

The "Entrepreneurial University": A Catalyst for the Redevelopment of the Azerbaijani Higher Education System

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ABSTRACT

The notion of the “Entrepreneurial University” refers to a type of educational institution that enhances university-industry cooperation, applies innovative learning methods, and promotes multidisciplinary approaches. This article explores new challenges that Azerbaijani universities have faced as part of the Azerbaijani higher education transformation in the post-Soviet period. The research investigated the experiences of Western-style universities that have been building relationships with Western partners with substantial leadership experience in university innovation and, specifically, in establishing entrepreneurial universities. This paper argues that Azerbaijan's transition to a knowledge economy will require a substantive transformation of the country's higher education system and, as such, must develop the entrepreneurial university model that has been embraced as an effective response to the challenges of our time by some U.S. universities.

Keywords: entrepreneurial university, knowledge economy, university-business partnership, post-Soviet, higher education

INTRODUCTION

It is undeniable that in today's vast knowledge economies, universities must constantly transform to stay competitive. Connections between industries and universities are necessary for universities to prepare students to successfully enter and succeed in the global economy. Their main goal must be to ensure that the education they provide reflects labor market conditions and sufficiently matches its standards. Universities need to be designed in such a way that enables graduates to succeed in reaching this target. In the knowledge economy, the university as an institution will remain at the center of the innovation system focused on the provision of human capital and to serve as a seedbed of entrepreneurship (Etzkowitz et al., 2000). The Fourth Industrial Revolution we are currently witnessing is fundamentally different from previous technological revolutions. It is characterized by a range of new technologies that combine the physical, digital, and biological worlds, to dramatically and concurrently impact all disciplines, economies, and industries (Schwab, 2017).

This reality reveals that insufficiently prepared universities must act urgently to develop a new system of higher education that will manage to transform the existing factory-style format, and make it more responsive to the demands of the Fourth Industrial Revolution (Toffler & Alvin, 1980). Azerbaijan presents such a case. The existing university structure in Azerbaijan and other post-Soviet countries needs to transform itself into a market-oriented model, like the United States, if it is not only to remain competitive but also to thrive. This means that Azerbaijani universities will have to fulfil the mission of being leaders in innovation and accelerators of economic development. As the range and impact of the Fourth Industrial Revolution expands and global competition intensifies, the modern phenomenon of the entrepreneurial university will play an increasingly important role in fostering economic growth. Currently, the employment skills that the markets demand are changing. Along with that, social and emotional skills are becoming particularly important. The Azerbaijani higher education system and labor market is no exception.

The purpose of this study was to explore some of these new challenges Azerbaijani universities have faced in their transformation from the post-Soviet period, and to compare and analyze the approaches of Azerbaijani universities with regard to innovation and the establishment of entrepreneurial universities.

Two main questions were thus addressed:

1. Will Azerbaijani universities be able to identify trends correctly during the move from a traditional classical model to a digital age?
2. How will the Azerbaijani higher education system transform over the next 15-20 years due to the economic, social, and technological changes that are taking place?

Since Azerbaijan's transition to a knowledge economy will require a substantive transformation of the country's higher education system, this study sought to conceptualize the entrepreneurial university model in Azerbaijan as an effective response to the challenges presented by today's global economy.

LITERATURE REVIEW

The Entrepreneurial University Concept in the Literature

Entrepreneurial universities can be understood as a myriad of things, but all of them must attract external funds through patents and other forms of cooperation with the private sector (Etzkowitz, 1983);

establish business ventures via their faculty (Chrisman, et al., 1995); create innovations that drive the business sector (Clark, 1998); deliver services to the knowledge industry (Williams, 2003); help its members become entrepreneurs (Röpke, 1998); and engage in the commercialization and commoditization of their research product (Jacob, et al. 2003). The entrepreneurial mindset that operationalizes this notion for universities means they need to engage in promoting economic development and interaction of their faculty and students in concert with local and regional business and industries. That level of interaction can be a major route for human capital flow between the public and private sectors (Douglass, 2016, p. 68).

The role of universities in today's economies is largely assessed by knowledge-based capital formation, such as Research & Development (R&D) data, software, and patents (Kaloudis et al. 2019). Universities are expected to play an important role in enhancing innovation, entrepreneurship, and structural changes (Perkmann & Walsh, 2007). Entrepreneurial universities already play a vital role in boosting innovation and business competitiveness in the economy. Research and the products that their innovation produces in the United States have played a significant role in the economic growth and prosperity of the country (Cohen, Nelson & Walsh 2002; Mowery et al. 2003; Lester, 2005).

Considering the innovation boosting role of the entrepreneurial universities in modern economic growth, transforming traditional universities to the entrepreneurial university model require the following:

- effective realization of intellectual capability;
- an advanced innovation system;
- financial resources ensuring the highest quality of education and scientific research;
- stability of educational services and products of an intellectual nature in the global marketplace;
- capitalization of knowledge;
- interdependence between university, industry, and government (Clark, 1998; Henry, 2008; Etzkowitz & Zhou, 2017; Bok, 2003; Audretsch, 2014; Subotzky, 1999; Altbach & Salmi, 2011; Marginson & Considine, 2000; Crow & Dabars, 2015; Pospelova, 2017; Kuzminov, Semenov & Froumin, 2015).

The new university model focused on entrepreneurialism seeks to redesign higher education according to the main demands of the knowledge economy. That is, to develop an entrepreneurial orientation guiding its mission. In implementing this goal, universities must not only change their infrastructure, but also form a new management style that can support the components of the university's competitiveness formula noted in the points above.

Due to ever-changing economic and social conditions, an important point here is to understand that the challenge for education is that teachers need to prepare their students for a future for which much-needed technologies and jobs have not yet even been created (Schleicher, 2011). A crucial ingredient for the development of the entrepreneurial university is therefore that it serves as a bridge between the knowledge sector and the economy; it must be market-oriented to not only what the employment sector requires today, but to what it will value *in the future*. The modern university must therefore provide opportunities for graduates “to gain skills and knowledge that make them adaptable in the labor market” (Douglass, 2016, p. 67). A newly developed university platform must offer a teaching process and a set of research tools that can be used by various disciplines to acquire new knowledge and share adaptable skills and competencies, that is able to adapt to the new knowledge society's demands for education.

The new paradigm of society that ensures the integrity of the innovation development process is most fully described in the model that has been presented by H. Etzkowitz's 'triple helix' concept. The concept of the 'triple helix' refers to the mutually beneficial partnering of university, government, and business, and argues that industrial society was based on government–industry relations, and knowledge society is based on university–industry–government interactions. The university of the future, in this view, is an entrepreneurial institution with a third mission, beyond teaching and research, aimed also at transferring technology and being a proactive contributor to regional innovation (Etzkowitz, et al., 2000). According to David B. Audretsch, "the emergence of the entrepreneurial university was the need to create new interdisciplinary fields and research areas devoted to providing solutions to specific societal problems and challenges, along with a series of mechanisms and institutions dedicated to facilitating the spillover of knowledge from the university to firms and non-profit organizations" (2014, p. 320). Moreover, as Clark (2004) notes, entrepreneurial universities play a vital role in promoting and fostering economic growth and the "state-led pathway is clearly not one appropriate for change in complex universities in the fast-moving environments of the 21st century (p.182)".

University-industry-state interaction, in other words the 'triple helix' model, seeks to create the basis for the development of high-quality human capital in Azerbaijani universities. Due to the lack of strategic planning so far in this area, however, a tripartite interaction has not yet taken place in most universities in Azerbaijan. In most cases, universities show an interest in obtaining patents, but they have not considered it necessary to commercialize and apply new technologies. As a result, these universities have been unable to formulate 'rules of the game' in the triple formula of the education-research-labor market as advocated by the Etzkowitz` model. The research infrastructure of Azerbaijani universities remains a Soviet holdover, with few exceptions. As a result, Azerbaijani universities continue to face challenges to adapting to the rules of the 'triple helix' model to successfully form their own version of the entrepreneurial university.

RESEARCH METHOD

The main data sources for this paper were interviews with experts, content analysis of existing documents, and surveys conducted in Azerbaijan, a mixed methods approach to ensure the most comprehensive coverage. Interviews were conducted with researchers who had been working in the education sector for many years, which also increased the credibility of the survey data. Interviews with academics and private sector actors were conducted via Skype calls. The research subjects were asked a) about the state of Azerbaijani universities from the perspective of entrepreneurial integration; b) what they perceived to be existing obstacles to developing the entrepreneurial university model; and c) policy advice for addressing these obstacles. The interviewees, who each gave the first author express oral permission to be identified by name, included Prof. Adalat Muradov, Rector of Azerbaijan State University of Economics (UNEC); Assoc Prof. Anar Valiyev, Dean of School of Public and International Affairs ADA University; Hamlet Isakhanli, Professor at Khazar University; and Salahaddin Khalilov, Professor at East-West Center, respectively.

To gain yet further insight into the university–industry interaction in Azerbaijan, we also conducted interviews with Mammad Karim, who is in charge of incubating start-ups through attracting venture capital. He is also founder of Khazar Ventures, an investment network. We also interviewed Bakhtiyar Aslanbayli, vice president of British Petroleum regarding necessary steps to move forward in

developing the entrepreneurial university model in Azerbaijan. Karim is a member of the board of trustees at Baku State University and vice president of Caspian Communications and the advocacy unit of British Petroleum. In selecting diverse interview subjects, the researchers were able to examine the issue of university entrepreneurialism from a wide range and divergent angles.

Next, a survey on the notion of the Entrepreneurial University was conducted among academic staff at four (4) Azerbaijani universities. The survey method allowed the researchers to define the problem from inside the university, to illustrate the overall view of the current concept of the university, and to fully examine the potential for reform to a more entrepreneurial vision. The survey carried out in late 2018 records the responses at four (4) big public universities that account for more than 37% of the total share of students in Azerbaijan (MoE, 2019). The survey sample included 421 teaching staff in total, made up of 130 teaching staff from ATU, 103 teaching staff from BSU, 53 teaching staff from UNEC, and 138 teaching staff from MSU. This method enabled the researchers to identify the main differences between central and regional universities and their development of a new university identity.

The sample of universities in the study were precisely selected for their specialization: Baku State University (BSU) has a high-profile law faculty; the Azerbaijan State University of Economics (UNEC) has a distinguished Economics faculty; and the Azerbaijan Technical University (ATU) has a notable Engineering faculty. In addition to having distinguished professors and alumni, these Azerbaijani HEIs are also the most integrated with the Western education system through their scientific and academic programs and the grants supporting them. UNEC, for example, can already be seen as a leading university in how it exemplifies a viable model of the university-industry partnership concept. BSU, also mentioned above, is already where extensive scientific studies and projects have been undertaken and is considered well on its way to becoming a significantly ranked research university. Finally, for the purposes of this study, Mingachevir State University (MSU) was selected as a moderate regional Higher Education Institution (HEI) to exemplify the countrywide results.

We employed quantitative analysis to assess the level of research, acknowledgment of the University 3.0 concept, and management style in Azerbaijani universities. In order to characterize the management style, we tracked the internationalization of the faculties across the country's top higher education institutes in view of the age structure of its university staff. These staff-age densities were determined by the following categories: below age fifty, age fifty to seventy, and over seventy years old. The age structure data repeats cross-sectional data across Azerbaijani universities and compares the change in the age structure of the facilities between 2015 and 2017. Due to the absence of some data points, however, we could not include further time periods that would have given us a better grasp of the evolution of the age structure in Azerbaijani universities.

Additionally, we also conducted quantitative analysis on the state of research at Azerbaijani HEIs by looking at the rankings of Azerbaijani HEIs and the R&D spending as a share of the country's gross domestic product. As such, we compared Azerbaijan's GDP share of R&D with other post-soviet countries and OECD members. We then elaborated on this regional and international level comparison for the state of research in Azerbaijan by looking at the national and international patent applications and corresponding H-index rankings. Finally, we incorporated the qualitative survey responses addressing the importance of the entrepreneurial university concepts into our overall analysis.

RESULTS

Evolution of Azerbaijani Higher Education Institutions since the Collapse of Soviet Union

After the collapse of the Soviet Union, Azerbaijan inherited a Soviet educational system that had long faced problems and embarked on reforms aimed at improving the education sector and significantly enhancing its quality. “Higher education (at that period) reflected the ideological and industrial aims of the Soviet regime and functioned to meet its socio-economic needs” (Ahn, 2016, p.8). Azerbaijan had been left not only with teaching materials, textbooks, and pedagogy from former times, but also with thousands of instructors, faculty, and researchers trained under the former system. Moreover, the absence of strategy to work for the market economy led to a situation wherein HEIs produced graduates unequipped to meet the new demands of their country’s quickly changing economic system and labor markets.

Since the mid-1990s, adapting the system of education in Azerbaijani to the needs of the modern marketplace has been one of competing necessities and deficiencies. Following a strategy to modernize its HEI system, in the mid-2000s Azerbaijan joined the European Bologna process (Crosier & Parveva, 2013). As a participant in Bologna, Azerbaijan contributed to the modernization of its university education system, however to an admittedly very limited extent. Although a two-tier system in higher education had been introduced in Azerbaijan in 1993, only after signing the Bologna Declaration did it start to implement the European Credit Transfer and Accumulation System (ECTS).

Despite the positive aspects and impact of that move, joining the process also created a myriad of challenges, particularly for the higher education sector. By the middle of the next decade, the national report on Azerbaijan’s progress in integration to the European Higher Education Area (EHEA) revealed that although the country had taken a significant leap forward in the higher education sphere, numerous gaps in the implementation of Bologna reforms also became apparent (BFUG, Azerbaijan Report, 2012-2015).

Azerbaijani universities have not rapidly overcome many of the challenges left in the wake of the collapse of the Soviet education system. Kuzminov, Semenov and Froumin (2015) argue that the formal structure of Soviet universities has stayed virtually unchanged since Soviet times. The industry affiliation of universities has remained at a formal level, reflecting the reality today that acute change is still needed to transform and replace the legacy of the Soviet mindset in Azerbaijani HEIs with a wholly new strategic view. To put a finer point on it, the emerging Entrepreneurial University trend has not yet been realized. As Farsi, Imanipour and Salamzadeh (2012) state, “the existing universities are more staying at the second generation and are just in the transit era” (p.197). Most Azerbaijani universities continue to implement traditional higher education practices and procedures rather than adapting broader socio-economic development and transitions the rest of the country is experiencing. While the Academy has the potential to change, to do so requires it to grasp the moment and seize the opportunity.

As noted in the Education Development Strategy (EDS) of the Republic of Azerbaijan (EDS, 2013), universities in Azerbaijan were established on a traditional (classical) basis, which does not provide opportunities for new fields that have developed in the 21st century. Azerbaijani universities therefore must embrace the concept of entrepreneurialism if they are to meet the modern demands of the economy head on. If they hope to sustain skilled human capital development in the whirlwind of the Fourth Industrial Revolution, they have no time so spare. However, doing so in many cases is exceedingly

challenging, but not impossible. Ultimately, successful university reforms require new frameworks that can contribute to and promote technological and socio-economic developments of any nation.

Existing Challenges of Azerbaijani Universities in the Transition to the Entrepreneurial Model Research at Universities

So far, development in the HE system in Azerbaijan has focused on improving the teaching skills and competencies of educational staff rather than on transforming the broader institutions themselves into research universities. However, large-scale transformation is crucial for the development not just of universities themselves and their integration with the third mission of the higher education sector but is also critically important for the overall development of Azerbaijan itself. Transitioning traditional, teaching-based universities into research-based ones remains a significant challenge for the higher education sector in Azerbaijan.

One way to measure the innovation-creating capacity of a university is to look at its ability to secure patents, an indicator that can be used to assess whether HEIs and their countries are successful at transforming public research into broader societal innovation. According to research by Clarivate Analytics (CA), 364 scientific results were patented between 1999 and 2017 as indicator for the commercialization of scientific results in Azerbaijan. Table 1 below shows that in patent applications, Azerbaijan had significantly lower results than its regional peer Belarus and to a lesser extent Georgia.

Table 1: Patent Applications by Selected Countries (WIPO, World Intellectual Property Indicators of 2017 and 2019, <https://www.wipo.int/publications/>)

Country/Year	National application		PCT international applications by origin	
	2016	2018	2016	2018
<i>Azerbaijan</i>	63	71	4	15
Belarus	21	47	14	23
Georgia	71	60	13	6
Bulgaria	41	98	58	60
Austria	315	207	1422	1475

In 2016, Azerbaijan had 163 national patent applications, compared to 513 patent applications by Belarus and 274 applications by Georgia. Although Azerbaijani patent applications for 2018 increased to 171, they were still below the indicators noted in the other two countries. The National Aviation Academy (5 patents) and Baku State University (4 patents) had the highest IP registrations in 2017 in Azerbaijan (CA, 2018).

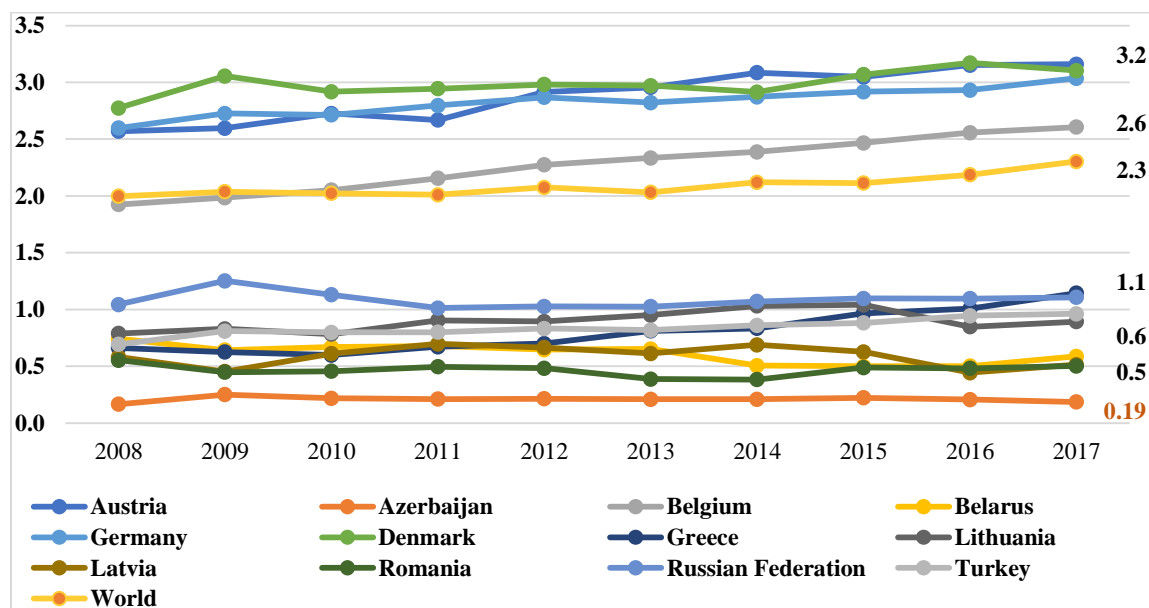
Table 2: Quality of Research is Relatively Low Compared to Other Countries – H Index Ranking (Scimago Journal & Country Rank, 2018, <https://www.scimagojr.com/countryrank>)

Rank	Country	Citable documents	Citations	Self-citations	Citations per document	H index
1	United States	570104	528530	268883	0.77	2222
2	China	569227	399135	273126	0.67	794
3	United Kingdom	172148	187806	60392	0.89	1373
4	Germany	158437	154187	54430	0.85	1203
11	Russian Federation	95359	34723	17562	0.35	540
53	Slovakia	7757	4561	1128	0.55	263
59	Slovenia	5729	5616	922	0.9	278
65	Kazakhstan	3606	1917	399	0.5	95
66	Lithuania	3523	3413	596	0.9	203
71	Estonia	2975	3980	663	1.18	255
79	Georgia	1837	3098	359	1.47	172
92	<i>Azerbaijan*</i>	<i>1235</i> <i>1053</i>	<i>1569</i> <i>478</i>	<i>211</i> <i>148</i>	<i>1.21</i> <i>0.44</i>	<i>103</i> <i>87</i>
108	Uzbekistan	581	233	43	0.38	86
115	Mongolia	462	277	37	0.56	91
117	Moldova	419	249	39	0.51	106
132	Kyrgyzstan	278	719	37	2.29	67
207	Turkmenistan	9	4	0	0.36	26

Further, publication of articles in impact factor journals can also be used as a metric of the success of research universities and an initial step for Azerbaijani universities to adapt the entrepreneurial university model. Azerbaijani universities have managed to get a significant number of publications into journals with impact factor metrics. In 2018, for example, Azerbaijan was first among the South Caucasus countries in terms of the quantity of publications. Nevertheless, the quality of research remains low compared to other countries. According to the H-index (Table 2), Azerbaijan ranks 92nd (albeit up from 113th in 2017) based on the quality (impact) of its worldwide research productivity. However, it still lags behind its regional peers of similar or smaller size, such as Slovakia (53rd), Slovenia (59th), Estonia (71st), and Georgia (79th) (WB, 2018).

Another metric for observing innovative development by universities is by measuring funds that have been allocated for scientific research. Government funding for universities should be directed toward enhancing the entrepreneurial university. However, in Azerbaijan, the majority of governmental funds, about 70 percent, are spent on salaries since available funds are limited. As a result, conducting new generation research is hampered by old tools, lack of funding, an unfavorable environment for entrepreneurial activities, and a lack of new research thinking. These are some of the main reasons why research conducted in Azerbaijani universities is not competitive, as noted in the World Bank Report (World Bank, 2018).

Figure 1: Gross Expenditures in Azerbaijan on R&D as a Percentage of GDP in Comparison with Select Countries from 2008-2017 (Source: WB, World Development Indicators)



Note. Azerbaijan spends less as a share of GDP on R&D compared to countries of a similar size.

As indicated in Figure 1, analysis of the levels of spending on research and development (R&D) by the institutions of higher education in Azerbaijan and OECD countries demonstrates the relative weaknesses of Azerbaijani universities' position in the R&D sector. In 2017, the percentage of Research and Development spending totaled 0.19 percent of GDP in Azerbaijan. This is exceptionally low compared to the allocation of funds toward research and development in OECD countries. Azerbaijan even falls significantly behind another post-Soviet country Belarus, which allocated 0.6 percent of its GDP toward R&D.

However, there are signs of progress. UNEC, one of the leading Azerbaijani universities in economics, in 2015 established a wage system linked to the scientific performance of its faculty, giving productive professors monthly payments several times more than their base salary. As a result, 89.7% of published articles by UNEC faculty during 1991-2020 and 80.1% of published articles by UNEC faculty during 1975-2020 correspond to 2015-2020 (WoS, 2020). These figures indicate that when the right kinds of incentive are offered, Azerbaijani HEIs has the potential to increase its research output and thereby strengthen the potential for a tangible transition to an entrepreneurial university model. However, HEIs in Azerbaijan need to create and embrace this vision for a transition to the entrepreneurial model; once it does it can reap the fruits of the promise this new model holds.

Nonetheless, Azerbaijani universities have not yet adequately understood their new mission, in which the development of knowledge should be a driving force for economic advancement. The potential for innovation in higher education in Azerbaijan is constrained by its traditional theoretical, less applied research tendencies, which severely limit the prospects for commercialization and more energetic collaboration between its universities and industries to capitalize on greater opportunities for innovation (A. Valiyev, personal communication, November 20, 2019). According to 2020 university research

rankings, Azerbaijan ranks 82nd of 131 countries in the Global Innovation Index of 2020 (WIPO, 2020). One metric in the report, knowledge, and technology output, has Azerbaijan ranking 118 among 120 economies, clearly highlighting one of the country's primary weaknesses. The low level of collaboration between universities and industry in innovation opportunities shows that the most important link for the entrepreneurial university model, to say the least, is out of place.

None of the HEIs from Azerbaijan were included in The Times Higher Education (THE) World University Rankings in 2020, which measures HEIs' performance through teaching, research, knowledge transfer and international outlook (THE, 2020). In the QS World University Rankings in 2020, Baku State University and Azerbaijan State Economic University (UNEC) were the only Azerbaijani HEIs to be listed among the 1001+ institutions ranked (QS, 2020).

Management Style. Rankings, however one views them, undoubtedly play a crucial role in attracting research investment and a highly skilled academic labor force into the university sector of any country. A university's ranking is important for attracting private funding. Broadly speaking and with some notable exceptions, primarily universities that have substantial resources and a faculty with global experience and impressive publications are listed. One of the key indicators among well ranked universities is the percentage of foreign teachers and students; instructors who have worked abroad are also considered important for providing quality education (ARWU, 2020; QS, 2020; THE, 2020). In contrast, a university with a substantial number of holdover faculty from the Soviet system and considered "too old to teach," research, or analyze modern Western science can mark an HEI as a non-developed university.

Table 3: The Number of Students and Teachers from Different Universities Who Participated in the Exchange Programs

	BSU	ASPU	GSU	ADAU	ASOIU	ATU	BEU	AUAC
Number of teachers invited within the last several years to foreign countries	130	17	4	40	16	18	3	5
Number of teachers invited from abroad to work	41	4	3	7	14	3	0	1
Number of teachers taking part in the exchange programs	18	3	15	58	8	2	13	5
Number of students taking part in the exchange programs	19	4	33	90	21	24	18	23
Number of foreign students	444	224	41	161	323	190	126	554

Table 3 indicates the ratio of teachers and students by different universities who participated in exchange programs abroad. These figures illustrate the home countries of the teachers who are invited from abroad, as well as the foreign students enrolled in Azerbaijani universities. It is evident that the number of invited academic staff in Azerbaijan is very low, even 0 at some universities. Important to note is that since the BSU has a large student enrollment, a higher number of invited teachers from abroad does not necessarily indicate it is in a relatively better situation. The number of students in exchange programs is also at a very low level, which highlights the low level of international cooperation among Azerbaijani HEIs.

Another critical issue with Azerbaijan’s HEIs is the lack of young forward-thinking personnel, and therefore the lack of a competitive environment. Most of the university administrators surveyed about the innovation ecosystem at their universities indicated difficulties introducing major changes within their universities because senior faculty reacted negatively to proposed changes. This is likely due to aging personnel and faculty, and few international exchange programs with Azerbaijani universities.

Lisyutkin and Froumin (2015) argue, “many faculty members perceive structural development and increasing internal competition as a threat to their job security. Indirect quantitative indicators of this factor are the average age of professors, the average length of tenure, and the proportion of graduates studying under professors younger than 45 years”(p. 455). This is the same situation at most Azerbaijani universities, where the problems of poor instructional quality and insufficient numbers of instructors are compounded by the unwillingness of universities to offer a competitive environment to their staff. A summary of the age structure of Azerbaijani universities appears in Table 4, below.

Table 4: Summary of the Age Structure of Pedagogic Staff at Azerbaijani Universities

Age structure of the scientific pedagogic staff of HEI	BSU		ASPU		GSU		ADAU		ASOIU		ATU		BEU		AUAC	
	2015	2017	2015	2017	2015	2017	2015	2017	2015	2017	2015	2017	2015	2017	2015	2017
Below 50 years	-	35%	33%	36%	56%	54%	42%	43%	20%	27%	23%	25%	-	83%	32%	35%
Between 50 and 70 years	-	51%	49%	49%	25%	35%	43%	46%	57%	53%	54%	55%	-	15%	47%	48%
Over 70 years	-	14%	18%	15%	19%	11%	15%	11%	23%	20%	23%	20%	-	2%	21%	17%
Total number of teachers	-	1080	702	720	555	548	934	839	600	583	667	610	-	246	543	511

As Table 4 indicates, the importance of youth in the age structure of scientific and pedagogical staff of Azerbaijani universities had been growing since 2015. At both the Azerbaijan State Pedagogical University (ASPU) and the Azerbaijan State Oil and Industry University (ASOIU), the two largest universities in the country, this difference is more tangible. Even in Ganja State University (GSU), which is considered a provincial university, this difference has gradually changed in favor of youth. Nonetheless, the ratio of faculty under 50 is still significantly low, around 30% at most universities. Since

the majority of staff over age 50 are alumni of the Soviet system, it will be additionally challenging to transition their institutions to the entrepreneurial university model.

Technology Transfer Offices (TTOs) and Start-up Activities

Within the entrepreneurship ecosystem, Technology Transfer Offices (TTOs) are responsible for the commercialization of research output. TTO's are a substantial phenomenon for the promotion of the state-university-industry partnership exemplified in the "triple helix" model. The World Bank (WB, 2018) explains, "TTOs are not only responsible for the legal procedures related to patenting and licensing, but they also help to define the host institution's commercialization strategy"(p.21). Through strong leadership, outreach, and encouragement to apply for commercialization grants, TTOs at regional and also more renowned schools involve faculty and support their universities to move toward the entrepreneurial culture.

However, when TTOs are inserted into the traditional academic culture, like the one in Azerbaijani HEIs, they may encounter indifference or even resistance (M. Karim, personal communication, November 24, 2019).

Table 5: Technology Transfer (TT) and Innovation Promotion by State and HEIs in Azerbaijan, WBG, Azerbaijan Human Capital Forum, December 19-21, 2018.

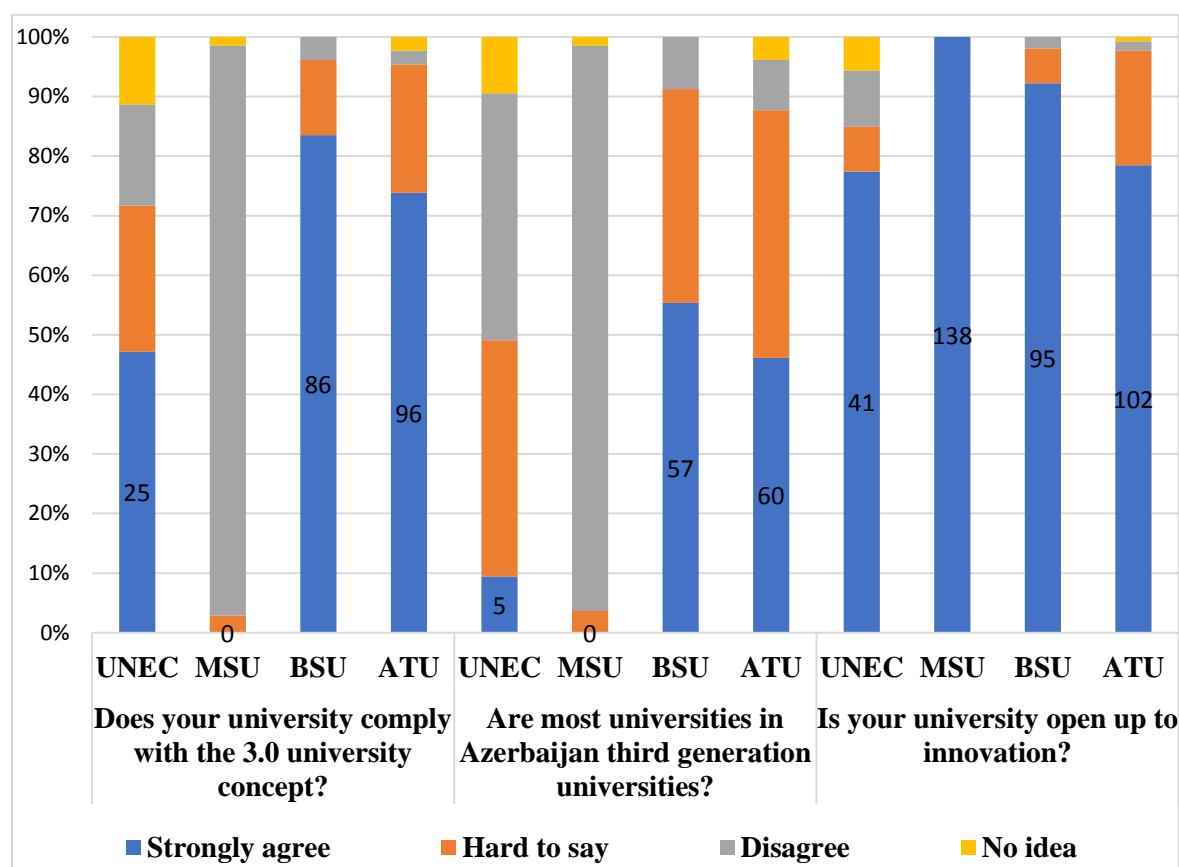
The State	HEIs
Traditional TT facilities are not widely developed	No university has assigned funding or specialists to implement expensive IP registration
Current legal framework does not efficiently support IP rights	TTOs at HEIs play a negligible role in actual commercialization of research
There is no effective linkage between R&D and private sectors	Universities and research institutes with potential to produce valuable IP do not have a practical platform for disclosure and allocation of IP rights or experience to commercialize their innovations

Despite several Azerbaijani universities--such as the Azerbaijan State University of Economics, the University of Architecture and Construction, and the Azerbaijan Technical University--having formed TTOs, they have yet to effectively carry out their mandate to support research commercialization. Since they perform poorly in commercializing inventions, there is no single funding allocated for universities to accomplish expensive international IP registrations (WB, 2018).

The challenges that face the work of TTOs at Azerbaijani universities affect the innovative aspirations of their university ecosystem, which is related to their efforts to engage in start-up activity. In terms of the quantity of start-ups, Azerbaijan ranks 67th among 202 countries. Despite this relatively high ranking, Azerbaijan has both wide scale deficiencies but also great potential opportunities for robust development of start-up activity within its higher education sector. Professor K. Imanov stresses that incubators and accelerators, funding and venture funds, at universities create a supportive environment for

student start-ups (2019, p. 72). In this environment, universities increase their capacity to go beyond their traditional roles and more effectively develop innovative technologies. However, the commercialization of the knowledge produced at Azerbaijani universities is not yet sufficiently fostering their innovation incentives.

Figure 2 University 3.0: Results of the Survey Regarding University-Industry Partnerships of Local Universities

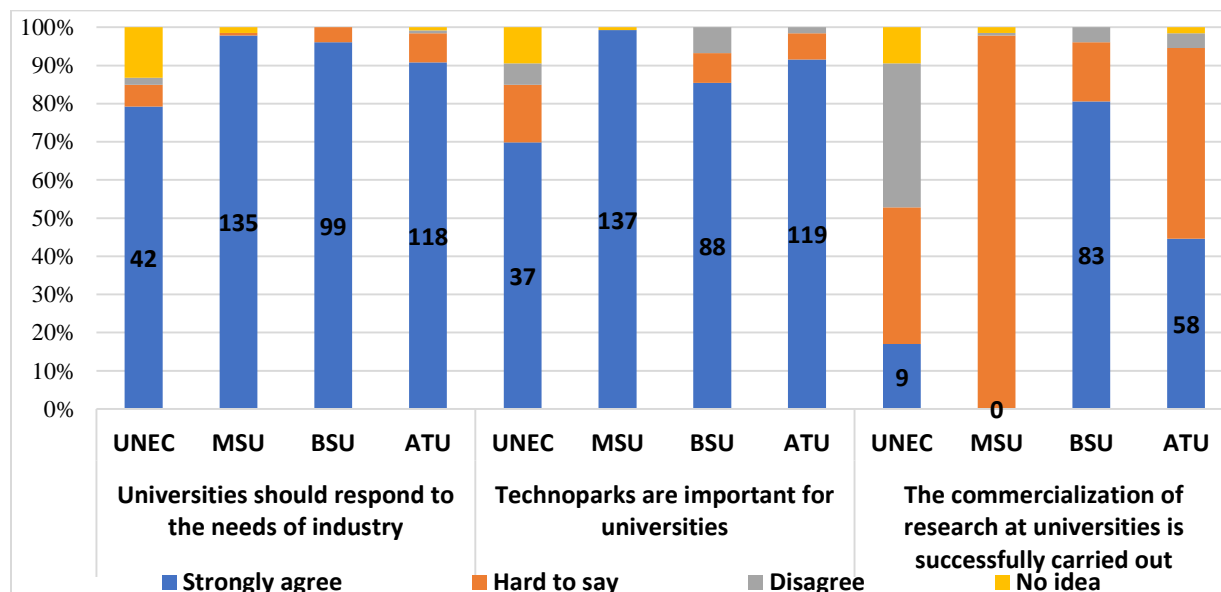


The University 3.0 model adds knowledge commercialization to the education and research missions of HEIs. To further measure the existing challenges involved in transitioning to University 3.0, we conducted a survey of academic personnel to query their transition to the Entrepreneurial University model. The main objective of our survey was to investigate ways that local universities understood the idea of University 3.0 and adapted, or failed to adapt, to this process. Additionally, it aimed to assess the level of University-Industry Partnership and how to upgrade to a University 3.0 concept. “Strongly agree” responses to the question, “Does your university comply with the University 3.0 concept?” by BSU and ATU were very high, whereas teaching staff at UNEC also believed that their university complies with this concept. However, MSU faculty believed that their university does not adhere to the University 3.0 concept.

Responses were similar to the question, “Most universities in Azerbaijan are third generation universities?” Whereas BSU and ATU agreed, MSU fully believed that they had not switched to being a

3rd generation university. As a response to the third question, all four universities believed they were open to innovation.

Figure 2: Results of the Survey Regarding University-Industry Partnerships of Local Universities



Note. Numbers indicate the ‘strongly agree’ responses. Source: Author 1.

The results of the survey reveal that these universities are aware of the importance of technoparks and industries for universities and for the knowledge economy. BSU and ATU were able to commercialize most of their research. MSU, as a proxy for regional HEIs, could not commercialize at all, however. It is obvious that MSU could be taken as a proxy for regional HEIs, which do not have capacity to be third generation universities and have little understanding of the University 3.0 concept. Despite this, both MSU and other regional universities are open to innovation. In summary, although academic personnel were somewhat aware of the importance of innovation and the entrepreneurial university model, a significant share of the academic personnel do not yet believe that HEIs in Azerbaijan comply with the concept of University 3.0.

What needs to be done?

In the higher education literature, it is broadly accepted that universities generally have teaching (1st) and research (2nd) missions, and over time may also develop social, enterprise, and innovative (3rd) missions (Zomer & Benneworth, 2011). In light of this developmental process, adapting an entrepreneurial mission is vital for Azerbaijani universities. As Imanov (2019) has argued, entrepreneurial universities must play leading roles in the modernization of their societies and in their successful transformation to knowledge economies. Creating a suitable environment for an entrepreneurial system to thrive requires adopting certain, carefully considered global trends. Taking the suggestions of the above-mentioned academics in the Azerbaijani Higher Education system into account, we grouped these trends into themes summarized in Table 6.

Table 6: Global Trends in Higher Education and Rebuilding Azerbaijani Universities (Valehov, J., 2017)

Themes	Trends
<p>The globalization of HE</p> <p>Establishment of non-traditional educational institutions</p> <p>Diversification of financial sources and strengthening of competition</p> <p>Increased focus on interdisciplinary subjects</p> <p>Increased links between universities and foreign partners</p>	<ul style="list-style-type: none"> • Teacher and student mobility are increasing. • Universities are opening campuses abroad. • Highly qualified personnel are being recruited, domestically and internationally. • The role of the English language in the learning process is increasing. • Corporate universities, specialized research centres, and online universities are being created. • The share of the state in financing and profitability is declining. • Aggressive fundraising campaigns are making competition for financial support more difficult. • Departments are redesigning and intensifying their interdisciplinary activities. • The role of cooperation with the economic sectors and the business community is increasing. • There needs to be an increase in ‘digital’ students and a modification toward online education. • The transition from the traditional higher education pyramid (bachelor - master - PhD) into a system that offers different diffused academic degrees must be smoother. • Investment and the demand for specialization and additional education needs to increase. • There need to be changes in student acceptance criteria and greater inclusiveness. • The salaries of teachers, professors, administrators, and partners must be based on an evaluation of their work. • There need to be more differentiated categories of teaching staff (research, teaching, practice, and general skills). • There needs to be greater involvement of professional managers to support institutional strategy, planning and other key processes.
<p>The ‘academic direction’ and the changing concept of being a student</p>	
<p>The professionalism of HE Leadership</p>	

Another important factor in the entrepreneurial development of the Azerbaijani university sector is related to the role that intellectual property (IP) plays. This role has changed to some degree in today’s modern Society of Knowledge. It must also be stressed that within universities, innovative centres, such as business incubators, and scientific-technological and innovative clusters need to be created (B. Aslanbayli, personal communication, December 12, 2019). Such structures both boost innovation and serve as primary vehicles for changes in environments undergoing transformation.

Finally, transformation also requires students to develop skills for the emerging green economy, not only to augment the old business model but also because their innovation and creativity can develop sustainable enterprises (Wagner, 2012, p.3). However, for that to happen, the abilities and skills of educators require switching from a ‘brown economy’ to a ‘green economy’ (Bapna & Talberth, 2011).

Considering the contextual elements of Azerbaijani HEIs, recommended actions in support of adapting to this modern, changing environment are listed in the table below. Considering the varying nature of the proposed policies, we categorized recommended actions according to the expected main actor in the implementation of the policy.

Table 7: Distribution of Recommended Actions by Implementing Policy Actors

<p>Government</p> <p>Wide implementation of STEAM models as early as middle school.</p> <p>Improving teaching skills and competencies of educational staff.</p>	<p>Private Sector Actors & University Collaboration</p> <p>Promoting science and technology parks under the lead of large universities with ready-to-use infrastructure and facilities, through a substantive amount of support and incentives for investors (e.g., free-of-charge staff insurance, tax exemption).</p> <p>Spending on R&D to develop a modern infrastructure, especially in universities so they can create an entrepreneurial landscape, TTOs, start-ups, incubation centres, techno parks and other hubs of innovation.</p>
<p>Government & University Collaboration</p> <p>Improving the efficiency of clusters to create an efficient and progressive entrepreneurship function of Azerbaijani universities and redesigning the curriculum.</p> <p>Connecting with international research networks and encouraging and incentivizing research partnerships.</p>	<p>Private Sector Actors & Government & University Collaboration</p> <p>Transferring technology to the labor market through licensing new discoveries of the university by a company that will generate a return from it.</p> <p>Encouraging higher education institutions to engage in distance education programs (especially in social sciences, such as business and education) for privately funded or company-sponsored students and workers who cannot attend scheduled classes.</p>

As we indicated above, the funding of the R&D projects and the sustainable research environment is carried out by the private sector in modern economies. Since some policy implementations requires governmental legislation (such as distance education for company workers and students), we created separate categories of Private Sector Actors & University Collaboration and Private Sector Actors & Government & University Collaboration. Further, some of the policy actions advised herein are under the responsibility of the government with regard to the preparation of university academic staff and preparation of students for modern university curricula. Considering the higher education environment in Azerbaijan, actions like redesigning the curriculum and incentivizing research activity needs government stimulus and legislation to support it. However, it is also worth mentioning that as these integration

efforts and innovations grow in Azerbaijani HEIs, their sustainability will need to be maintained through the involvement of private sector actors and the significant incentives they must also provide.

Limitations

A key limitation of this paper is that while we collected survey data to illustrate the level of university–industry partnerships, these surveys provided the opinions of HEI staff members only, rather than possibly more objective voices in other sectors to look at the context of entrepreneurial education from a different view. For example, such data would include Return on Investment (ROI) analysis for the funds allocated to research and allow for the development of a generalizable metric to compare the level of integration to the entrepreneurial university model among Azerbaijani HEIs. Constructing and collecting such data would also have enabled us to conduct comparative analysis with the HEIs of other emerging economies.

While our study sheds light on the state of the Azerbaijani higher education system and discusses some of the necessary steps to integrate modern entrepreneurial higher education institutes, and the interaction with the labor market is stressed as a vital variable in the integration process, our study only covers one side of this interaction by focusing on higher education institutes. Focusing on the opportunities in the labor market that can be captured by universities and conducting a sectoral analysis to differentiate the nature of university–industry interaction would have complemented our analysis further.

Finally, our study does not capture the regional heterogeneity in the academic and industry integration level of Azerbaijani universities. Although some of the surveys contain the data of the regional universities not situated in the capital, further analysis is missing. Considering the significant socioeconomic differences at play we could expect to find different labor market conditions and educational capacity in more regional settings. Varying initial conditions ideally require consideration of socioeconomic and educational differences in policies describing what steps are involved in adaptation to the entrepreneurial university concept.

IMPLICATIONS AND CONCLUSION

Innovative higher education is one of the key factors that stimulate economic growth in any country. Especially during the period of the Fourth Industrial Revolution, doing so depends on how universities have been redesigned. According to numerous prominent researchers the third mission of universities is to create an organizational development process that can transform traditional universities into more self-sufficient, progressive, and responsive institutions that can adjust and adapt to changing environmental demands (Clark, 1998; Etzkowitz & Zhou, 2017; Marginson & Considine, 2000; Beecher, Streitwieser & Zhou, 2019). Through adjusted professional norms, acceptance of new responsibilities and accountability, and enhanced collegial and administrative participation in decision-making, entrepreneurial responses to rapidly changing and extremely demanding environmental conditions are possible. In the end, the entrepreneurial university concept will not only bring about alternative revenue for an institution, but it will also build a stronger, rejuvenated, and ultimately more autonomous identity than has been the case in the past, while at the same time giving it a more trusted place in society.

In this research we outlined the importance of the adoption of the entrepreneurial university model by Azerbaijani HEIs. We identified the existing challenges among Azerbaijani universities and what we see as the necessary steps to undertake in order to overcome these challenges in terms of

transitioning to the entrepreneurial university model. The formation of innovation clusters at Azerbaijani universities should go far in improving their patent activity and the quality of their scientific publication output. The nature of the existing challenges in Azerbaijan's higher education system hinders both the adaptation of universities to rapidly changing labor market demands and the formation of a knowledge society. Implementation of the entrepreneurial university model holds out great promise to catalyze the redevelopment of higher education in Azerbaijan.

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