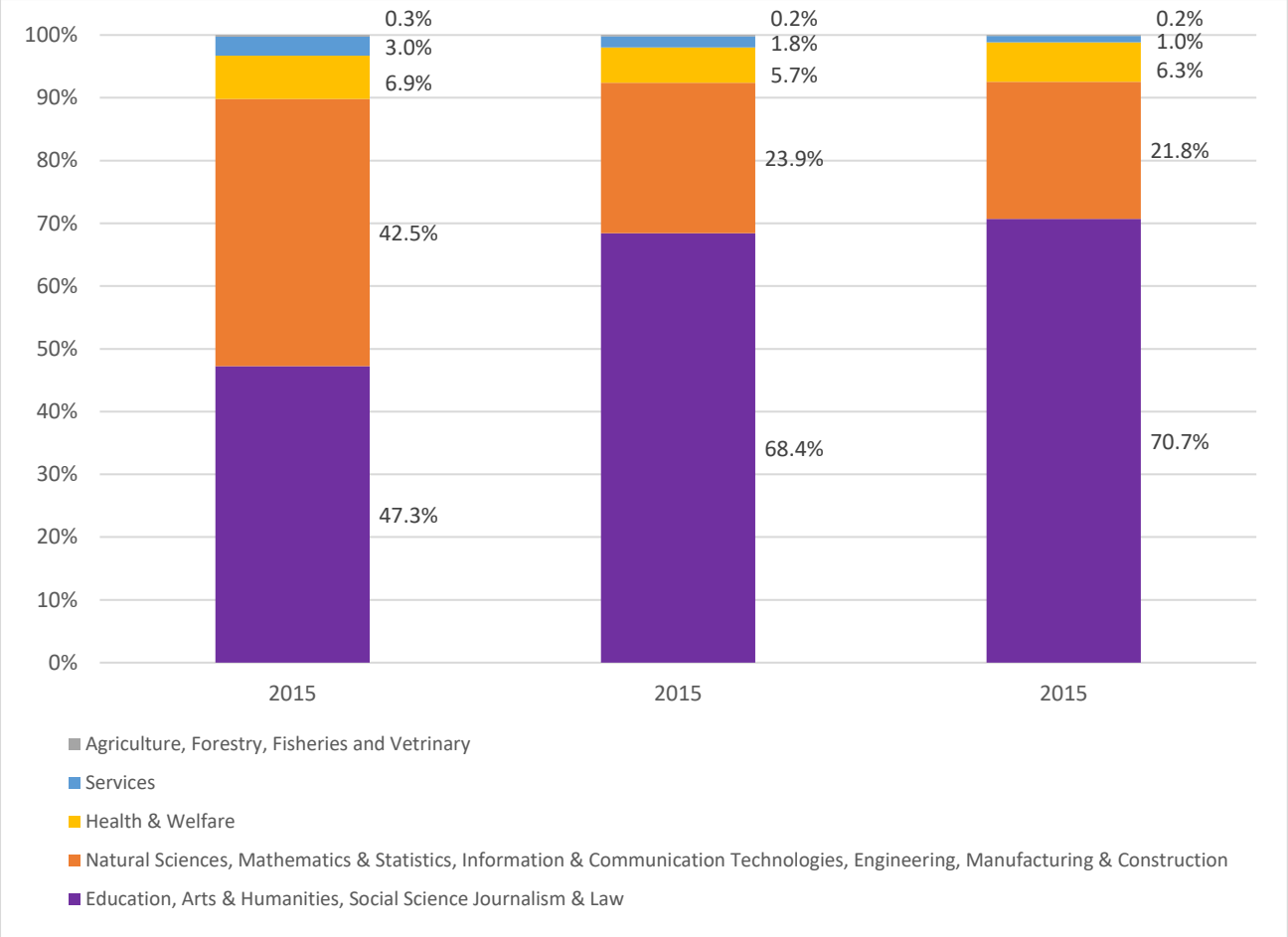

Figure 5 - Percentage of graduates from tertiary education graduating from various tertiary education (by programme type)

In Saudi Arabia the transition from upper secondary to tertiary education has a ratio close to 1. Saudi Arabia has at least 35 universities and around 70 plus tertiary education institutes. 35% of the tertiary education graduates are from tertiary education pertain from engineering, manufacturing, construction, natural science, mathematics, statistics, information and communication technology, and health and welfare programs. Another 15% graduates are from education field. Whereas around 50% finish their tertiary education in social science, law, business, and service sector related programmes. In terms of tertiary education, we observe that UAE has two universities ranked at 51-60 in the QS University 50 under 50 ranking. Overall, for tertiary education we also observe that business, administration, and law programmes form close to 50% of the total graduates in UAE. This may be related to the strong focus on trade in the UAE economy. The UAE is the largest host of international

branch campuses in the world. It has done very well in increasing the intake of secondary school graduates into tertiary education. In 1993 only 25% of the students that were enrolled in the upper-secondary education two years earlier from were enrolled in tertiary education. This ration has increased to roughly 80% by 2015. The attrition rate at every level of education is a cause of concern. The technical or vocational education in the UAE is highly focused on business and IT as such it is not clear how the country aims to include the national population in the process of setting up a diversified and innovative economy. Another cause of concern is the type of programmes offer by the UAE's education system. The branch campuses have become a highlight of the UAE education policy. However, most of them offer the same easy to set-up, low-cost, high return programs that is Business administration and Information Technology. The biggest of these private universities have lower than 15% enrolment of national students. Since, there is a large foreigner population in there is currently no mechanism through which the objectives of these universities can be aligned with the labour force, social, and economic growth objectives of the United Arab Emirates. The open and free-market style education system with the branch campuses popping up since 2005 are based on the mentioned targets. The result is that The UAE has less than 15% of tertiary graduates completing from natural science, statistics, mathematics, technology, engineering, and construction programmes all together.

Gonzalez et al. (2008) has pointed out for Oman, that secondary school graduates who do not make it to tertiary education or higher education are not ready for vocational and service jobs and there is not adequate post-secondary vocational, technical and service education available thereon. The data for Saudi does to not show the numbers related to vocational secondary education. The problem of getting the youth ready for the labour market in UAE is compounded by the fact that there is no coordinated policy for vocational education. Some vocational training institutes operate in the private and public sector, however since UAE has very high expatriate population, the education provided by the institutes is not always aimed at the requirements of UAE rather the monetary objectives that may be greatly driven by demand of foreigners.

4.4. R&D

The condition of the R&D policy sphere is essentially different from the education sphere for GCC countries. Whereas Oman performs relatively well in education outcomes, Saudi Arabia has a clear advantage on the R&D inputs side of the picture. Oman spends the least in proportion to its GDP on R&D followed by UAE with Saudi Arabia having the highest spending on R&D as a percent of its GDP. The number of researchers in Oman is also lower than its GCC neighbours. Saudi Arabia has more high-ranking universities and higher rating on research capabilities of these universities. UAE performs better than Oman whereas Oman clearly lags behind in the research arena. The Development of R&D parks and R&D and Innovation focussed sovereign funds has also entered the agendas of all three countries however these agendas will take time to show results.

Expenditure and Inputs: The gross expenditure in research and development as a percent of GDP for Oman has hovered between 0.14% to 0.25% during the period 2011 to 2016. The headcount number of researchers per million population has dropped gradually from 450 to 129 during the same period. The research expenditure has shifted from Higher education institutes to Government between 2011 and 2012. The total GERD has ranged between USD 150 million and 250 million per year (constant USD 2005 PPP). The contribution of business enterprises towards R&D has been in the range of 24 to 29% in the recent year. Saudi Arabia in contrast has been spending between 0.8 to 0.9% as a percent of it GDP on R&D. The UAE spent only 0.5% of its GDP on Research and Development (R&D) in 2011 with 0.2% spent by public sector, another 0.14% by higher education institutes, and only 0.14% by business enterprises. The Gross Expenditure on Research and Development (GERD) in UAE increased to 0.7% by 2014 with 0.5% carried out by the government and 0.2% by private enterprises. This number has been pushed to 0.8% in 2015.

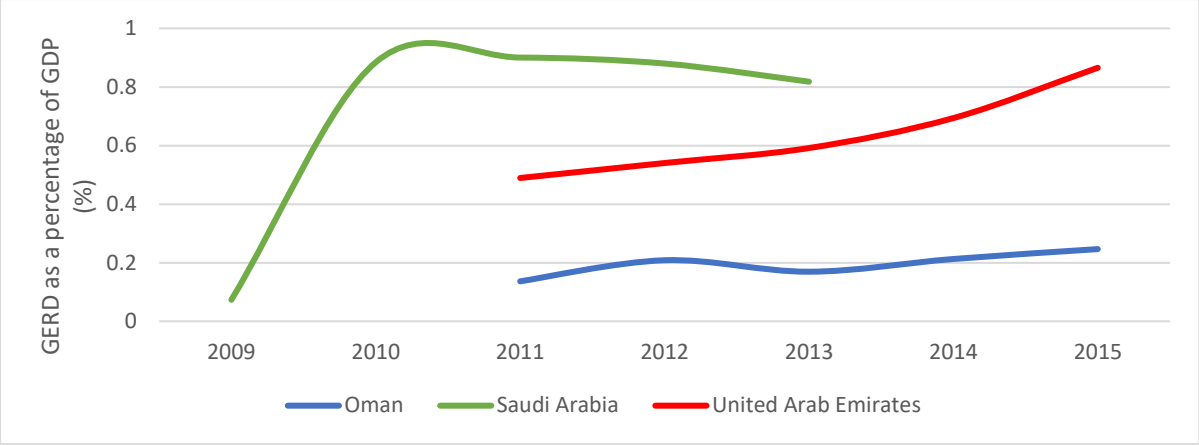

Figure 6 - GERD as a percentage of GDP - *(Selected years for which data for all three countries is available)*

Whereas, Oman clearly lags in most inputs that contribute to research and development it boasts the highest ratio of science and engineering graduates as a portion of its total graduates when compared to rest of the world, as discussed earlier. The headcount of researchers shows that the number of researchers active in research was 1446, 1301 and 1235 in 2011, 2012 and 2013 respectively. The total R&D personnel in the UAE numbered at 11400 in 2011 that is roughly 1300 per million inhabitants. The same data was not available for Saudi Arabia however is expected to be higher than both Oman and UAE.

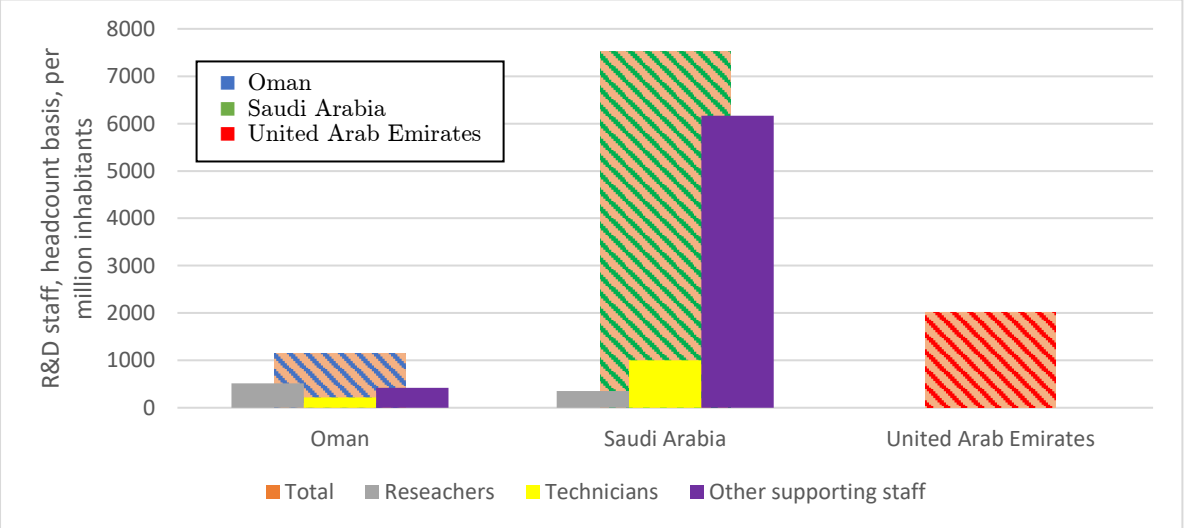

Figure 7 - R&D personnel, headcount basis, per million inhabitants *(in the year 2015, breakdown for UAE not available)*

Performance: The average QS Universities Ranking for top three universities in Oman has hovered around 9 (0 being the lowest and 100 being the highest). However, it must be noted that Oman with 3 million inhabitants has only one university ranked in QS top 700. It is noteworthy that this university in ranked 61 in universities under 50 years old. The top 10 universities in UAE show a rating of medium to high in terms of research, with the highest rating possible being very high. Only two universities the United Arab Emirates University and Khalifa University perform at the level of high ranking in research according to QS University Ranking 2016. Oman scores a meagre 4.2 (0=weakest 100=strongest) on the R&D in the Innovation Input sub-index of the Global Innovation Index 2017 report. This is following a gradual drop from 9.0 in the previous 5 years. Saudi Arabia perform very well in its R&D in the Innovation Input sub-index of the Global Innovation Index having a score of 41.2 and ranked 22 in the world. UAE is not doing as well as it would appear and has a score of 18.2 on the R&D sub-index.

Reforms, Coordinated Policy and Central Research Institution: To improve the situation of research and development and drive the research and innovation ecosystem in Oman towards a positive direction the Research Council (TRC) with it research and innovation section was setup in 2005. Since then the research council has launched many initiatives. The UAE lack a central authority and a central policy for directing Research and Development in the country. The main weaknesses observed include a weak intellectual property regime, non-clarity of the government in terms in terms of the R&D priorities that the industry and academia is to follow, and absence of an overreaching regulatory body that can communicate the governments R&D priority areas with the ability to facilitate and/or enforce partnerships between national and international stakeholders. Whereas Oman is the first one to have a central Research coordination institution, a research agenda has only been recently outlined. However, it seems that Saudi Arabia does quite well without a central research institution. Saudi Arabia does not have a coordinated research policy or a dedicated central research institution and in UAE research policy is handle by the Ministry of Higher Education and Research. In the same regard it UAE has also tried to improve it R&D footprint by trying to establish central policy and induce a coordinated R&D effort.

Research Funding: Oman has the Open Research Grants Program that allocates funds to small and medium-sized research in areas highlighted as priorities in the National Research Strategy2. In 2011, the fifth cycle of the Open Research Grants Program set 13 million constant 2011 USD PPP for the funding of 20 Research Proposals that included funding towards 12 PhD and 20 Masters students associated with the projects.

In 2010 the Industrial Innovation Centre (IIC) took place of the Industrial Innovation assistance program that existed before. Between 2009 and 2013 this program invested 7.8 million constant 2011 USD PPP for 31 projects of which 2.6 million USD were contributed by the IIC and the remaining from the Industrial Partners in the Projects. The TRC also had the Strategic Research Program since 2012, and the Faculty Mentored Undergraduate Research Award Program (FURAP) since 2013 that sponsored 249 projects by 2016. The annual spending of the FURAP program is roughly half a million USD. The TRC also established the Publication & Awareness department to create a learning culture using media. Their initiatives included TRC Youth Science and Innovation Show, Print media coverage, Social media coverage, Television coverage and show casing research activities in Exhibitions. Since there are no central research institutes in Saudi Arabia and UAE it is hard to estimate the research grant and funding of research project in these countries

R&D and Innovation Clusters and Sovereign Funds: In 2016 The Research Council *(TRC)* in Oman launched Ibtikar an innovation investment company with a 360 million USD constant 2011 PPP equivalent initial capital to invest in start-ups and also to attract international companies that will utilise the Oman's natural and human capital and benefit Oman directly with knowledge transfer and development. In 2016 the TRC finalized the development of its Innovation Park Muscat (IPM) with 560,000 square meters of area research, innovation, incubation integrated facilities available for research and development activities. The program has an estimated 8 to 10 years of maturation period thereafter it is expected to generate job,

[2] The areas of research highlighted as priorities in the National Research Strategy include; Culture & Basic Sciences, Energy & Industry, Environment & Biological Resources, Education & Human Resources, Health & Social Services, Information & Communication Technology

provide direct revenue and establish flow of companies to Oman while increasing foreign direct investment.

Saudi Arabia has established at least four major research clusters that include the KAUST Research and Technology Park, Riyadh Valley Makkah Park, and Dahran TechnoValley (DTV). DTV is particularly interesting as it started with 4 major international business and 2 Saudi corporates setting up their research centers in 2011. By 2017 there are now 12 research centres belonging to major and international businesses and 4 for Saudi firms in DTV. There are plans of a 2 trillion USD sovereign fund for R&D and innovation projects that will be accompanied with a national transformation plan. However, the exact details of these is yet to be revealed.

UAE does not have dedicated research and innovation cluster or sovereign fund for setting up technology, innovation, and research related institutes and organisation however, three major clusters Dubai Science Park, Dubai Internet City and Dubai Silicon Oasis are established for businesses with the expectation of R&D and innovation spill-overs.

4.5. Business and Entrepreneurship

Index of Economic Freedom: Oman has maintained relatively stable scores on the overall Index of Economic Freedom. The overall score is composed of many different indices amongst these we have selected business freedom, trade, investment, and monetary indices as they directly relate with government policies to boost businesses *(100 representing the frontier).* We observe that Oman scores high on business freedom and trade conditions with the scores being in the range of 70 to 80 during most of the period from 1995 to 2015. During the same period, monetary and investment conditions have improved continuously with recent scores on the sub-indices being 60 and 65 respectively. The same is true for Saudi Arabia with the scores on business freedom and trade freedom improving regularly between 2005 and 2016 from 50 and 60 to 80 and 70 respectively. However, the scores on the index for business freedom are currently lower than those observed in 1995 where Saudi Arabia scored 85 on the business freedom sub-index. Fiscal freedom has remained at 100 while investment freedom has been below 50 and hovered from 30 to 40 for most of the period 1995 to 2016. The UAE

has a long tradition of business and entrepreneurship and in particular international trade. From 1996 to 2002 we observe that business freedom was at 85 out of 100 on the business freedom sub-index of the Index of Economic Freedom (IOEF). From 2002 to 2008 we observe a steady drop in the business freedom sub-index and there-after it increases to 80 by 2016. Trade freedom sub-index has maintained around the 80 points from 1995 to 2016. Fiscal freedom has been steady at 100 or close to 100 on the IOEF index. However, investment freedom appears to be on the lower side and has been below 50 on the index and in most years closer to 30.

Doing Business: A more detailed picture of the business policies and environment is presented by the Doing Business indicators. Figure 8, shows distance from frontier (DTF) for various business-related policies in Oman. The measure DTF is ordered from 0 being the furthest from the frontier and 100 being at the frontier. We notice that, since 2008 Oman has made great strides in improving the Starting a Business measure, going from 49.22 in 2008 to 92.85 in 2017. This improvement has been achieved through reducing the number of days, procedures, and capital required to start a business. For example, the Paid-in minimum capital in was reduced to 0 % of the income per capita. It is apparent that policies to boost entrepreneurship have been put in place in Oman. Paying taxes and Trading across borders measures maintained close to the frontier in the last 13 years and were at 90.6 and 80.17 in 2017, respectively. Enforcing contracts measure has seen modest improvement in from 2014 to 2015 and was steady at 61.55 in 2017. The areas where Oman is far behind the frontier includes that of Resolving insolvency and Getting credit at 42.65 and 35 during 2017.

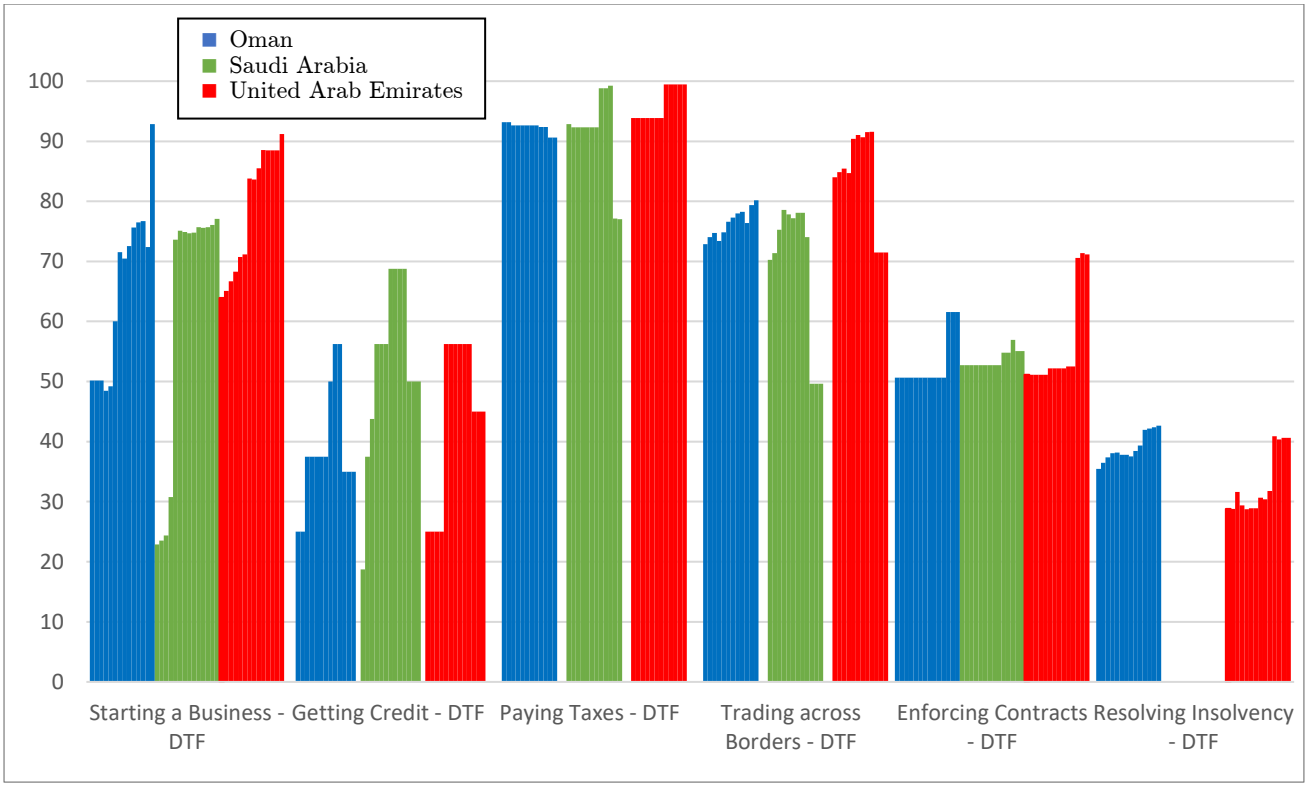

Figure 8 – Distance to frontier (DTF) on Doing Business indicators – Oman, Saudi Arabia and UAE *(100 being the frontier)* – 2004 to 1017

Saudi Arabia has been close to the frontier with the value of Paying Taxes DTF close to 100 between 2013 to 2015 owing to low tax requirements and ease of tax payment systems, however, in the last two years 2016 and 2016 the Paying Taxes DTF has fallen to 80. The ease of starting a business DTF saw an improvement in 2008 and jumped from 30 to 70 and since then has slowly hovered close to a value of 80 still below the leader in ease of starting business among the GCC countries that is Oman. The situation regarding ease of resolving insolvency is alarming as it appears that Saudi Arabia is furthest from the frontier. This can be very important in terms of attracting businesses and also could be a potential inhibitor of risk taking behaviour among entrepreneurs leading to slow down of innovation efforts.

United Arab Emirate has a low tax regime and this appear in the Doing Business indicators with UAE close to the frontier in terms of Ease of Paying Taxes. Trading across borders had always been one of the strong points of the UAE economy however, during 2015 and 2016 the UAE has witnessed movements away from the frontier. The ease of starting a business that

is critical for entrepreneurial activity has steadily improved going from 63 to 91 from 2004 to 2016. Finally, resolving insolvency, getting credit and enforcing contracts remain areas where UAE needs further efforts and policy to get closer to the frontier.

Trade Zones: There are at least 24 free trade-zones in the UAE with most of them concentrated in the Emirate of Dubai. The companies that setup in free trade-zones in the UAE can benefit from 100% foreign ownership, full repatriation of capital and profits, no requirement for minimum capital investment, quick approval procedures for setup and no corporate or personal income taxes. However, a free trade-zone company in UAE cannot trade directly with the UAE or broader GCC market. This can be done only through locally appointed distributors that need to have appropriate trade licenses and 51% ownership by UAE National. A custom duty of 5% is applicable when the free zone company sells its products or services in the local market.

Through the establishment and effective operation of trade zones UAE is able to accomplish two direct goals. First is that the country profits from real estate development and secondly it can make products and services from all around the world to be available at its door steps. Whereas, the target of diversification of the economy is clearly helped through free trade-zone, it is not very clear how the policies relate to activities in the free trade-zones impact the aim of inducing innovation in the UAE.

4.6. Governance and Infrastructure

The worldwide governance indicators (WGI) from World Bank show that Oman has improved in the rule of law and control of corruption indices from 1995 up to early 2000s and there on seen a drop. Regulatory quality and government effectiveness data show a regular drop from 1995 to 2013. The situation is not alarming as Oman is above the threshold of 50 points for all governance indices indicating reasonable governance structure and confidence in the public authorities. However, it can be observed that there is a lot of room for improvements. The countries with the best quality and perceptions of governance exhibit scores of above 90 points in terms of government effectiveness, regulatory quality, rule of law and control of corruption.

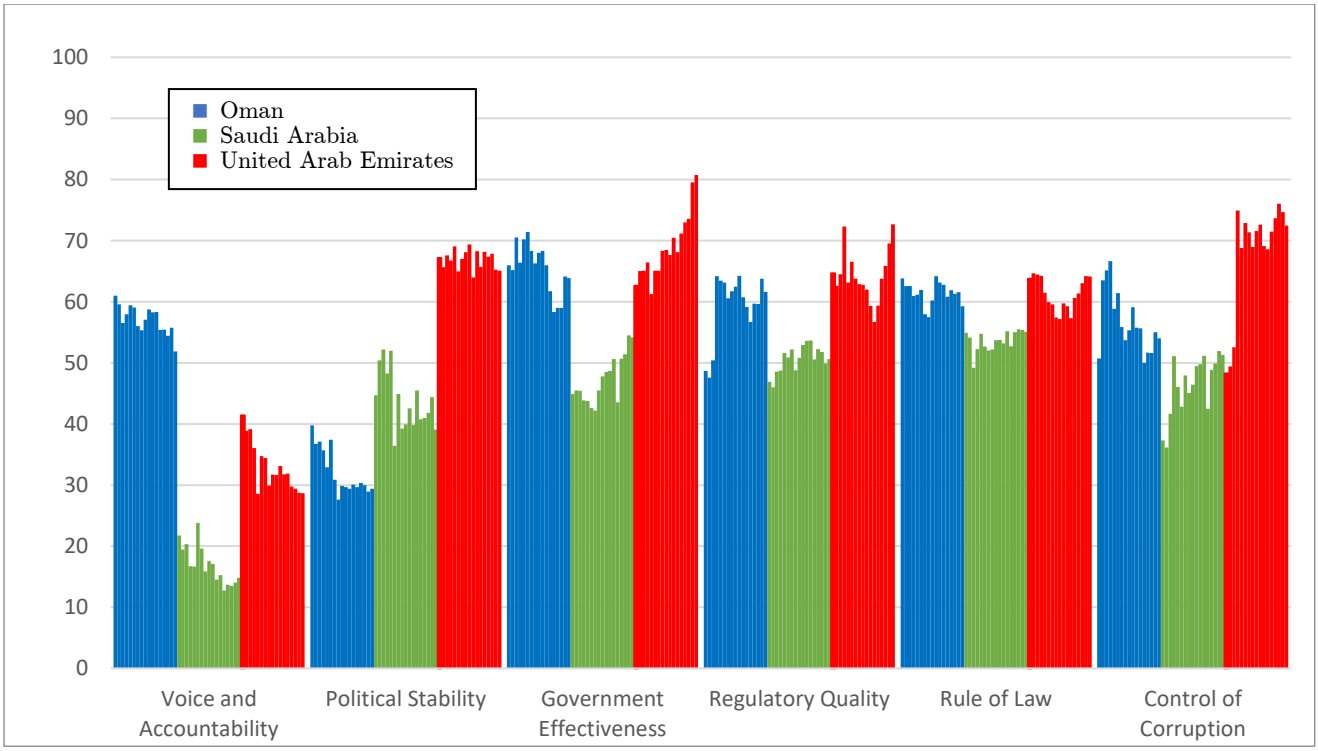

Figure 9 – World Governance Indicators – Oman, Saudi Arabia, UAE – 1996-2015

The main improvements are apparent in the Regulator Quality in Oman that went up from 50.4 to 64.2 between the years 2000 and 2002. Other indicators including Government Effectiveness, Political Stability, Rule of Law, and Control of Corruption have stay somewhat stable between 1996 and 2017. The indicator that seems to show the worst performance is that of Voice and Accountability. The was a steady drop from 39.76 to 27.61 points between 1996 and 2006 and 2007 onwards the indicator has been stable around 30 points.

The WGI show that Saudi Arabia has the lowest levels for all Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality and Control of Corruption. Political Stability dropped from 50 to 40, while control of corruption has improved from 40 to 50 from 2000 to 2015. Regulatory quality and rule of law have remained relatively steady at approximately 50 and 55 respectively. Government effectiveness has steadily improved from 45 to 55 from 1996 to 2015. Finally voice and accountability measure is low as expected for GCC countries.

The World Governance Indicator show that UAE has been steadily improving its governance. Government effectiveness has improved from 63.75 to 80.74 from in the last 20 years from 1996 to 2015. Political Stability and Rule of Law appear to be in a stable and healthy position since at a level around 65 out 100 on the indices. Regulatory quality had seen a dip from 1996 to 2010 and thereafter improvements have been observed. The regulatory quality from 2010 to 2015 has improved from 57 points to 72.5 points on the index. As is often the case in the GCC region, Voice and Accountability is seen to be low and dropping from 40 to 30 points from 1996 to 2015.

5. The Outputs of GCC – Indicators of Innovation and Diversification

Table 3 abovebelow shows that patent activity in Oman is lower than both Saudi Arabia and UAE. Meanwhile Industrial design activity is relatively higher in Oman and UAE than Saudi Arabia on a per capita basis. In terms of sectoral diversification Oman and UAE have explicit positive trends in tourism and trade sectors respectively, and Saudi Arabia has explicit positive trends in all sectors other than industry and manufacturing sector. An increase in the share of value added of industry and manufacturing sector in the economy of Oman was observed between 1990 and 2013. While the same was true for UAE, yet the overall increase was observed to go through cycles of fluctuation during the period. While the trade, financial and business service and public sector were shrinking in Oman the overall productivity in the sectors was increasing. The industry and manufacturing sector witnessed a decrease in labour productivity. The UAE also witnessed similar trend in industry and manufacturing, while the opposite was true in Saudi Arabia where the overall share of manufacturing reduced as the labour productivity in these sectors grew. The overall trend shows that Oman improved in the tourism sector with the value added from the tourism sector as a percent of total GDP being stable with increasing labour productivity. Saudi Arabia performing well in trade sector with both share of value added of the trade sector and labour productivity of the trade sector improving. Saudi Arabia's share in value added for both tourism, and, finance and business-related service sector was stable with increasing labour productivity, while the public, education and health sectors increased in size with stable labour productivity. UAE has a

clear positive trend in only trade sector where the share of value added increased with labour productivity being stable.

Table 3 - Comparing Innovation and Diversification Outputs

Country → Innovation and Diversification Outputs ↓	Oman	Saudi Arabia	UAE
Innovation			
Patent Applications	– –	+	o
Variation in Patents by Fields of Technology	– –	o	+
Industrial Design	++	+	++
Summary	-	o	+
Share of Value Added (VA) & Labour Productivity (LP) by Sector			
Industry – Chemical & Metals (VA)	++	–	+
Industry – Machinery, Equipment and Other Manufacturing (VA)	++	–	+
Trade – Wholesale and Retail (VA)	–	++	+
Service – Tourism Related (VA)	o	o	o
Service – Finance and Business (VA)	–	o	o
Public Sector, Education and Health (VA)	–	+	–
Manufacturing (LP)	–	+	–
Trade (LP)	++	+	o
Service – Tourism Related (LP)	++	+	o
Service – Finance and Business (LP)	++	+	–
Public, Education, and Health (LP)	++	o	+
Summary	++	o	-

Note: Description of the quality of or level of success in policy, enablers or outcomes

– – – Extremely Negative – – Negative – Slightly Negative
o Moderate
+++ Highly Positive ++ Positive + Slightly Positive

5.1. Patents, Trademarks and Industrial designs

The patent, trademark and industrial design data shows that Oman is slowly progressing in a positive direction. The number of patent applications abroad had risen to 24 by the year 2012 coming back to around 10 in the year 2015. Resident Patent application have also seen a positive trend. It is noteworthy that a major portion of the patent applications are related to Civil Engineering. Non-Resident Industrial Design Registrations have tripled from 2007 to 2015. Oman's innovation output is dwarfed in comparison to Saudi Arabia that has developed its R&D and innovation systems for a longer time period than Oman. Additionally, Oman's pace in producing patent and industrial design applications and grant is much slower than UAE that appears to be active in the arena since 2001 onwards *(See Figure 10 and Figure 12 below).*

Figure 10 – Patent, Trademark & Industrial Design Data – Oman (WIPO Statistics Database)

Saudi Arabia appears to have benefited from conversion industry setup during the early phases of its development and by 2015 it had 200 resident patent grants from those filed previously while filing 1000 resident patent applications during the year. The top five fields in which patents are filed in Saudi Arabia being associated with chemical and material industry clarifies the role of the chemical process industry in this development. Industrial design applications in both Oman and Saudi Arabia seem to have picked up pace since 2009. Saudi Arabia may also show higher number of patent applications due to having setup a local patent office as well as having the GCC patent office located in its borders.

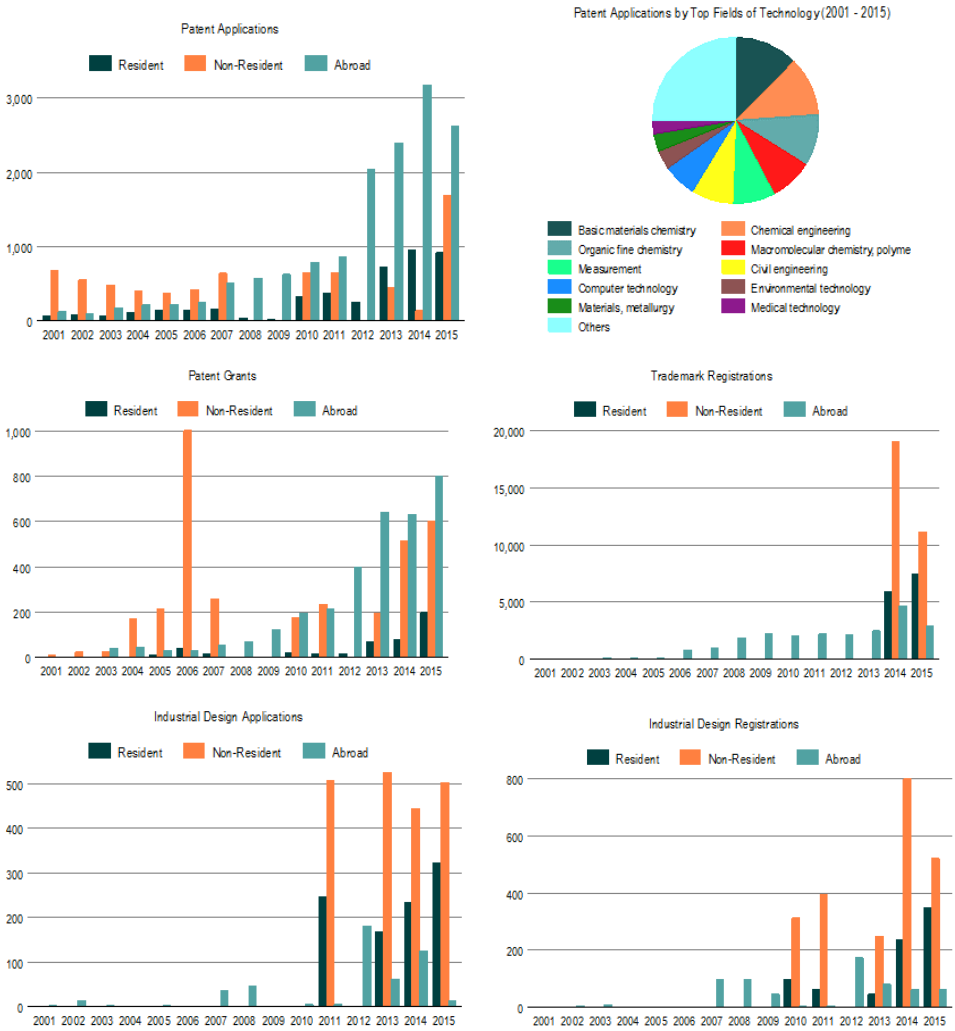

Figure 11 – Patent, Trademark & Industrial Design Data – Saudi Arabia (WIPO Statistics Database)

The patent, trademark and industrial design data for UAE shoes that patents application in UAE from 2001 and 2015 are from in many different areas. Civil engineering patents are related to the real estate development in UAE, whereas computer technology, engines and machine patent application, information technology and medical technology patent application are associated with the various free zones that have been instated to develop the economy and push local innovation.

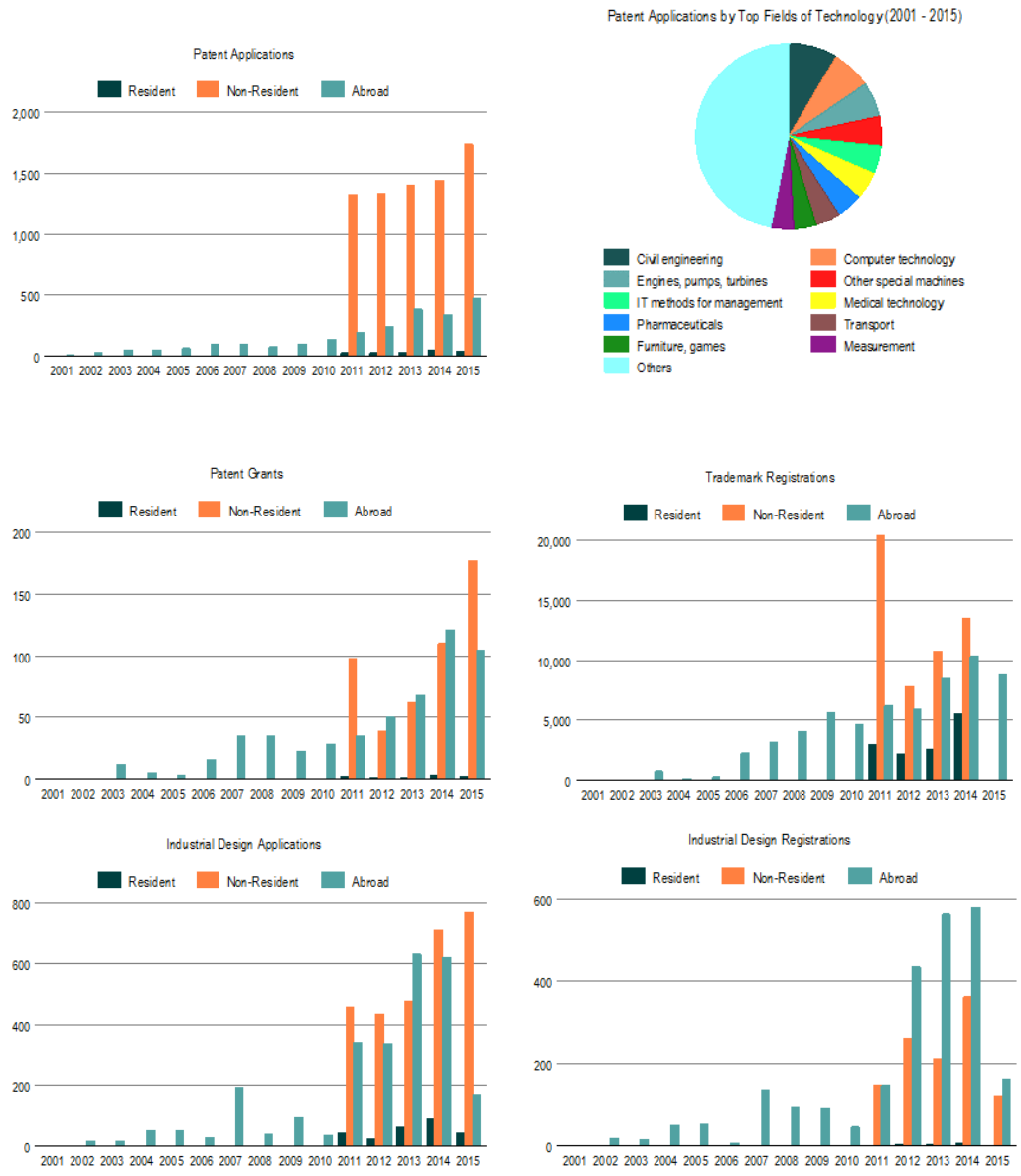

Figure 12 – Patent, Trademark & Industrial Design Data - UAE (WIPO Statistics Database)

Overall trends exhibit that patenting, design and trademark registration activity when considered on a per capita basis is roughly 20 time higher in Saudi Arabia than Oman, and 10 times higher in UAE than Oman. Meanwhile, Oman and UAE have similar levels of activity in terms of industrial design applications and registrations on a per capita basis that is roughly 10 time higher than the activity in this area in Saudi Arabia.

5.2. Non-traditional sector - share in the economy and labour productivity

In terms of share of value added of sectors as a percent of total output in Oman, we observe that value added in the mining and quarrying sector increased from 7.0% to 12.0%. In addition

to that we observe increases in Chemical Manufacturing, Metal Manufacturing and Machinery and transport Manufacturing in the range of 1.0% to 2.5%. One exception to this apparent growth in share of sectors in addition to Mining and Quarrying sector is that of the Hotel and Restaurant sector within the Services broad category. Despite having strong policy to promote Tourism sector in Oman and the tourism sector having grown in absolute terms in the past few years we observe in the Figure 13 that the share of Hotels, Restaurants, and Transport services sector in the economy has remained virtually stagnant. Saudi Arabia on the other hand observed a drop in the share of value added as a percent of total output from the Mining and Quarrying sector along with Petroleum, Chemical and Non-Metallic manufacturing sectors, Metal products sector. Wholesale and Retail Trade is the main sector in private industry that appears to be improving from 2002 onwards. UAE's Mining and Quarrying Sector has also reduced in share of value added from 2002 onward while Electrical and Machinery, Transport Equipment and Other Manufacturing have seen a rise it their share of value added as a percent of total output in the UAE economy.

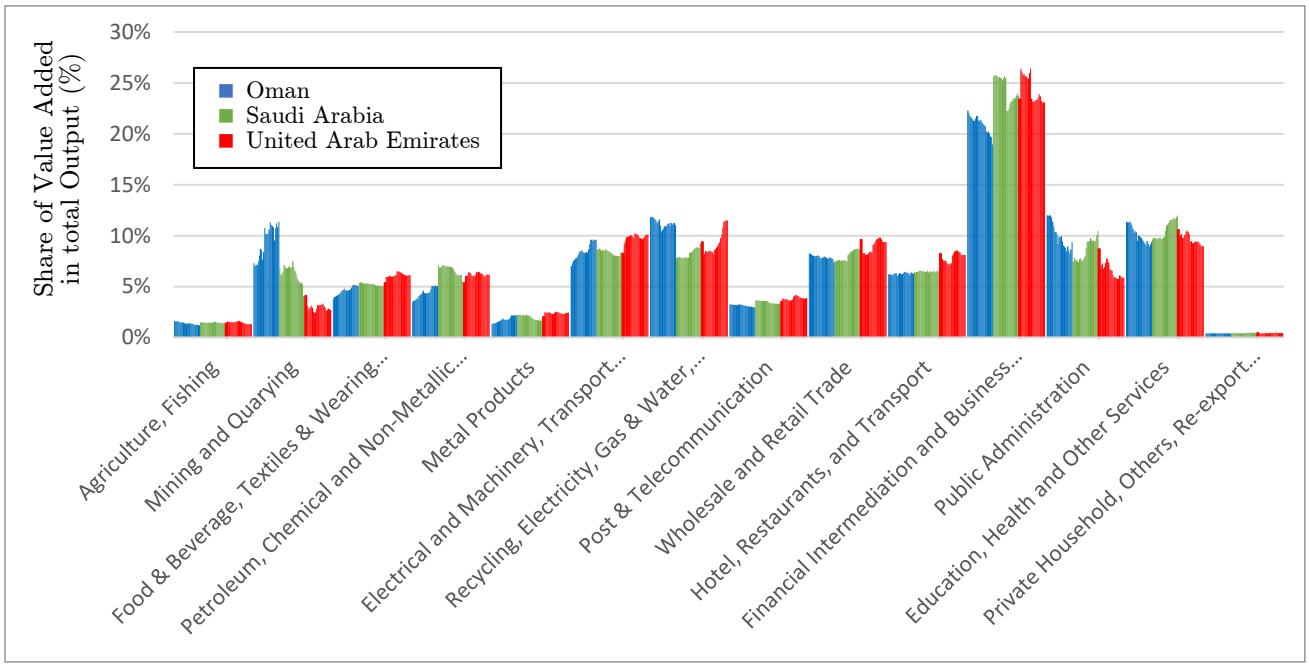

Figure 13 – Share of value added by sector as a percent of total output for Oman, Saudi Arabia and United Arab Emirates (1990 to 2013)

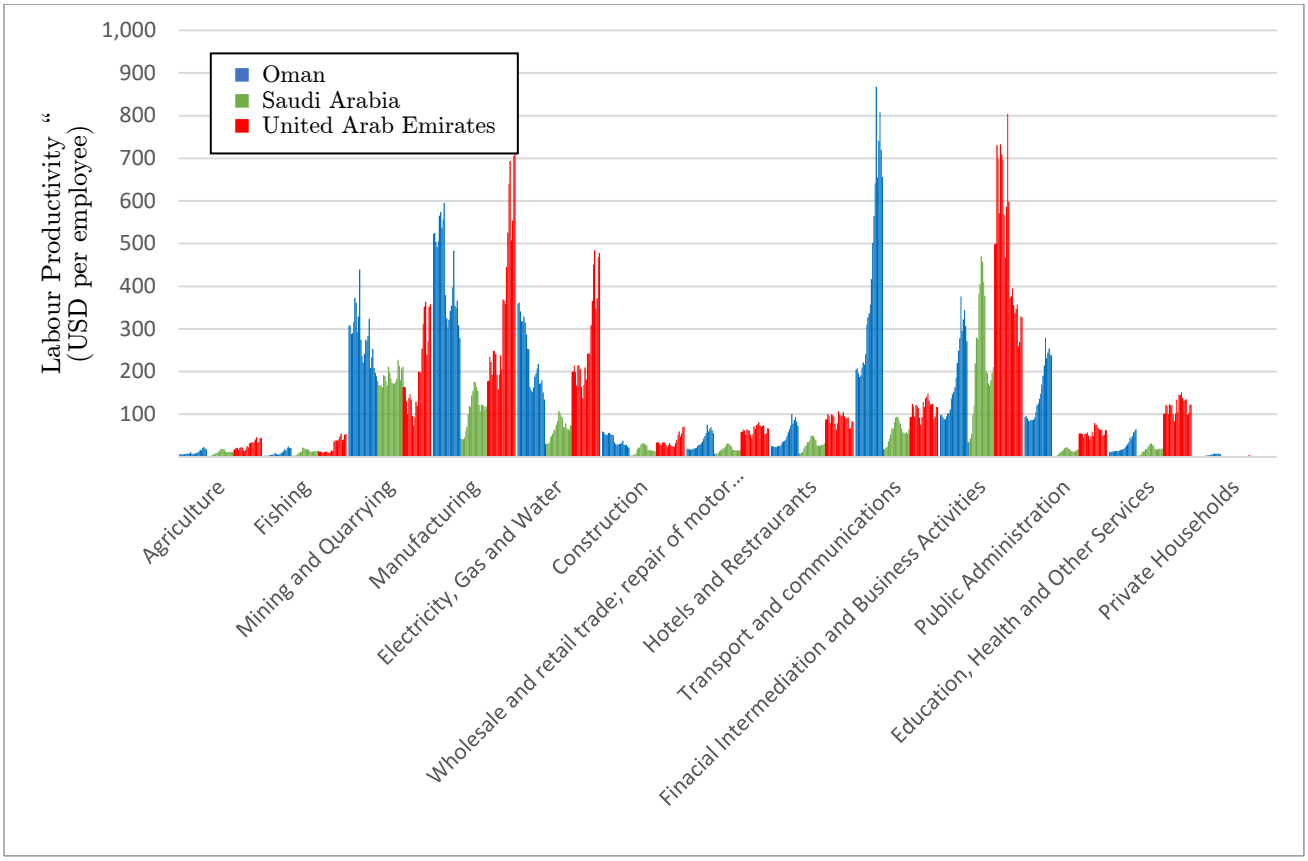

Figure 14 – Labour Productivity by sector, Saudi Arabia and United Arab Emirates (1990 to 2013)

The labour productivity changes in various sector provide additional information on sectoral diversification in the three countries. Figure 14 aboveabove shows that the labour productivity in all sectors except Mining and Quarrying, Manufacturing, and Electricity, Gas & Water saw a steady increase between 1998 and 2008. Consequently, Manufacturing in Oman has dropped from being the most productive to the second most productive sectors in Oman. The productivity increase in transport and communication sector may be related to two events. In the transport sector Oman Air a government owned airline that was formed in 1993 became a part of IATA and expanded its operations in 1998. Also, in transport sector, Oman Shipping Company, a government owned enterprise was incorporated in 2003 and started operations. Oman also deregulated the telecommunications sector in 2004, privatized part of the government owned telecommunication company, and opened license market for additional private player in the market. These three events coincide with the first and second increase in labour productivity in the transportation and communication sectors.

Saudi Arabia's labour productivity in all sectors appears to be stagnant from 2007 onwards. This levelling followed the rise and fall of labour productivity in all sectors except Mining and Quarrying from 1994 to 2007 with the peak productivity observed in most sectors in the years 2001 and 2002. The mining sector has retained productivity levels around to USD 200,000 per employee with an slight increasing trend. In UAE the mining and quarrying sector and manufacturing sector that all together contribute less than 20% of the value-added in the economy have become the most productive sectors in the economy. It is interesting to note that the trade sector while being the largest employer in the economy is amongst the lowest productive sectors in the economy of UAE. It contributes approximately 10% of value-added in the overall economy of UAE.

6. Connecting Policies, Enablers, and Outcomes

The comparative analysis of the three countries discusses indicates that all three of them have had very little success in terms of innovative activity and diversification in the economy away from natural resources such as oil and gas. This result provides indication that the level of success achieved by the countries in their intention to diversify is closely matched to the quality and level of policy inputs and condition of enablers in the country. The pattern indicates that it is often the lowest ranking policy measure or enabler that decides the highest possible level of success in innovation and diversification. Leading to the understanding that the condition of all inputs needs to be strong in order for innovation activity as well as diversification to prosper.

Oman's failure to have strong progress in innovation activity and only achieving moderate results is coincident with moderate policy measures in the research and development arena. Similarly, Saudi Arabia's failure to have a strong industrial and sectoral development policy associated with an excellent business environment has led to moderate success in diversification. Not only that but relatively moderate condition of the primary and secondary education policy and quality expresses in vocational, tertiary graduates and overall labour quality. Even though primary and secondary education quality may thought to be a indirectly related to innovation and diversification efforts of a country, yet there is a direct correlation

observed between the highest quality of education in the country to the highest level of success achieved in the ultimate outputs of innovative activity and diversification. United Arab Emirates is another example of the same trend where vocational, technical and tertiary education and the condition of the R&D policy and enablers are leading to moderated levels of diversification despite relatively stronger business environment and governance regime in comparison to the other two countries. It is important to note that the slightly positive output trends for Oman diversification arena and those for Saudi Arabia and UAE in the area of innovation activity are just that – slightly positive. The innovation and diversification goals of these countries are far from their full potential and constrained by the lowest performing policy areas.

Table 4 – Summary of policy and enablers condition to innovation and diversification output in the three GCC countries Oman, Saudi Arabia and United Arab Emirate

Country	Input Trend and Overall Rating		Output Trend	
Oman	Primary & secondary education	++	Innovation (Patenting activity and industrial design)	–
	Vocation, technical & tertiary education	o		
	Research & development	–		
	Business environment and industrial/sectoral development policy	+	Diversification (sectoral value added and labour productivity)	++
	Governance & infrastructure	+		
Saudi Arabia	Primary & secondary education	–	Innovation (Patenting activity and industrial design)	+
	Vocation, technical & tertiary education	+		
	Research & development	+		
	Business environment and industrial/sectoral development policy	–	Diversification (sectoral value added and labour productivity)	o
	Governance & infrastructure	–		
UAE	Primary & secondary education	+	Innovation (Patenting activity and industrial design)	+
	Vocation, technical & tertiary education	o		
	Research & development	–		
	Business environment and industrial/sectoral development policy	+	Diversification (sectoral value added and labour productivity)	–
	Governance & infrastructure	++		

Note: Description of the quality of or level of success in policy, enablers or outcomes

– – – Extremely Negative – – Negative – Slightly Negative
o Moderate
+++ Highly Positive ++ Positive + Slightly Positive

The summary of these policy inputs and enablers has been discussed in Section 4 on page 13 and the detail of these in the sub-sections of the same section. Similarly, the summary and details of the innovation and diversification outputs have been discussed in Section 5 on page 34.

7. Summary, Discussion & Conclusion

The systems of education in the GCC countries developed distinctly. Oman delayed the development of a tertiary education system in subsequence to successes in primary and secondary education in order to provide an adequate base for the next level. Whereas, Saudi Arabia developed its vocational and tertiary education in parallel to primary and secondary education systems. The UAE seems to have focused equally on the development of primary and secondary education, while lacking a specific policy in terms of tertiary and vocational education.

The literacy and primary education performance has been excellent for Oman, Saudi Arabia and UAE. Secondary education seems to lack from clear policy for both Oman and Saudi Arabia. Oman has the highest enrolment rate in secondary education whereas Saudi Arabia and UAE do not perform very well in primary to secondary transference. The job satisfaction of primary school teachers in Oman and UAE is among the best in the world while Saudi Arabia lags slightly behind. In terms of qualifications of teachers, Oman does relatively better than Saudi Arabia and UAE and a larger proportion of students in Oman are taught by teachers who have both concerned subject *(Math or Science)* qualification and education as their major. Oman has been the first in the region to phase-out primary education reforms moving toward student-oriented approach. UAE has followed suit in both primary and secondary education. Whereas primary and secondary education reform have been recommended for Saudi Arabia for some time by experts, any firm action toward comprehensive education reform has yet to be seen. The performance improvement in both Oman and UAE has been observed following reforms, with the TIMMS scores for maths and science improving in Oman and UAE while Saudi Arabia witnessed a drop in TIMMS scores leading to concerns in terms of system performance.

In Oman, it is also apparent that the government has put in efforts to increase enrolment in tertiary education. It is estimated that roughly half of the students in tertiary education are funded by the government. While not all secondary school graduates in Oman enter tertiary education yet the tertiary education science, technology and engineering graduates' ratio to the total graduates is 45% that is highest in the world. The transition ratio from upper secondary to tertiary in Saudi Arabia is close to 1 and in UAE is as low as 0.25. The natural science, technology and engineering graduates' ratio for Saudi Arabia is also high being close to 35% while in UAE it is a very low of only 15% with most of the tertiary education graduates pertaining from law, social science and business programs. All three countries appear to suffer from lack of technical training, vocational education programs and coordinated education policy

The condition of the R&D policy sphere is essentially different from the education sphere for the individual GCC countries. Whereas, Oman performs relatively well in education outcomes, Saudi Arabia has a clear advantage on the R&D inputs side of the picture. Oman spends the least in proportion to its GDP on R&D followed by UAE with Saudi Arabia having the highest spending on R&D as a percent of its GDP. The number of researchers in Oman is also lower than its GCC neighbours. Saudi Arabia has more high-ranking universities and higher rating on research capabilities of these universities. UAE performs better than Oman whereas Oman clearly lags behind in the research arena. The Development of R&D parks, and R&D and innovation focussed sovereign funds has also entered the agendas of all three countries however these agendas will take time to show results.

In understanding the business policies and environment through the lens of Index of Economic Freedom we observe that Oman does the best among the three countries in terms of providing investment freedom with a score of 70 *(out of 100)* for investment freedom. The countries perform similarly in terms of business freedom, trade freedom and fiscal freedom with scores close to 70, 80 and 100, respectively. When we look at the business environment through the lens of Doing Business indicators we find that UAE and Oman have the most attractive tax regimes, ease of starting a business and ease of trading across borders with Saudi Arabia

lagging relatively behind. In terms of getting credit and enforcing contracts, the three countries seem to perform equally moderate. Saudi Arabia has no system installed to ensure smooth insolvency resolution while Oman and UAE perform moderately in this aspect.

In terms of governance Oman and UAE perform well with most scores being in the range of 50 to 70. Oman has seen improvements in regulatory quality and UAE in control of corruption from 2002 onwards. Saudi Arabia lags behind with scores ranging from 40 to 55 in all aspect of governance. Voice and accountability is an important area for attention in order to develop and improve the overall standard of governance in the GCC countries.

In terms of innovation output both Saudi Arabia and UAE are performing better than Oman. Whereas Saudi Arabia's patent output seems to be concentrated on chemical and conversion industry, UAE seems to have patent activity in a variety of areas. Development of R&D systems in parallel with education systems, development of conversion industry and pulling innovation and R&D centres of multinational firms seems to be paying off for Saudi Arabia in terms of high patent and design activity. UAE has also benefited from its free zone and clusters model triggering innovative activity in the particular areas that have dedicated market clusters in the country. Oman despite have stronger education base, lacks the relevant market, business environment and industrial setup for the high paced and diversified innovative activity.

These sets of policy instruments and conditions act as enablers for the market to innovation the economy to diversify. The overall conclusion for the three GCC countries discussed is that the innovation and diversification goals of these countries are constrained by the comparatively lowermost performing policy area and the lowest quality enablers.

References

Abdelal, R., Khan, A. & Tarun, K., 2008. Where oil-rich nations are placing their bets. *Harvard Business Review,* 86(9), pp. 119-128.

Abouchakra, R., Moujaes, C. N., Maroun, N. & Samman, H., 2008. *How to succeed at education reform: the case for Saudi Arabia and the broader GCC region,* Abu Dhabi: booz&co..

Ahmed, A. & Alfaki, I. M. A., 2010. Transforming the United Arab Emirates into a knowledge-based economy: The role of science, technology and innovation. *World Journal of Science, Technology and Sustainable Development,* 10(2), pp. 84-102.

Al Azri, M. S. J., 2016. *Foreign Investment in the Sultanate of Oman: Legal Guarantees and Weakness in Providing Investment Protection.* 1st ed. Leeds: University of Leeds .

Al Raee, M., Ritzen, J. & Crombrugghe, D. d., 2017. Innovation Policy & Labour Productivity Growth - Education, Research & Development, Government Effectiveness, and Business Policy. *UNU-MERIT Working Papers Series.*

Al Shehry, A., Rogerson, S., Fairweather, N. B. & Prior, M., 2006. *The motivations for change towards egovernment adaption: Case studies from Saudi Arabia.* London, eGovernment Workshop 2006 - Brunel University.

Al-Balushi, S. M., 2016. Science Education Research in Oman: Opportunities, Trends, and Challenges. In: M. Chiu, ed. *Science Educagtion Research and Practice in Asia.* Singapore: Springer, pp. 129-153.

Al-Ghassani, A. M., 2010. *Entrepreneurship Education in the Arab States - A case study of Oman,* Bonn: UNESCO & StratREAL Foundation.

Al-Hammadi, A. S., Al-Mualla, M. E. & Jones, R. C., 2010. Transforming and Economy through Research and Innovation. In: L. E. Weber & J. J. Duderstadt, eds. *University Research for Innovation.* London: Economica Ltd., pp. 185-198.

Al-Rahbi, I. A., 2008. *An empirical study of the key knowledge economy factors for sustainable economic development in Oman.* Al-Rahbi, Ibrahim Abdullah ed. Melbourne: Victoria Unversity.

Al-Sayegh, F., 1998. Merchants' role in a changing society: the case of Dubai, 1900-90. *Middle Eastern Studies,* 34(1), pp. 87-102.

Alyahmadi, H. H. H., 2006. *The development and expansion of higher education in Oman: planning for the future..* 1st ed. Sheffield: The University of Sheffield,.

Al-Yahya, K. O., 2010. The Over-Educated, Under-Utilized Public Professionals: Evidences from Oman and Saudi Arabia. *Journal of Management & Public Policy,* 1(2), pp. 28-40.

Archibugi, D. & Coco, A., 2004. New Indicator of Technological Capabilities for Developed and Developing Countries (ArCo). *World Development,* 32(4), p. 629–654.

Bashehab, O. S. & Buddhapriya, S., 2013. Status of Knowledge Based Economy in the Kingdom of Saudi Arabia: An Analysis. *Journal of Social and Development Sciences,* 4(6), pp. 268-277.

BMI, 2017. *Oman Infrastructure Report,* London: Business Monitor International.

Boparikar, N., 2015. Entrepreneurship in Sultanate of Oman: A Case Approach. *International Journal of Asian Business and Information Management,* 6(4), pp. 14-36.

Byat, A. b. & Sultan, O., 2014. The United Arab Emirate: Fosgtering a unique innovation ecosystem for a knowledge-based economy. In: S. Dutta, B. Lanvin & S. Wunsch-Vincent, eds. *The Global Innovation Index 2014: The Human Factor in Innovation.* Fontainebleau, Ethica and Geneva: Cornell University, INSEAD; The World Intellectual, pp. 101-110.

Chen, D. H. C. & Dahlman, C. J., 2005. The Knowledge Economy, the KAM Methodology and World Bank Operations. *The Knowledge Assessment Methodology (KAM) website (www.worldbank.org/kam),* 19 October.

Cornell University, INSEAD, and WIPO, 2016. *The Global Innovation Index 2016: Winning with Global Innovation,* Ithaca, Fontainebleau, and Geneva: World Intellectual Property Organization (WIPO).

Darandari, E. & Cardew, P., 2013. Accreditation and Quality Assurance. In: L. Smith & A. Abouammoh, eds. *Higher Education in Saudi Arabia - Achievements, Challenges and Opportunities.* Dordrecht: Springer, pp. 103-115.

Fagerberg, J. & Srholec, M., 2008. National innovation systems, capabilities and economic development. *Research Policy,* 37(2), pp. 1417-1435.

Freeman, C., 2002. Continental, national and sub-national innovation systems—complementarity and economic growth. *Research Policy,* 31(2), pp. 191-211.

Furman, J. L., Porter, M. E. & Stern, S., 2002. The determinants of national innovative capacity. *Research Policy,* p. 899–933.

Gackstatter, S., Kotzemir, M. & Meissner, D., 2014. Building an innovation-driven economy – the case of BRIC and GCC countries. *Foresight,* 16(4), pp. 293-308.

Gonzalez, G. C. et al., 2008. *Facing Human Capital Challenges of the 21st Century: Education and Labor Market Initiatives in Lebanon, Oman, Qatar, and the United Arab Emirates.* Doha: RAND Corpration.

Grant, J., Golawala, F. S. & McKenchnie, D. S., 2007. The United Arab Emirates: The Twenty-First Century Beckons. *Thunderbird International Business Review,* 49(4), pp. 507-533.

Haouas, I. & Heshmati, A., 2014. Can the UAE Avoid the Oil Curse by Economic Diversification?. *IZA Discussion Papers*, February, p. Discussion Paper Number 8003.

Hvidt, M., 2013. *Economic diversification in GCC countries: Past record and future trends,* London: Kuwait Programme on Development, Governance and & LSE.

Issan, S. A. & Gomaa, N. M. M., 2010. Post Basic Education Reforms in Oman: A Case Study. *Literacy Information and Computer Education Journal (LICEJ),* 1(1), pp. 19-27.

Khan, M. R., 2010. Mapping entrepreneurship ecosystem of Saudi Arabia. *World Journal of Entrepreneurship, Management and Sustainable Development,* 9(1), pp. 28-54.

Looney, R. E., 2013. The Omani and Bahraini Paths to Development: Rare and Contrasting Oil-Based Economic Success Stories. In: A. K. Fosu, ed. *Achieving Development Success: Strategies and Lessons from the Developing World.* London: Oxford University Press & UNU-WIDER, pp. 419-456.

Lundvall, B.-Å., 2007. *Innovation System Research and Policy: Where it came from and where it might go.* Oslo, The Centre for Advanced Study (CAS) at the Norwegian Academy of Science and Letters.

McGlennon, J., 2006. *Building Research Capacity in the Gulf Cooperation Council countries: Strategy, funding and engagement.* Paris, Second International Colloqium on Research and Higher Education Policy.

McGlennon, J., 2015. *Higher education in the United Arab Emirates : is it supporting the development of a knowledge economy?.* 1st ed. Bath: University of Bath.

McMinn, M., Dickson, M. & Kadbey, H., 2015. Emirati science teachers' beliefs, self-confidence, challenges faced, and their reported practice. *International Online Journal of Primary Education,* 4(1).

Mellahi, K., Guermat, C., Frynas, J. G. & Al-Bortmani, H., 2003. Motives for foreign direct investment in Oman. *Thunderbird International Business Review,* 45(4), pp. 431-446.

Mina, W., 2007. The location determinants of FDI in the GCC countries. *Journal of Multinational Financial Management,* 17(4), pp. 336-348.

Ministry of Education Saudi Arabia; Ministry for Higher Education; the General Establishment of Technical and Vocational Training, 2004. *The Development of Education,* Geneva: 47th Session of the International Conference on Education, September 8-11.

Nelson, R. R., 1993. *National Innovation Systems: A Comparitive Analysis.* 1st ed. Oxford & New York: Oxford University Press.

Oxford Business Group, 2014. *Infrastructure development is prioritised for future expansion,* London: Oxford Business Group.

Rajasekar, J. & Al Raee, M., 2012. An analysis of the telecommunication industry in the Sultanate of Oman using Michael Porter's competitive strategy model. *Competitiveness Review,* 23(3), pp. 234-258.

Samulewicz, D. & Aswad, N. G., 2010. *Towards a Knowledge Society: Expanding the role of women in science, technology and engineering in the United Arab Emirates.* Madrid, International Conference on University, Industry and Government Linkages.

Schiliro, D., 2013. Economy, Diversification and Development of the United Arab Emirates' Economy. *Journal of Applied Economic Sciences,* 8(2(24)), pp. 228-254.

Seznec, J., 2011. Financing Industrialization in the Arab-Persian Gulf.. In: J. Seznec & M. Kirk, eds. *Industrialization in the Gulf: A Socioeconomic Revolution.* London: Center for Contemporary Arab Studies, Georgetown University & Routledge, pp. 30-43.

Shachmurove, Y., 2009. Entrepreneurship in Oman. *PIER Working Papers,* pp. 09-26.

Shayah, M. H. & Qifeng, Y., 2015. Development of Free Zones in United Arab Emirates. *International Review of Research in Emerging Markets and the Global Economy (IRREM),* 1(2), pp. 286-294.

Shin, J. C., Lee, S. J. & Kim, Y., 2012. Knowledge-based innovation and collaboration: a triple-helix approach in Saudi Arabia. *Scientometrics,* Volume 90, pp. 311-326.

Sultan, K. S. A. & Zaharnah, I. T. A., 2012. Academia-Industry Innovation Linkages in the Case of Saudi Arabia: Developing a University-Industry Triple-Helix Framework to Promote Research and Development Collaboration. In: S. Dutta, ed. *The Global Innovation Index 2012: Stronger Innovation Linkages for Global Growth.* Maastricht: INSEAD and the World Intelletual Property Organization (WIPO), pp. 89-95.

Thomson Reuters, 2011. *Global Research Report Middle East - Exploring the changing landscape of Arabian, Persian and Turkish research,* Leeds: Evidence, a Thomson Reuters business.

UNCTAD, 2014. *Science Technology & Innovation Policy Review,* Geneva: United Nations.

Watkins, K., 2000. Education for all: promises and progress. In: K. Watkins, ed. *The Oxfam Education Report.* Bath: Oxfam GB and Oxfam International, pp. 71-121.