Universities: increasingly global players

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Global competition but also a global family

As I am writing this essay in June 2015, 9.5 million students are simultaneously taking the *gaokao* (高考), the Chinese National College Entrance Examination giving access to university. What better illustration of the formidable importance of higher education at the beginning of the 21st century? More than ever, people are convinced today that knowledge and skills obtained at universities are crucial to personal well-being, as well as to the social and economic health of cities, nations and regions.

Universities have become institutions of a global world, in addition to assuming their traditional local and national roles. The answers to global challenges (energy, water and food security, urbanization, climate change, etc.) are increasingly dependent on technological innovation and the sound scientific advice brokered to decision-makers. The findings contributed by research institutes and universities to the reports of the Intergovernmental Panel on Climate Change and the Consensus for Action[1] statement illustrate the decisive role these institutions are playing in world affairs. Research universities also attract innovative industries. The Googles and Tatas of this world only thrive in proximity to great research institutions and it is this winning combination that fosters the emergence of dynamic entrepreneurial ecosystems such as Silicon Valley in the USA and Bangalore in India which are at the root of innovation and prosperity.

Universities themselves have become global players. Increasingly, they are competing with one another to attract funds, professors and talented students[2]. The reputation of a university is made at the global level. This trend will accelerate with the digital revolution, which is giving world-class universities an even greater global presence through their online courses.

As testimony to this evolution, global university rankings have appeared in the last ten years. They reflect both the existence of global competition and a global family of universities. The annual Academic Ranking of World Universities (ARWU) was first published in June 2003 by the Center for World-Class Universities of Shanghai Jiao Tong University, China. Quickly, other international rankings followed: the QS World University and the Times Higher Education rankings. International university rankings may often be debated but they never go unnoticed.

What makes a university world class? A world-class university has a critical mass of talent (both faculty and students), self-governance and administrative autonomy; academic freedom for faculty and research, which includes the right to critical thought; the empowering of young researchers to head their own laboratories; and sufficient resources to provide a comprehensive environment for learning and cutting-edge research. Some of the top-ranked institutions are seasoned Western universities, from which younger universities might learn a few things. Most universities do not feature in these world-class rankings but they nevertheless fulfil important educational roles at the local level.

In the past ten years, many new universities – most notably from Asia– have entered ARWU's top 500, even though US universities still dominate the top positions. The past decade has seen the advent of an increasingly multi-polar academic world, as noted already in the *UNESCO Science Report 2010*.

If competition between universities is one hallmark of this new league, co-operation and collaboration between scientists is another. In recent years, long-distance scientific collaboration has become the rule: scientists now live in a hyper-connected world. One way to measure this is by examining the co-authorship of scientific papers. The 2015 European Leyden ranking of universities for their capacity to engage in long-distance collaboration shows that six of the top ten universities come from Africa and Latin America, with the University of Hawaii (USA) in the lead.

Explosive growth in brain circulation

Student numbers are exploding around the world, as there has never been a greater need for a good tertiary education. Emerging economies will have around 63 million more university students in 2025 than today and the number worldwide is expected to more than double to 262 million by the same year. Nearly all of this growth will take place in the newly industrializing world, more than half of it in China and India alone. Student migration, brain circulation and the internationalization of universities has never been higher. There were 4.1 million students enrolled at universities abroad in 2013, 2% of all university students[3]. This number could double to eight million by 2025. Given this small percentage, brain drain should generally not represent a threat to the development of national innovation systems, so brain circulation should remain as unencumbered as possible in higher education. Universities will remain in high demand around the world, at a time when public financial support is

1. A message of scientific consensus addressed to world leaders on the need to maintain humanity's life support systems; the project is hosted by Stanford University (USA). See: http://consensusforaction.stanford.edu

2. Malaysia, for instance, hopes to become the sixth-largest global destination for international university students by 2020; between 2007 and 2012, the number of its international students almost doubled to more than 56 000. See Chapter 26.

3. This global figure masks strong variations from one region to another. See Figure 2.12.

strained in most countries. Gains in productivity will therefore be unavoidable, despite the very competitive nature of science; in particular, the emergence of university networks to enable institutions to share their faculty, courses and projects is a way forward.

Be relevant: close the innovation gap

The creation and transfer of scientific knowledge are critical to building and sustaining socio-economic welfare and integration in the global economy. In the long run, no region or nation can remain a simple 'user' of new knowledge but must also become a 'creator' of new knowledge. Closing the innovation gap is a necessary role of universities; innovation (or technology transfer) must become as important a mission as teaching and research.

Unfortunately, many countries in Africa and Asia mainly are producing fewer inventions today than they did in the early 1990s, despite healthy rates of economic growth. An analysis of patents signed between 1990 and 2010 shows that 2 billion people live in regions that are falling behind in innovation. This decline is overshadowed by the extraordinary development in India and China:[4] almost one-third of the 2.6 million patents filed worldwide in 2013 came from China alone.

Youth need to know their (IP) rights and engage in reverse innovation

This deficit in new patents in many countries is not due to a lack of entrepreneurial spirit, as many examples show, such as the re-invention of mobile banking in Africa. Rather, the gap is due to the fact that universities cannot bear the cost of research and technology transfer for lack of financial resources. According to Bloom (2006), responsibility for this relative neglect of higher education lies partly at the door of the international development community, which in the past failed to encourage African governments to prioritize higher education. An estimated 11 million young Africans are set to enter the job market each year over the next decade; efforts must be made to support their ideas, says Boateng (2015). For young people to find good jobs in the global economy, they will need skills, knowledge and will to innovate, as well as greater awareness of the value of intellectual property (IP).

One way to create the best conditions collectively for collaborative and 'reverse innovation' is for universities to work on appropriate (or essential) technology. These technologies aim to be economically, socially and environmentally sustainable; they are both high-tech (and therefore appealing to researchers) and low-cost (and therefore suited to innovators and entrepreneurs).

At the Ecole polytechnique fédérale de Lausanne, we have set up one such initiative, EssentialTech. This programme implements essential technologies in the context of a comprehensive value chain: from understanding needs to monitoring the real impact of these technologies and contributing to their long-term viability. For technology to have a significant and sustainable impact, scientific, economic, societal, environmental and institutional factors all have to be considered. This programme requires an interdisciplinary and multicultural, collaborative approach, as well as partnerships between the private sector, public authorities and civil society, particularly with stakeholders from low- and middle-income countries. Across the globe, many universities have set up such initiatives, or are in the process of doing so.

Digital disruption: a way of going global

The digital revolution is one new and disruptive way for universities to 'go global' beyond their single campuses to reach a global audience. Cloud computing and supercomputing, as well as the handling of big data, have already transformed research. They have given rise to global collaborative projects such as the Human Genome Project in the 1990s and the more recent Human Brain Project.[5] They allow for crowd-based networked science where researchers, patients and citizens can work together. In education, this revolution is increasingly taking the form of massive open online courses (MOOCs). Some world-class universities have realized what MOOCs can do for their visibility and reputation and begun offering such courses.

Two factors have contributed to the rapid rise of MOOCs (Escher *et al.*, 2014). Firstly, digital technology has come of age, with widespread use of laptops, tablets and smartphones in many countries and growing broadband penetration on all continents. Secondly, the 'digital native' generation has now reached university age and is totally at ease with the all-pervasive use of digital social networks for personal communication. The number of world-class universities committed to this digital innovation is steadily growing, as is the number of students – one MOOCs provider, Coursera, has seen the number of students almost double from 7 million in April 2014 to 12 million today. Unlike their online educational predecessors, the costs of MOOCs are borne not by students but by the institution producing the courses, which adds to their attractiveness. MOOCs allow a single university to extend its teaching to a global audience: the Ecole polytechnique fédérale de Lausanne counts 10 000 students on campus but has close to 1 million registrations worldwide for its MOOCs.

4. See Chapters 22 (India) and 23 (China).

5. This is one of the European Commission's Future and Emerging Technologies Flagship projects to 2023. See : https://www.humanbrainproject.eu

MOOCs could also alleviate the textbook gap

In the coming years, MOOCs will allow affordable, quality courses to be disseminated everywhere. On-campus education will remain fundamental to student life but universities will have to adapt to global competition and increasing demand from students for quality lectures dispensed by top universities. Universities that share their lectures, complemented by seminars and exercises unique to each location, are certain to be part of the landscape in 2020. MOOCS will foster the co-design and co-production of these courses by partner universities. One could also imagine providing a set of high-quality introductory lectures online to a network of partner institutions. MOOCs could also alleviate the textbook gap by providing freely accessible modules of knowledge produced by the best experts and stored in a Wikipedia-like repository.

The momentum created by MOOCs may also result in new educational packages. Up until now, MOOCs have been delivered as individual courses. However, they may aggregate into accredited programmes, in future. Universities – sometimes as networks – will decide on certification and perhaps even revenue-sharing. Certified courses are of great importance for professional education because employers are increasingly focusing on the potential employee's skill set rather than on a formal degree. Through MOOCs, the lifelong learning that is so crucial to knowledge societies is becoming a globally feasible target.

At first, universities feared that a few fast-moving world-class universities would take over the MOOC business to install domination and homogeneity. What we are actually seeing is that MOOCs are becoming a tool for co-operation, co-production and diversity. Competition to produce the best courses, yes, but monolithic domination, no.

The partnering of universities will happen

For many years, and understandably so, primary education was the main challenge in education. Now has come the time to recognize, in parallel, the crucial importance of the research experience and skills that only universities can deliver to students and lifelong learners.

The partnering of universities to co-produce, re-appropriate, integrate, blend and certify classes will happen across the world. The university of tomorrow will be a global and multilevel enterprise, with a lively campus, several antennae located with strategic partners and a global virtual online presence. The Ecole polytechnique fédérale de Lausanne is among those universities that have already embarked on this path.

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Physics students from Iran, Senegal, Spain, Venezuela and Viet Nam enjoying an impromptu study session on the terrace of UNESCO's Abdus Salam International Centre for Theoretical Physics in Italy in 2012. There were 4.1 million international students worldwide in 2013.