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THE PENTA HELIX MODEL OF INNOVATION IN OMAN: AN HEI PERSPECTIVE

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ABSTRACT

Aim/Purpose	Countries today strategically pursue regional development and economic diversification to compete in the world market. Higher Education Institutions (HEIs) are at the crux of this political strategy. The paper reviews how HEIs can propel regional socio-economic growth and development by way of research innovation and entrepreneurship.
Background	Offering an academic perspective about the role of HEIs using the Penta Helix innovation network for business and social innovation, the paper discusses opportunities and challenges in gestating an innovation culture. It likewise seeks, identifies and details strategies and workable programs.
Methodology	Best-practice innovation campaigns initiated by Omani HEIs in collaboration with capstone programs organized by the government were parsed from selected local and international literature. The study includes a causal analysis of innovation information contained in 40 out of 44 published OAAA Quality Audit reports about HEIs from 2009 to 2016. The best-practice programs serve as success indicators and will be used as a field metric effect a Penta Helix blueprint for innovation.
Contribution	The paper discusses how HEIs can engender, nurture, drive, and sustain innovation and entrepreneurial activity by using an innovation strategic blueprint like the Penta Helix model. It gathers together the recent historical attempts at promoting innovation by HEIs. It likewise suggests the creation of a network channel to allow key players in the innovation network to share innovation information and to collaborate with each other. Furthermore, it contributes to the development of innovation culture in HEIs.
Findings	Expectations run high in academia. For one, universities believe that all innovations embryonically begin within their halls. Universities—too—believe it is naturally incumbent on them to stimulate and advance innovation despite that most

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innovation programs are initiated by the government in Oman. HEI engagement is perceivably still weak. HEIs have yet to come out as a strong leading force in promoting systems of innovation. There is clear awareness of the need to adopt leading-edge practices in innovation strategy and management, curriculum and assessment, staff support and reward systems, funding and ICT infrastructure, research commercialization and IP management, and community engagement.

Recommendations for Practitioners	There is need to conduct more in-depth analyses about the synergy and partnerships between key players of the Penta Helix model. A large-scale survey will help completely reveal the status and impact of innovation practices in the region and among HEIs.
Recommendation for Researchers	There is need to conduct more in-depth analyses about the synergy and partnerships between key players of the Penta Helix model. A large-scale survey will help completely reveal the status and impact of innovation practices in the region and among HEIs.
Impact on Society	The paper hopes to influence policy. It fully intends to convince policymakers increase the adoption of strategic interventions. The paper is not a theoretical description of the problem. It suggests several concrete courses of action.
Future Research	The paper has seen the need to measure the effectiveness of the current innovation practices among key players in the innovation network and how these practices advance Oman's knowledge economy. We propose a Likert-based bottom-up engagement metric.
Keywords	entrepreneurship, HEI, innovation, knowledge economy, Penta Helix

INTRODUCTION

In view of depleting oil reserves and production, and declining oil prices, the Sultanate of Oman currently faces huge budget constraints and deficits. The government has introduced major economic reforms to address this economic issue. The Sultanate has begun to pursue a policy meant to boost economic diversification and regional development (Nair, 2016). Likewise, it currently seeks to increase fees and taxes of non-oil revenues and lower subsidies for less important projects. Much like other knowledge-based economies, the Sultanate has decided to capitalize on its human resources to achieve socio-economic goals and maintain economic growth, stability, and global competitiveness. Knowledge is believed to be a key that redefines the dynamics of economic development and global competition because it spawns new businesses and innovative products. The Knowledge Economy Index (KEI) produced by World Bank in 2012 ranks Oman as 47th among 145 countries in terms of overall preparedness in becoming a Knowledge Economy. Oman's KEI measured in terms of four (4) sub-indexes, namely: (1) economic incentive and institutional regime, (2) innovation and technological adoption, (3) education and training, and (4) ICT infrastructure, is 6.14 out of 10. A knowledge economy is driven by an "efficient innovation system made up of firms, research centers, universities, think tanks, consultants, and other organizations" that uses global knowledge to create new technological solutions for local and regional needs (Zhukovskii, 2016). In 2012, Oman scored 5.88 and 6.14 out of 10 in the innovation and knowledge economy indices respectively. Given a steady increase in both indices, Oman must take full advantage of its readiness in becoming a knowledge economy while it still has the resources to support an efficient transition (Al Rahbi, 2008).

Innovation is a major pillar in a knowledge economy. Bjork (2016) maintains that innovation is an important strategy to address sustainability issues and promote economic growth. Innovations are products of consumer's needs and creative ideas (Amabile, 1996), reinventions of existing ideas, and remodels of other innovative ideas that are identified by entrepreneurs and entrepreneurial organizations (Saublens, 2011). Likewise, innovation entails the creation and exploitation of opportunities

that will result in better products and services and improvement in systems and management, and development of new skills and competencies. Schumpeter (1947) emphasized the adoption and dissemination of these products to the market. Existing literature on research, innovation, and entrepreneurship seemingly overlap in several ways as each one is related to the other (Etzkowitz, 2007). Therefore, innovation is the combination of an individual's enterprising nature and an organization's entrepreneurial endeavor (National Centre for Entrepreneurship in Education [NCEE], 2013).

Education, in the form of knowledge and ideas, is the building block in an innovation and knowledge economy that drives social change and improves the quality of life (OECD, 1997). The Higher Education Institutions (HEIs) and research institutions play a key role in forming a knowledge-based society. They possess the capacity to shape communities through the provision of a skilled workforce that is needed for a knowledge economy to thrive. They prepare learners to think critically and develop innovative, enterprising, and entrepreneurial knowledge and skills. These institutions produce the key players in knowledge generation and preservation and transfer, and afford the needed knowledge and skills. The HEIs contribute to economic growth and development through their innovation programs and commercial applications of the knowledge, products and services, technologies, and processes they create. They are responsible not only for developing talents and generating knowledge (Feller, 1990) but also transforming their accomplishments to economic benefits (Department for Business, Innovation & Skills, 2009; Etzkowitz, 2007). Moreover, HEIs are responsible for developing innovativeness that "supports new ideas, novelty, experimentation, and creative processes, thereby departing from established practices and technologies" (Lumpkin & Dess, 1996, p. 142). This core value is defined in an HEI's strategic plan, embedded in the curriculum, and implemented in the teaching and learning and research activities.

The research paper analyzes the state of innovation among Omani HEIs from an academic perspective to gain a broad understanding of the role of HEIs in fostering innovation. Specifically, the paper attempts to answer the following questions:

1. How do HEIs collaborate with other key players within the Penta Helix network?
2. What are the innovation and entrepreneurship practices of HEIs in Oman?
3. How can HEIs develop and improve internal innovation and entrepreneurial practices?

The paper is organized into five (5) main sections. The first section introduces the literature review. The second section presents the research methodology. The third section describes how HEIs collaborate with other key players within the Penta Helix network. The fourth section identifies exemplary innovation practices in Oman. It also details the challenges and opportunities as well as the enabling mechanisms in key areas of HEI management that can power innovation and entrepreneurship. The fifth and last section ends with a conclusion and offers a praxis using the Penta Helix model of innovation.

LITERATURE REVIEW

The global economy is now widely integrated and focused on discovering new models of ideas and opportunities due to globalization and digitalization. Israel Kirzner introduced the term *entrepreneurial discovery* to describe the systematic process of searching for "technological, political, and regulatory, social and demographic changes" in discovering new ideas or opportunities (European Commission, 2017). Entrepreneurial discovery allows individuals, communities, and businesses to work collectively to create innovation.

The Penta Helix (as shown in Figure 1) is a socio-economic development model that drives a knowledge economy to pursue innovation and entrepreneurship through collaboration and beneficial partnership among the academe, government, industry, NGOs and civic sectors of the society, and the social entrepreneurs (REPEC, 2012). The Penta Helix model has its roots in Etzkowitz and Leyesdorff's (2000) Triple Helix where a tri-lateral network of academe, industries, and government combine to take advantage of the innovative research projects that are cultured within educational

institutions and transform these projects to viable commercial products or services. NGOs, civil society, and the social entrepreneurs were added to the Penta Helix. They have significant roles to play in supporting shared innovation goals (Rampersad, Quester, & Troshani, 2010) and they contribute to socio-economic progress of the region. Von Stamm (2004) stated that innovation is best achieved when there is strong collaboration and partnership among key players.

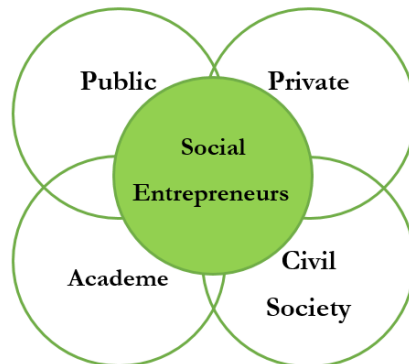


Figure 1. The Penta Helix (Calzada, 2016, p. 37)

A national innovation ecosystem helps facilitate collaborative learning and information sharing among its players in order to engage in creative problem solving, co-creation of projects, and building synergies, mutual understanding, and trust (Markkula & Kune, 2013). Implementing a strong innovation system can have a positive effect on economic growth and development (OECD, 2007). The Penta Helix model of economic and social development promotes a culture of innovation and creative synergies. It moves for social innovation where players come together from various sectors of society to share common goals using specialized skills and resources to address a range of societal challenges. The academes (otherwise known as “HEIs”) foster and enable the dissemination and implementation of innovation and entrepreneurship. A government plays a significant role in the promotion and support of an innovation system through public investments in research and development and knowledge infrastructures, public innovation policy, and support for innovation network and public-private partnerships. Industries support the HEIs through research funding and product development and commercialization. In return, HEIs enrich industries with new technology and research. NGOs and civil society engage in social and economic development through active participation in regional development programs.

The HEIs are vital resources for innovation dissemination, development, and implementation that cross cultural networks of innovators and entrepreneurs and foster interdisciplinary communities of educators and experts (Dykes, Groff, Renfrew-Knight, & Sutch 2010). They need to leverage human resources and external linkages to improve the delivery of services and address the socio-economic needs of the region (Peiris, 2015). The HEIs take the lead role in the triple helix. They function as knowledge generators. The triple helix focuses on the commercialization of research output generated by academe. Having indicated that, the triple helix is not an ideal setup for social innovation to flourish. Mulgan (2006) states that the triple helix entails negative side effects. It blinds HEIs to the belief that innovation activities by way of commercialization of products and services, and profit maximization is the best and sole avenue for innovation. It leaves social innovation aside. Social innovation and social enterprise address a collective social need rather than the needs of a single individual or certain organization. There is a profusion of innovative ideas that address social problems but they are sidelined by pragmatic considerations about scant financial benefits. It is also highly expected that it is the purview of the academic community to stimulate, initiate, and advance social innovation. HEIs furthermore grow in relevance and importance through research and innovation and, above all, when the consequent enterprise provides opportunities to help address social challenges in society and around the world. HEIs have become platforms that enable innovation for the

sustainable development of a country. They are primarily responsible for molding students into socially responsible professionals who are able to implement projects with positive societal impact. Several countries and organizations have placed importance on collaborative efforts influenced by academia, business and society in a multihelix innovation system to address global issues and accelerate development (MacGregor & Carleton, 2011, p.6). These countries have stepped up research production and have updated the national innovation agenda from conventional technology transfer and research commercialization to addressing economic development and global challenges that include, but are not limited to, health and safety, homelessness, unemployment, food production and climate change (OECD, 2011).

METHODOLOGY

The following qualitative research methods are employed.

- A review of selected local and international literature about innovation within and outside the higher education sector in Oman. The key phrases *innovation in higher education*, *entrepreneurship in higher education*, and *Penta Helix model of innovation* were used to search for academic literature in high-quality peer-reviewed journals.
- A summative and causal content analysis of information contained in 40 out of 44 published OAAA Quality Audit reports of HEIs in Oman from 2009 to 2016. The data in these reports were counted, compared, summarized, and interpreted to gain valuable insights about the country's innovation practices.

THE INTERPLAY OF HEIS AND THE PENTA HELIX KEY PLAYERS

The HEIs are not only institutions of learning, they are also highly engaging organizations of knowledge acquisition, and transfer and exchange. They give birth to knowledge workers, innovators, and social entrepreneurs in an innovation network.

HEIS AND GOVERNMENT

The government is primarily seen as a capitalist and financier of new companies because they provide seed capital and business advice for entrepreneurs whose research projects have socio-economic potential. Entrepreneurial activities are not limited to individuals alone but they are also carried out by HEIs and government organizations. Government supports HEIs typically through training programs for knowledge acquisition and transfer, and infrastructure development, establishment of research labs, technology centers and science parks, training centers and incubation hubs, consultancy services, skills and technology transfer, spin-offs, start-ups, to name a few. In return, government taps academic experts and invites them to be members of national advisory and consultancy committees. For this reason, government has come to be considered as a driver of technology growth because it creates the right environment for technology-related businesses to prosper (Okunji, 2016).

HEIS AND THE PRIVATE SECTOR

The Private Sector, which is represented by industries, is expected to provide employment opportunities for graduates. It has other roles. It supplies job internships, program design, and business counseling, among others. Likewise, industries also invest and supply needed capital and human resources to produce and distribute innovative projects to the market through research funding and commercialization (Oettinger & Henton, 2013). HEIs are able to build strong partnerships with industries because they can provide the financial resources that help transform research projects into business ventures. The small industries and business can commission higher education and research institutions to conduct product and service development. Accordingly, HEIs see value in Corporate Social Responsibility (CSR). It gives them the opportunity to create business from university research output. Collaboration with universities is not exclusively an issue of money. It also gives companies a chance to get external, expert-opinion and counseling. The knowledge which HEIs possess is "highly

useful for the private sector since it can complement the companies in areas where they lack experience and knowledge and vice versa” (Lindmark, Stureson, & Nilsson-Roos, 2009, p.10).

Many HEIs find innovation arduous. Leading innovation and instituting organizational change is a tall order for most higher education leaders to carry out. Much less was the task made any easier when creating a sustainable innovation culture and obtaining the requisite human and financial resources. The HEIs cannot entirely depend on government to dole out financial assistance, not to mention the laborious bureaucratic process needed to compete for research and technology grants. HEIs must source grants from other funding agencies as well. Nowadays, SMEs (a new entry) help provide capital to meet the need. SMEs support innovation and entrepreneurial initiatives not only through financial assistance but also through financial advice and mentoring start-up initiatives. This partnership is an opportunity for HEIs to expand their network and include a wider range of organizations.

HEIs AND NGOS & CIVIL SOCIETY

As we course through the century, we notice an evolutionary transformation of major cities that are slowly becoming centers of social innovation. These cities have recognized the importance of innovation networks as channels of dialogue among various stakeholders, including HEIs (PricewaterhouseCoopers, 2005, p. 8). Social innovation must be supported within and outside the academe. In the Penta Helix model, societies innovate as a group to create positive change for communities. Van der Walt (2016) suggests that regional development should not be entirely built up from thriving business communities but should also be complemented by societal drive where new business opportunities can surface. There must be emphasis on impact investment where the focus is on the positive impact of a business for society and not on the size of its profit.

Non-Governmental Organizations (NGOs) and civil society organizations are essential groups that contribute to social development in both local and regional development. They are usually recipients of donations, contributions, and government subsidies. Their participation in policy making and in the preparation of the comprehensive development plans and programs is critical. Therefore, HEIs must open opportunities for dialogue and partnership with them by engaging them in social innovation programs and product development (Tonkovic, Veckie, & Veckie, 2015).

HEIs AND THE SOCIAL ENTREPRENEURS

Social innovation sprouts from the creative ideas and problem-solving abilities of social entrepreneurs who prefer to invest in businesses with social value over personal gains. Dhesi (2010) notes that social entrepreneurs are synergistic people from the academe, public sector, private sector, and NGOs who cross their boundaries and link different sectors together. They initiate vital societal change to promote socio-economic sustainability through financial and moral investments. The HEIs can develop social entrepreneurs among their faculty, staff, and students given the right opportunity. The HEIs’ stakeholders, especially their graduates with good socio-economic status, can use their innovative thinking, shared values and interests, and monetary contributions to forward their social mission.

INNOVATION AND ENTREPRENEURSHIP PRACTICES OF HEIs IN OMAN

There must be a culture of excellence in any organization to ensure business success. Adopting an innovation culture and environment (which is seen as a competitive edge) is a major challenge for organizations in the 21st century. Organizations ought to be able to identify and value in-house skills and knowledge as well as collaborate with external environments to produce creative opportunities and innovative ideas (Mazzarol, 2013). In the case of higher educational institutions, quality means excellence in the delivery of teaching, research, and community engagement in order to provide high academic standards which are relevant and responsive to societal needs. Addressing challenges in

setting a global standard requires equipping knowledge workers with the right knowledge and skills that evolve with time.

The Sultanate has identified the need for innovation and entrepreneurship to advance its knowledge economy. It has stimulated the different sectors of the economy to address societal needs (The Research Council, 2016). Academic institutions are now evolving from being traditional teaching institutions to research-oriented institutions that are committed to improving the socio-economic development of the region. They are building strong ties with a wide range of stakeholders through partnerships and collaborations. These stakeholders become the driving force that fosters innovation and entrepreneurship in the economy.

The government is the principal regulatory body that looks after an economy's innovation and entrepreneurship activities. Moreover, The Research Council (TRC) has been mandated by the government to take the lead role in promoting and managing research innovation in the region through close cooperation with relevant stakeholders. Furthermore, it is tasked to regularly review Oman's innovation system and develop a national innovation strategy (The Research Council, 2016). Technological and product developments and research innovation is funded by the government through the TRC. TRC supports Omani innovators who express interest in commercializing their innovative ideas and bringing it to the marketplace. Usually the academic community in Oman relies on government financial grants to implement research and development activities. TRC manages R&D through various research programs including Open Research Grant (ORG), Strategic Research Grant, Faculty Mentored Undergraduate Research Award Program (FURAP), and Research and Innovation Award. On the other hand, it also awards assistance through its Industrial Innovation Assistance Program, Education Innovation Assistance Program, Academic Innovation Assistance Project, and Community Innovation Assistance Program.

The Smart City initiative in Oman, which includes Digital Oman Strategy, ePayment, eHealth portal, Educational portal, and Open Data initiatives have empowered regional development through the use of information and communications technology. These initiatives have fostered collaboration and cooperation between government and society. It fast-tracked the delivery of government services to the people (Al Shidhani, 2016). Additionally, TRC regularly sponsors innovation competitions among higher education institutes that foster environmental sustainability. It awards recognition to deserving Omani students through its Oman EcoHouse Design Competition that aims to increase awareness about green building designs (The Research Council, 2016).

The economy in Oman has historically been largely dependent on the oil industry while research and development expenditures in Oman have remained at 0.21 percent of the GDP in 2012 ("Oman: R&D Expenditure," 2016). The big oil companies have their own research and development (R&D) units whereas small companies only have limited research facilities. These factors limit the collaboration and partnership between oil companies, the academe, and other R&D institutions (UNCTAD, 2014). One of the successful innovation and entrepreneurship initiatives in Oman that showcases the synergy between the academe, government, industries, NGOs, Civil Society, and the social entrepreneurs has been the Upgrade Program. It invites Omani students to convert their final-year projects into business ventures. The aim of the multi-partner initiative is to advance the knowledge-based economy by instilling an innovation and entrepreneurial culture among students. With this program, students in Oman can now address business-driven problems by transforming research projects into business opportunities. TRC takes the lead role in managing the startups that have a societal impact. The industries provide the seed fund. The SMEs host the incubation services, business advices, and trainings. This knowledge transfer approach creates a win/win situation for small-sized companies (in the form of SMEs). It increases profitability and improves teaching and learning outcomes in the academe (Sas, 2009). Additionally, TRC recently launched the Oman Chamber of Commerce and Industry (OCCI) Award that aims to honor and popularize the innovative ideas of science and technology from the community that become transformed into commercial products and services. Other multi-partner initiatives have been introduced. Among them are the SANAD, Inti-

laaqah, and Know About Business (KAB) programs. These programs provide training in starting a small business. They likewise furnish co-working space or incubation opportunities for young Omanis. As a result, the programs have boosted the delivery of public services and have promoted cooperation and partnerships, and have increased human resource participation for economic growth (UNESCO, n.d.).

To uplift the SME sector in Oman, the government required higher education students to complete an entrepreneurship course, trained teachers to conduct it, and required HEIs to adopt an entrepreneurship-bent curriculum to further inculcate an entrepreneurial culture. In this regard, Oman's SME Development Fund has provided for the training of HEI teachers in a Certified Entrepreneurship Educator Program that has standardized entrepreneurship education across the region.

Another significant branch of government is the Oman Academic Accreditation Authority (OAAA), formerly the Oman Accreditation Council (OAC), which is mandated by the government to promote quality in higher education. The OAC moves HEIs to meet international standards. It oversees the quality assurance systems of HEIs through quality audit and assessment. The OAAA quality audit oversees the following key areas that are relevant to innovation: student learning, research, consultancy, industry engagement, and community engagement. HEIs in Oman are expected to engage in research and community enablement activities that promote synergies and drive economic progress (Quality Audit Manual, 2008). These HEIs are able to mobilize the regional innovation network to take advantage of their high-quality innovative research projects. The innovation network is robust and active.

The research paper studied the OAAA audit reports to seek out what were the innovation practices among HEIs in Oman. Twelve (12) reports out of 40 OAAA public audit reports from 2009 to 2016 disclosed HEI practices related to innovation (OAAA, 2016). It included seven (7) reports from colleges, four (4) reports from university colleges and six (6) reports from universities as shown in Figure 2.

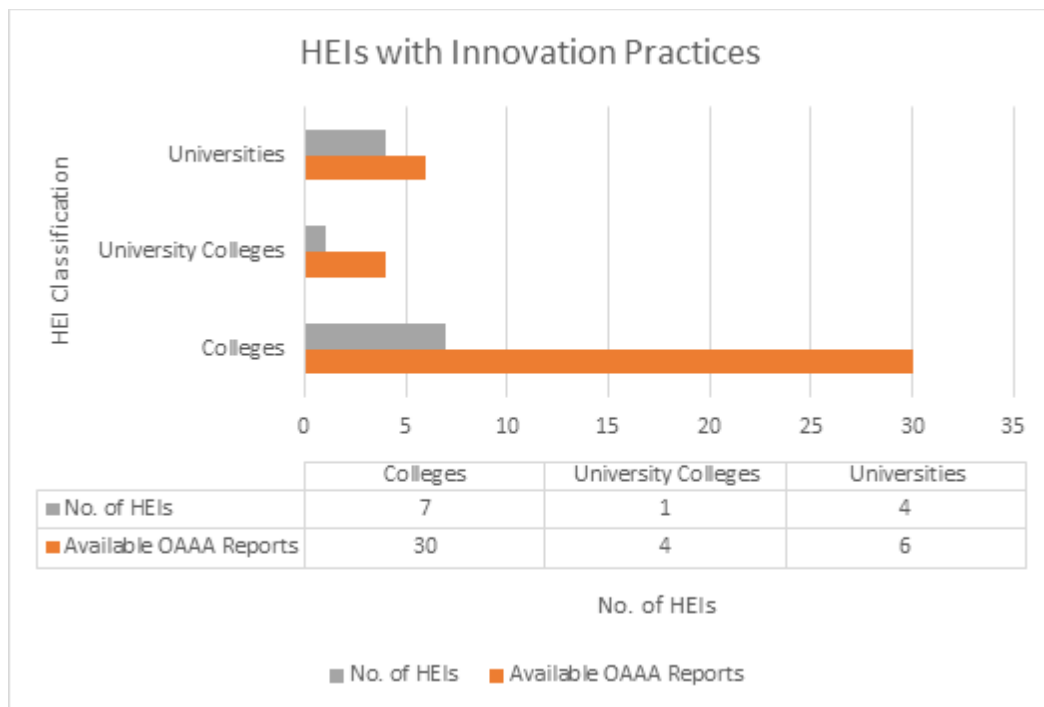


Figure 2. HEIs with Innovation Practices

The findings revealed the following:

- All universities have included innovation as part of the vision and mission statement and/or organization values. Only one (1) college mentioned innovation (with a strong statement of intent to realize it) within the vision and mission instrument while 4 out of 7 colleges embedded it in the organization values. The remaining two (2) colleges spoke of innovation only as part of their institutional practices. Meanwhile, one (1) university stated that it needs to intensify the awareness level of its stakeholders. Similarly, a university college identified the need to improve the appreciation level and understanding of innovation among its stakeholders.
- Although one (1) university initiated a partnership with an identified industry player, its efforts have yet to be strengthened and its effectiveness monitored. Other universities -as well- need to build innovation partnerships with the industry sector. Likewise, none of the colleges have initiated any innovation partnerships with industries.
- Two (2) universities stated that innovation was part of research planning and management. They also articulated innovation (with enabling mechanisms) in their strategic plans. Furthermore, they clearly identified (to some extent) a provision for the establishment of intellectual property rights, research commercialization, and external partnerships. Additionally, one (1) college aimed to integrate innovation as part of its professional development program for teachers.
- One (1) university stipulated that their research performance included a good number of research innovations.
- Two (2) universities continued to retain in place an undergraduate program that allowed the practice of innovation and development of innovative skills despite having gained notorious unpopularity among students. Another (1) college seems to be silent about innovation, evidently badly needing a culture of innovation.

The influence of innovation has not escaped attention in Oman as exemplified by the different innovation programs launched by the government through the TRC. The findings reveal that although the universities have included innovation within their vision and mission statements and strategic plans, there still is a strong need to intensify internal innovation practices and management. Most of the HEIs, especially colleges, have yet to be leading-edge, pioneering, and aggressive in pushing for innovation and regional growth. Many HEIs are still in the early stages of developing an innovation culture. The findings further reveal that there have been initial efforts to embed innovation in the programs of study, professional development, and other academic activities in some HEIs but these too have yet to be strengthened. The academic discussion mainly focuses on innovation for research commercialization and partnerships with the public and private sectors. Accordingly, Markman Phan, Balkin, and Gianiodis (2005) articulated that there is still a need to enhance the understanding of innovators and entrepreneurs in HEIs starting from knowledge creation to knowledge transfer and commercialization. Furthermore, social innovation in HEIs has never been a topic in the OAAA reports. This is echoed in the study of Brundenius, Göransson, and Carvalho de Mello (2016) by which they stated that there is limited literature as regards social innovation at universities. Furthermore, they suggested exploring the possibility of integrating social innovation in HEIs' activities particularly through its third mission, that is, community engagement. Hence, this area needs to be explored by the HEIs in Oman. In a study conducted by Iddris (2016), who conducted a systemic review on innovation capability in 30 journals from 2000-2015, he reported that there were no formal studies on innovation capability from countries in the Middle East. This made it more difficult for the researchers to find the needed academic literature on innovation, much more, innovation in the academe. This justifies the need to involve primary data for this research.

DEVELOPING INNOVATION IN HIGHER EDUCATION

There is limited literature that guides organizations to increase their innovation outputs (Bjorkdahl & Borjesson, 2012). However, Jackson (2008) proposed five (5) fundamental factors that facilitate successful innovation with social agenda at universities, these are “an institutional strategic policy commitment to social innovation; an inclusive, institutionalized process for mobilizing all faculties and disciplines to advance social innovation; a robust and diversified approach to community engagement; a university-wide commitment to employing free licensing and open-source software values and strategies to the research and innovation-transfer process; mobilization of internal and external resources to support social innovation” (as cited in Matheson, 2008, para. 4). These factors are enabling mechanisms in support of social innovation in key areas of HEI management. This section discusses the areas of opportunity for educational organizations to develop innovation.

INNOVATION STRATEGY AND MANAGEMENT

Lawson and Samson (2001) and Prajogo and Ahmed (2006) have suggested that in order for organizations to achieve high innovation capability, they need to develop first a culture of innovation and practice. The culture of innovation is defined as an environment that continuously produces new innovative ideas and thinking to solve problems and seize opportunities (Setser & Morris, 2015). There then must be a clear innovation strategy and set of policies with a strong focus on innovation in an HEI. The innovation activities must be planned, aligned and developed to actualize the strategic plan. Innovation must be fully understood by all stakeholders and openly integrated in their organizational culture and operations. Furthermore, an HEI must implement policies concerning staff engagement in innovation activities and ensure their activities are aligned with the institutional strategy. Similarly, it must provide the necessary incentives schemes, reward systems, professional development, and ICT infrastructure to motivate its people to engage in innovation practices (Geels, 2002).

The HEIs provide a relevant education system that meets the regional requirements and encourage national and global mobility and competitiveness of their staff and students (Chatterton & Goddard, 2003). Aside from being a source of knowledge, academic institutions are responsible for developing not only employability skills but also innovative, entrepreneurial, and enterprising skills as part of their organization's core values. Likewise, HEIs must develop strong collaboration and partnership with the other players in order to advance innovation. The initiative to establish a collaboration network must come mainly from the HEIs and complemented by government programs and innovation in companies and other economic sectors (Cimoli, 2013). The HEIs are expected to promote a culture of innovation and entrepreneurship that encourages stakeholders to address real societal needs, to encourage staff to utilize interdisciplinary and multi-disciplinary knowledge, and to work collaboratively with other academic institutions and external linkages to solve societal problems for the greater good of the society and the global community.

CURRICULUM AND ASSESSMENT

Students in higher education conduct research primarily for the purpose of completing the requirements of a degree and not so much about preparing themselves to have the right competencies needed by industry. The research they produce may have no socio-economic value and significance at all, thus limiting their innovation and entrepreneurial potential. Gordon, Hamilton, and Jack (2010) asserted that having an entrepreneurship education provides economic benefits for SMEs and the region. An HEI is the central unit that nurtures employable graduates and provides an education that capacitates these graduates to become innovators and entrepreneurs. It must prepare and restructure its curriculum to make it more relevant and responsive to the needs of students and the community at large. Moreover, it must implement effective mechanisms to ensure its academic programs are relevant and designed based on national and international needs (Fugate & Jefferson, 2001). Likewise, HEIs must engage employers and industry professionals in curriculum design and review to sharpen

and fine-tune the needed knowledge, skills and expertise of human resources taught at the HEIs and that are critical for success in a knowledge-based economy (UNCTAD, 2014).

Accordingly, an HEI must support a strong research culture and creative environment where innovative and entrepreneurial thinking is practiced. The study of Matlay (2011) revealed that academic staff and students are the primary stakeholders that influence the development of enterprising graduates. The HEIs must promote a free flow of ideas by allowing multidisciplinary and collaborative research among its stakeholders while supporting its practical application and not just for publication purposes. The HEIs must implement a framework of skills and competencies that are aligned with the requirements needed for the knowledge economy. Therefore, students' assessments must allow for the measurement and practice of entrepreneurial skills. A successful knowledge economy is one that integrates substantial Information and Communications Technology (ICT) in education. It allows millennial learners to innovate more and make the most of their learning.

STAFF SUPPORT & REWARD SYSTEMS

Makimattila, Saunila, and Salminen (2014), who conducted a study on innovation and organizational design, stated that the various stages of innovation in an organization require different types of management and support. For HEIs to achieve successful innovation performance and outcomes, they must revisit their reward structures and consider financial incentives including tenure and promotion, and commit resources when needed.

The HEI stakeholders must also be given the appropriate professional development support so that they are encouraged to undertake innovation activities. As innovation is gradually making its way to the core activities of the academia, it needs to be managed by trained individuals who have the knowledge and skills to do such. Moreover, the HEIs must also build the skills capacity of the other Penta Helix players. These will empower them to replicate key kernel research into technology startups.

FUNDING & ICT INFRASTRUCTURE

One of the major concerns of an HEI is the need for financial resources. According to Amboala and Richardson (2016), research commercialization success is dependent on the fund availability and utilization. An institution's commitment to innovation demands having the right infrastructure, human resources, and collaboration network.

Some HEIs install sophisticated innovation laboratories that prototype or simulate ideas for promising projects. Usually these projects aim at addressing national priorities and pressing societal challenges. Moreover, providing opportunities for staff and students to engage in the innovation process means that they must have the financial resources to do so. With the huge human and financial resources required, the HEIs must seek external funding and collaboration of external networks. In this situation, HEIs can work alongside their innovation partners, most especially, attract the participation of the social entrepreneurs who have the financial resources to drive social innovation and transformation. Eventually, their ability to forge strategic relationships and joint business opportunities with outside communities will allow innovation activities to grow.

RESEARCH COMMERCIALIZATION & IP MANAGEMENT

HEI innovation activities include, but are not limited to, design and development of innovative projects, consultancy, research commercialization, and patent and licensing. These activities allow the HEIs to deliver effective solutions to pressing social problems and provide educational opportunities for staff and students to engage in social innovation.

In a study conducted by Rubin, Aas, and Stead (2015), they estimated that three quarters of inventions and patents in the university are not licensed. This poses a certain degree of difficulty of transforming researches into viable commercial products. HEIs must institute an Intellectual Property (IP)

strategy and effective system that manages the products of research innovation. Since these products are transformed to business start-ups or new business models, it is necessary to measure the entrepreneurial level and innovativeness of these products through patent and licensing (Acs, Brooksbank, O’Gorman, Pickernell, & Terjesen, 2012). It is also imperative that the institutional intellectual property policy must conform to the national Intellectual Property Rights (IPR) laws and implementing rules (Oman: IP Laws and Treaties, 2016).

COMMUNITY ENGAGEMENT

Hazelkom (2009) argues that community engagement in HEIs can be used for social innovation. The HEIs can involve social goals in their research agendas that allow civil society to be actively involved rather than being mere consumers. Matheson (2008, para. 16) maintains that academic institutions can run into danger in promoting innovation when they are disconnected with the community. He further stressed that the more connections an HEI has with the other sectors of the community, the more it is able to make a difference. The HEIs must prioritize research with high value and relevance. They must be able to utilize their research outputs not only for their welfare but also for the benefit of their partner organizations and the society at large.

Innovation can be pursued by letting the local communities participate in academic discussions, developing practical solutions to social problems through joint research projects and allowing community partners in HEI’s decision-making process. Likewise, the HEIs can mobilize their competent research staff that are able to convert research into practice by allowing them to partner with field practitioners or connect with co-innovators in the local communities. Hence, their research has practical relevance and is utilized by the other Penta Helix players, whether in policy or practice (Panda & Gupta, 2014, p. 163).

CONCLUSION

Globalization pressures economies to compete, innovate, and cultivate an innovation culture and to build a knowledge economy. The Penta Helix model specifies a strategic blueprint for developing an effective innovation network where HEIs and other key players can collaborate to meet national development goals. This innovation network has begun to gestate in Oman through the synergy of various sectors of society. HEIs universally have played a critical role in inducing the innovation network. They are challenged to break the barriers in promoting innovative activities. HEIs engender research projects that are created, transferred, and transformed into innovative products with commercial value and social relevance. For Oman to compete in the global market, HEIs must rethink and reposition themselves, craft and be nimble and fast enough to adopt innovation strategies in collaboration with the other Penta Helix players.

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