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Sustainable development: a developmental evaluation of logistics higher education in the Sultanate of Oman based on two innovation approaches (the triple helix of innovation and innovation competencies)

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Abstract

Purpose – This research seeks to identify evidence of innovation elements in the implementation of a sustainable development ecosystem in the HE environment. For the purposes of this investigation, the use of developmental evaluation has been deemed appropriate to fully explore the depths of the topic.

Design/methodology/approach – The research follows a qualitative approach of inductive reasoning. For the purpose of this developmental evaluation, the collection of information from several stakeholders has been pursued in the study. Both a semi-structured interview and documents analysis were used.

Findings – Different awareness levels among logistics faculty members, while the incentives given are minimal. Availability of grants and lack of tenure are some of the reasons raised. Industry is not cooperative in providing placements/internships restricting students of industry experience. Internationalisation is slow and international collaborations limited. Limited freedom in topical discussions and their implications to learning.

Research limitations/implications – The research has considered possible limitations and used other methods for triangulation of the findings.

Practical implications – Low awareness on the implementation of pedagogical approaches for innovation. Not all faculty can be innovative (owing to current practice) neither they are incentivised to be so. Government spending is very low on R&D – 0.136 of the GDP in 2016. The industry is not ready for University-Business Collaborations, therefore achieving a low theory to practice ratio for students.

Originality/value – In the context in which the research has taken place (HE in Oman), there has been no evaluation (and more so developmental evaluation) previously implemented. Additionally, a longitudinal study, integrated as part of an ESD system targeted to innovation could increase the innovation capacity of the country on the international innovation index.

Keywords Innovation, Triple helix, University-business collaboration, Sustainable development, Sustainable development goals, Higher education

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Introduction

Sustainable development (SD) is of interest to researchers and policymakers alike since diminishing natural resources, mismanagement and contamination of existing resources could pose threats to future generations (Granados Sanchez *et al.*, 2011; Blessinger *et al.*, 2018). It has been defined by the World Commission on Environment and Development (WCED, 1987) as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs", and therefore, each generation makes use of the surrounding environment in an equitable, inclusive and secure manner for social development and sustained economic growth, in an effort to create the conditions necessary for preserving life on Earth (see Figure 1).

Racing to leave industrialisation behind, developed and developing nations are adapting to technology-focused, knowledge-based entrepreneurial economies (Viens, 2019). Knowledge-based economies are less dependent on material resources, capital and labour, and focus more on knowledge and information sharing (diffusion of knowledge) (Camagni and Capello, 2009) making them effective in ensuring long-term sustainable economic growth (Lohani, 2014). In the context of the 4th industrial revolution, a fusion of leading-edge production techniques and smart systems, SD becomes vital for long-term competitiveness and survival (Leisenberg, 2019). The technological transformation that was coined as a concept by Klaus Schwab (2016) has already been responsible for dramatic changes in the ways we live, work and communicate, disrupting almost every industry and every country with technology breakthroughs.

In this competitive, technologically advanced and innovative environment, HEIs are seen as primary actors in the transformation of HE in educating future decision-makers, entrepreneurs, and leaders (Lozano *et al.*, 2013). Since 1972, from the Stockholm Declaration, to today, several academic declarations, chapters and partnerships were developed to foster SD in HE and were designed to provide the ecosystem for HEIs to assimilate sustainability into their system (Lozano *et al.*, 2013).

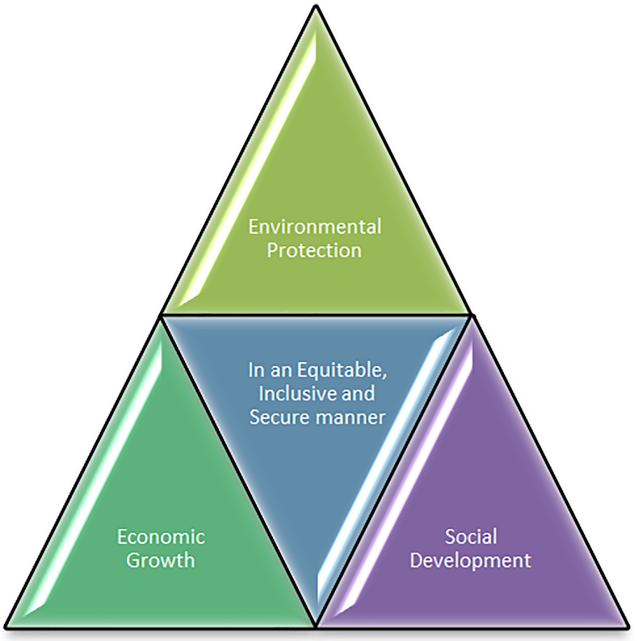

Figure 1.
The key elements of sustainability and sustainable development (the equilateral triangle)

HEIs have, for centuries, been considered to be at the forefront of change, by creating ecosystems responsible for economic activity and prosperity (Etzkowitz *et al.*, 2007). HEIs have since grown from centres for knowledge and knowledge creation (knowledge space) (Smith and Waters, 2015) to entrepreneurial universities – from knowledge producers or teaching universities to research universities, and eventually, entrepreneurial universities (Elton, 2003; Etzkowitz *et al.*, 2007; Lozano *et al.*, 2013; Smith and Waters, 2015). Some examples include the Massachusetts Institute of Technology (MIT) and Stanford University in the United States (Smith and Waters, 2015; Farinha *et al.*, 2016; Cohan, 2017; Pfotenhauer and Jasanoff, 2017).

In the educational context, SD becomes Education for Sustainable Development (ESD) of Education for Sustainability (EfS). The expectation is that "education empowers learners with the knowledge, skills, values and attitudes in order to take informed decisions and make responsible actions for environmental integrity, economic viability and a just society" (UNESCO, 2021a). Innovation is key to success, competitiveness and growth. This is particularly evident in innovative countries which share many similar characteristics, as their citizens enjoy an overall improved standard of living (Job Wizards, 2017). However, creating and maintaining a knowledge-based economy are a difficult undertaking and requires first building a genuine innovation ecosystem (Gackstatter *et al.*, 2014), that will enhance technological innovation and gradually build the infrastructure required for competitive economic growth (Kimatu, 2016). Through the article, the intention is to evaluate the implementation of the sustainable development goal (SDG) of innovation, focusing on logistics HE.

The article intends to examine the current development of the Education for Sustainable Development (ESD) ecosystem conducive to achieving SDGs in Omani HE, and explore the efficiency and effectiveness thereof, of the ecosystem in supporting innovation development in logistics programmes in the country. To do that, the research will focus specifically on HEIs running logistics programmes, and its overall aim is to understand:

(1) How different stakeholders of the ESD ecosystem (academics, and the Ministry of higher Education and its agencies – OAAA, TRC) in Oman perceive SD and its implementation?

(2) How logistics-related programmes in HEIs in Oman incorporate elements of enhancing innovation in their policy, pedagogy and curricula?

(3) If efforts by logistics-related programmes in the country are supported by the decision making–innovation system, through policies or other means?

There is a clear need for every stakeholder, either businesses, governments or individuals to commit to sustainable development (Lukman and Glavič, 2007). According to Lukman and Glavič (2007), sustainable HEIs are the most suitable stakeholders to promote and manage the duality between the principles of economic growth and natural laws, while at the same time promote cultural awareness and social responsibility. This exploratory research as a product of developmental evaluation (DE) is an attempt to investigate the innovation ecosystem in Omani HE. As seen in the literature review that follows, research has focused on different elements of innovation and sustainable development, yet a holistic approach to its implementation, through the view of DE, has not been undertaken. This research seeks to identify evidence of innovation elements in the implementation of a sustainable development ecosystem in the HE environment. For the purposes of this investigation, the use of DE has been deemed appropriate in order to fully explore the depths of the topic. Prior to exploring DE and its contribution to the research, a brief contextualisation of the importance of logistics in Oman is provided.

The Omani-logistics context

In brief, the main reason for focusing on the Omani logistics HE, which accounts for numerous HEIs teaching logistics at different levels, such as Bachelors and Masters, is the importance the Sultanate of Oman Logistics Strategy (SOLS 2040) placed on the (logistics) industry. SOLS 2040 is a review and gap analysis document that identifies gaps in the development of the logistics industry in Oman, and puts logistics on the map as one of the high-potential income industries, offering a diversification alternative to the Oil and Gas industry, that still accounts for about 68%–80% of the government's revenue (depending on the fluctuation of prices) (Fanack, 2020) and around 51% of the GDP (Trading Economics, 2020).

Logistics in Oman currently accounts for approximately 2.5% of GDP. If, for comparison, we look into the average contribution of logistics to GDP in OECD countries, this is between 8 and 10%. SOLS 2040 is targeting logistics to contribute 14% to GDP by 2040. HE in Oman has grown and made significant developments in the past decade (Baporikar and Iqtidar, 2012). It was established for the provision of teaching and limited incentives to conduct research are available today (Chryssou, 2020). This development, amongst others, has left Oman behind on the Innovation Index, ranking 84th out of a total 131 economies (2020), while it ranked 80th out of 129 economies in 2019 (Oman Daily Observer, 2020), and 48th out of 49 high-income group economies (Organisation, 2021). The main reason for this is that gross expenditure towards R&D lags behind other countries worldwide with an average percentage of 0.2 for the last decade (UNESCO 2021b).

There are 12 HEIs that teach logistics at different levels, including Diploma, Bachelors and Masters (OLC, 2020). Regarding research on Sustainability and SD, Sultan Qaboos University (SQU), the country's only public University, that was inaugurated in 1986 (SQU, 2021a), has a record on Sustainability that can be tracked back before the turn of the century (Hussain and Al Barwani, 2015). Currently, there are two Research Centres (RCs) within the first public University of Oman, Sultan Qaboos University (SQU) that are related to sustainability, the Centre for Environmental Studies and Research (CESAR) and the Sustainable Energy Research Centre (SERC) (SQU, 2021b). Both centres conduct research and also bridge together interested parties/researchers from within the University interested in energy and the environment. It was in 2011, when His Majesty Sultan Qaboos Bin Said envisioned the collaboration and cooperation of all responsible bodies in a speech, ". . . in a way that leads to the success of national plans and programmes in playing their desired role in comprehensive development and serving the present and future generations" (Hussain and Al Barwani, 2015).

Developmental evaluation: complex environments

The use of DE in this research provides an evaluative study of the implementation of SDGs, and in particular of the practice of innovation in HEIs in the Sultanate. Innovation practice itself works in a complex framework with numerous parties that strive to enact policy or coordinate activities and actions. According to the United Nations Conference on Trade and Development (UNCTAD) (2014), several important bodies are involved in supporting innovation in the country. These include the IT Authority, the Ministry of Industry and Commerce, the Ministry of Higher Education, the Educational Council and the Supreme Council for Planning and later Tanfeedh Implementation Support and Follow-up Unit (responsible for monitoring and following up on the implementation of specific national projects), the Research Council (responsible for funding research in HE), and Riyada, the national authority for Small and Medium Enterprises Development (see Figure 2 below for the organisation of decision making in Oman). Recently, at the end of August 2020, a major change was announced leading to combining and consolidating numerous Ministries and

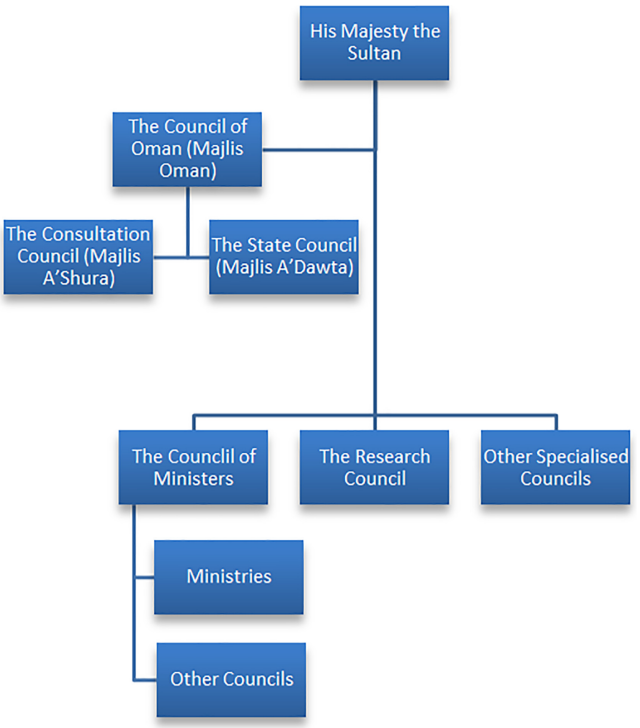

Figure 2.
Organisational chart of decision-making in Oman (for R&D and Innovation-related issues)

other authorities and bodies, including some of the ones we have mentioned above. The changes are yet to be enforced and the impact, according to Ambassador Sievers (2020), is yet to be seen, including the Oman Academic Accreditation Authority (OAAA) and The Research Council (TRC), which have been absorbed by the Ministry of Higher Education, Research and Innovation (MoHERI) without a clear transition of their roles. TRC proposed an Innovation Strategy in 2017 that could boost innovation in the country, which was then replaced (May 2020) by Oman Vision 2040, a document that places the 17 SDGs into perspective for Oman.

DE-based evaluative research has mainly focused on academic or non-academic learning programmes (Singer and Kusumoto, 2006; Fagen *et al.*, 2011; Honadle *et al.*, 2014), whether personal development or developmental programmes (Lutz *et al.*, 2013; Honadle *et al.*, 2014), government initiatives or projects like public awareness programmes (Fagen *et al.*, 2011; Herrenkohl *et al.*, 2014). Literature on DE focuses on describing the use of DE, discussing the when and how DE may be useful on different programmes or projects (Patton, 2011, 2012; Herrenkohl *et al.*, 2014).

DE is an emerging paradigm that provides an alternative to traditional, formative and summative-based evaluations and can be adapted for complex, highly dynamic environments where traditional approaches do not fit (Herrenkohl *et al.*, 2014). The difference from the two traditional and structured approaches is that formative evaluation focuses mostly on delivery and implementation, while summative emphasises outcomes. DE instead, assesses the project in real time, as it is being conducted and provides feedback throughout the project (Honadle *et al.*, 2014). Moreover, it is considered a more appropriate, evaluative approach when innovations are in early stages, when environments are either

changing or are particularly complex, when organisational learning is emphasised, or when systems and not individuals are the change target (Fagen *et al.*, 2011). DE was first defined by Patton in 1994 and is considered to be particularly suited to serve five purposes: (1) Ongoing development; (2) Adaptation; (3) Rapid response; (4) Preformative development and (5) Systems change. This article presents an evaluation effort that serves all five purposes. The choice of developmental evaluation for SDG implementation varies across HEIs around the world, and in Oman it is only at its initial stage (the Oman Vision based on the SDGs only came out in 2020). There is no single model of guaranteed success that has emerged; therefore, there is no space for formative or summative evaluation. DE is utilised for the purposes of this study due to its flexibility to work within the complex (academic) system and its ability to drive accountability and quality improvement (Herrenkohl *et al.*, 2014).

Sustainable development goals and higher education

Many authors have previously identified the need for incorporating innovation into SD practices if the SDGs are to be achieved (Taylor, 2017). Previous research has recognised the gap in the implementation of SDGs in HE or has identified slower than expected progress of HEIs in becoming more entrepreneurial, thus providing graduates with the knowledge and skills required for the demands of the 21st century (Elton, 2003; Lozano *et al.*, 2013; El-jardali *et al.*, 2018; Selznick, 2018). Other research is focusing on the different aspects of SD and the contribution of HEIs, from addressing main challenges in the process of implementation (Keeffe, 2016), contributions and best practice from different faculty (Tord, 2020), contribution of educational programmes on Master's level and of particular content (Slocum *et al.*, 2019; Kioupi and Voulvoulis, 2020), implications for governance and management on embedding SD into their mission, vision and strategies (Lukman and Glavič, 2007), rethinking the role of HEIs, and considering localisation of practices (Ahmadein, 2019).

Research on sustainable universities has mainly focused on whether universities are pioneering the integration of sustainability into their study programmes (Stough *et al.*, 2018), or engaging in collaboration between the different stakeholders in the Triple Helix to boost research and development and innovation among students and staff through designing or re-designing of HE curricula (Etzkowitz, 1995; Bialon, 2013; Tassone *et al.*, 2018). There has not been specific research that has utilised DE in identifying the use of innovation, and therefore, appropriate implementation in HEIs. Nevertheless, several studies have focused on how to measure/assess students' innovation competences in HE, allowing great insight into what the elements of innovation actually are (Gatignon *et al.*, 2002; Marin-Garcia *et al.*, 2012; Watts, Marin-garcia and Aznar-mas, 2012; Marin-Garcia *et al.*, 2013; Doroodian *et al.*, 2014; Keinänen, Ursin and Nissinen, 2018; Selznick and Mayhew, 2018). The innovation competences identified in the above research are used in order to successfully undertake a DE on the implementation of these practices in logistics HE in Oman. In order to understand the build-up of elements and competencies used for the purpose of DE, the following research is to be considered.

Most research previously done on achieving innovation in HE focused on interactions of the HEIs with different stakeholders, and how these interactions achieve the development of innovation competences in graduates of HE as well as the impact expected, either with regard to spin-offs or to local human capital obtaining compensatory benefits (off-sets) or further development of expertise which will improve of the socio-economic environment of the country.

Even though several approaches to innovation have been discussed, the research will focus on the two approaches found in the following sections. The two have a set of clear indicators that can be used for the purposes of evaluating the progress of a new and innovative approach to teaching and learning and other interactions for enhancing

innovation. They focus on the HEIs and their immediate environments and interactions within (different actors) providing appropriate foci of the evaluation in accordance with the RUFDATA (Saunders, 2000) framework for an evaluation plan, providing the evaluation plan and basis for the research.

The following two approaches were then broken into their components, as discussed here and evaluated against the current programme implementation as this is done in Oman and for the HEIs under the consideration of this study.

Approach 1: the triple helix of innovation and university-business collaborations

The first innovation approach to be considered is the Triple Helix of innovation, which Etzkowitz and Leydesdorff theorised in 1995. Their research assumed the role of universities at par with industry and governments in promoting innovation and discussed the potential of cooperation between the three actors. In the triad, governments without excessive dirigisme, focus on creating effective and dynamic interdependencies between the actors of the helix, and encourage, through targeted policy, the creation of strategic alliances between companies and universities. The expectation of the concept is to help them overcome blockages in their relationships and foster cooperation and innovation on technologies with significance for future product development (Etzkowitz, 1995). The actors and elements of the triple helix are best understood in the University-Business Collaboration model (U-BC), which accounts for 8 different types of interactions (Healy *et al.*, 2014).

These 8 types of interaction are (Healy *et al.*, 2014; Chryssou, 2020):

(1) *Collaboration in Research and Development (R&D):* working together on R&D activities, on joint publications or contract research, cooperating in innovation, student projects etc.

(2) *Mobility of academics:* temporary movement from HEI to industry, industry advisory boards, staff in external committees, etc.

(3) *Mobility of students:* temporary movement of students between institutions in and out of the country (student exchange), visits to the industry, career fairs etc.

(4) *Commercialisation of R&D results:* spin-offs, disclosure of inventions, patenting and licences (Intellectual Property) etc.

(5) *Curriculum development and delivery:* collaborative approach of developing the learning environment with the support of industry, advisory boards and guest lectures, etc.

(6) *Lifelong learning:* learning that takes place throughout one's life, including training, workshops, seminars, professional development courses.

(7) *Entrepreneurship:* ventures for the creation and development of innovative culture in cooperation, use of facilities and other joint R&D activities.

(8) *Governance:* cooperation as enforced by management level, for both industry and HEIs.

Each type of interaction includes several elements, as expanded earlier. These breakdown elements are essentially the 13 types of UBC interactions that are also used in the OAAA quality audit reports for eliciting information on the 9 standards of institutional assessment and for this reason the availability of these reports was sought. The 9 standards of the institutional accreditation are namely: governance and management, student learning by coursework programmes, staff research and consultancy, industry and community

engagement, academic support services, students and student support services, staff and staff support services and finally, general support services and facilities.

Approach 2: innovation competences

Lastly, Keinänen *et al.* (2018), presented an assessment tool for HEIs to measure students' innovation competences by taking into consideration previous innovation theories in the field of HE and builds on an assessment tool based on earlier validation studies. Even though the aim of the study is to test and evaluate the assessment tools in the HE learning environment, it describes in depth the innovation competences in HE and allows for an insight in previous studies as well as presents the steps and results for earlier development processes for constructing an assessment tool. There were several phases to the research, one of which included documentation review of past articles in order to define and operationalise innovation competences, the advisory and in-depth interviews with human resource managers and academics to reduce the list of 50 items on the innovation competence list down to 25, that could be grouped then into the following three dimensions. This categorisation was built on past work we already discussed (Kiristo-Mertanen *et al.*, 2011) and was based on certain skills as follows:

(1) The *individual scale* of innovation competences that includes 12 items (these focus on target oriented and tenacious actions, independent thought and decision-making, problem-solving and development of working methods, persistence, risk taking and personal outlook);

(2) The *interpersonal scale* of innovation competences that includes 8 items (these are based on communication, teamwork and team leadership), and finally

(3) The *network scale* of innovation competences that includes 5 items (these are based on one's ability to create and maintain working connections, work in networks, co-operate in multidisciplinary and multicultural environment, and communicate and interact in an international environment).

The three scales of innovation sums up the competencies required in order for a helix or a UBC model to fully function, and therefore, they go one level higher in terms of what is expected to be done, to the level of what competencies need to be achieved and therefore, the extend that innovation, as part of the SDGs is integrated in HE activities.

Methodology

The research follows a qualitative approach of inductive reasoning. For the purpose of this developmental evaluation, the collection of information from several stakeholders has been pursued in the study.

The inductive approach used allows the investigation to make predictions about the implementation of SDGs in logistics HE in Oman, based on existing knowledge (Hayes *et al.*, 2010) and identify inferences that are considered to re-occur in the future (Grant and Quiggin, 2013). Identifying inferences in the implementation of SDGs in Oman, and through the DE, we can make suggestions that can change these inferences for a more successful implementation.

Five questions were addressed to a total of seven logistics faculty members from six out of the 13 HEIs running bachelor programmes in Oman, to study their awareness of SDGs and how these are translated in HEI teaching and learning for innovation. Three of the seven interviewed held a teaching position within their respective organisation, three held some form of Management positions (programme coordinators), and finally, one held a Quality Assurance related role. Difficulties in carrying out additional interviews, is owed to general restrictions of the pandemic (COVID-19), in terms of faculty availability, but also difficulty in

coordinating with HEI Management, owed to restrictive HEI information management policies. Nonetheless, inductive reasoning suggests that the same will be true of all other individual faculty members in the HEIs that were not addressed (Grant and Quiggin, 2013). Through an official process, it was also requested that these HEIs share, for the purposes of this research, a sample of logistics related module descriptions, and their teaching and learning/pedagogical approach currently in use. The module descriptions are used to identify the assimilation of innovative teaching and learning methods in the curriculum, while the pedagogical approach, further support the argument. Four out of thirteen institutions supplied the research with module descriptions, while only one shared their teaching and learning approach.

The research has considered possible limitations and used other methods for triangulation of the findings. The websites of all HEIs in search of additional details. Additionally, Oman Academic Accreditation Authority (OAAA) institutional assessment reports were reviewed for all HEIs and research that been previously undertaken. In order to assess the performance of each HEI against a set of interactions that have been identified under the eight types of interactions, this research will be making use of the methodology used by Chryssou (2020) which separates the interactions on a rating scale of three levels.

(1) *Recorded activity:* to show clear evidence of significant activity under each type of interaction;

(2) *Limited recorded activity:* to show evidence of a limited number of projects under each type of interaction;

(3) *No recorded activity:* to show that no evidence could be found of demonstrated activity under each type of interaction.

Furthermore, from the OAAA reports the governance of the institution, in order to assess commitment and effectiveness thereof, as well as the section for graduate attributes and student learning objectives to assess whether innovation competencies are present.

The results of the exploratory developmental evaluation are separated into three different sections. One includes the findings of the interviews with 8 representatives from logistics faculty of 6 HEIs in the country. The second includes documentation provided by the HEIs themselves, and the HEI websites in order to assist in identifying elements of the two innovation approaches utilised. Lastly, a review of the (OAAA) reports that have been released on their website in order to identify how HEIs implement these directives.

Evaluation findings: logistics faculty

The outcomes of the interviews from logistics faculty can be separated into several themes, primarily related to the five questions that were asked during the interviews. The first theme is related to the degree of *awareness* of logistics faculty of two specific subjects, the SDGs and the way innovation is sought after through teaching and learning. For the first, four out of the six faculty members suggested they are aware of the SDGs at different depths. For the latter, all but one faculty member were able to connect innovation to different means of teaching and learning pedagogy, such as research, involving students in projects, only a couple included involvement with industry, but also key industry visits and guest lectures, matching the elements of interaction that were discussed in the two innovation models above. The next theme that can be identified is that of the *implementation* of SDGs and the pedagogy for innovation in logistics HE. Here most faculty responses could not identify clear links through the system, neither in its implementation, "*even though evidence is available, for instance in the institutional standards assessment of the OAAA*", as one of the respondents stated. Most faculty members are aware of the SDGs because of their personal interest, and some exposure

to Oman Vision 2040, rather than obvious links that were addressed through the HEI, the Ministry, or any other agency (like the OAAA).

Next theme identified is that of *limitations* identified as paramount barriers to further implementation. If the themes are broken down further, the first part concerns promulgations from academics concerning the overall ecosystem, owing to *lack of incentives*. Some of the respondents expressed their concerns about implementation arguing that not all faculty can be innovative, neither they know how to be, nor they are incentivised to do so. As the STI Review Report (2014) also suggests, most colleges and universities have been established for the provision of teaching and their staff are not given the right incentives, neither have been requested to conduct research, until recent years. Many of the HEIs have had to hire faculty capable of performing research, therefore increasing their PhD staff pool, to cope with directives. Nevertheless:

> The budget made available for Research and Development (R&D) in Oman is very low, as a result not enough to allow for innovation.

Indeed, on average government spending accounts for 2.4% of the GDP for the OECD countries (OECD, 2018), while for Oman gross expenditure on R&D was only 0.136% of the GDP (World Bank, 2016). All research requires the approval of The Research Council (TRC), which is a policymaking and funding body founded to promote and support research and innovation efforts, and technological and scientific inquiry in Oman. Many of the respondents supported that the TRC does not provide the right funds, when "*in other countries funds are much higher, giving researchers incentives to be innovative*". Furthermore, "*there are no incentives or support for someone to present their work on international conferences*".

Several other concerns have been shared that are considered an impediment to innovation, for instance the opportunity of tenure, i.e. guaranteeing permanent employment after a probationary period. Job security seems to be yet another reason for the limited amount of research that takes place in the country; "*contracts expire after two (2) years and faculty is insecure on whether their contract will be renewed or not . . . there is no stability*".

The second part concerns promulgations about *the industry and* their capacity to provide appropriate traineeship schemes for students. It was, mentioned that although industry placements are required in the process of developing innovative thinking, both as means of getting ideas and experience (Triple Helix) after they are given the opportunity of putting theory into practice, but also on developing the numerous skills required in the industry (Innovation Competencies). "*Industry does not fully support with availability of placements, leaving many students at loss of industry experience*". At the same time, industry's "*funds allocation for and engaging students in research, either through internships or industry led assignments is restricted, leaving once again students at loss of experiencing industry problems firsthand.*

The third part concerns promulgations about *mobility.* Mobility of students and faculty has also been deemed important and terms of sharing ideas and seeing best practices and better understanding and supporting implementation. "*Not many exchange programmes are facilitated in Oman like abroad, staff spend time in other HEIs around the world for their development and for seeing best practice . . . they can then bring these to their home institution*". Mobility, whether in industry or another educational institution, is decisive for building up of knowledge on best practices, which can then be incorporated in the local system. "*Allowing students and faculty to spend a semester abroad or in industry should be embedded in the system*" for the development of both. Additionally, "*the chances that are given to foreign students should be equal to those of local students, they should be given equal opportunities as they bring their own experiences in and share ideas with local students*".

The fourth part concerns promulgations of the inclusiveness of several *qualities of education and learning.* Furthermore, freedom, openness and equal opportunity in academics should also be considered as pivotal, some related activities which are censored by the HEI's

management. "*Of course, political correctness should be taken into account, nevertheless, there are topics that we cannot touch upon; how can we discuss their implications to learning then?*"

Finally, the last part concerns the suggestion for reviewing the implementation of the Entrepreneurship and Innovation module that has been promoted by the Ministry of Higher Education (MoHE) and taught in HEIs since 2016, yet with no obvious results 5 years later. Even though the period is rather limited to make any observations, faculty raised concerns on whether the way it is taught allows for the full exploration of the module.

Evaluation findings: the HEI documentation and website

All documents that have been made available from four different HEIs for the purposes of this research were reviewed. These documents describe how teaching takes place for a particular module, and whether this is practiced widely throughout the HEI as it has been described earlier in the methodology. According to the documents, elements of innovative practice can be found in the module descriptions reflected in the module learning outcomes, even though still the largest percentage is gauged towards the final exam rather than other continuous assessment. It is evident that self-study is increasingly considered important through the reference of self-study hours in the module descriptions, yet not in the majority of HEIs, while it is not made clear how students are expected to make use of these hours. All HEIs had incorporated research, both as means of learning a module, through case studies and projects, one successfully incorporates training into their curriculum, while for the remaining, training is an optional activity for students and do not account for credits towards the degree. Additionally, international exposure, as international mobility of students and staff is obtained at one HEI, and is incorporated in the curriculum with significant credit, from research that is undertaken during the visit to another country.

Information of the links of modules to industry have also made their way into module descriptions in an effort to highlight industry involvement in the development of the module, as links to industry through the U-B Collaborations model. Additionally, their way into module descriptions is slowly making assessment methods that require students to develop portfolios of work throughout the semester and include work that will be performed in groups or independently, and the expectation of students building upon specific skills is highlighted. The learner-centred inquiry-based learning approach is strongly gaining momentum and more problem-based learning is introduced.

Exhausting the documentation available, the research focused on the webpages of all HEIs with logistics undergraduate programmes. From the webpages and in particular the Mission and Vision section, all but one institution are using the word innovation in some form, while two mention that they will, through education, promote development in a sustainable fashion. Generally, most HEIs reflect their emphasis on a teaching and learning approach that focuses on the learner, a student-centred approach, while at the same time they state, either in the mission or in a separate section, openly promoting graduate attributes, that their intention is to promote critical thinking and creative [problem] solving, targeting only a couple of the innovation competencies under the individual scale (page 7). Additionally, and in promoting the Triple Helix and University-Industry interactions, only one HEI covers many of the elements of the two innovation approaches, such as collaborating with industry and community, creating scholarship opportunities for students, and promoting commercialisation of research.

A research paper from Hussain and Al Barwani (2015) at Sultan Qaboos University identifies the University's efforts made in promoting and incorporating Sustainability and SD throughout the University. The authors undertook research through the University's computer database to identify returns that either contained sustainability in their title, or elsewhere in the curriculum. Their findings showed that many of the courses that concern SD

do not come up in the research because their titles (and content) do not contain the searched-for key words. It is surprising to the researchers why the research engine used did not pick up these keywords. Another respondent in an interview that was undertaken for top management and Deans within SQU, commented, that sustainability can be found throughout the university, yet no conscious work goes into it and suggests that more work is required to embed SD in the university's strategy. Finally, the research finds that SD is practiced widely "between the lines". Regarding courses related to Sustainability and SD, online research at the University's website produced the following returns. These comprise by an MSc in Environmental Science, an MSc in Civil Engineering (Environmental Engineering and another in Water Resources) at the different Colleges of the University. There are no returns for any other courses or programmes at Colleges or Universities in the country when online research including "study sustainability in Oman" is undertaken.

Finally, The Research Council (TRC) the Ministry's of Higher Education, Research and Innovation (MoHERI), right arm, makes the following funds available to all researchers in all HEIs in Oman that want to research topics that are of interest to the Ministry and the country. There are three types of grands: (1) The Undergraduate Research Grand (URG), capped at 1,500 Omani Rials (around US$4,000 dollars in current exchange rates), that are awarded to undergraduate students currently enrolled in HE in Oman, to conduct research projects, either on campus or at other research institutes in the Sultanate, with the option of being part of the student's academic course or graduation projects. (2) The Graduate Research Grand (GRG), capped at 3,000 Omani Rials (around US$8,000 dollars in current exchange rates) that encourages Omani graduates and pre-doctoral investigators, either they are working professionals or postgraduate students to pursue research. (3) The Open Research Grand (ORG), capped at 24,000 Omani Rials (around US$60,000 dollars in current exchange rates), allocate small-to-medium size research grants to short-term and mid-term research projects within the fields of sciences and humanities and to expand and enhance research capacity in the Sultanate. Additionally, TRC has numerous programmes to promote research in specific topics of interest, such as the Renewable Energy Strategic Research programme, or the Smart City Platform).

Evaluation findings: the reports

The OAAA findings reports, where used for triangulating the information gathered from faculty interviews and website claims. Starting from the UBC interactions, according to the reports, HEIs are mostly keen on training, allowing thus students to spend time within industry and exercise theory into practice (Figure 3). Nevertheless, these efforts are sporadic and eventually a small percentage of students end with industry training during their studies for most institutions. There are also examples where all students attain industry training and training is embedded within the curriculum. Limited contribution to research has been seen

Figure 3.
Breakdown of UBC interactions as per OAAA reports

slowly picking up from Colleges, while Universities have been stable in producing a small, but evident amount of research, which nevertheless, does not reflect all Universities. Additionally, a lot of effort is put on lifelong learning activities, while seminars, workshops seem to be on the rise, along with student mobility, dedicating resources in organising career fairs, inviting guest lectures from industry, organising visits to industry to expose students to current work practices, while to the contrary, very little efforts are recorded for mobility activities that include international exchange programmes for students, and participating in industry committees, or participating as guest lecturers in other universities for staff (Figure 4). Learning by coursework, an activity that entails students sharpening critical thinking and problem-solving skills seems to have limited recorded activity, meaning that the shift to a more student-centred learning approach is yet to be realised. Regarding consultancy and commercialisation of research some effort has been evident; nevertheless, evidence of valorisations activities (IP protection and prototype development) for technology commercialisation efforts or entrepreneurial businesses could be identified through the quality audits for the concerned HEIs.

As discussed earlier, the following figures portray the interactions between HEIs and Industry through the UBC activities, rated as described in the methodology (page 8). Figure 3 summarises the implementation of those elements that enhance UBCs, as per activity and Figure 4 summarises all the different activities under the 8 types of interactions identified (the activities are mentioned next to each type under approach 1).

The reports highlight among other, that various efforts have targeted the improvement of documentation and reporting systems of HEIs, with general statistics about students and alumni, nevertheless, little of that information and efforts makes its way into decision making or utilised beyond the planning stage. Finally, as Chryssou (2020) suggests in an overview of all HEIs in Oman, interactions are mostly traditional in nature related more on education, rather that research and valorisation through consultation activities. There has been substantially more attention on the development of more effective and meaningful interactions between the HEIs and other stakeholders, whether the industry or surrounding society; nevertheless, the progress made is very small without tremendous results on their transformation.

Discussion

The study offers important insights into the implementation of the SDGs and SD in Omani HE, and in particular in the way student innovation is enhanced through the relatively new

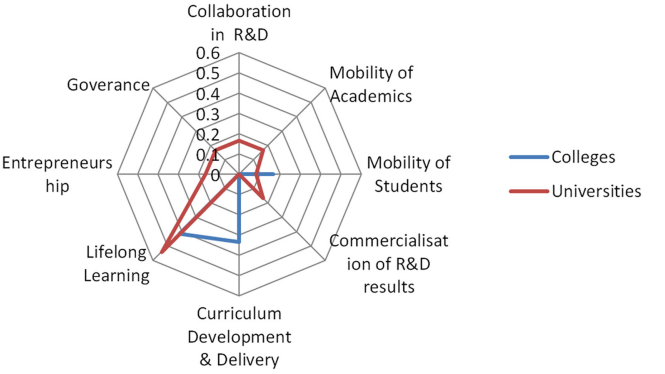

Figure 4.
Breakdown of UBC according to types of interactions

innovation ecosystem. Innovation has been considered the pillar of knowledge-based economies that drive nations to economic and societal growth, and HE has been seen as an incubator for the society, expected to create the environment that is appropriate and conducive, not only to learning, but also beyond, building upon the creativity and innovation of students.

Even though awareness among staff appears to be high and many of the elements of the two innovation approaches have been integrated in HE practice in the country, many of the activities that were promoted as practice, have not gone beyond planning stage. Faculty made it clear that more is required to be done in order for SDGs to be achieved and to be implemented in unison by all HEIs in the country and in order to reach higher levels of awareness between staff. They highlighted the importance of elements such as mobility of students and staff, exposure to other systems and methods, as well as an increased accessibility to funds for research, reduced teaching hours in order to increase research output that will then inform teaching and can potentially assist in the development of an ecosystem conducive to learning and innovation. Faculty further requested freedom and openness, that they suggest is currently limited and a more integrated approach, with clear roles and responsibilities should be sought. Finally, faculty focused on the limited incentives available that further prompt limited research. As Chryssou (2020) earlier identified, activities in HEs focus mostly on life-long learning, such as training, field trips, or seminars, guest lectures and other, not as much is done towards research and valorisation (cashing in on research).

Industry appears also far from having the capacity to take in, provide adequate training and exposure, and little work is done for developing interns' skills, no programme exists with regard to providing students an integrated and valuable experience that will count towards their development as professionals (organised internships). Little effort is also put on mentoring the trainees and providing guidance for their future in a professional role. It is obvious that inappropriate structures are in place for industry to initiate and foster common activities with HE, including research. In agreement with previous literature (Chryssou, 2020), industry is considered to be far from essentially engaging in valorisation of research with HE and one of the reasons for this is that it has not yet reached the absorptive capacity. Currently, companies have limited in-house R&D capacity, in an industry that is largely oil and gas dominated, with an SME sector still underdeveloped and a trade-based approach to R&D investments (i.e. imported from abroad), as it is often seen as too expensive to develop in the country (UNCTAD, 2014).

HEIs appear to slowly incorporate the required (SDGs related) information and pedagogies into their module descriptions and teaching and learning is expected to reflect these increasingly, creating a challenging environment for students. Nonetheless, these are still at an early stage of implementation (Chryssou, 2020; OAAA reports), and therefore, it will take some time until full implementation is understood and is done so successfully. Other studies have made it clear that a universal model of innovation practice does not exist, and therefore, the mix of elements that led HEIs, for instance MIT, to success, may not be the same that will lead another institution in another country to the same success (Pfotenhauer and Jasanoff, 2017). As Pfotenhauer and Jasanoff (2017) suggest in their research that failure to implement an innovation model successfully is rarely attributed to the models themselves. Instead, it is commonly held that cultural differences subsumed under the heading of "context" – prevent the model from functioning well. According to Pfotenhauer (2017) what may work for one country may be ineffectual or even harmful when the intention is to be transferred as is in a different region or country.

Cultural bottlenecks hindering the implementation of an innovative environment through enhancing the required skills in students, is mainly identified in the lack of motivation from faculty to engage with industry and involve in other commercialisation activities. Another

cultural bottleneck is the communication and clarity of the actors involved in terms of roles and responsibilities, which arose from previous research (United Nations, 2011; Chryssou, 2020) seem to be delaying the transformation of the HEIs in Oman.

Additionally, considering faculty, there seem to be difficulties in stimulating research capabilities as there is a common understanding that, insufficient incentives are offered, both by the HEI themselves and by other actors in the innovation ecosystem. Moreover, there is an argument of available time for research, as faculty is given many teaching hours throughout the week and no provisional hours for research are given, neither the support faculty would like to see in place for such endeavours.

Several interventions could be considered by policymakers to stimulate a more effective approach to implementing SDGs in HE and enhancing innovation throughout teaching and learning and in cooperation with other actors towards enhancing innovation among students. This could further contribute to the development of a knowledge-based economy model for long terms sustainable and equitable societies and economies.

Conclusions and recommendations

From the research, several conclusions can be drawn about the way implementation has been approached by the different actors, as it is obvious the results are not building a long-term sustainable ecosystem. Therefore, this study adds to the literature by considering two different innovation approaches to an exploratory developmental evaluation in a transitioning ecosystem, a developing country, in the process of diversification from oil and gas, and in a non-Western context.

Developmental evaluation has proved to be the most appropriate type of evaluation for those countries and institutions that aspire to the substantial transformation of their HE system, and its use should be promoted and enhanced in order to provide appropriate and timely information for transformational action to take place.

There is enough literature to date for academics to consider when it comes to good and sustainable practice in teaching and learning for ESD, with some indicators, relevant competencies for educators a series of materials integrating ESD into teacher educational programmes and even a teacher education curriculum (Sims and Falkenberg, 2013). Additionally, there is the OAAA Institutional and Programme Assessment guidelines that outline these requirements, and finally these are made available in Colleges and Universities by their Academic Development offices; nevertheless, there is no guide on best practice. As a result, any results towards knowledge-based economies and societies should be supported by these different pedagogical methods under the constructivist approach that places the learner rather that the teacher to the centre (Hedden *et al.*, 2017; Geitz and de Geus, 2019). Nevertheless, educators are still unwilling to fully embrace those practices in the classroom, and therefore, have little or no impact on learners, and less impact on the outcomes produced.

The economic impact of both logistics and of innovation (all countries on the pantheon of the innovation index are well-developed economies) provide a justified archetype for the implementation of more effective educational methods. SOLS2040 supported that, if all conditions are met, the promising sector is expected to create 300,000 jobs in 2040, an increase from about 80,000 in 2020. An integrated approach between the country's institutions and responsible authorities should lead to the creation of a plan that includes the training of faculty, it being argued that all academics must not be assumed to know how to develop these skills and competencies with their students (Straková and Cimermanová, 2018). Further deliberation and training may be required on a national scale. Renewal should include further involvement of all actors and research on how the system should be implemented in order to lead to the long-term SDGs successful outcomes.

Policymakers should focus on building, disseminating and organising a pragmatic and sustainable long-term innovation ecosystem (with a horizon of 15–20 years) around SDG implementation in HE and a clear innovation strategy is required (on specific long-term sustainable goals, instead of short-term gains which might not lead to long-term growth, e.g. focusing on building internal capacity of these projects through Public-Private Partnerships (PPPs) in order to fund efforts that would otherwise be undertaken by external consultants (UNCTAD, 2014)). Additionally, a longitudinal developmental study that continuously feeds the system with information and feedback on what has been realised, how it was realised (considering the specific characteristics of the country) and what more needs to be done should be implemented.

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