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RESEARCH

The Roles of Higher Education Institutions (HEIs) in Supporting Entrepreneurship and Innovation in Developing Countries: Evidence from Oman

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ABSTRACT

PURPOSE: The purpose of this study is to determine whether innovation and entrepreneurship activities are being adopted by higher education institutions (HEIs) in developing countries and specifically in Oman. It aims to explore the entrepreneurial ecosystem at HEIs and understand the support and challenges facing those institutions in order to promote entrepreneurship, innovation, and to spillover of knowledge from universities' campus to the market.

DESIGN/METHODOLOGY/APPROACH: A combination of semi-structured and in-depth interviews was used to gather the data, and one-sample and independent-sample t-tests were used to analyse the data. The study's results confirmed that all variables contributed to enhancing entrepreneurship and innovation activities in HEIs.

FINDINGS: This study's results confirmed that all variables contributed to enhancing entrepreneurship and innovation activities in HEIs. However, the findings reveal that HEIs failed to support some activities regarding access to finance, programmes and support activities, and policies and guidelines for promoting entrepreneurship and innovation in their education system.

RESEARCH LIMITATIONS/IMPLICATIONS: The findings of this study can be used as a map plan for universities in developing countries to provide the necessary actions to support innovation and entrepreneurship activities. HEIs can utilise the findings of this research to collaborate with external parties to facilitate students' commercialisation to the market.

ORIGINALITY/VALUE: This study fills the knowledge gap by exploring the entrepreneurial ecosystem components in developing countries and enabling a better understanding of the challenges faced by innovation and entrepreneurial activities.

KEYWORDS: *Entrepreneurship; Innovation; Higher Educational Institutions; Entrepreneurial Ecosystem; Oman*

INTRODUCTION

There are ongoing changes in the university system due to global transformation and socio-economic development. It is widely recognised that universities have a significant impact on economic and social growth and development (Alshamsi *et al.*, 2024; Lv *et al.*, 2022; de Moraes *et al.*, 2023). Consequently, there is a growing consensus that universities should transition from the traditional approach of merely generating and transferring knowledge to embracing the "4th generation of universities", commonly known as "Entrepreneurial Universities" (Adu *et al.*, 2020; Zaidan *et al.*, 2024).

Universities play a commanding role in socio-economic development. They support the government's approach towards a knowledge-based economy, technology innovation (Choi and Markham, 2019; Diotay *et al.*, 2024; Preedy *et al.*, 2020) and sustainability transitions (Buzzao *et al.*, 2024). Mohamed and Sheikh Ali (2021) and Dajani *et al.* (2021) declared that, today,

universities play many roles in society and the economy, not only traditional roles. Universities are becoming more important in supporting innovation and entrepreneurship, as well as knowledge commercialisation and transfer in this new millennium. Although there are a considerable and growing number of studies in the field of entrepreneurship and commercialisation of knowledge in many developed countries, so far, few studies have been found that discuss entrepreneurship and innovation activities at higher education institutions (HEIs) in developing countries, and specifically in Oman. Therefore, the purpose of this paper is to explore the entrepreneurial ecosystem at HEIs and understand the support and challenges that are facing those institutions in promoting entrepreneurship, innovation, and to the spillover of knowledge from universities' campus to the market in the context of developing countries.

LITERATURE REVIEW

Entrepreneurial Leadership

According to Huda (2016) and Poček *et al.* (2024), universities play a vital role in strengthening the relationship between entrepreneurship and the national economy; this is called an "entrepreneurship-friendly ecosystem". The concept of entrepreneurial universities is widely discussed in the literature (Etzkowitz, 1983; Hassan, 2024; Henry and Lahikainen, 2024); this is encouraging universities to change their mission from teaching, research and community services to focus on innovation and entrepreneurship. Through engaging in entrepreneurial and intrapreneurship activities, HEIs will enable the competiveness of the economy and support the response to rapid global economic changes (Alfalih and Ragmoun, 2020; Henry and Lahikainen, 2024; Zaidan *et al.*, 2024). Therefore, entrepreneurial leadership at the HEI level has become one of the critical factors affecting the entrepreneurial ecosystem in terms of enhancing entrepreneurial education, industrial engagement and promoting entrepreneurial culture through the university context.

The Role of Universities in Facilitating the Access to Finance

Most early studies, as well as current work, focus on the role of HEIs in establishing the business incubators and accelerators that can help researchers and inventors to transfer their outcome to the market (Hassan, 2024). Access to finance is one of the significant factors of gaining strategic competitive advantages, enabling new innovative enterprises to grow and sustain their activities (Rocha *et al.*, 2021; Smith *et al.*, 2020). At the local, national, and international levels, the establishment of new enterprises requires solid regulations and policies that facilitate the process of starting up businesses, including finding funding sources such as banks and/or angel investors (del Giudice *et al.*, 2019; Eichelberger *et al.*, 2020; Hahn *et al.*, 2020; Lv *et al.*, 2022). Therefore, funding entrepreneurial ideas is considered one of the critical challenges for HEIs (Elnadi and

Gheith, 2021; Guindalini *et al.*, 2021; Lv *et al.*, 2021; Smith *et al.*, 2020) concerning the lack of finance in line with other constraints, such as lack of entrepreneurial pertinent knowledge, lack of mentors and experience (Choi and Markham, 2019; Elia *et al.*, 2020; Ghafar, 2020; Liu *et al.*, 2019; de Moraes *et al.*, 2023; Yi *et al.*, 2021).

The Role of Universities in Enhancing the Entrepreneurial Education and programmes

Over time, an extensive literature has developed that explains the relationship between entrepreneurship education and the intention of students to start a business (Kassim *et al.*, 2024; Overwien *et al.*, 2024). The Knowledge Spillover Theory of Entrepreneurship (KSTE) is one entrepreneurship theory that examines the entrepreneurial intention and why some people take action and why others do not, and the time of raising an entrepreneurial opportunity (Hanandeh *et al.*, 2021; Bilal and Hussien, 2019). KSTE indicates that entrepreneurial behaviour reacts to profitable opportunities from knowledge spillovers. This means that the reason behind people's motivation to start up their business is that they have access to knowledge spillovers. Accordingly, the potential of utilising the advantage of a knowledge spillover generates entrepreneurial opportunity, consequently driving knowledge spillover entrepreneurship (Syed *et al.*, 2024).

The Role of Universities in R&D and Innovation

A number of authors have recognised the importance of the knowledge commercialisation of HEIs' innovations and research output, and enhancing HEIs industry collaboration (Alshamsi *et al.*, 2024; Marzouk, 2024; Omotosho *et al.*, 2024; Pujotomo *et al.* 2023). Diotay *et al.* (2024) and Rajagopal *et al.* (2024) mentioned that many universities have established specialised structures that facilitate the process of transferring knowledge; these include technology transfer offices, science parks and incubators.

The Role of Universities to Access the Market

One of the fundamental roles of the university is to share knowledge outside the university, or so-called "knowledge exchange" (Cai *et al.*, 2020). In other words, the new function of HEIs is to facilitate knowledge transfer, specifically to empower young entrepreneurs in effectively accessing the market (Del Giudice *et al.*, 2019). According to Adesola and Datta (2020), universities' engagement with external partners, outside of teaching and academic research, becomes more expansive overtime.

The Role of Universities in Policies and Guidelines

Al Harrasi and Al Subhi (2024), Hojeij (2024) and Zaidan *et al.* (2024) discuss the policies and institutional frameworks with a specific focus on the policies and strategies universities adapt to promote entrepreneurship and bridge the gap between knowledge creation and commercialisation. They emphasise the importance of policies and guidelines in the creation of an enabling environment that fosters entrepreneurial activities within universities and facilitates the transfer of knowledge, technology, and innovation. Bagiatis *et al.* (2020) state that there is a high positive relationship between flexible and coherent policies and entrepreneurship education. According to Diotay *et al.* (2024), this will contribute to regional and national economic sustainability and social development.

METHODOLOGY

Questionnaire Design

The survey questionnaire used in the research was designed to gain an in-depth understanding of the role of higher education institutions (HEIs) in support of entrepreneurship and innovation activities, including the main obstacles hindering knowledge transfer from HEIs to the market. This consists of seven factors, including leadership (20 items), access to finance (5 items), education and training (11 items), research and development (6 items), support activities and programmes (9 items), access to the market (6 items), policies and guidelines (4 items). A five-point scale was utilised to measure these factors, ranging from "strongly disagree" (1) to "strongly agree" (5). According to the results, the questionnaire was found to be highly reliable with a Cronbach's alpha value of 0.91 (Peterson, 1994).

Sampling and Data Collection

The targeted respondents were diverse experts and policy-makers from HEIs in Oman. The questionnaire was conveniently distributed online via Google Forms during the spring semester 2022. A total of 40 responses were obtained; most responses were from public (55%) and private (42.5%) HEIs. It is worth mentioning that four public, and nine private HEIs participated in the survey. The respondents were not just faculty members and administrators but also included the assistant dean (7.5%) and dean (5%) of HEIs, providing a comprehensive view of the situation.

Our survey revealed interesting preliminary findings about the support activities for entrepreneurship and innovation at the participating universities or colleges, as shown in Table 1. The results from the cross-tabulation analysis presented in Table 1 indicate that all public HEIs have entrepreneurship centres (except one) and offer academic programmes for entrepreneurship. However, only two HEIs have incubators, technology transfer centres, accelerator centres, and

funding programmes supporting entrepreneurship and innovation activities. In contrast, only eight private HEIs have entrepreneurship centres, five with incubation centres, two each with technology transfer and accelerator centres, and only three have funding programmes. Nevertheless, all private HEIs offer academic programmes for entrepreneurship. These results provide valuable insights into the current support landscape for entrepreneurship and innovation in higher education.

Table 1: Entrepreneurship and Innovation Support Activities Provided by HEIs

Type of HEIs	*Do you have an entrepreneurship centre?*	*Do you have an incubation centre?*	*Do you have a technology transfer centre*	*Do you have accelerator programmes?*	*Do you have funding programmes?*	*Do you have entrepreneurship academic programmes?*
Public (n=4)	Yes = 3 [75.0%]	Yes = 2 [50.0%]	Yes = 2 [50.0%]	Yes = 2 [50.0%]	Yes = 2 [50.0%]	Yes = 4 [100.0%]
	No = 1 [25.0%]	No = 2 [50.0%]	No = 2 [50.0%]	No = 2 [50.0%]	No = 2 [50.0%]	No = 0 [0%]
Private (n=9)	Yes = 8 [88.8%]	Yes = 5 [55.6%]	Yes = 2 [22.2%]	Yes = 2 [22.2%]	Yes = 3 [33.3%]	Yes = 9 [100.0%]
	No = 1 [11.1%]	No = 4 [44.4%]	No = 7 [77.8%]	No = 7 [77.8%]	No = 6 [66.7%]	No = 0 [0.0%]
Total	13	13	13	13	13	13

Source: Constructed by authors

Next, we assess and identify the factors that could facilitate or hinder entrepreneurship and innovation activities that support Oman's HEIs. We then describe the procedures, processes, and methods used to analyse the data

Data Analysis

The responses were processed using the Statistical Package for Social Science (SPSS) version 29. The research relied on a balanced mix of qualitative and quantitative analysis, which many researchers advocate (Creswell, 1999). This approach ensures the robustness of the findings. Statistical analyses were conducted wherever necessary to reinforce the conclusions obtained through qualitative analysis.

The analysis of various statements of the seven factors of entrepreneurship and innovation was done by assigning the following rating based on the degree of agreement among the respondents with statements as shown in Table 2. Thus, the rating of three pluses (+++) indicates a substantial contribution, two pluses (++) indicate a moderate contribution and one plus (+) indicates a weak contribution. A similar approach was used by Ghazali *et al.* (2003) in assessing the pertinent factors in the process of Information Technology/Information system (IT/IS) support for firms' agility in Malaysia. Considering the exploratory nature of this research, this approach is relevant. It aims to assess and identify the factors that could facilitate or hinder the successful adoption of HEIs'

entrepreneurship and innovation activities. Additionally, a one-sample t-test was conducted to compare the sample mean with the population mean of 2.5.

Table 2: Ratings used to Assess Entrepreneurship and Innovation Support for HEIs

Criteria	*Assigned rating*
80% or more of the respondents either strongly agreed or agreed with the statement	+ + +
61- 79% of the respondents either strongly agreed or agreed with the statement	+ +
50- 60% of the respondents either strongly agreed or agreed with the statement	+

Source: Ghazali *et al.* (2003)

RESULTS

The results obtained from the rating and one-sample t-test analyses are presented in Table 3 and discussed in the following sections.

Entrepreneurial Leadership

The results in Table 2 show mixed evidence (agreed by most respondents) that out of the 20 statements posed to the academicians, 12 statements received strong agreement (+++ rating, i.e., strongly agreed/agreed by over 80% of the respondents), four statements received strong (++ rating, i.e., strongly agreed/agreed by 61-79% of the respondents), while four statements received an average rating (+ rating, i.e., strongly agreed/agreed by 50-60% of the respondents).

Statements receiving +++, ++, + ratings are shown in Table 3.

Therefore, it is evident that the HEIs displayed positive entrepreneurial leadership towards supporting entrepreneurship and innovation in their education system. Overall, the respondents' perceptions of the entrepreneurial leadership of the HEIs were generally favourable.

Access to Finance

There is mixed support for the access to finance variable, where more than 50% of the respondents agreed with three statements. The results provided strong and average support. Statements receiving +++, ++, + ratings are shown in Table 3.

Table 3: Rating analysis and one sample t-test

Item	*Variable*	*SA (%)*	*A (%)*	*D (%)*	*SD (%)*	*NA (%)*	*Mean*	*SDev*	*t_value*	*p_value*	*Rating*[a]
Entrepreneurship leadership											
EL1	A strategic plan emphasising entrepreneurship and innovation	35.0	57.5	5.0	0.0	2.5	3.23	0.77	26.57	0.00***	+++
EL2	An operation plan emphasising entrepreneurship and innovation	37.5	60.0	0.0	0.0	2.5	3.30	0.72	28.86	0.00***	+++
EL3	A vision emphasising entrepreneurship leadership	45.0	50.0	2.5	0.0	2.5	3.35	0.77	27.53	0.00***	+++
EL4	Policy and guidelines emphasising entrepreneurship and innovation	22.5	62.5	12.5	0.0	2.5	3.05	0.68	28.47	0.00***	+++
EL5	Objectives emphasising entrepreneurship and innovation	35.0	60.0	2.5	0.0	2.5	3.25	0.74	27.68	0.00***	+++
EL6	Action plans emphasising entrepreneurship and innovation	35.0	60.0	0.0	2.5	2.5	3.15	0.77	25.89	0.00***	+++
EL7	Funding programmes supporting entrepreneurship and innovation	10.0	45.0	30.0	2.5	12.5	2.38	1.13	13.35	0.00***	+
EL8	Collaborations with different parties (e.g., entrepreneurial ecosystem in Oman) focusing on entrepreneurship and innovation	30.0	60.0	7.5	0.0	2.5	3.00	0.85	22.39	0.00***	+++
EL9	Faculty development programmes focusing on entrepreneurship and innovation	27.5	50.0	20.0	2.5	0.0	3.00	0.72	26.50	0.00***	+++
EL10	Students' co-working encourages entrepreneurship and innovation among them	17.5	70.0	10.0	2.5	0.0	3.00	0.85	22.39	0.00***	+++
EL11	Students' teamwork encourages entrepreneurship and innovation between teams	27.5	50.0	20.0	0.0	2.5	3.03	0.89	21.47	0.00***	++
EL12	Students' competition events encouraging entrepreneurship and innovation	25.0	62.5	12.5	0.0	5.0	3.10	0.67	29.19	0.00***	+++
EL13	Students' hands-on experience encourages entrepreneurship and innovation	20.0	75.0	2.5	0.0	2.5	3.13	0.76	26.09	0.00***	+++
EL14	Administrative support for entrepreneurship and innovation programmes	27.5	62.5	7.5	2.5	0.0	3.08	0.83	23.47	0.00***	+++

Item	Variable	SA (%)	A (%)	D (%)	SD (%)	NA (%)	Mean	SDev	t_value	p_value	Rating[a]
EL15	Industry-university collaborations supporting entrepreneurship and innovation	15.0	65.0	15.0	0.0	5.0	2.85	0.86	20.87	0.00***	+++
EL16	Clear identification of the industry's key stakeholders who support entrepreneurship and innovation	15.0	57.5	22.5	0.0	5.0	2.78	0.89	19.69	0.00***	++
EL17	Corporate participation supporting entrepreneurship and innovation	17.5	60.0	20.0	0.0	2.5	2.90	0.78	23.58	0.00***	++
EL18	Angel and investor networks supporting entrepreneurship and innovation	7.5	45.0	30.0	10.0	7.5	2.35	1.03	14.48	0.00***	+
EL19	Industry sponsors supporting entrepreneurship and innovation	10.0	42.5	32.5	7.5	7.5	2.40	1.03	14.70	0.00***	+
EL20	Internship opportunities supporting entrepreneurship and innovation	17.5	37.5	32.5	7.5	5.0	2.55	1.04	15.56	0.00***	+
Access to Finance											
AF1	Sufficient funds available for student start-ups (e.g., generated by the University/College itself, funds, budgets, etc.)	5.0	37.5	30.0	12.5	15.0	2.05	1.15	3.02	0.00***	-
AF2	Sufficient network to facilitate students' communication (e.g., with angel investors, and venture capital, investors)	20.0	40.0	22.5	12.5	5.0	2.58	1.11	6.14	0.00***	+
AF3	Adequate awareness of different external funding available from government agencies (e.g., SMEs Development Authority fund)	15.0	60.0	20.0	2.5	2.5	2.83	0.81	10.31	0.00***	++
AF4	Sufficient linkage with informal investments	0.0	40.0	42.5	15.0	2.5	2.20	0.79	5.60	0.00***	-
AF5	Student start-ups have been funded by external investors	2.5	42.5	40.0	7.5	7.5	2.25	0.93	5.12	0.00***	-
Education and training											
ET1	Courses are taught related to entrepreneurship, innovation, and creativity	45.0	50.0	2.5	0.0	2.5	3.35	0.77	15.20	0.00***	+++
ET2	Course requirement related to entrepreneurship, innovation, and creativity at the university level	37.5	50.0	12.5	0.0	0.0	3.25	0.67	16.52	0.00***	+++

Item	Variable	SA (%)	A (%)	D (%)	SD (%)	NA (%)	Mean	SDev	t_value	p_value	Rating[a]
ET3	Course requirement related to entrepreneurship, innovation, and creativity at the college level	37.5	50.0	10.0	0.0	2.5	3.20	0.82	13.07	0.00***	+++
ET4	Course requirement related to entrepreneurship, innovation, and creativity at both university and college levels	27.5	67.5	5.0	0.0	0.0	3.23	0.53	20.57	0.00***	+++
ET5	Entrepreneurship courses taught students to search for innovative business ideas	37.5	50.0	7.5	2.5	2.5	3.18	0.87	12.12	0.00***	+++
ET6	Entrepreneurship courses taught students to prepare their own business plan	47.5	50.0	2.5	0.0	0.00	3.45	0.55	22.33	0.00***	+++
ET7	Entrepreneurship courses taught students to become entrepreneurs	47.5	45.0	5.0	2.5	5.0	3.38	0.71	16.83	0.00***	+++
ET8	Adequate academic curriculum that facilitates the students' starting up and growing new firms	37.5	45.0	10.0	5.0	2.5	3.10	0.96	10.59	0.00***	+++
ET9	Sufficient training programmes for preparing start-ups and growing new firms	20.0	42.5	30.0	5.0	2.5	2.73	0.93	8.30	0.00***	++
ET10	Available vocational programmes for starting and growing new firms	12.5	47.5	27.5	5.0	7.5	2.53	1.04	6.25	0.00***	+
ET11	Available professional programmes for starting and growing new firms	20.0	45.0	22.5	5.0	7.5	2.65	1.10	6.62	0.00***	++
R&D Transfer											
RD1	Research and development transfer from science to new and growing firms	7.5	50.0	20.0	0.0	22.5	2.20	1.31	3.39	0.00***	+
RD2	A transfer of scientific research and development to new and growing firms	7.5	50.0	20.0	0.0	22.5	2.20	1.31	3.39	0.00***	+
RD3	Transfer of research output to new and growing firms	10.0	40.0	22.5	2.5	25.0	2.08	1.37	2.66	0.01**	+
RD4	A transfer of applied research and development to new and growing firms	7.5	52.5	25.0	0.0	15.0	2.38	1.15	4.82	0.00***	+
RD5	Transfer of new technology to new and growing firms	10.0	47.5	27.5	2.5	12.5	2.40	1.13	5.05	0.00***	+

Item	Variable	SA (%)	A (%)	D (%)	SD (%)	NA (%)	Mean	SDev	t_value	p_value	Rating[a]
RD6	A transfer of new technology research and development to new and growing firms	10.0	45.0	27.5	0.0	17.5	2.30	1.22	4.14	0.00***	+
Programmes and support activities											
PSA1	The entrepreneurship centre is easily accessible	15.0	50.0	12.5	0.0	22.5	2.35	1.39	3.87	0.00***	++
PSA2	The incubation centre is easily accessible	35.0	20.0	2.5	0.0	30.0	1.98	1.46	2.06	0.05*	+
PSA3	The accelerator centre is easily accessible	5.0	32.5	20.0	2.5	40.0	1.60	1.43	0.44	ns	-
PSA4	The technology park centre is easily accessible	12.5	22.5	17.4	2.5	45.0	1.55	1.55	0.20	ns	-
PSA5	The technology transfer centre is easily accessible	20.0	17.5	22.5	2.5	37.5	1.80	1.59	1.19	ns	-
PSA6	The facilities for commercialising ideas to the market are easily accessible	5.0	40.0	32.5	5.0	17.5	2.10	1.17	3.24	0.00***	-
PSA7	There is collaboration with external parties offering access to suppliers	10.0	37.5	32.5	2.5	17.5	2.20	1.22	3.62	0.00***	-
PSA8	There is collaboration with external parties offering access to labs	5.0	32.5	40.0	2.5	20.0	2.00	1.18	2.69	0.01**	-
PSA9	There is collaboration with external parties offering access to raw materials	2.5	32.5	45.0	2.5	17.5	2.00	1.09	2.91	0.01**	-
Market											
M1	Students can participate in exhibitions, either inside the University/College or outside the campus, showcasing their business ideas	52.5	42.5	0.0	0.0	5.0	3.38	0.93	12.82	0.00***	+++
M2	Students can participate in showcasing and pitching their business ideas to investors and stakeholders	37.5	55.0	5.0	0.0	2.5	3.25	0.78	14.26	0.00***	+++
M3	Students can participate in business forums discussing their business ideas	37.5	60.0	0.0	0.0	2.5	3.30	0.72	15.74	0.00***	+++
M4	Students can participate in local or international competitions showcasing their business ideas	37.5	57.5	0.0	0.0	5.0	3.23	0.89	12.24	0.00***	+++
M5	Support centre for students' start-ups to market their products and services	22.5	45.0	20.0	2.5	10.0	2.68	1.16	6.39	0.00***	++

Item	*Variable*	*SA (%)*	*A (%)*	*D (%)*	*SD (%)*	*NA (%)*	*Mean*	*SDev*	*t_value*	*p_value*	*Rating*[a]
M6	There is/are cases of students who enter the market and commercialise their business ideas	22.5	35.0	27.5	5.0	10.0	2.55	1.20	5.55	0.00***	+
Policies and guidelines											
PG1	A proper intellectual property policy that is available for students	25.0	47.5	10.0	5.0	12.5	2.68	1.27	5.86	0.00***	++
PG2	A proper incubation policy that is available for students	12.5	35.0	25.0	7.5	20.0	2.13	1.32	2.99	0.01**	-
PG3	An investment policy that is available for students	5.0	37.5	30.0	10.0	17.5	2.03	1.19	2.80	0.01**	-
PG4	Other regulations emphasising support for students' project	10.0	57.5	12.5	10.0	10.0	2.48	1.13	5.45	0.00***	++

Notes: NA = Not applicable; SD = Strongly disagree, D= Disagree, A= Agree, and SA= Strongly agree; a +++ over 80% of the respondents either strongly agreed or agreed with the statement; ++61-79% of the respondents either strongly agreed or agreed with the statement; +50-60% of the respondents either strongly agreed or agreed with the statement; *** significant at p <0.001; ** significant at p <0.01; * significant at p <0.05

Source: Constructed by authors

Education and Training

In contrast, there was strong, average, and weak support for the campus systems and activities in providing HEI education and training. Statements receiving +++, ++, + rating are shown in Table 3. Notably, a good academic curriculum that facilitates the students starting up and growing new firms was rated most highly (97.5%) by the respondents, indicating the importance of an academic entrepreneurship curriculum to prepare students for start-ups.

R&D Transfer

Overall, the respondents agreed that HEIs' support of entrepreneurship and innovation through research and development transfer was favourable. In general, all respondents faced challenges in supporting knowledge commercialisation and transferring the students' innovations to the market.

Programmes and support activities

Surprisingly, only two statements support the role of HEIs in entrepreneurship and innovation, saying that entrepreneurship centres (++ 65%) and incubation centres (+ 55%), respectively, are easily accessible (see Table 3).

There were also some indications that, in many ways, programmes and support activities have failed to support the HEIs' role in entrepreneurship and innovation (since less than 50% of the respondents agreed with the respective statements), particularly concerning the following:

- the accelerator centre is easily accessible (37.5%);
- the technology park centre is easily accessible (35%);
- the technology transfer centre is easily accessible (37.5%);
- the facilities for commercialising ideas to the market are easily accessible (45%);
- there is collaboration with external parties offering access to suppliers (47.5%);
- there is collaboration with external parties offering access to labs (37.5%);
- there is collaboration with external parties offering access to raw materials (37.5%).

Market

The results were favourable for the market since the majority (more than 50%) of the respondents agreed with the statements posed to them. The results provided strong support, particularly in terms of the following (Table 3):

- students can participate in exhibitions, either inside the University/College or outside the campus, showcasing their business ideas (+++);
- students can participate in showcasing and pitching their business ideas to investors and stakeholders (+++).

Policies and Guidelines

In terms of policies and guidelines, the results in Table 3 were obtained from two statements and indicate average support for the availability of intellectual property policy (++ 72.5%) and regulations for students' projects (++ 67.5%), while the results for the other two are unfavourable, especially for the following:

- a proper incubation policy that is available for students (47.5%);
- an investment policy that is available for students (42.5%).

Overall, Table 3 shows that the sample means for all the items are significantly higher than the population means value of 1.5. Next, independent-sample t-tests were performed to determine whether differences exist between the public and private HEIs regarding the statements.

Independent sample t-test analysis

The independent-samples t-test compares the mean scores of two groups, namely public and private HEIs, concerning the statements. The results in Table 4 indicate that only four statements are found to show significant differences in scores. There was a statistically significant difference at the $p < 0.05$ level in policy and guidelines emphasising entrepreneurship and innovation; at $p < 0.01$ in awareness of different external funding available from government agencies; $p < 0.001$ in entrepreneurship courses taught students to become entrepreneurs; and at $p < 0.001$ in the academic curriculum that facilitates the students starting up and growing new firms scores for public and private HEIs.

Table 4: Independent-Sample T-test Group Statistics

Item	*Variable*	*HEI*	*n*	*Mean*	*SDev*	*t_value*[b]	*p_value*[c]
Entrepreneurial leadership							
EL1	A strategic plan emphasising entrepreneurship and innovation	Public Private	26 14	3.35 3.00	0.49 1.11	1.38	0.18
EL2	An operation plan emphasising entrepreneurship and innovation	Public Private	26 14	3.31 3.29	0.47 1.07	0.09	0.93
EL3	A vision emphasising entrepreneurship leadership	Public Private	26 14	3.38 3.29	0.57 1.07	0.38	0.70
EL4	Policies and guidelines emphasising entrepreneurship and innovation	Public Private	26 14	2.88 3.36	0.52 0.84	-2.21	0.03*
EL5	Objectives emphasising entrepreneurship and innovation	Public Private	26 14	3.23 3.29	0.51 1.07	-0.22	0.83
EL6	Action plans emphasising entrepreneurship and innovation	Public Private	26 14	3.12 3.21	0.59 1.05	-0.38	0.70
EL7	Funding programmes supporting entrepreneurship and innovation	Public Private	26 14	2.46 2.21	0.91 1.48	0.66	0.51
EL8	Collaborations with different parties focusing on entrepreneurship and innovation	Public Private	26 14	3.04 2.93	0.66 1.14	0.39	0.70
EL9	Faculty development programmes focusing on entrepreneurship and innovation	Public Private	26 14	3.08 2.86	0.56 0.95	0.92	0.36
EL10	Students' co-working encourages entrepreneurship and innovation among them	Public Private	26 14	2.92 3.14	0.63 1.17	-0.78	0.44
EL11	Students' teamwork encourages entrepreneurship and innovation between teams	Public Private	26 14	3.15 2.79	0.46 1.37	1.26	0.22
EL12	Students' competition events encouraging entrepreneurship and innovation	Public Private	26 14	3.15 3.00	0.46 0.96	0.69	0.50
EL13	Students' hands-on experience encourages entrepreneurship and innovation	Public Private	26 14	3.12 3.14	0.52 1.10	-0.11	0.92
EL14	Administrative support for entrepreneurship and innovation programmes	Public Private	26 14	3.08 3.07	0.63 1.14	0.02	0.99
EL15	Industry-university collaborations supporting entrepreneurship and innovation	Public Private	26 14	2.85 2.86	0.73 1.10	-0.03	0.97

Item	Variable	HEI	n	Mean	SDev	t_value[b]	p_value[c]
EL16	Clear identification of the industry's key stakeholders who support entrepreneurship and innovation	Public Private	26 14	2.85 2.64	0.78 1.08	0.62	0.54
EL17	Corporate participation supporting entrepreneurship and innovation	Public Private	26 14	2.88 2.93	0.59 1.07	-0.14	0.89
EL18	Angel and investor networks supporting entrepreneurship and innovation	Public Private	26 14	2.31 2.43	1.05 1.02	-0.36	0.73
EL19	Industry sponsors supporting entrepreneurship and innovation	Public Private	26 14	2.38 2.43	1.02 1.09	-0.12	0.90
EL20	Internship opportunities supporting entrepreneurship and innovation	Public Private	26 14	2.46 2.71	0.95 1.20	-0.68	0.50
Access to finance							
AF1	Sufficient funds available for student start-ups (e.g., generated by the University/College itself, funds, budgets, etc.)	Public Private	26 14	2.15 1.86	1.05 1.35	0.77	0.45
AF2	Sufficient network to facilitate students' communication (e.g., with angel investors, and venture capital, investors)	Public Private	26 14	2.69 2.36	0.97 1.34	0.91	0.37
AF3	Adequate awareness of different external funding available from government agencies (e.g., SMEs Development Authority fund)	Public Private	26 14	2.73 3.00	0.60 1.11	-1.00	0.32
AF4	Sufficient linkage with informal investments	Public Private	26 14	2.31 2.00	0.74 0.88	1.18	0.25
AF5	Student start-ups have been funded by external investors	Public Private	26 14	2.23 2.29	0.91 0.99	-0.18	0.86
Education and training							
ET1	Courses are taught related to entrepreneurship, innovation, and creativity.	Public Private	26 14	3.27 3.50	0.53 1.09	-0.90	0.37
ET2	Course requirements related to entrepreneurship, innovation, and creativity at the university level	Public Private	26 14	3.15 3.43	0.61 0.76	-1.25	0.22
ET3	Course requirement related to entrepreneurship, innovation, and creativity at the college level	Public Private	26 14	2.96 3.64	0.82 0.63	-2.69	0.01**
ET4	Entrepreneurship courses taught students to prepare their business plan	Public Private	26 14	3.15 3.36	0.54 0.50	-1.16	0.25
ET5	Entrepreneurship courses taught students to become entrepreneurs	Public Private	26 14	2.92 3.64	0.89 0.63	-2.67	0.01**

Item	Variable	HEI	n	Mean	SDev	t_value[b]	p_value[c]
ET6	Adequate academic curriculum that facilitates the students starting up and growing new firms	Public Private	26 14	3.27 3.79	0.53 0.43	-3.12	0.00***
ET7	Entrepreneurship courses taught students to become entrepreneurs	Public Private	26 14	3.23 3.64	0.71 0.63	-1.82	0.08
ET8	Available vocational programmes for starting and growing new firms	Public Private	26 14	3.00 3.29	0.85 1.14	-0.90	0.37
ET9	Sufficient training programmes for preparing start-ups and growing new firms	Public Private	26 14	2.69 2.79	0.84 1.12	-0.30	0.77
ET10	Available professional programmes for starting and growing new firms	Public Private	26 14	2.46 2.64	0.91 1.28	-0.52	0.60
ET11	Available professional programmes for starting and growing new firms	Public Private	26 14	2.62 2.71	0.94 1.38	-0.27	0.79
R&D transfer							
RD1	Research and development transfer from science to new and growing firms	Public Private	26 14	2.31 2.00	1.23 1.47	0.71	0.48
RD2	A transfer of scientific research and development to new and growing firms	Public Private	26 14	2.23 2.14	1.18 1.56	0.20	0.84
RD3	Transfer of research output to new and growing firms	Public Private	26 14	2.23 1.79	1.28 1.53	0.98	0.33
RD4	A transfer of applied research and development to new and growing firms	Public Private	26 14	2.42 2.29	0.99 1.44	0.36	0.72
RD5	Transfer of new technology to new and growing firms	Public Private	26 14	2.46 2.29	0.95 1.44	0.47	0.64
RD6	A transfer of new technology research and development to new and growing firms	Public Private	26 14	2.31 2.29	1.09 1.49	0.05	0.96
Programmes and support activities							
PSA1	The entrepreneurship centre is easily accessible	Public Private	26 14	2.54 2.00	1.24 1.62	1.18	0.25
PSA2	The incubation centre is easily accessible	Public Private	26 14	1.96 2.00	1.40 1.62	-0.08	0.94
PSA3	The accelerator centre is easily accessible	Public Private	26 14	1.77 1.29	1.45 1.38	1.02	0.31
PSA4	The technology park centre is easily accessible	Public Private	26 14	1.81 1.07	1.50 1.59	1.45	0.16

Item	*Variable*	*HEI*	*n*	*Mean*	*SDev*	*t_value*[b]	*p_value*[c]
PSA5	The technology transfer centre is easily accessible	Public Private	26 14	2.00 1.43	1.44 1.83	1.09	0.28
PSA6	The facilities for commercialising ideas to the market are easily accessible	Public Private	26 14	2.31 1.71	1.05 1.33	1.55	0.13
PSA7	There is collaboration with external parties offering access to suppliers	Public Private	26 14	2.35 1.93	1.09 1.44	1.03	0.31
PSA8	There is collaboration with external parties offering access to labs	Public Private	26 14	2.23 1.57	1.03 1.34	1.73	0.09
PSA9	There is collaboration with external parties offering access to raw material	Public Private	26 14	2.12 1.79	0.99 1.25	0.91	0.37
Market							
M1	Students can participate in exhibitions, either inside the University/College or outside the campus, showcasing their business ideas	Public Private	26 14	3.31 3.50	0.84 1.09	-0.62	0.54
M2	Students can participate in showcasing and pitching their business ideas to investors and stakeholders	Public Private	26 14	3.19 3.36	0.85 0.63	-0.64	0.53
M3	Students can participate in business forums discussing their business ideas	Public Private	26 14	3.15 3.57	0.78 0.51	-1.79	0.08
M4	Students can participate in local or international competitions showcasing their business ideas	Public Private	26 14	3.19 3.29	0.80 1.07	-0.31	0.76
M5	Support centre for students' start-ups to market their products and services	Public Private	26 14	2.65 2.71	1.06 1.38	-0.16	0.88
M6	There is/are cases of students who enter the market and commercialise their business ideas	Public Private	26 14	2.62 2.43	1.06 1.45	0.47	0.64
Policies and guidelines							
PG1	A proper intellectual property policy that is available for students	Public Private	26 14	2.88 2.29	0.82 1.82	1.44	0.16
PG2	A proper incubation policy that is available for students	Public Private	26 14	2.27 1.86	1.12 1.66	0.94	0.35
PG3	An investment policy that is available for students	Public Private	26 14	2.19 1.71	0.94 1.54	1.22	0.23
PG4	Other regulations emphasising support for students' project	Public Private	26 14	2.62 2.21	0.70 1.67	1.07	0.29

Notes: n = sample size; b Equal variances assumed; c at 2-tailed*** significant at p <0.001; ** significant at p <0.01; * significant at p <0.05 at 2-tailed

Source: Constructed by authors

DISCUSSION

This research aimed to explore how different aspects in HEIs, including entrepreneurial leadership, access to finance and education and training, etc., can support entrepreneurship and innovation. However, most of the respondents agreed that HEIs in Oman have a future strategic plan to promote and enhance university entrepreneurship. There is a need for more focus on collaboration programmes with stakeholders. Guindalini *et al.* (2021) argue in line with our findings that future plans needed to create funding programmes and target new innovative financial sources at the university level. Also, there is a need to promote more internship programme opportunities supporting entrepreneurship and innovation.

However, this study indicates that there are no adequate sources of funding available at universities (internally) to support student start-ups, neither are sufficient funds available from external investors for student start-ups. This is debated by Lv *et al.* (2022) who stated that there is weak communication with angel investors and venture capital investors. There is also a moderate rate for awareness programmes available at HEIs regarding increasing the awareness of different external funding sources available from government agencies for student start-ups. The results show that weak investment comes from informal investment; this is consistent with previous studies conducted by Abootorabi *et al.* (2021), Al-Abri *et al.* (2018) and Ghouse *et al.* (2019).

On the other hand, the findings clarify that there is strong evidence that all respondents from HEIs have an adequate academic curriculum related to entrepreneurship, innovation, and creativity. Many previous studies show that there are many courses given to students at HEIs to help them prepare their business plan and to promote their skills to become entrepreneurs (Al-Abri *et al.*, 2018; Elnadi and Gheith, 2021; Ghouse *et al.*, 2019). Furthermore, there is average support for the availability of training and professional programmes for starting and growing new firms at some HEIs; however, there is a need to promote more training programmes for preparing start-ups and growing new firms. In this respect, previous literature supports our findings, showing that there is weak support at HEIs regarding the availability of vocational programmes for starting and growing new firms; therefore, there is urgent need to design such programmes at the university level (Choi and Markham, 2019; Ghafar, 2020; Hahn *et al.*, 2020; Lv *et al.*, 2022; de Moraes *et al.*, 2023).

The results of this current study illustrate that there was weak support for the role of HEIs in research and development transfer, which is consistent with previous research. In addition, the findings of this study show that 65% of HEIs in Oman have established an Entrepreneurship Centre, and 55% have established Incubation Centres. Most HEIs in Oman have no accelerator fund programme, technology park or technology transfer centre, and weak support for commercialising ideas to the market. Weak collaboration or networks with external parties offering access to suppliers, labs and raw materials that could help students to prepare their prototypes and launch their business is evidenced by previous studies (Eichelberger *et al.*, 2020; Guindalini *et al.*, 2021; Lv *et al.*, 2022; de Moraes *et al.*, 2023). The findings confirm a lack of incubation policy and investment policy available at HEIs that could help students to establish their start-ups.

CONCLUSIONS AND IMPLICATIONS

This study's results confirmed that all variables contributed to enhancing entrepreneurship and innovation activities in HEIs in Oman. However, the findings reveal that HEIs failed to support some activities regarding access to finance, programmes and support activities, and policies and guidelines for promoting entrepreneurship and innovation in their education system. HEIs can promote and support entrepreneurship and innovation by focusing on these activities. Therefore, it seems worthwhile for HEIs to continue to improve on these activities so that any shortcomings can be remedied. The findings also found strong, average, and weak support towards entrepreneurial leadership, education, and training, research and development transfer, and market by the HEIs. There was a significant difference in scores for public and private HEIs. Private HEIs were more supportive than public HEIs regarding policy and guidelines emphasising entrepreneurship and innovation, awareness of other external funding available, entrepreneurship courses, and academic curriculum facilitating students' start-ups and growing new firms.

Several managerial implications could be derived from this research. First, HEIs must consider funding students' start-ups and attracting external investors by showcasing students' projects. Second, HEIs should collaborate with external parties for students to quickly commercialise to the market. Finally, HEIs should develop an incubation and investment policy that is available for students.

LIMITATIONS AND FUTURE RESEARCH SUGGESTIONS

The revealed findings of this research confront some limitations that suggest future research to overcome these constraints. The collected data were from only a few universities/colleges in Oman. Therefore, it is recommended that future researchers expand the data sample that will lead to higher result generalisations. However, this study did not examine the role of universities in supporting entrepreneurship and innovation in terms of quantitative data. Therefore, a quantitative research approach is recommended in future research. In addition, the barriers towards starting up entrepreneurial business need further exploration using mixed methods.

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