Higher Education Policy in Central Asia and Afghanistan

Emma Sabzalieva

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Abstract:

The purpose of this report is two-fold. Its first aim is to take stock of contemporary higher education in Central Asia, with a particular emphasis on Kyrgyzstan and Tajikistan, and Afghanistan. The second is to offer policy propositions that may support these states to make their higher education systems more innovative, with innovation also incorporating science and technology. The report is structured in two sections.

The first outlines some cross-cutting trends and issues in higher education in Central Asia and Afghanistan. Some of the major challenges and opportunities facing these higher education systems and the societies they are based in are highlighted. It approaches the notion of challenges and opportunities from the perspective of the national governments' priorities as identified in publicly available documents.

The second moves from a review of the current situation towards future planning. The report lay outs factors that can introduce innovation into higher education systems and provides examples from other relevant settings of practice in these areas. Finally, the report offers a series of policy proposals for the three states that are aimed at promoting science and technology capacity, which in turn can lay the basis for pathways to innovation in Afghanistan, Kyrgyzstan and Tajikistan.

The policy recommendations made in the report are grouped into a policy plan covering five areas: regulation, skills, research, scientific culture, and business. The purpose of the policy plan is to support the development of science, technology and innovation in higher education.

Keywords: Higher education, innovation, government policy, Central Asia, Afghanistan, research, teaching, scientific culture.

JEL classification: I280

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Contents

Figures

Tables

List of Acronyms

ADB	Asian Development Bank
HEI	Higher education institution
ISCED	International Standard Classification of Education
OECD	Organization for Economic Co-operation and Development
QA	Quality assurance
STI	Science, technology and innovation
SWOT	Strengths-weaknesses-opportunities-threats

1. Introduction

To set the context for the report, this section provides a brief historical background to higher education in Central Asia and Afghanistan. This is followed by a SWOT (strengths-weaknesses-opportunities-threats) analysis of the current social, political and economic factors that are relevant for higher education.

1.1. Development of higher education

Formal[1] institutions of higher education were first founded in Central Asia in the early Soviet period.[2] The first higher education institutions were pedagogical institutes, dedicated to training the teachers required in the fight against illiteracy that formed the Soviet Union's major education policy initiative of the 1920s and 1930s.[3] Higher education across the Soviet Union accelerated rapidly after the Second World War with the expectation that young people would continue to higher education to qualify in specialisms that would help reconstruct and develop the economy.[4] At the time of the dissolution of the Soviet Union in 1991, Kyrgyzstan had 12 higher education institutions (HEIs) and Tajikistan 13.[5] Gross student enrolment in tertiary education was 25% in Kyrgyzstan and 22.5% in Tajikistan.[6] The influence of the Soviet era is therefore crucial to understanding the starting point for post-1991 developments in higher education in Central Asia. Tajikistan's experience of conflict with a civil war lasting from 1992-1997 also impacted the country's higher education system.

In Afghanistan, the country's first university – Kabul University – began to emerge during the 1930s before being established in 1946.[7] Access to higher education under the then King of Afghanistan Mohammed Nadir Shah and his successors was selective; gender and ethnic discrimination were also features of higher education between the 1930s and 1970s.[8] Higher education was nevertheless considered to be highly developed before the 1978 military coup and outbreak of the Soviet-Afghan War in 1979, which led to the outflow of over 40% of faculty members (through migration, death or imprisonment) between 1978-1986.[9] The later rise of Islamist par-

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1   'Formal' refers both to the French/German model of universities and research institutes that formed the basis of the Russian imperial higher education system and was later inherited by the Soviet government as well as the built environments dedicated to higher learning.

2   A. A. Krasheninnikov and N. N. Nechaev, "Universities as Centres of Culture: An Historical Approach to Higher Education in Central Asia," *Higher Education in Europe* 15, no. 3 (January 1, 1990): 54–60, https://doi.org/10.1080/0379772900150308.

3   Sheila. Fitzpatrick, *Education and Social Mobility in the Soviet Union, 1921-1934* (New York: Cambridge University Press, 1979).

4   Larisa Shpakovskaia, *Politika vysshego obrazovaniya v Evrope i Rossii [The Politics of Higher Education in Europe and Russia]* (St Petersburg: Norma, 2007).

5   National Statistics Committee of the Kyrgyz Republic, "Official Statistics: Education and Culture," National Statistics Committee of the Kyrgyz Republic, accessed June 13, 2018, http://www.stat.kg/ru/statistics/obrazovanie/; Statistics Agency under the President of the Republic of Tajikistan, "Obrazovaniye v respublike Tajikistan: 25 lyet gosudarstvennoi nezavisimosti [Education in the Republic of Tajikistan: 25 years of state independence]," Statistical handbook (Dushanbe: Statistics Agency under the President of the Republic of Tajikistan, 2016).

6   UIS Statistics, "Education: Gross Enrolment Ratio by Level of Education," UIS, September 2018, http://data.uis.unesco.org/index.aspx?queryid=142.

7   Saif R. Samady, "Education and Afghan Society in the Twentieth Century" (Paris: UNESCO, 2001).

8   Yahia Baiza, *Education in Afghanistan: Developments, Influences and Legacies since 1901*, Routledge Studies in Middle Eastern Society (London, Abingdon, Oxon: Routledge, 2013).

9   Daniel Couch, "The Policy Reassembly of Afghanistan's Higher Education System," *Globalisation, Societies and Education 0*, no. 0 (September 28, 2018): 1–17, https://doi.org/10.1080/14767724.2018.1523708.

ties, takeover by the Taliban and subsequent US invasion combined to cause the collapse of the education system by 2001.[10]

1.2. SWOT analysis

This SWOT (strengths-weaknesses-opportunities-threats) analysis lays out some of the key current social, political and economic factors that are relevant for higher education. The purpose of the analysis is to contextualize some of the constraints and opportunities that exist in policymaking. These have been accounted for in the policy ideas section of the report. The factors identified below apply across the country settings unless otherwise noted.

Strengths	Weaknesses
Demand for higher education is (and has long been) strong.	Lack of funding of higher education, particularly compared to other sectors of education.
Legacy of structures and norms of higher education from 20th century have persisted.	Many faculty members lack higher level qualifications; salaries low in public HEIs; academic careers not considered attractive.
All countries recognize the importance of investment in education.	Widespread perception that quality of teaching and learning has diminished.
(Afghanistan) Separate Ministry for Higher Education allows greater focus and attention on higher education issues.	Teaching/learning resources and infrastructure often outdated.
	High centralization of governance and management of publicly funded HEIs.
Opportunities	**Threats**
Society clearly values higher education.	Level of government control over entire education system hinders innovation.
Ongoing processes of globalization open up greater scope for international collaborations for research and capacity building.	Persistent corruption at all levels of education.
International funding agencies now more concerned with higher education and may be more likely to offer support.	So-called societal 're-traditionalization' is anti-women and threatens attempts to strive for gender equity.
All governments have education strategies in place which discuss higher education, demonstrating commitment to improvement.	(Afghanistan/Kyrgyzstan) Quality of provision, especially in the private sector, is variable and reliable quality assurance mechanisms not in place.
	(Afghanistan) Safety and security not guaranteed.

2.   Trends and challenges in higher education

This section outlines important recent trends and challenges in higher education in Central Asia and Afghanistan relating to sectoral growth, female participation, subject distribution, faculty, funding, and external donors. These factors offer a sense of the current structure and future prospects for these higher education systems.

2.1. Sectoral growth

Across Central Asia and the former Soviet space, the post-1991 period has been epitomized by huge growth in the number of students enrolled in higher education and in the number of higher

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[10]   *Baiza, Education in Afghanistan.*

education institutions (HEIs) providing sub-degree and degree level programmes. In addition to the explosion of new HEIs in both public and private sectors, expansion also occurred through institutional upgrading, whereby institutions that previously offered upper secondary education have become HEIs, and academies and institutes that used to be highly specialized changed their profiles to become universities.

The rapid growth in the number of HEIs is shown in figure 1. Growth was particularly pronounced in Central Asia in the 1990s, as shown in the data for Kyrgyzstan (public and private sectors) and Tajikistan (public sector). In Afghanistan, significant quantitative growth has occurred over the last decade, with the number of state-funded HEIs nearly doubling from 19 to 36. However, the public higher education sector is dwarfed by a huge private sector, which, beginning in 2007/08 has grown exponentially to a total of 122 HEIs in 2017/18.[11] It is important to note that these privately-run HEIs tend to specialize in their course offerings and generally have much smaller enrolment numbers than their state-funded counterparts, with an average of just over 1,000 students per private HEI.

There are a range of explanations for this sectoral expansion, including:

- In Central Asia, the ending of Soviet-era imposed caps on institutional growth;
- Legislation passed in former Soviet states in 1992/1993 permitting privately-operated HEIs to open;
- Addressing Soviet-era disparities in stratification, where high status (often urban-based) jobs were reserved for Russian/other European nationalities and where, as a result, titular nationalities were under-represented in some areas in higher education and the labour market;
- Institutional upgrading of what were previously upper secondary institutions (as described above);
- Expansion of public HEIs to parts of the country that did not previously have much higher education coverage, principally through the opening of branch campuses;
- Rational action taken by societal actors to open private HEIs as a source of income in otherwise economically uncertain times;
- High levels of demand from students and their families,[12] enhanced by the new ability to be more mobile between cities in the country after the propiska (registration) system was abolished in the former Soviet republics;
- The 'youth bulge' in Afghanistan and Tajikistan, where the majority of the population (55% in Tajikistan and 65% in Afghanistan in 2015) is under 24;[13]
- Dramatic increases in gross secondary school enrolment in Afghanistan, from 20% in 2005 to 55% in 2017. For female students, gross enrolment increased from 10% to 40% over the same period.[14]

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[11]   Islamic Republic of Afghanistan National Statistics and Information Authority, "Afghanistan Statistical Yearbook 2017-18" (Kabul: Islamic Republic of Afghanistan National Statistics and Information Authority, August 2018).

[12]   World Bank, "Higher Education in Afghanistan: An Emerging Mountainscape" (Washington, D.C: The World Bank, 2013).

[13]   UIS Statistics, "Demographic and Socio-Economic: Population," UIS, September 2018, http://data.uis.unesco.org/index. aspx?queryid=239.

[14]   UIS Statistics, "Education: Gross Enrolment Ratio by Level of Education."

Figure 1. Number of HEIs in Afghanistan, Kyrgyzstan and Tajikistan, 1991-2017[15]
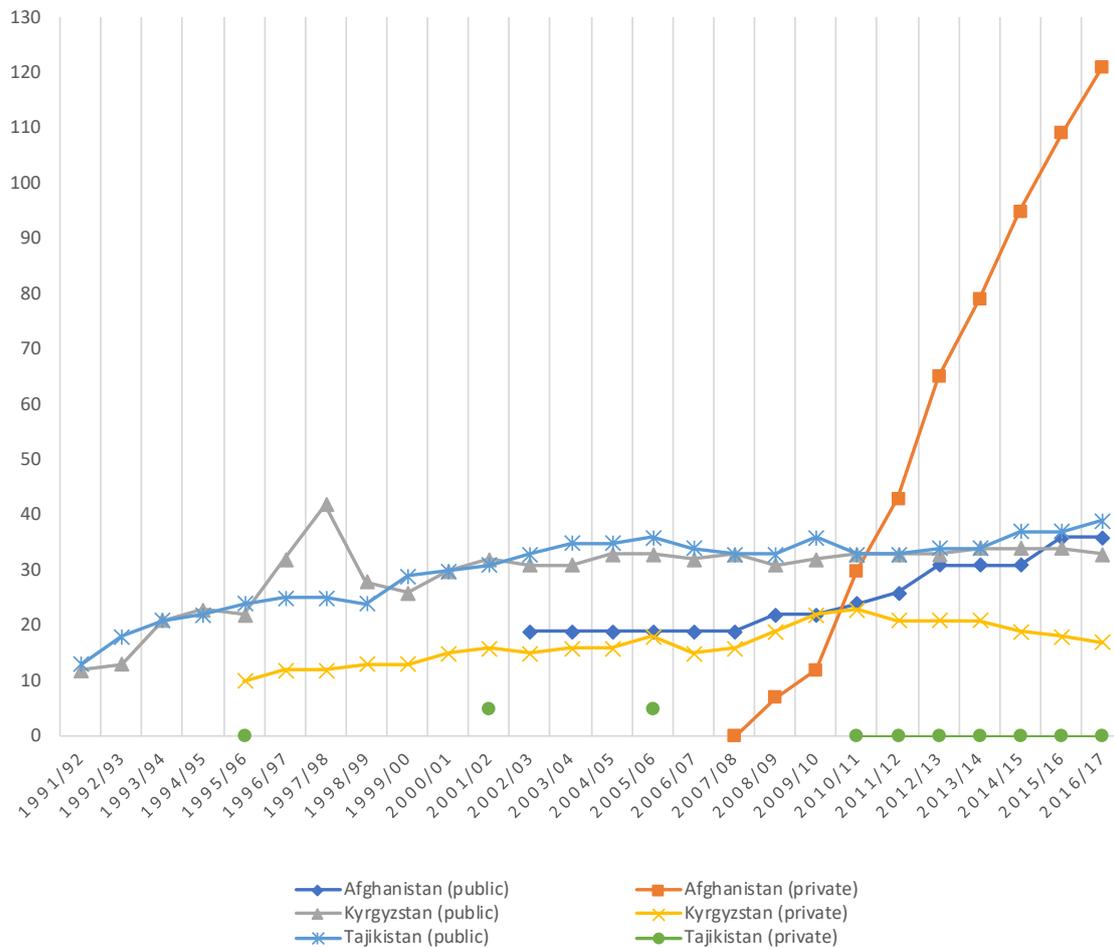
Note: Data for Afghanistan available from 2002 onwards.

As the number of HEIs has expanded, so too has the student population. Gross enrolment rates in tertiary education were around 25% at the end of the Soviet period in both Kyrgyzstan and Tajikistan. As shown in figure 2, gross enrolment in Kyrgyzstan experienced a sharp increase in the late 1990s and is currently at around 45%. In Tajikistan, growth was negatively affected by the 1992-1997 civil war, but in recent years has recovered and is currently at around 30%, exceeding late Soviet figures.

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[15]   Statistics Agency under the President of the Republic of Tajikistan, "Obrazovaniye v respublike Tajikistan: 25 lyet gosudarstvennoi nezavisimosti [Education in the Republic of Tajikistan: 25 years of state independence]," 90–91; Statistics Agency under the President of the Republic of Tajikistan, "Obrazovaniye v respublike Tajikistan [Education in the Republic of Tajikistan]" (Dushanbe: Statistics Agency under the President of the Republic of Tajikistan, 2017), 60; Daria Platonova, "Appendix," in *25 Years of Transformations of Higher Education Systems in Post-Soviet Countries: Reform and Continuity*, ed. Jeroen Huisman, Anna Smolentseva, and Isak D. Froumin, Palgrave Studies in Global Higher Education (Palgrave Macmillan, 2018), 461–82; National Statistics Committee of the Kyrgyz Republic, "Official Statistics: Education and Culture"; Islamic Republic of Afghanistan National Statistics and Information Authority, "Afghanistan Statistical Yearbook 2009-10 (Education Section)", "Afghanistan Statistical Yearbook 2011-12 (Education Section)"; "Afghanistan Statistical Yearbook 2013-14 (Education Section)", "Afghanistan Statistical Yearbook 2017-18".

Figure 2. Gross enrolment rate in tertiary education (%), 1991-2016, Kyrgyzstan and Tajikistan[16]
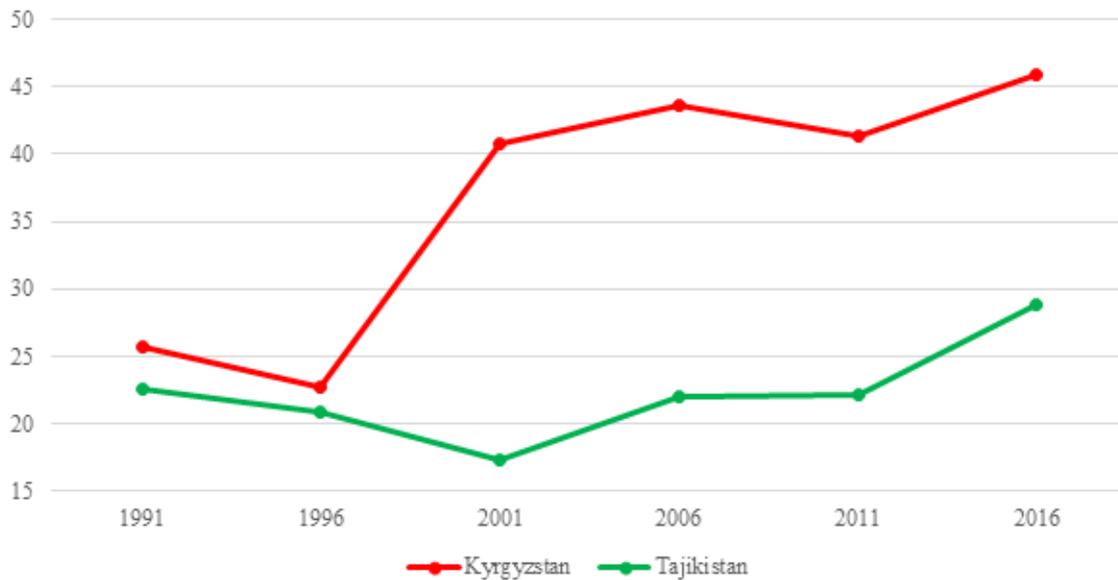
Note: 1996: Tajikistan data are from 1995

In Afghanistan, higher education enrolment rates have rapidly increased in more recent years, doubling between 2011 and 2014, surpassing government targets.[17] In 2017/18, 365,982 students were enrolled in higher education, split almost evenly between private and public HEIs.[18] The number of students studying in publicly-funded HEIs has increased exponentially, by more than three times to 184,729 in 2017/18 compared to the 2009/10 total of 49,311.[19]

Population growth in these countries has been explosive between 1991 and 2017: from 13 to 35.5 million in Afghanistan, 4.4 to 6.2 million in Kyrgyzstan and from 5.4 to 8.9 million in Tajikistan.[20] Population rates are certainly a driver of increased enrolment in higher education, but there are also other factors at play, some of which are mentioned above.

Despite extensive growth in Afghanistan, tertiary gross enrolment remains one of the lowest in the world at 8.5% (see figure 3). Gross enrolment rates in tertiary education in Afghanistan are also significantly lower than for surrounding countries: in Kyrgyzstan and neighbouring China and Kazakhstan, they are very high at between 44% and 51%, whilst India and Tajikistan have enrolment ratios of between 27 and 31%.

16   UIS Statistics, "Education: Gross Enrolment Ratio by Level of Education."

17   UNESCO, "UNESCO Science Report: Towards 2030" (Paris: UNESCO, 2015), 49.

18   Islamic Republic of Afghanistan National Statistics and Information Authority, "Afghanistan Statistical Yearbook 2017-18."

19   Islamic Republic of Afghanistan National Statistics and Information Authority, "Afghanistan Statistical Yearbook 2009-10 (Education Section)."

20   Population data from World Bank sources: https://data.worldbank.org/country/afghanistan; https://data.worldbank.org/country/kyrgyz-republic; https://data.worldbank.org/country/tajikistan.

Figure 3. Gross enrolment ratio in tertiary education (%), 2017, Afghanistan, Kyrgyzstan and Tajikistan plus selected comparator countries (China, India, Kazakhstan) [21]
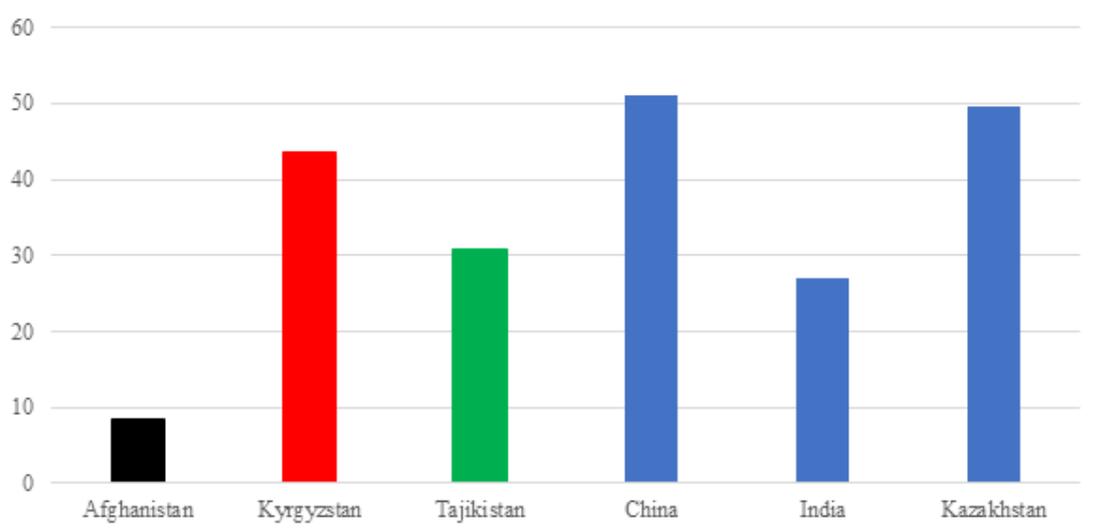
Note: Data for Afghanistan are from 2014; data for India are from 2016

2.2. Female participation

The number of women in higher education across Central Asia and Afghanistan varies significantly. Disparities across the region since 2004 – including China and India for the sake of comparison – are shown in figure 4. Female participation has historically been much more balanced in Kazakhstan and Kyrgyzstan, with more women students in higher education than men since the 1960s.[22]

In contrast, far fewer women than men enter higher education in Afghanistan and Tajikistan, although female participation appears to be increasingly quickly in Tajikistan where the rate is currently just over 40%. Although Afghanistan's Ministry of Higher Education emphasizes the importance of gender equity, women still only make up 20% of the total student body. There are many explanations for lower levels of female participation in higher education in these countries, ranging from basic issues such as a lack of university dormitories for women in Afghanistan to broader societal discrimination against women that undermines attempts by these states to introduce policies that would enhance equal participation.[23] In Afghanistan, perceptions of security and distance of HEIs from home are two further barriers to female participation, particularly as this pertains to women from rural areas.[24]

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[21]　UIS Statistics, "Education: Gross Enrolment Ratio by Level of Education."

[22]　Emma Sabzalieva, "Gender Gaps in Higher Education across Central Asia," *University World News*, July 8, 2016, http://www.universityworldnews.com/article.php?story=20160707140807406.

[23]　See e.g. UNESCO, "UNESCO Science Report," 381–82.

[24]　World Bank, "Higher Education in Afghanistan: An Emerging Mountainscape."

Figure 4. Female enrolment in tertiary education (%), 2004-2017, Afghanistan, Kyrgyzstan and Tajikistan plus selected comparator countries (China, India, Kazakhstan)[25]
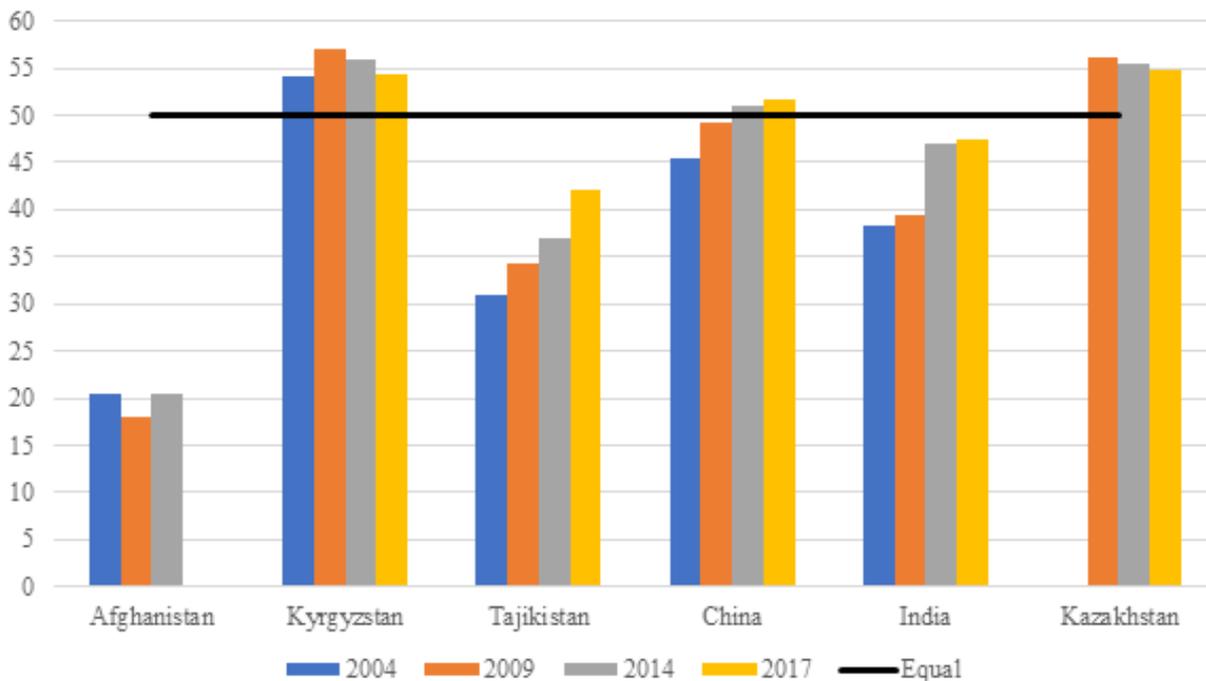
Notes: 2009: No data for Kazakhstan, replaced with 2010 data; 2017: No data for India, replaced with 2016 data

2.3. Subject distribution

As figure 5 shows, students/graduates are not equally distributed between fields of study either within a single country setting or across the countries included in the figure (Afghanistan, Kyrgyzstan, Tajikistan, India and Kazakhstan).

There is a general trend towards non-science subjects, categorized on the left-hand side of the graph at figure 5. Significant numbers of students are enrolled in education, business, and law degrees. In Central Asia and other former Soviet states, the upward trend towards these 'professional' subjects was marked following the collapse of the Soviet Union,[26] resulting from a sense that a) there would be a transition towards a market economy and b) that this would require a different set of skills and knowledge from those that were required under the Soviet command economy.

However, even outside the former Soviet space, similar trends can be observed in Afghanistan. As shown in figure 5, a similar number of students in Afghanistan, Kazakhstan and Tajikistan follow degrees in education, for example – between 20 and 25% of all students. The higher number of graduates in Arts and Humanities courses in Afghanistan can be ascribed in part due to a large number of students studying Theology within the regulated public higher education sector.

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[25]   UIS Statistics, "Education: Percentage of Female Enrolment by Level of Education: Tertiary Education," UIS, September 2018, http://data.uis.unesco.org/index.aspx?queryid=139.

[26]   On Kyrgyzstan see e.g. Alan J. DeYoung, "Conceptualizing Paradoxes of Post-Socialist Education in Kyrgyzstan," *Nationalities Papers* 36, no. 4 (September 1, 2008): 641–57, https://doi.org/10.1080/00905990802230571.

Figure 5. Distribution of tertiary enrolment by aggregated field of study, 2017 (%), Afghanistan, Kyrgyzstan and Tajikistan plus selected comparator countries (India and Kazakhstan)[27]
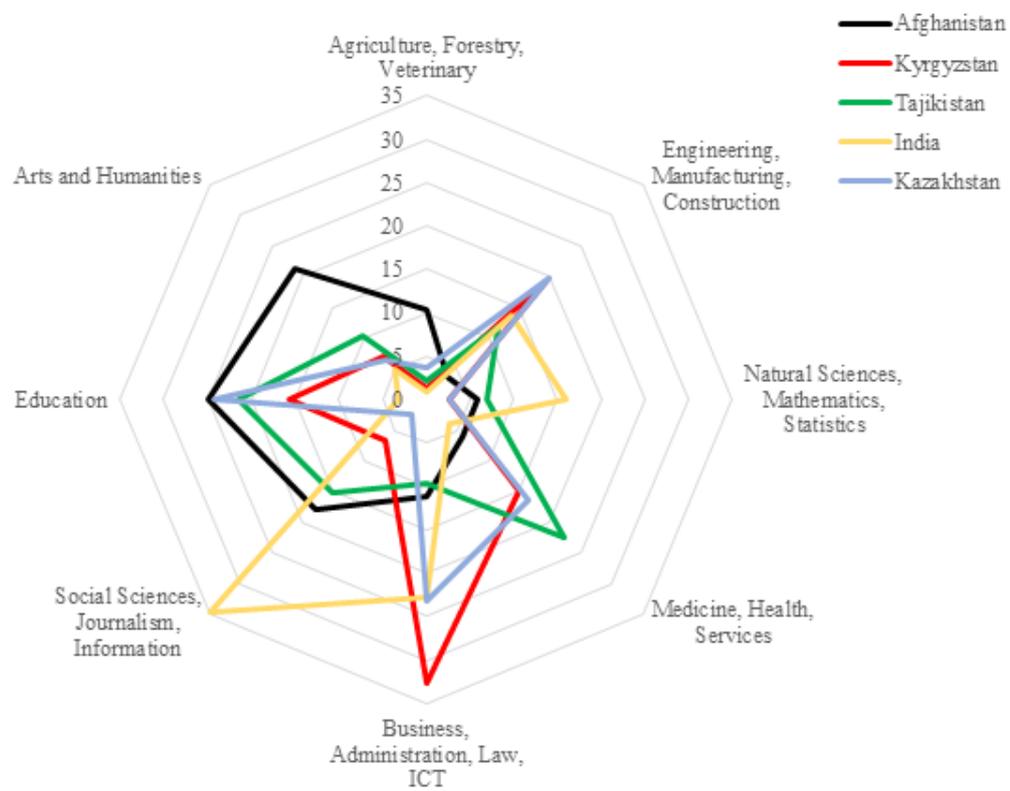
Notes: Data for Afghanistan are for graduates from public HEIs. Data for India are from 2016.

Even after the initial response to the fall of the previous regime in the former Soviet states, the trend towards the social sciences has continued, as shown by a detailed breakdown of the data from Kyrgyzstan in figure 6. Universities in the country have reported a decline in math skills taught at school level that may partially explain why students avoid science and technical subjects in higher education.[28] Students are not anticipating market requirements in their choice of degrees: in Kyrgyzstan in 2017, 6,542 students graduated with bachelor's degrees in law and just 517 received qualifications in mining.[29] The latter sector has enormous growth potential in the country[30] whereas the law market has long been saturated. Exploring students' rationales for continuing to choose subjects that are now no longer in demand will be a useful line of future enquiry.

No country would purport to have the perfect mix of student enrolments. Yet, the net effect of the persistent trend towards studying social sciences and humanities subjects is a huge gap between what HEIs are offering and what regional labour markets demand – even when students with degrees in these areas subsequently choose to work in more science and technology related fields.

27   Kyrgyzstan, Tajikistan, India, Kazakhstan: UIS Statistics, "Education: Distribution of Enrolment by Field of Study: Tertiary Education," UIS, September 2018, http://data.uis.unesco.org/index.aspx?queryid=137; Afghanistan: Islamic Republic of Afghanistan National Statistics and Information Authority, "Afghanistan Statistical Yearbook 2017-18," 48.

28   Asian Development Bank, "Assessment of Higher Education in the Kyrgyz Republic" (Manila, 2015).

29   National Statistics Committee of the Kyrgyz Republic, "Obrazovaniye i Nauka v Kyrgyzskoi Respublike: Statisticheskii Sbornik [Education and Science in the Kyrgyz Republic: Statistical Handbook]," 2018.

30   Ministry of Economy, Kyrgyz Republic, "Srednesrochnaya i dolgosrochnaya strategiya razvitiya gornodobyvayushei promishlennosti Kyrgyzskoi Respubliki [Medium-term and Long-term Strategy for the Development of the Mining Industry in the Kyrgyz Republic]" (Bishkek, 2014).

Economic growth requires innovation, which in turn requires HEIs to be much more responsive to the labour market. The remarkable resilience of enrolment by discipline in Kyrgyzstan (as per figure 6) aligns with years of limited economic growth, which in this high participation system suggest a disconnect between the degrees HEIs offer and the skills and know-how required for the economy to innovate and grow in different ways.

Figure 6. Distribution of tertiary enrolment by field of study, 2001-2017 (%), Kyrgyzstan[31]
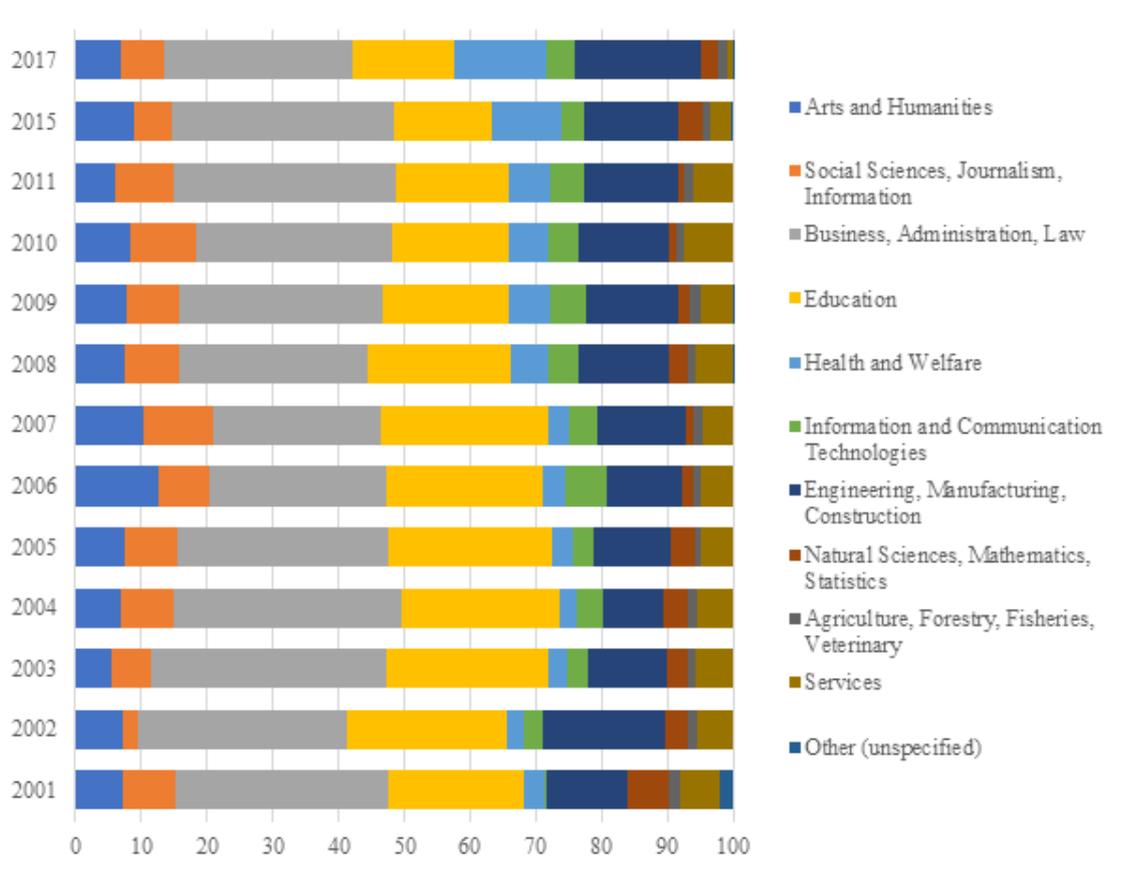
Note: No data available for 2012, 2013, 2014 or 2016

2.4. Faculty

As important to higher education as good students and sufficient physical resources is well-qualified and highly motivated faculty to teach future generations and undertake basic and applied research that aims to expand and improve available knowledge. In Central Asia and Afghanistan, there are several barriers that obstruct the achievement of these aims. They can be summarized as follows:

Underqualified. Ensuring that faculty meet minimum qualification criteria is an important policy objective in Central Asia and Afghanistan and across the world. The summary of national policy priorities in the next section shows that all three countries have targets in place to improve faculty qualification levels, whether through the provision of postgraduate scholarships (Afghanistan) or by setting goals for the number of faculty members holding a minimum of a master's

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[31]   UIS Statistics, "Education: Distribution of Enrolment by Field of Study: Tertiary Education."

level qualification (Kyrgyzstan and Tajikistan). However, as a whole, faculty across the region remain underqualified. For example, only 5% of faculty members in Afghanistan have a PhD.[32]

Undervalued. Whilst higher education is highly valued, the academic profession has lost some of the prestige it garnered during the twentieth century. This is in part due to the huge expansion of the higher education systems in which the skills of faculty in some of the private HEIs have been poorly aligned to educational needs, leading to an associated drop in public perceptions of their capabilities. It also relates to dissatisfaction with teacher-centred pedagogies that were commonplace in Central Asia in the pre-1991 era but which today can be seen as outmoded, particularly with growing awareness of alternative teaching methods practiced in other systems. Another relevant factor is the lack of academic freedom faced by many faculty members who do not have the ability to choose what they teach (or research) owing to state control over the curriculum and are limited in what they may feel able to share with students based on the current political situation.

Overworked. Faculty workloads in teaching institutions are high compared to the salaries that are paid in state HEIs (estimated at around US$100-$400 per month). The Soviet legacy wherein teaching and research were separated has two implications. Firstly, faculty workloads still tend to be calculated on teaching hours with little consideration given to preparation or to how to work with students on independent projects that are becoming a new feature in higher education systems that have adopted the Bologna Process (see the section on national policy priorities). Secondly, another new feature at universities and institutes is the introduction of research, but again, this is not 'budgeted' in faculty workloads. As a result, faculty – more so in HEIs than the Academy of Sciences network of research institutes – are becoming ever more overburdened.

Leaving the country/system. In all three countries, there has been significant out-migration of qualified personnel, whether as a result of conflict or to pursue better economic opportunities elsewhere. In Afghanistan, a vicious cycle of a shortage of spaces in local universities prompts some students with the means to do so to study abroad, most of whom fail to return home thus leading to a shortage of qualified future academics in the national system.[33] In Tajikistan, more students study in domestic HEIs but then move abroad. As the Government of Tajikistan puts it, this means that 'Tajikistan finances the economic development of other countries'[34] – commonly known as 'brain drain'. As a result of the collapse of the Soviet Union and ensuing economic crises, significant numbers of faculty left the system in Central Asia, either to move abroad (especially common amongst ethnic Russians) or to enter the nascent private sector where salaries tended to be higher than in state HEIs.

Aging. A consequence of the above trends is the aging of faculty and the 'disastrous generation gap' that is being observed in most post-Soviet states.[35] In Kyrgyzstan, the average age of faculty at the state-run Technological University is close to 55 years. Across Kyrgyzstan, 46% of all researchers are over 50, with the proportion increasing to 57% counting only those holding a Can-

32   Fred M. Hayward, "Progress on Gender Equity in Afghan Higher Education," *University World News*, January 13, 2017, http://www.universityworldnews.com/article.php?story=20170111130351745.

33   World Bank, "Higher Education in Afghanistan: An Emerging Mountainscape."

34   Government of the Republic of Tajikistan, "National Strategy of Education Development of the Republic of Tajikistan till 2020" (Dushanbe, 2012), 15.

35   Ministry of Economic Development and Trade, Republic of Tajikistan, "Nauchno-tekhnicheskii potentsial Respubliki Tajikistan v 2016 godu [Science and Technology Potential of the Republic of Tajikistan in 2016]" (Dushanbe: National Patent and Information Centree, 2017), 18.

didate of Sciences (postgraduate degree).[36] In Tajikistan's universities in 2016, only 18% of Candidate of Science holders are under 35.[37] Low enrolments in postgraduate studies in the fields of science and technology add to concerns about insufficient numbers coming through in the next generation of university instructors. In Kyrgyzstan in 2017, for example, there were only 42 postgraduate students in chemistry and 44 in agriculture whereas in law the number was 320.[38]

Infrastructural barriers. A common issue across Central Asia and Afghanistan is aging infrastructure with education buildings that are not fit for purpose. Whether as a result of physical destruction arising from conflict or lack of financing available to undertake repairs, the overall state of publicly-funded HEIs is a growing problem facing these states. This situation is acute in Afghanistan, where, for example, there were no functioning laboratories for physics students as recently as 2013.[39] Another major issue for Afghanistan as it grapples with discrimination against female students is the lack of accommodation set aside for women. National funding has been allocated and donor funding (see also the subsequent section on external donors) is being used to build new student housing, leading to greater availability of accommodation than before. This does not resolve the structural inequalities against women inherent in Afghan society but is a small step towards removing the physical barriers to women accessing higher education in a society where living arrangements are gendered.

2.5. Funding

Expenditure on higher education follows different patterns across the three countries. This variation is shown in figure 7. In Kyrgyzstan, expenditure has dropped from a peak of 3.3% of total government expenditure in 2008 to a low of 0.53% in 2016, a significant decline. Expenditure in Tajikistan has been fairly consistent, averaging just less than 1.5% of total government expenditure. From this lower base, the impact of the 2008 global economic recession is less evident in Tajikistan than it is in Kyrgyzstan, at which time expenditure markedly decreased. In Afghanistan, where data are only available from 2010, expenditure on tertiary education has increased to a high of 2% of total government expenditure in 2015.

With extensive private sectors, it might be expected that government expenditure on higher education in Afghanistan and Kyrgyzstan would be low, but in an entirely state-operated system, the share of expenditure on tertiary education in Tajikistan is surprisingly similar. Kyrgyzstan and Tajikistan allow all HEIs to charge tuition fees, which may be one explanation for low levels of state expenditure on higher education. In Afghanistan, state universities have not been allowed to charge fees or retain any other income they may make, although plans are underway to offer HEIs more financial autonomy.[40] The constitutional obligation of the Afghan government to provide free undergraduate education has been seen by the World Bank as an impediment to the introduction of a cost-sharing model into the higher education system.[41]

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[36]   National Statistics Committee of the Kyrgyz Republic, "Obrazovaniye i nauka v Kyrgyzskoi Respublike: Statisticheskii sbornik [Education and Science in the Kyrgyz Republic: Statistical Handbook]," 141.

[37]   Ministry of Economic Development and Trade, Republic of Tajikistan, "Nauchno-tekhnicheskii potentsial Respubliki Tajikistan v 2016 godu [Science and Technology Potential of the Republic of Tajikistan in 2016]," 21.

[38]   National Statistics Committee of the Kyrgyz Republic, "Obrazovaniye i nauka v Kyrgyzskoi Respublike: Statisticheskii sbornik [Education and Science in the Kyrgyz Republic: Statistical Handbook]," 135.

[39]   UNESCO, "UNESCO Science Report," 578.

[40]   UNESCO, 580.

[41]   World Bank, "Higher Education in Afghanistan: An Emerging Mountainscape," 62.

Figure 7. Expenditure on tertiary education as % of total government expenditure (%), 2002-2015, Afghanistan, Kyrgyzstan and Tajikistan[42]
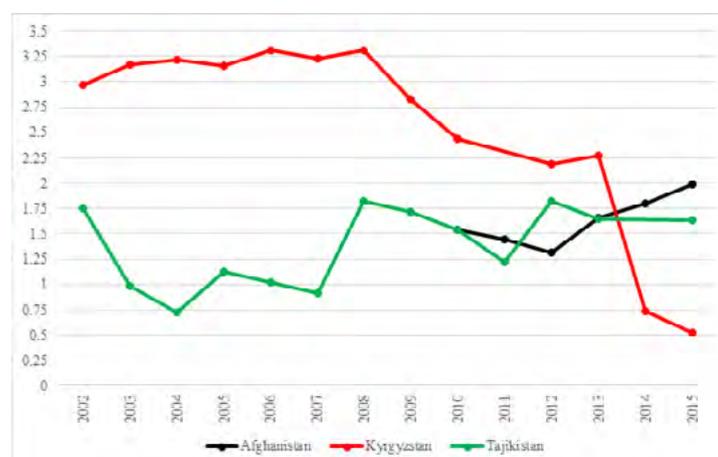
Notes: No data on Afghanistan until 2010. Data for 2015 for Kyrgyzstan are from 2016.

There is more consistency in Kyrgyzstan and Tajikistan when comparing government funding per student in higher education, as shown in figure 8. Until recently, the Kyrgyz government spent around US$600 per student per year, although that dropped rather dramatically in 2014 to under US$200 per student. Figures in Tajikistan are similar to pre-2014 Kyrgyzstan with the state now spending just under US$600 per student. With only two data points available, it is difficult to draw any patterns from the data for Afghanistan other than to note that expenditure since 2011 remains significantly higher than in Kyrgyzstan and Tajikistan, and in 2014 was just over US$800. (By contrast, annual per student expenditure on core educational services in tertiary institutions in OECD countries was US$8,944.[43])

Figure 8. Initial government annual funding per tertiary student (constant PPP$), 2002-2015, Afghanistan, Kyrgyzstan and Tajikistan[44]
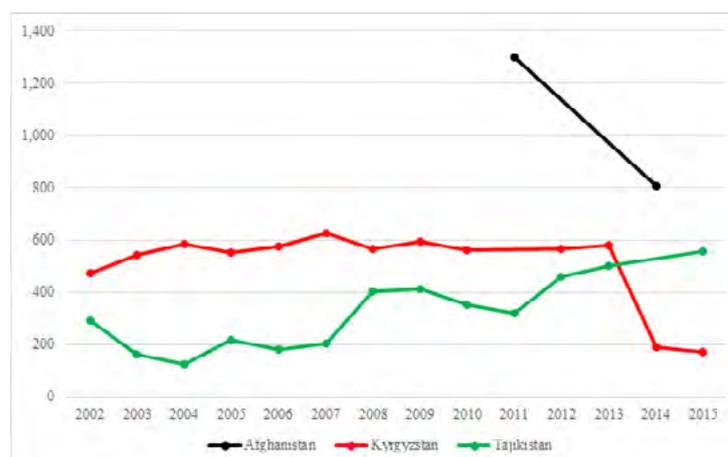
Notes: No data on Afghanistan until 2011. Data for 2015 for Kyrgyzstan are from 2016.

[42] UIS Statistics, "Education: Expenditure on Education as a Percentage of Total Government Expenditure (All Sectors)," UIS, September 2018, http://data.uis.unesco.org/index.aspx?queryid=3374.

[43] OECD, https://doi.org/10.1787/eag_highlights-2012-16-en.

[44] UIS Statistics, "Education: Initial Government Funding per Student, Constant PPP$," UIS, September 2018, http://data.uis.unesco.org/index.aspx?queryid=3386.

Despite relatively low levels of expenditure on higher education compared to overall government expenditure, it is important to point out that spending on education as a whole represents a more significant share of GDP in Kyrgyzstan and Tajikistan than in other countries. Expenditure on education was 6.6% of GDP in Kyrgyzstan in 2016 and 5.2% in Tajikistan in 2015, whereas in neighbouring Kazakhstan – which has a considerably richer economy – expenditure on education was 3% in 2016[45]. Having committed significant government resources to other levels of education, Kyrgyzstan and Tajikistan cannot afford to fund higher education at the same level.

All three countries have historically provided high levels of scholarship funding for study at domestic HEIs (i.e. generally not for study abroad). State stipends are based either on merit to school leavers who score well on university entrance examinations or as a tool designed to address socio-economic disadvantages, for instance targeting funding to women, orphans, or those from rural areas. In some cases, students in receipt of state funding are expected to work for public institutions for a certain number of years after graduation. In such instances, the scholarship can be seen more as a hybrid credit/loan scheme that must be repaid if the post-graduation conditions are not met.

Another major issue in terms of financing higher education for these countries is their ongoing reliance on external donors for technical assistance in thinking about reform of this sector, which is explored in the next section.

2.6. External donors

External donors feature prominently in all three countries, but until recently their involvement in higher education was limited and focussed more on providing technical assistance. Donor support for education in the region through to the mid-2010s emphasized meeting the Millennium Development Goals,[46] which led to a focus on basic education – the conditions for which had long been met in Kyrgyzstan and Tajikistan. Historically, there has also been a marked lack of donor interest in funding reform in higher education compared to other education or social sectors. The lack of support is somewhat paradoxical given the critical role higher education can play in the countries' development. In response, many of the policy ideas presented later in this report make recommendations for constructive ways that external donors can meaningfully increase their support for higher education and move beyond the technical assistance/consultancy model.

The World Bank, Asian Development Bank, Islamic Development Bank, European Union and UNESCO are among the donors that have begun to invest in higher education projects.

The World Bank has been influential in shaping the recent direction of higher education in Afghanistan and Tajikistan. It supported the development of the 2010-2014 strategic plan for Afghanistan's higher education sector[47] and is funding a US$40m Higher Education Development Project in 2015-20 to 'increase access to, and improve the quality and relevance of, higher educa-

45   UIS Statistics, "Education: Government Expenditure on Education as a Percentage of GDP," UIS, September 2018, http://data.uis.unesco.org/index.aspx?queryid=3373.

46   http://www.un.org/millenniumgoals/

47   Ministry of Higher Education, Government of Afghanistan, "National Higher Education Strategic Plan: 2010-2014," November 2009.

tion in Afghanistan'.[48] In Tajikistan, the World Bank is currently financing a US$15m grant/loan project[49] to 'improve and monitor the quality and labor-market relevance of higher education'.[50]

The Asian Development Bank (ADB) produced detailed assessments of higher education in Kyrgyzstan and Tajikistan in 2015.[51] Whilst the ADB is not funding projects directly related to higher education, it supports economic projects that implicitly link education to labour market needs. In Kyrgyzstan, for example, the ADB has funded a project aiming to enhance the availability of vocational education programmes and their status in a society that valorises higher education.[52] Another regional development bank, the Islamic Development Bank, has provided funding to create an international Islamic University in Afghanistan[53] and vocational skills training in Tajikistan.[54]

The European Union has provided financial support for system modernization, faculty training, and faculty and student exchange programmes. The Tempus programme[55] that ran from 2007-13 contributed to higher education reform efforts in Kyrgyzstan and Tajikistan through HEI-to-HEI collaborations. Efforts to align with European models and ideas in higher education such as the three-cycle model of degrees (Bachelor's-Master's-PhD) and quality assurance mechanisms are in the process of being adopted in Kyrgyzstan and Tajikistan. The European Union provides technical support and capacity building training to support these endeavours.

UNESCO is a prominent supporter of higher education in Afghanistan. Collaboration is based on the United Nations' Sustainable Development Goals[56] and in particular Goal 4 on quality education.[57] Thus, UNESCO is working with Afghanistan in pursuit of scholarships to address concerns about low levels of faculty qualifications and to support the development of ICT in higher education.[58]

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[48]   World Bank, "Higher Education Project (P146184): Implementation Status & Results Report," May 2018.

[49]   World Bank, "Projects: Higher Education Project for Tajikistan," accessed January 4, 2019, http://projects.worldbank.org/P148291?lang=en.

[50]   World Bank, "Project Appraisal Document on a Proposed Grant and Credit to the Republic of Tajikistan for a Higher Education Project" (World Bank, June 9, 2015), 6.

[51]   Asian Development Bank, "Assessment of Higher Education in the Kyrgyz Republic"; Asian Development Bank, "Assessment of Higher Education in Tajikistan" (Manila, 2015).

[52]   Asian Development Bank, "Building Skills in Kyrgyz Republic: Good Training Means Good Jobs," Text, Asian Development Bank, February 9, 2016, https://www.adb.org/results/building-skills-kyrgyz-republic-good-training-means-good-jobs.

[53]   Islamic Development Bank, "F.S. for the Establishment of an International Islamic University Project," May 22, 2013, https://www.isdb.org/project/fs-for-the-establishment-of-an-international-islamic-university-project.

[54]   Islamic Development Bank, "Vocational Literacy Program for Poverty Reduction Project (VOLIP)," April 30, 2013, https://www.isdb.org/project/vocational-literacy-program-for-poverty-reduction-project-volip.

[55]   https://eacea.ec.europa.eu/sites/2007-2013/tempus-programme_en

[56]   United Nations, "Sustainable Development Goals Knowledge Platform," accessed January 4, 2019, https://sustainabledevelopment.un.org/.

[57]   United Nations, "Sustainable Development Goal 4," accessed January 4, 2019, https://sustainabledevelopment.un.org/sdg4.

[58]   UNESCO Bangkok, "Higher Education for a Peaceful Afghanistan – Deputy Minister Outlines Vision during UNESCO Bangkok Visit," February 14, 2018, https://bangkok.unesco.org/content/higher-education-peaceful-afghanistan-%E2%80%93-deputy-minister-outlines-vision-during-unesco.

3.   National policy priorities

The publicly-stated government policy priorities for higher education in Afghanistan, Kyrgyzstan and Tajikistan are summarised in tables 1a (Afghanistan), 1b (Kyrgyzstan) and 1c (Tajikistan). This section thus provides a bridge between the previous outline of trends and issues in higher education and the ideas and priorities currently being considered by these three states. The summaries in Tables 1a-1c illustrate the major concerns of governments as articulated in recent policy documents. The summaries give a good sense of the types of issues that have gained importance by successfully reaching the policymaking agenda.

Table 1. a: Afghanistan higher education policy priorities in Second National Higher Education Strategic Plan 2015-2020[59]

Country context	Vision for education	Identified challenges in higher education	Higher education policy priorities
'Devastated by thirty years of war including foreign invasions, occupation and civil war' (p.1)	'Improving the quality of the higher education system is central to the economic rejuvenation of Afghanistan' (p.1) Higher education as one of eight pillars of the Afghan National Development Strategy 'A high quality [higher education] system that will provide the trained graduates, knowledge and creativity essential for the national development and well-being of the people of Afghanistan' (p.27)	Teaching is based on 'traditional, teacher-centred methods' (p.4) Participation levels are 'very low' (p.5) and access to higher education is inequitable for women Low levels of suitably qualified academics. Many faculty fled country due to violence Over-centralized governance resulting in low capacity to budget, manage and plan in HEIs Almost no research takes place Physical destruction/shortage of higher education facilities	Shift to outcome-based education Develop market-oriented degree programmes that are relevant to economic development Student-centred learning Expand enrolment, especially of women Develop research culture e.g. through competitive research funding, postgraduate scholarships Upgrade faculty/staff professional skills e.g. through postgraduate scholarships Modernize quality assurance and accreditation; establish independent quality assurance agency Decentralize governance by giving HEIs more financial and procedural autonomy Make higher education sector more strategic e.g. through central office to support strategic planning Build/renovate facilities e.g. libraries, labs, sanitation, dormitories, ICT infrastructure

59   Ministry of Higher Education, Government of Afghanistan, "Environmental and Social Management Framework. Second National Higher Education Strategic Plan and Higher Education Development Project," Final Report, March 5, 2015. This plan is closely linked to its predecessor, National Higher Education Strategic Plan 2010-2014 which contains more substantive detail on the higher education and country context and is used/cited in the sections on the vision for education and country context.

Table 1. b: Kyrgyz Republic higher education policy priorities in Education Development Strategy of the Kyrgyz Republic for 2012-2020[60]

Country context	Vision for education	Identified challenges in higher education	Higher education policy priorities
'The Kyrgyz Republic is at an important stage of its history, for the first time being able to make a long-term plan for the country' (p.4)	Education (and health) are both public goods and economic resources 'Every citizen should have the opportunity to receive quality education' (p.14) based on principles of lifelong learning and state as regulator rather than sole provider	Inadequate graduate skill levels and gap with labour market requirements Ineffective quality assurance mechanisms (licensing and certification) Low levels of suitably qualified academics; fewer than 40% hold Master's degree or higher. State-funded students not completing degree or working in area for which they received funding. Especially problematic for teacher training graduates Lack of research	Improve quality assurance systems e.g. by developing independent accreditation Complete roll-out of two-level degree structure[61] Reduce the gap between higher education and labour market requirements (especially in regions) Increase graduate employment rates Increase number of faculty with Master's degree or higher to 100% by 2020 Increase the number of state HEIs that are self-financing from 3 to 14 (of a total of 52 HEIs) Develop research in universities Increase completion rates for Candidate of Sciences and Doctor of Sciences from less than 25% to 50%

60   Government of the Kyrgyz Republic, "Education Development Strategy of the Kyrgyz Republic for 2012-2020," 2012. Data for the country context and vision for education are taken from the Sustainable Development Strategy 2018-2040.

61   The levels are Bachelors and Masters, and this structure is part of the country's adoption of the European Union Bologna Process framework for higher education. See also http://ec.europa.eu/education/policy/higher-education/bologna-process_en

Table 1. c: Tajikistan higher education policy priorities in National Strategy of Education Development in the Republic of Tajikistan till 2020[62]

Country context	Vision for education	Identified challenges in higher education	Higher education policy priorities
'Developing country' (p.1) Sustainable economic development is key, defined as having three objectives: energy 'sovereignty', 'overcoming the country's communication deadlock'[63], food security.	'Education is becoming the most important resource for [the] economic and social development of countries, improving wellbeing and individual development of citizens' (p.1)	Poor infrastructure and lack of resources, including internet access Lack of clear system for faculty professional development Lack of research Labour market unable to provide suitable jobs for majority of graduates Brain drain – 'Tajikistan finances the economic development of other countries' (p.15) Lack of planning and quality assurance in/across HEIs No nationwide distance learning system Underdeveloped vocational education system Participation rates are 'relatively low' at 18% (p.15) Disproportionate number of students in humanities/social sciences (more than 50%)	'Priority should be given to the development of energy, industry, agrarian sector, infrastructure and other fields' (p.2) as basis for (stable) economic growth and reducing poverty. Mining and non-ferrous metals industry also listed (p.26) Improve 'practice-oriented' higher education (p.20) Complete transition to two-level degree structure[64] Modernize vocational education structure to better meet economic/labour market requirements; develop new courses Provide Master's and PhD training for faculty Create/maintain open-access database of online teaching resources Shift the role of teacher from pedagogue to facilitator Introduce modular programme structures based on competencies. Employers mandated to be involved. Continue creating science parks[65] Undertake joint research between Academy of Sciences and universities Reduce number of teaching training institutes; encourage universities to do teacher training; make the teaching profession (in very short supply) more attractive Switch from state-funded scholarships to 'educational credits' (p.35) that are repayable unless student works in designated area (e.g. rural area, teaching) after graduation Co-finance education programmes with employers Extend reach of TARENA[66] internet provider to all regions

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62   Government of the Republic of Tajikistan, "National Strategy of Education Development of the Republic of Tajikistan till 2020."

63   It is not clear whether this refers to Tajikistan being landlocked or its historically poor relations with neighbouring Uzbekistan (which since 2016 have been rapidly improving)

64   The levels are Bachelors and Masters, and this structure is part of the country's adoption of the European Union Bologna Process framework for higher education. See also http://ec.europa.eu/education/policy/higher-education/bologna-process_en

65   Often translated from the Russian технопарк (tekhnopark) into technological park, but called science parks in North America/Europe

66   http://tarena.tj

4.   Science, technology and innovation: A policy plan

Moving from the specifics of the current state of higher education in Central Asia and Afghanistan, this section considers features of a higher education system that allow for more effective contributions to national scientific and technological development and innovation. These broad characteristics are then considered within the framework of specific policy propositions for Central Asia and Afghanistan.

4.1. Defining science, technology and innovation

The late Egyptian-American Nobel Laureate Ahmed Zewail outlined three aspects critical to the creation of a strong and purposive scientific culture:[67]

1.   Human resources: eliminate illiteracy, ensure active participation of women in society, reform education at schools and higher education institutions;

2.   Legal and normative basis: allow freedom of thought, minimize bureaucracy, develop a merit system, create a credible and enforceable legal code;

3.   Science base: invest in special education for gifted students, establish centres of excellence, create opportunities to apply knowledge to national and later global industries/economic markets, train experts in advanced technologies.

Recommendations for scientific development tend to go hand in hand with ideas about technology. It has long been known that technological change leads to economic growth;[68] recent research on the 'green revolution' in agriculture in India, for example, has shown that technological shifts may also lead to political change by introducing more democratic elements into states traditionally dominated by one party.[69]

Drawing again on Zewail, three types of technology can be identified: [70]

1.   Simple technologies that solve everyday problems[71] – an example given by Zewail is traffic lights.

2.   Innovative technologies that enable nation states to be part of world markets – e.g. microelectronics.

3.   Frontier technologies that research the unknown future possibilities.

To be effective, systems of education, research and development must encompass the 'simple' and 'innovative' technologies alongside 'serious engagement'[72] with frontier technologies. This means that governments considering scientific and technological development must be committed to these on a large and comprehensive scale. It is not sufficient to accentuate only one or two of the three types, even if that seems like a more manageable (and cost-effective) strategy.

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[67]   "Science and Technology in the Twenty-First Century," ASM Lecture Series (Kuala Lumpur: Academy of Sciences Malaysia, 2002).

[68]   Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (New York: Oxford University Press, 1990).

[69]   Aditya Dasgupta, "Technological Change and Political Turnover: The Democratizing Effects of the Green Revolution in India," *American Political Science Review* 112, no. 4 (November 2018): 918–38, https://doi.org/10.1017/S000305541800031X.

[70]   "Science and Technology in the Twenty-First Century."

[71]   This is an important point, offering a reminder that innovation is not a 'big bang' but a process of incremental, constant change, and adaptation of low-cost technologies to add value and increase productivity

[72]   Zewail, "Science and Technology in the Twenty-First Century," 9.

The term 'innovation' became widespread during the second half of the 20th century in close connection with the rise of the idea of the 'knowledge economy'. This construct emphasizes human capital as an industry to be developed in place of manufacturing or heavy industry that was more typical of nineteenth and twentieth century non-colonized economies. The growth of innovation also ties in with neoliberal political ideologies that seek to minimize the role of states in place of markets and competition driving economic growth and international competitiveness.[73]

In a study of 20 national science policies from around the globe, remarkable convergence was found across national contexts, with, for example, 15 of the 20 countries including the term 'innovation' in the name of the policy[74]. This convergence is also visible in Central Asia and Afghanistan, where policymakers are also reflecting global trends. For example, Kyrgyzstan's *National Strategy for Sustainable Development 2013-2017* "recognizes the need to remove [state] controls on industry in order to create jobs, increase exports and turn the country into a hub for finance, business, tourism and culture within Central Asia".[75] That this trend is so identifiable around the world speaks to the perceived importance of the idea of innovation and its obvious connections to science and technology, and, by extension, to higher education.

Bringing the three concepts of science, technology and innovation (STI) together, the Organization for Economic Co-operation and Development (OECD)[76] identified no fewer than nine recent policy trends identified in national STI strategies both in OECD countries and around the world.[77] These can be summarized into four areas:

1. Stable or increased investment
   a. In the wake of the 2008 global economic crisis, states that were hardest hit are investing more funds into STI to re-start economic growth.
   b. However, around half the OECD governments had retained relatively stable expenditure on research and development.

2. Targeted support
   a. Some states are selecting particular sectors or technologies to support. These may be 'frontier' technologies or more 'traditional' sectors such as agriculture.
   b. Another form of targeting is found in growing support for 'grand challenges', issues that are global and require large-scale research/solutions. Examples include climate change and food security.

3. Commercialization of science and research
   a. Rather than attempting to set the agenda through supply-side policies, some states are aiming to increase innovation by including demand-side policies i.e. those driven by industry

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[73] Bent-Åke Lundvall and Susana Borrás, "Science, Technology and Innovation Policy," in *The Oxford Handbook of Innovation*, ed. Jan. Fagerberg, David C. Mowery, and Richard. Nelson (Oxford: Oxford University Press, 2006), 600–631.

[74] Creso M. Sá and Emma Sabzalieva, "Scientific Nationalism in a Globalizing World," in *Handbook on the Politics of Higher Education*, ed. Brendan Cantwell, Hamish Coates, and Roger King (Northampton, MA: Edward Elgar, 2018), 149–66.

[75] UNESCO, "UNESCO Science Report," 380.

[76] A forum of 36 countries, most of which are advanced economies in Europe and North America. OECD, "List of OECD Member Countries," accessed January 4, 2019, http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm.

[77] OECD, "National Strategies for Science, Technology and Innovation," STI e-Outlook, 2012, https://www.oecd.org/sti/sti-outlook-2012-national-strategies-for-sti.pdf.

    b. Increasing transfer, exploitation and commercialization of publicly-funded research, especially in states where basic research is already well established.

    c. Increasing support for innovation in business through e.g. research and development tax credits, public-private partnerships, improving conditions for small and medium-sized enterprises.

4. Connecting science to society

    a. Some states are using STI policies to reduce/minimize the growth of social inequalities whilst boosting economic growth.

    b. Improving human resources in STI, reducing gender gaps, encouraging inbound and outbound mobility to develop talent.

Not an OECD member but recognized by that group as a partner country, China is also heavily involved in efforts to boost the country's capacity to be innovative. China is already a major global player in many science, technology and innovation fields[78] and is on track to become the world's biggest research and development spender. Chinese scholars are now the most cited after US researchers.[79] Nevertheless, the current policy debate is around unleashing more innovative thinking. In this connection, a panel of academic leaders in China laid out the following issues:[80]

Employment. Students are overly concerned with finding a well-paid job. This also affects their choice of subject. The government substantiates this by viewing employment as the main purpose of higher education. Universities are required to report on graduate employment rates every month. This obsession has a negative impact on staff/faculty wellbeing. Instead, universities should be training "leaders of the society of the future" (624) not just seeking to place as many possible in existing high paying jobs.

Culture and values. General culture is too focused on short-term gain. Higher education, which should be propagating a "healthy research culture" (623) is too busy meeting targets – report filing, publication targets, impact factors etc. Trust between people is low; collaboration is limited. Higher education should be about producing "wholesome people with independent judgment and critical thinking, who have a sound moral sense, citizen consciousness and the ability to appreciate different cultures" (625). Academic freedom and university autonomy, whilst discussed frequently, have not increased. This means bureaucratic influence remains high and innovation cannot succeed. Universities should be allowed to make mistakes in order to learn from them.

Modes of teaching and research. Scientists are caught in disciplinary silos whereas "innovation these days often takes place in multidisciplinary research" (623). Some degree programmes require students to choose a narrow specialization early, which means they miss the broad perspectives that would offer them greater flexibility in their future career(s). University administrators should give high performing departments more freedom to decide how to train students.

Strategy and values. The government does not have a clear strategy for higher education, which has "become merely a numbers game" (624). Higher education has become too utilitarian; whilst there is a need for applied/useful knowledge, cultivating lifelong learning habits, creativity and

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78   At the time of writing, Chinese scientists had just successfully landed a spacecraft on the far side of the Moon, a world first. Paul Rincon, "Chang'e-4: Chinese Rover Exploring Moon," *BBC News*, January 4, 2019, https://www.bbc.com/news/science-environment-46760729.

79   UNESCO, "UNESCO Science Report."

80   Jane Qiu, "Higher Education and Research Innovation in China," *National Science Review* 1, no. 4 (December 1, 2014): 623–26, https://doi.org/10.1093/nsr/nwu073; page numbers that follow are from this article.

critical thinking is equally important. Any strategy for China should be formed around the need for "leaders with vision, imagination and courage in every single field" (625-6). For higher education, the emphasis must be on quality and not quantity.

4.2. A policy plan for developing STI in higher education

Creating the conditions in which STI flourishes in a national setting demands long-term engagement and potentially significant change spanning social, political and economic factors. That is to say, the issue goes well beyond higher education, although higher education should play a critical role in any government strategy. The policy plan presented in this report identifies five key areas in which higher education policy could support the development of STI. The plan is presented in figure 9 and discussed in the next part of the report.

This plan is designed for countries where (additional) financial resources may not be readily available and thus minimizes policy ideas that come with a high price tag.[81] The policy plan assumes that national governments are key players in financing and controlling higher education, and that efforts to relax regulatory requirements/introduce market mechanisms would need to be incremental as they require levels of trust between state and society and a vast shift in general culture that may not currently exist. It is imperative for government leadership to demonstrate commitment and long-term support in order to successfully embed a culture of STI in higher education and in society as a whole. These efforts will positively impact the shaping of new norms supportive of STI, and constructive engagement with all sectors of the population will embed the legitimacy of an STI-infused culture.

Whilst the basic components of the policy plan may be found in higher education systems around the world, they have been selected here for their relevance to systems that are currently considered to be in the global science periphery. The purpose of the plan is to enhance the status and standing of STI in the country to produce long-term economic and social benefits.

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[81]   This includes the issue of enhancing faculty salaries, which is an obvious mechanism to attract talented people to work in higher education and reduce some of the endemic corruption in the region. As this report focusses where possible on low-cost policy options, the salary issue is touched on but not emphasized in the recommendations that follow. However, it must be a top priority for policymakers.

Figure 9. A policy plan for developing science, technology and innovation in higher education

Regulation	Skills	Research	Scientific culture	Business
Focus on effective quality assurance	Promote vocational and technical higher education	Select priority areas for simple, innovative and frontier technology research	Foster academic community	Engage businesses in joint planning on the future of work
Improve HEI governance	Support multidisciplinary teaching and learning	Create centres of excellence	Include and promote women at every level and in every capacity	Reward businesses that fund HE infrastructure development
Stimulate faculty innovation	Enhance quality of learning	Encourage international research collaborations	Develop HEI-community engagement	Extend cooperative learning

5. Policy ideas

This final section of the report advances policy ideas on science, technology and innovation in higher education (publicly-funded HEIs) taking regional specificities into account. It considers the five areas identified in the policy plan: regulation, skills, research, scientific culture, and business.

5.1. Regulation

5.1.1. Focus on effective quality assurance

Rationale

Policies and processes on quality assurance (QA) are critically important to improving the quality of teaching, research and governance in HEIs. They can also address issues of corruption that occur when there is too little regulation or, conversely, too much regulation with too many loopholes. QA is a "systematic process of assessing and verifying inputs, outputs and outcomes against standardized benchmarks of quality, to maintain and enhance quality, ensure greater accountability and facilitate harmonization of standards across academic programmes, institutions and systems".[82] QA measures have already been introduced across the region but with varying levels of effectiveness.

Afghanistan's quality assurance agency is a government department that is funded in full by the government.[83] Yet practice from other settings has shown that to be effective, QA agencies must be fully independent or at least at arm's length from the state to avoid conflicts of interest.

In Kyrgyzstan, QA is mandated by legislation and is currently split into two processes, one dealing with licensing[84] and the other with accreditation.[85] All universities must be accredited by an independent QA agency, of which there are currently four. Implementation of accreditation is hindered by the high cost charged by each QA agency and the lack of clarity around QA procedures.

In Tajikistan, the ADB found that few people have sufficient expertise in assessment and quality at the level of higher education.[86] A 2016 World Bank funded higher education project included the objective of creating an external quality assurance system for Tajikistan, a process that was not yet fully implemented at the time this report was written.[87]

Recommendations

1. With mixed experiences and understandings of QA, an immediate recommendation is to establish either a pan-regional or national working group(s) to agree definitions of QA and the route by which its various policies and procedures will be determined. This should include recording distinctions between different terminologies (licensing, accreditation etc), ensuring no duplication in legislation on QA (an issue more for the former Soviet states), and es-

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[82] UNESCO, "Quality Assurance in Higher Education," June 2013, 2.

[83] World Bank, "Higher Education in Afghanistan: An Emerging Mountainscape."

[84] The process of obtaining a license that enables an HEI to operate and provide certain courses/programmes. Licences can also be offered for the operation of specific courses/programmes.

[85] The process of receiving accreditation confirming that degree programmes/courses are being implemented at certain defined standards. Accreditation can also be given to an entire HEI but in Central Asia and Afghanistan is more commonly given at programme level.

[86] Asian Development Bank, "Assessment of Higher Education in Tajikistan."

[87] World Bank, "Higher Education Project (P148291): Implementation Status & Results Report," December 21, 2018.

tablishing a timetable for new or clarificatory legislation through parliament. The European Union would be a suitable external partner for these endeavours, particularly as Kyrgyzstan and Tajikistan seek to make their higher education systems compliant with the Bologna Process (see section on National Policy Priorities).

2. Build capacity in HEIs and at government level to undertake QA processes. External partners (international academics with QA experience, organizations such as UNESCO with a direct mandate to support QA in higher education)[88] can support this work by providing country-specific training and materials. Capacity building should be seen as a long-term strategy that is broken down into shorter-term parts. A first step, for example, would be to develop a system for institutional self-assessment and then to provide training and a handbook/other materials. Institutional self-assessment also connects to the recommendations that follow on increasing HEI accountability.

5.1.2. Improve HEI governance

Rationale

Establishing or improving robust QA procedures as outlined above will enable policymakers to support improved governance in HEIs. Improving governance has two aspects. On the one hand, it ensures that there are measures in place to support and assess the strategic direction and day-to-day management of HEIs, both as individual institutions and as part of a national system. With these measures in place, the second aspect comes from governments providing HEIs with greater autonomy to manage their own affairs.

In Kazakhstan, for example, 2017 legislation has led to major governance reform by granting 12 top performing HEIs some degree of autonomy. The selected HEIs are able to set their own admissions policies, develop new degrees and courses with greater flexibility, and take on more responsibility for the recruitment and retention of faculty. This pilot group will set the stage for the roll-out of autonomous principles across the Kazakh higher education system. Having more freedom to operate creates the conditions in which innovation can take place by allowing HEIs and departments to try new methods, ways of working, and organizational structures. The Kazakh government has been able to give these HEIs more autonomy because steps have already been taken to improve governance across the entire higher education system. For example, university leaders are selected through a transparent process that involves multiple state, societal, and business stakeholders.[89]

Recommendations

1. Use QA procedures to identify a small number of high performing HEIs. As in the Kazakh example, provide these HEIs with greater autonomy to set and manage their own affairs. This should include having the ability to reward pockets of excellence within the institutions (i.e. at departmental level). If these are successful, there should be a ripple effect across the higher education sector. Successful HEIs and departments can be positioned as 'thought leaders' in the national context and given extra responsibility to train or mentor others.

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88   UNESCO, "Quality Assurance in Higher Education."

89   Emma Sabzalieva, "Selecting University Leaders in Kazakhstan," *Emma Sabzalieva* (blog), April 4, 2018, https://emmasabzalieva.com/2018/04/04/selecting-university-leaders-in-kazakhstan/.

2. On a trial basis, government should provide the funding they have allocated for high performing HEIs directly to the HEI. The HEI becomes responsible for allocating the funding and reporting back to the government at the end of the funding period. A system to 'measure' the performance of the HEI at the start and end of the funding period would need to be devised. If performance has improved, the HEI should continue to receive support. This could alternatively be targeted to particular departments within the HEI with the block grant funding managed either by government or the HEI's leadership.

3. To further improve governance, the number of reports each HEI has to provide government should be reduced. Onerous and often unnecessary reporting requirements take up the time and energy of faculty, staff and students, and reduce the scope for innovation to take place and for governance to improve. In streamlining reporting, the main consideration should be whether the report adds value for the HEI/government. It may be useful to engage external technical assistance in reforming administrative requirements.

5.1.3. Stimulate faculty innovation

Rationale

Faculty are pivotal to the success of policy endeavours to enhance innovation in higher education, an important point that is often overlooked in favour of considerations of how structural or environmental factors can support increased innovation.[90] Even in constrained environments, research has shown that faculty are able to introduce innovation into teaching and learning processes.[91]

Examples of faculty innovation can be found around the world. For instance, a faculty member in the Netherlands created an interdisciplinary undergraduate programme in science, business and innovation "to show students the value in studying science" despite a lack of funding from the university and initial resistance from other faculty members.[92] In Macao, a faculty member introduced student research into a course where it did not exist before on the grounds that the "absence of research practice inhibits both regional and national socio-economic development and the engrained capacity of students to think critically about subjects they would deal with in their future workplaces".[93] This innovation – which has since been implemented at HEIs across the country – came about even though the university governance did not initially support the initiative or provide funding.

For policymakers, these examples demonstrate the importance of a) creating structures in which constraints on innovation are lifted and b) enabling faculty to freely pursue teaching and research without fear of censure or reprisal. In other words, it is the role of policymakers to create the overall conditions in which such innovation may take place. Encouraging bottom-up innovation is a more cost-effective way of introducing positive change than, for example, engaging international consultants to propose reforms.

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[90] Sandra Hasanefendic et al., "Individuals in Action: Bringing about Innovation in Higher Education," *European Journal of Higher Education* 7, no. 2 (2017): 101–19, https://doi.org/10.1080/21568235.2017.1296367.

[91] Hasanefendic et al.

[92] Hasanefendic et al., 110.

[93] Hasanefendic et al., 110.

Recommendations

1. Review existing policies and directives on faculty work conditions and revise any that could inhibit innovation. Restrictions on the directions of teaching and research, ability to engage in international research/partnerships, and overburdened workload allocations are examples of policies that would deter innovation.
2. Improve faculty salaries to encourage recruitment and retention in the sector. Attracting and retaining the brightest minds away from the private sector where salaries are often higher is critical to bringing in academics that have the capacity and motivation to innovate.
3. Reward innovation through, for example, an annual prize for Innovation in Higher Education. As part of the prize, the winner could meet with policymakers in the Ministry of Education to brainstorm ways that the innovation could be incorporated at HEIs across the country. The winner could be provided with funding to visit other HEIs and support them as they implement the innovation.

5.2. Skills

5.2.1. Promote vocational and technical higher education

Rationale

Higher education systems in Central Asia and Afghanistan emphasize universities and specialized institutes, valorising high-level academic knowledge and undervaluing mid-level technical and vocational knowledge. Yet to diffuse STI and add value to the economy requires people with scientific and technical skills and knowledge. Rather than directing the majority of school-leavers to university, a higher education system that enables innovation must have a range of pathways into and through education and training. In Kyrgyzstan, a study of labour market needs showed significant misalignment with what the educational system was offering. The majority of labour market demand (55%) was for skilled workers, but only 9% of students were enrolled in technical or vocational education (level 3 ISCED). The lowest demand (15%) was for university educated managers and professionals, yet 75% of students were enrolled in universities (levels 5-8 ISCED).[94]

In Afghanistan, the government already recognizes the need to promote vocational and technical higher education and has committed to establishing an 'alternative higher education sector'.[95] In the former Soviet states, the value placed on higher education is exceptionally high, so social stereotypes will need to be addressed in introducing mid-level programming which is perceived to be of lower importance and prestige.

Such mid-level programming could be in the form of community colleges, understood as institutions that provide a bridge between secondary/high school, higher education, and the workplace. Community colleges offer both general and technical education and provide greater access to post-compulsory education. More than just a bridge, community colleges can also offer an effective alternative to an undergraduate degree. Furthermore, a survey involving multiple countries found

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[94]   Gulnara Djunushalieva, "Professionalno-kvalifikatsionnaia struktura rynka truda Kyrgyzskoi Respubliki i ego vliianie na strategiiu obrazovaniia [The vocational qualification structure of the labour market in the Kyrgyz Republic and its influence on education strategy]," *Business Times*, Bishkek, May 24, 2011.

[95]   World Bank, "Higher Education in Afghanistan: An Emerging Mountainscape," 15.

that 70% of young people believe schools offering vocational education and training are more help-ful in finding a job and half said they found it more appealing than the academic track.[96]

Community college courses are generally two years long (if studied-full time) and many closely aligned with HEI courses, enabling students who wish to do so to transfer into those courses in the second or third year. Thus, students could in principle complete a Bachelor's degree in four or five years through a combination of two years at community college and two/three years at an HEI. Alternatively, students may leave community college after two years with a professional diploma and would be well equipped to enter the workforce.

Recommendations

1. Use and expand existing institutions to establish community colleges. For example, the Tajik Tech-nical University has already introduced multiple pathways through vocational and higher educa-tion, having established a lycée for those at the equivalent stage of the final two years of secondary/high school and a junior technical college (what the Tajik Technical University calls a community college)[97] as an equivalent to the first two years of an undergraduate degree. Students can enter the lycée and continue through to graduation from the university or can leave after completing the lycée and/or the junior technical college. This model could be used for the introduction of commu-nity colleges on the base of other science/technology HEIs. The use of pre-existing facilities, staff and so on would reduce the cost of creating new institutions and increase the pathways into high-er education. The expansion of existing institutions would enable them to move beyond narrow specialization towards a broader focus on applied science and technology, offering skills of direct relevance to an STI-enhanced economy and society. Future expansion would focus on building standalone institutions with multiple specializations and would reinforce the idea that mid-level higher education can be a worthy standalone post-school and pre-employment route.

2. Information campaigns should be organized by the government with the aim of increasing societal awareness of and support for mid-level vocational/technical programmes. One option is to 'market' the community college option as a new concept, thus disassociating it from possible negative per-ceptions of low quality in existing mid-level institutions (technicums). This campaign could be un-dertaken in association with the European Union or European partners, as a 2011 report found that 71% of European citizens have a positive image of vocational education and training.[98] There is widespread admiration for the German higher education model with its extensive apprenticeships and vocational/technical courses; this would be a meaningful example to draw on in this campaign.

3. Devise a further information campaign using the findings from the future of work report (see Busi-ness recommendations below) to emphasize the enhanced employment prospects for graduates of mid-level programmes. The model of working with European partners as suggested above may be beneficial: the same 2011 report also found that over 80% of EU citizens agree that vocational education and training contributes positively to their country's economy.[99] In this campaign, the government can make the case for the need for people to study at this level on the grounds of future employment prospects. This may also be a useful way to encourage people already in the work-

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96   Dominic Barton, Diana Farrell, and Mona Mourshed, "Education to Employment: Designing a System That Works" (McKinsey, 2013), https://www.mckinsey.com/industries/social-sector/our-insights/education-to-employment-designing-a-system-that-works.

97   From the Russian техникум (tekhnikum)

98   European Commission, "Attitudes towards Vocational Education and Training" (Brussels, 2011).

99   European Commission.

force to retrain, or to attract those outside the workforce – especially women – to engage in further education in vocation-specific training.

5.2.2. Support multidisciplinary teaching and learning

Rationale

Making higher education more relevant to a society's current and future STI needs requires courses that transcend traditional disciplines. Multidisciplinary courses better equip students to face unknown future workplace and societal challenges and give them greater flexibility as they develop their careers. However, it is also critical for students to have a good grasp of basic concepts as they are elaborated upon specific disciplines, so the recommendation here is to enhance multidisciplinarity in conjunction with core subject knowledge/principles.

Recommendation

1. Based on the nationally identified priority STI areas (see Research section), create a taskforce of academics from different disciplines to develop courses in these areas. The courses should be a mix of basic science and applied/multidisciplinary approaches to the subject. For example, the Bachelor's degree in Agriculture taught at the University of Reading in the UK organizes its course as follows:[100]
    a. Compulsory modules in Natural Sciences, Life Sciences, Economics, Environment, Management, Data Analysis, Marketing;
    b. A wide range of optional modules including Animal Science, Ecology, Agronomy, Microbiology, Biogeography, Forestry, Entrepreneurship, Food Retailing, Sustainability, Human Resource Management, Supply Chain Management;
    c. Compulsory practical training (e.g. grow a winter cereal, lab test it for quality, sell it to merchants);
    d. Compulsory study tour to another part of the country to investigate farming enterprises;
    e. Optional one-year cooperative placement (see also Business section below).

5.2.3. Enhance quality of learning

Rationale

Widely held societal perceptions that the quality of higher education has diminished are not without substance. The rapid increase in the number of HEIs, particularly in the private sector, has made it easier for students to access higher education, even when their grades would not in the past have enabled them to study at degree level. This does not, however, mean that these students should be prevented from entering higher education. Rather, in a system that permits wider participation, it suggests a new role for HEIs in enhancing the quality of learning. These recommendations focus on the under-addressed but critical issue of student and teacher quality of learning.

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[100]   University of Reading, "BSc Agriculture," accessed January 4, 2019, http://www.reading.ac.uk/ready-to-study/study/subject-area/agriculture-ug/bsc-agriculture.aspx.

Recommendations

1. Make study skills a compulsory element of all undergraduate courses. This could incorporate modules such as anti-plagiarism, writing skills, effective use of the internet for literature reviews, writing for publication, and so on. The type of study skill taught will depend on the year of study and subject discipline. To make time for this in the curriculum and to source staff to teach the courses, study skills could replace the 'general education'[101] components of former Soviet systems.

2. Fund faculty professional development so that academics can improve their teaching/research skills, which in turn has a positive impact on their students. It may be impossible to resurrect the expansive system of 'upgrading' that existed in the Soviet Union, but governments can introduce policy measures that formalize professional development requirements on a smaller-scale. If study skills are introduced in HEIs, the training needs of the staff who will teach these courses should be addressed as a priority.

5.3. Research

5.3.1. Select priority areas for simple, innovative and frontier technology research

Rationale

In line with Zewail's argument (see STI section above), Afghanistan, Kyrgyzstan and Tajikistan should identify priority areas across the three realms of technology:

1. Simple technologies that solve everyday problems;
2. Innovative technologies that enable countries to be part of world markets;
3. Frontier technologies that research the unknown future possibilities.

The rationale for doing so at policy level is to help governments prioritize spending on STI in higher education so that it is directed towards these priority areas. However, this should not be to the detriment of financing other subjects: basic science and the humanities/social sciences are also critical to a country's wellbeing and economic prosperity.

Recommendation

1. Convene a taskforce made up of government actors, HEIs, and other experts to assess the country's current technological strengths, weaknesses and areas for opportunity. The taskforce should be explicitly given the remit to look broadly at both the current situation and future prospects. It should have the freedom to make recommendations that may be different from the government's current directions without fear of sanction or reprisal.

2. Based on the assessment, select a limited number of priority areas that encompass simple, innovative and frontier technologies. Increase funding for research institutes already engaged in research on these areas and provide new grant funding for the development of these technologies where they do not currently exist. Prioritize projects that can demonstrate the application of the research e.g. basic science research that can influence HEI curricula or lay the foundation for future discovery, applied research that leads to the development of new technologies, etc. Higher education institutions in other countries with expertise in proposed new areas for development may be suitable partners for funding and/or capacity building support.

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[101]   From the Russian 'воспитание' (vospitaniye) and 'воспитательная работа' (vospitatelnaya rabota)

5.3.2. Create centres of excellence

Rationale

Since funding to upgrade and improve research across the higher education system is limited, many governments have introduced selected initiatives to support excellence, either in STI or higher education as a whole. In Kazakhstan, for example, the government has a special budget line to fund Nazarbayev University, which it intends to develop as a flagship 'world-class' HEI within the national system.[102] Institution building is a costly endeavour; a more feasible option in Afghanistan, Kyrgyzstan and Tajikistan is to create centres of excellence within existing HEIs and research institutes, concentrating funding on selected sciences and technologies.

Recommendations

1. Using the identified priority areas for innovative and/or frontier technologies (see previous recommendation), provide funding to create a small number of centres of excellence in these areas. Funding should be sufficient to fund faculty, staff, students, equipment and to upgrade or pay for new infrastructure, and it must be available for a long period e.g. a minimum of five to ten years, in order for the centre to have any real impact. Having identified priority areas using national experts, policymakers may wish to invite international experts in settings that have centres of excellence in similar areas to help develop, for example, legal and organizational structures. This could also be a good way to attract international partners and funding to support national scientific research.
2. Invite HEIs/research institutes in public and private sectors to bid for funding to create a centre of excellence in one of the priority areas. Bidders would need to demonstrate why their institution would be a suitable base for a centre of excellence (e.g. they already have academics in that area, they have a physical location for a lab, they have international partners who will work with them etc.). Private HEIs bidding for funds must additionally be able to demonstrate the public benefits they would produce by securing state funding. Selection must be transparent and based purely on the merit of the application.
3. To enhance the impact of research at the centres of excellence, each could be tasked with developing graduate programmes to educate Master's and PhD/Candidate of Science students. This will support the development of the next generation of researchers as well as those who will work in the public or private sector to implement and further develop the technologies. It also addresses the issues identified in the previous section on underqualified and aging faculty.

5.3.3. Encourage international research collaborations

Rationale

The governments of Afghanistan, Kyrgyzstan and Tajikistan stand a better chance of making their higher education systems more innovative by connecting to and engaging with international communities of practice. Enabling faculty and students to travel abroad enhances their horizons, deepens their knowledge base, and creates cross-national expert networks. A scientist working on resilience in mountain communities, for example, will be able to improve their own research and improve the research of others by sharing and building expertise with scientists working in

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[102]   Emma Sabzalieva, "The Policy Challenges of Creating a World-Class University Outside the Global 'Core,'" *European Journal of Higher Education* 7, no. 4 (October 2017): 424–39, https://doi.org/10.1080/21568235.2017.1292856.

other mountain communities. Globalizing processes that have made travel easier and communications faster readily facilitate such collaboration.

Many states have already developed policies that actively encourage international collaboration. In India, for example, participation in transnational projects helps to share the large cost of resource intensive modern science as well as enhance the country's prospects of gaining global experience and competitiveness by sharing access to cutting edge large-scale international facilities.[103] This emphasis on fostering cost-effective innovations has been called 'frugal innovation', an interesting strategy for states that have fewer financial resources of their own.[104]

Expanding international research collaborations help build national knowledge bases. Authorities can utilize international expertise (and funding, where appropriate) to benefit their national STI development. To date, these states have been eager recipients of international funding and engagement and therefore already have experience in this area. However, too often the agenda has been set by the international actor, placing the states in a subservient position of recipient rather than mutual partner.

Recommendations

1. Incentivize researchers to engage in international research collaborations by offering funding for international site visits to partner researchers and providing official support to in-country visits by partner countries (e.g. by facilitating the visa process, meetings with government officials and the research team to demonstrate the state's endorsement of the research). This type of funding scheme could be targeted towards collaborations that will help the country achieve its stated STI priorities.
2. Lift any restrictions on international travel that currently exist e.g. the need to obtain approval before leaving the country to present at a conference. This recognizes the benefits of international research collaboration, enhances trust, and encourages researchers to innovate by demonstrating the government's support for their work.
3. At the level of the state, deepen collaboration with international organizations whose activities are in line with the national STI priorities and which understand the mutual benefits of collaboration. For example, the International Science and Technology Centre is now based at Nazarbayev University in Kazakhstan[105] and could be a good partner for deeper cooperation. Kyrgyzstan and Tajikistan already have connections that could be developed; these could be created in the case of Afghanistan.

5.4. Scientific culture

5.4.1. Foster academic community

Rationale

With disruption caused by extended periods of conflict and chronic under-funding of higher education and research since the dissolution of the Soviet Union, the infrastructure of academic life has deteriorated in Afghanistan, Kyrgyzstan and Tajikistan. There is very little networking between disciplinary communities or across universities within the countries, let alone opportunities for international collaboration.

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[103]   Ministry of Science and Technology, India, "Science, Technology and Innovation Policy 2013," 2013.

[104]   UNESCO, "UNESCO Science Report," 599.

[105]   International Science and Technology Center, "ISTC," accessed January 4, 2019, http://www.istc.int/.

In Kyrgyzstan and Tajikistan, the adoption of European Bologna principles has begun to see teaching and research understood as collective responsibilities for higher education rather than atomized as it was in the Soviet era, when universities did teaching and the Academies of Science undertook research. However, university faculty continue to have incredibly heavy teaching loads that prevent lecturers from engaging seriously with knowledge generation through research. Research is also inhibited by restrictions on access to national and international publications and data that researchers could use to keep informed and engage with current debates in their field.

Recommendations

1. Provide all publicly-funded HEIs with access to electronic journals and books through services such as JSTOR,[106]which hosts more than 12 million journal articles. Subscriptions could be funded by external donors. Some journals are open access and therefore cost-free, such as the Directory of Open Access Journals.[107] Others provide reduced cost subscriptions for developing countries and these are routes worth exploring to minimize additional expenditure. [108]
2. Access to resources and inter-/intra-national networking will be greatly facilitated by reliable and widespread internet access. The Government of Tajikistan has recognized this as a national challenge that needs addressing, but the connectivity also remains an issue in Kyrgyzstan and Afghanistan. Funding this type of infrastructure development may be appealing to an international company or organization, but the cost of ongoing maintenance will require policymakers to allocate budget resources over the long term.
3. For research to become more integrated into HEIs as well as the Academies of Science, policymakers should make reductions to lecturers' teaching loads. This could be approached in a number of ways, from bringing in sessional lecturers to reducing the number of teacher-student contact hours; the mix of solutions to reduce teaching loads could be most suitably designed by HEIs themselves.
4. If one of the purposes of enhancing the research capacity of HEIs is to increase national capacity for knowledge generation, there needs to be more coordination across institutions so that ideas and practices can be shared, and potential project partners sought. Such coordination could be supported by government through the organization of discipline-based academic conferences, or by providing/procuring seed funding to establish national learned (academic) societies.

5.4.2. Include and promote women at every level and in every capacity

Rationale

Women are integral to every aspect of society and make up half of the world's population, yet they continue to face significant barriers that are often deeply entrenched in societal norms and values. Governments in the region do promote women's equality through policies such as gender quotas, but deep-rooted social and cultural obstacles remain, particularly in rural areas.[109]

Yet there is no justifiable reason that women should be treated differently from men. Beyond the obvious and basic point about the criticality of gender equality, levelling the playing field between men and women in higher education has many positive outcomes. In a study of female

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[106]   https://www.jstor.org/

[107]   https://doaj.org/

[108]   See e.g. https://www.jstor.org/librarians/fees/dnai, https://www.espa.ac.uk/news-blogs/news/2014-09/55740

[109]   Samina Malik and Kathy Courtney, "Higher Education and Women's Empowerment in Pakistan," *Gender and Education* 23, no. 1 (2011): 29–45, https://doi.org/10.1080/09540251003674071.

participation in higher education in neighbouring Pakistan[110], multiple affirmative effects were found: increased awareness of legal rights (extremely important in societies where women are often excluded from decision-making processes), greater opportunities to obtain economic independence, increased levels of self-confidence (often damaged through childhood experiences in which boys are consistently valued over girls), higher chances that women will be listened to in society because they are educated and therefore able to contribute to society. These impacts may be seen as an 'upward spiral' affecting not only women's opportunities to participate but having an impact on their families, friends and communities[111].

These recommendations are most appropriate to the current situation in Afghanistan and Tajikistan, where female participation in higher education is well under 50%. It is also important to note that these measures can only be successful if implemented in combination with a wide range of other policies to improve the situation for girls at school and at home and to combat discrimination in the workplace.

Recommendations

1. Implement measures to strategically expand female participation. Women should be encouraged to enrol in subjects they are traditionally under-represented in, such as the natural sciences and technology-based programmes. Enhanced stipends could be offered to suitably qualified women enrolling in the designated programmes. More funding could be offered to departments seeking out well-qualified female candidates. Offering indirect rewards by, for example, providing funding for confidence building training would provide the 'soft skills' that female students may have been denied in the home environment. Funding could be sought from international organizations or other states. Kazakhstan, for example, has provided scholarships for female students from Afghanistan to study in Kazakhstan since 2010[112] and may be willing to extend the programme to cover study within the home context.

2. Ongoing public information campaigns should continuously raise awareness about the importance of female participation in higher education. Television programmes and social media clips could be made about role model female academic leaders, business women and other women leaders demonstrating the importance of higher education on their careers and how this has positively impacted on their family. Crucially, these campaigns must clearly show that advocating for women is not a 'threat' to national values – on the contrary, these campaigns should have the ambition to change any pre-existing discriminatory values.

3. As part of the public information campaigns, the government from the very highest echelons must provide its support for gender equality and must do so consistently. This can be done through choices of where the leadership visit to make public speeches e.g. a university department that has successfully recruited a good number of women to a science or technology course. It can also be done by referencing the critical importance of women to education and the workforce using language that is more likely to resonate with national audiences. As with the public information campaigns, this top-down support must be sustained: changing deep-set gender biases will not happen overnight.

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[110]   Malik and Courtney.

[111]   Malik and Courtney, 38.

[112]   Anna Velichko, "Kak v Astane reshili poddzerhivat afghanskikh zhenschin [How Astana decided to support Afghan women]," *Karavan*, September 8, 2018, https://www.caravan.kz/news/kak-v-astane-reshili-podderzhat-afganskikh-zhenshhin-478080/.

5.4.3. Develop HEI-community engagement

Rationale

HEIs today operate across global, regional, national and local communities, but the emphasis here is on community engagement at the national and particularly the local levels. By engaging more closely with these communities, HEIs can support national economic needs by producing well-qualified graduates and play an important role in propagating a scientific culture across society. HEI-community engagement can range from the very straightforward, such as offering public access to the HEI's facilities or inviting the public to join lectures, to complex longer-term undertakings to encourage economic regeneration and enterprise.[113] The recommendations here focus on modes of engagement that increase the understanding of and support for STI in society.

Recommendations

1. Make the necessary reductions to teaching or research load to enable academics to spend more time in their local communities. It could even be a requirement that all faculty members e.g. spend the equivalent of one day a month on community engagement, or it could be organized on a less formal basis. HEIs should encourage faculty members to engage in a wide range of activities. This could incorporate, for example, giving public lectures in small towns or villages, visiting local schools to encourage (female) students to apply to STI-related programmes, or learning from farmers about local agricultural issues. The purpose of these 'field trips' must be mutual: this is not just about the HEI providing information/knowledge to communities but about learning from those communities. In turn, this could support research that academics are undertaking. The government can support this with directives on workload allocation and by providing funding for travel.
2. Provide funding for HEIs to organize community science days.[114] These offer opportunities for HEIs to break down barriers with communities by inviting them onto the HEI's site, showcasing student and faculty work, and engaging a wide audience of all age groups to interact with the HEI. Students may enjoy the opportunity to volunteer at the open days e.g. by offering tours or running experiments. It is possible that international organizations would support these initiatives with funding and other resources.

5.5. Business

5.5.1. Engage businesses in joint planning on the future of work

Rationale

A common trope amongst employers worldwide[115] is that there is a mismatch between the skills students have on graduating from HEIs and the skills required to be successful in the workplace.

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[113] See Sabzalieva "Understanding Universities' Responsibilities to Their Wider Communities," *Perspectives: Policy and Practice in Higher Education* 16, no. 4 (October 1, 2012): 123–28, https://doi.org/10.1080/13603108.2012.667846. for a discussion of different modes of engagement

[114] A long-running and very successful science fair in the UK is run by Oxford Brookes University. See https://www.brookes.ac.uk/about-brookes/events/brookes-science-bazaar-2018/.

[115] On Tajikistan see Dilrabo Jonbekova, "University Graduates' Skills Mismatches in Central Asia: Employers' Perspectives From Post-Soviet Tajikistan," *European Education* 47, no. 2 (April 3, 2015): 169–84, https://doi.org/10.1080/10564934.2015.1033315.

This is one reason for persistently high unemployment rates. It may also contextualize perceived low rates of private sector innovation. Governments are uniquely well placed to play a coordinating role in mediating between higher education and employers.

Recommendations

The recommendations here are adapted from ideas put forward by Australian academic Dr Gavin Moodie.[116]

1. Commission a report that analyses the future of work as well as the future of higher education. The report should be undertaken by a mix of private sector employers and academic leaders who are embedded in the national context. The aim would be to make available to the public the way higher education is organized and the collective views of the future of work.
2. Create an employer-higher education forum, which would convene on a regular basis. The purpose would be to have a formal group that could explore on an ongoing basis issues around the relevance of higher education curricula to future jobs and to support higher education in implementing new technologies in learning and teaching. The forum would build trust and mutual understanding between sectors, and over the long term should reduce the skills mismatches between graduating students and new employees.

5.5.2. Reward businesses that fund HE infrastructure development

Rationale

Governments are not in a financial position to fund all the required developments that would bring publicly-funded higher education infrastructure up to contemporary standards. However, a good standard of infrastructure is necessary to support the development of STI in higher education. All three states wish to develop their private sectors in part to reduce dependence on government funding. One way to achieve both aims is to incentivize the private sector to take on the financial burden of upgrading infrastructure. Provision of internet, teaching and learning facilities and access to digital resources should be prioritized.

Recommendations

1. Change legislation and/or introduce new laws that promote corporate philanthropy in ways that would reward businesses that choose to fund higher education development.
2. With high levels of mobile phone penetration in the three states but comparatively low levels of internet access, organize a competition for a business or individual to develop innovative ways of employing non-internet-enabled mobile phones to support teaching and learning. The competition could be established on an annual basis and must be well publicized with as few entry requirements as possible. There should be a substantial cash prize for the best innovation and/or a state-funded contract to implement the innovation across the country's public HEIs. The award should be made at a high-level ceremony. International organizations operating in the state may be prepared to provide mentoring to applicants, help with judging, and/or co-fund the prize.
3. Based on a needs assessment that higher education leaders would undertake, the government could compile a list of costed infrastructure development requirements at public HEIs across the country. Governments could offer tax breaks to private companies that agree to take on one or more of

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[116] "Four Ideas for Reforming Higher Education Policy-Making," The Conversation, February 27, 2018, http://theconversation.com/four-ideas-for-reforming-higher-education-policy-making-88885.

the listed requirements. A recognition strategy could be developed to ensure these businesses are thanked appropriately e.g. a building named after the business, annual roll of honour published by government.

5.5.3.   Extend co-operative learning

Rationale

Co-operative learning, also known as work-based learning, practical work or sandwich placements, provide students with substantive workplace experience as an integral part of their diploma or degree programme. It gives them a competitive edge when applying to jobs after graduation but more importantly gives them a taste of the 'real world'. It builds stronger connections between higher education and the workplace. Students are paid for the work they do, though generally at a lower rate than regular employees. For employers, this is a low-risk low-cost opportunity that may help them find future employees. The concept is not unfamiliar in Afghanistan, Kyrgyzstan and Tajikistan, but is often set up as short-term internships.[117]

Recommendations

1.   Task university leaders to integrate longer-term placements into degree programmes including one-year work placements (extended undergraduate education to five years in the former Soviet jurisdictions). This could initially be restricted to programmes in science and technology areas but could in future be extended to a broader range of courses.
2.   Subsidize the salary of co-op students to incentivize firms to take on more such students.
3.   Organize an information campaign geared at students and their parents to raise awareness of and desire for programmes with integrated co-operative placements.

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[117]   E.g. Ministry of Higher Education, Government of Afghanistan, "Environmental and Social Management Framework. Second National Higher Education Strategic Plan and Higher Education Development Project," 31.