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500

SHANGHAI
RANKING

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Foreword
Dr Ying Cheung

An introduction to the Academic Ranking of World Universities

Building world-class universities has been the dream for generations of Chinese. At the 100th anniversary of Peking University in May 1998, the then president of China declared that the country should have several world-class universities, resulting in the “985 Project”, a program specially designed for building world-class universities in China. At that time, many top Chinese universities including Shanghai Jiao Tong University set up their strategic goals to become world-class universities, most of them set up time tables. However, there was no consensus on many fundamental questions about world-universities, such as what is the definition of and criteria for a world-class university? How many world-class universities should there be in the world? What are the positions of top Chinese universities in the world higher education system?

In order to answer many of these questions, a team led by Prof. Nian Cai Liu at the Center for World-Class Universities (formerly the Institute of Higher Education) of Shanghai Jiao Tong University had spent two years on the benchmarking of top Chinese universities with four groups of US research universities, and another two years on the creation of a global university ranking. Upon the request of many colleagues from various countries, the Center for World-Class Universities decided to publish the ranking on its website.

The Academic Ranking of World Universities (ARWU) was first published in June 2003, and then updated on an annual basis. ARWU uses six objective indicators to rank world universities, including the number of alumni winning Nobel Prizes and Fields Medals (10%), number of staff winning Nobel Prizes and Fields Medals (20%), number of highly cited researchers selected by Thomson Reuters (20%), number of articles published in journals of Nature and Science (20%), number of articles indexed in Science Citation Index - Expanded and Social Sciences Citation Index (20%), and per capita performance of a university (10%). About 1200 universities are ranked by ARWU every year and the best 500 are published.

Although the initial purpose of ARWU was to find the global standing of top Chinese universities, it has attracted a great deal of attention from all over the world. The mainstream media throughout the world regularly reports the ARWU. Hundreds of universities cite the ranking results in their campus news, annual reports and promotional brochures. A survey on higher education published by The Economist commented ARWU as “the most widely used annual ranking of the world’s research universities”. Burton Bollag, a reporter at Chronicle of Higher Education wrote that ARWU “is considered the most influential international ranking”.

One of the factors for the significant influence of ARWU is that its methodology is globally sound and transparent. ARWU tries to rank research universities in the world by their academic or research performance based on internationally comparable third-party data that everyone could check. No subjective measures are taken. Nevertheless, there are still many methodological and technical problems. ARWU emphasizes the research function of universities. The fundamental role of universities - teaching, and their contributions to society are not well taken into account. In addition, ARWU is biased in favor of universities in English-speaking countries and universities strong in hard sciences. Technical problems include definition of higher education institutions, affiliated units of institutions, and attribution of publications to institutions. My colleagues and I have been working hard to study these problems and improve the ARWU.

Ever since the publication of ARWU, we have received numerous requests, asking for us to provide rankings of world universities by fields or by schools/departments. In response to these requests, since February 2007, the Center for World-Class Universities began to publish the Academic Ranking of World Universities by Broad Subject Fields (ARWU-FIELD). ARWU-FIELD provides the world’s top universities in five broad subject fields, including Natural Sciences and Mathematics, Engineering/Technology and Computer Sciences, Life and Agriculture Sciences, Clinical Medicine and Pharmacy, and Social Sciences. In November 2009, the Academic Ranking of World Universities by Subject Fields (ARWU-SUBJECT) was published; the five ranked subjects are Mathematics, Physics, Chemistry, Computer Science and Economics/Business. Both ARWU-FIELD and ARWU-SUBJECT employ a similar methodology to that which is used in the ARWU.

Any ranking is controversial and no ranking is absolutely objective, therefore users should carefully examine the ranking methodologies before looking at the ranking results. For any kind of decision-making, rankings should be used only as a starting point and more comprehensive analysis are always necessary.

Dr Ying Cheng

Executive Director, Center for World-Class Universities, Shanghai Jiao Tong University, Shanghai, China

**SHANGHAI
RANKING**



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#1 ASU #2 Stanford #3 MIT

– U.S. News & World Report, 2016 and 2017

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–2016 Center for World University Rankings

Among the best-qualified graduates according to employers

–Global University Employability Survey 2016

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A satellite view of Earth from space, showing the curvature of the planet and the blue oceans. The landmasses are visible in shades of green and brown. The image is used as a background for the University of Southampton advertisement.

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Based on the academic excellence of its faculty, academics and researchers, the University of Athens lately enters the world market offering an abundance of distance learning courses on a variety of academic fields:



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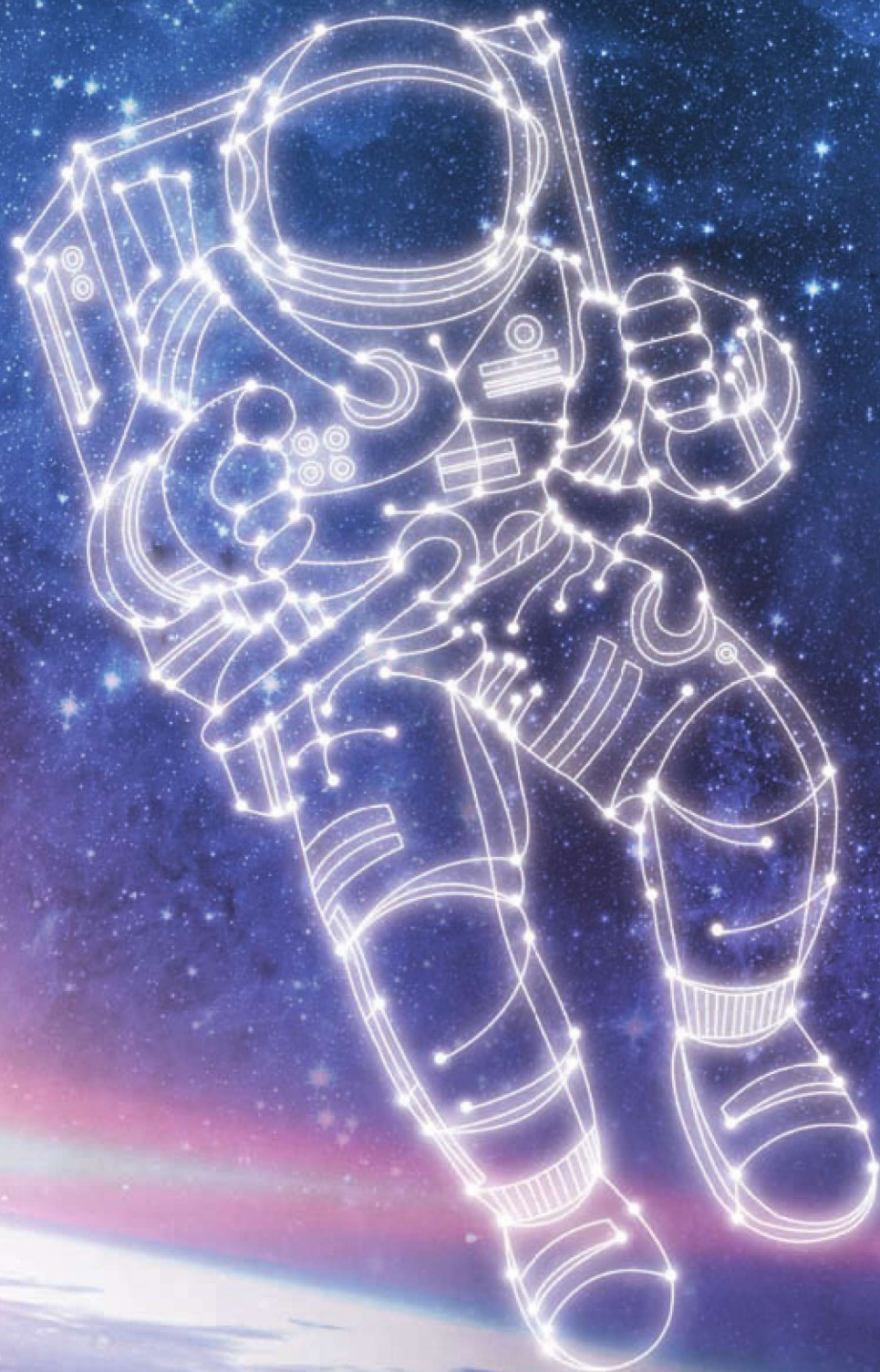
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THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

Opening Minds • Shaping the Future



Whilst rankings in themselves act as a useful initial guide as to the relative strengths between universities in particular areas, it is quite an impossible task to portray the different character, philosophy, values and many of the strengths one can expect between universities in such a format. We are fortunate not to live in a uniform world, many structural, linguistic and cultural differences play a key role in determining the ways in which universities are represented in ranking systems.

Whilst rankings are an excellent initial guide, at the Shanghai Ranking Consultancy we passionately believe that every single one of the top 500 universities are excellent institutions, helping great young minds achieve their dreams and fulfil their potential through the knowledge, friendships, experience and skills one can expect to develop at university.

Perhaps equally as importantly, certainly lesser well known, is the role that leading universities play in the discovery and dissemination of new knowledge, pushing the frontiers of our understanding to meet countless challenges as in the fight against cancer, Alzheimer's disease and HIV / AIDS. The scope of university research is so enormous in its scale that quantifying it all in a single volume is an impossible task. Research universities today are working tirelessly to better understand critical phenomena such as global climate change, the demographic shift towards an ageing society and the myriad impacts that globalization are having on the ways we can expect to lead our lives.

Undoubtedly there are universities developing ideas and technologies today, which will help meet challenges we don't even know exist yet. Some even have this at the heart of their philosophy such as President Daniel Zajfman of Israel's Weizmann Institute: "I think the role of universities is to solve problems that people don't even know exist. If we just solve the problems of today, we are

basically doing the job of everyone else. But the focus and the profile of universities as has always been in the past, and I hope it will stay like this to be able to provide knowledge for the sake of knowledge. That has always been the goal. When we look at the values of knowledge for the sake of knowledge, we realize 100 years later what we can do with this."

At the same time, our leading research universities grapple with some of the most inspirational concepts and ideas known to humankind such as trying to understand the origins of the universe, the origins of life on earth, the nature of consciousness and the depths of the ocean; as well as perhaps the most compelling of all - in the question of extraterrestrial life. The recent Higgs Boson Particle discovery is a truly inspirational piece of science that helps us answer questions such as who we are, and what connects the universe together. Equally one cannot forget the landing on Mars, and the paradigm transformation discoveries made there could herald for human perspective. Both are remarkable achievements with research universities at the helm, exemplifying the spirit of curiosity, inspiration, collaboration and discovery that such institutions bring to our world today.

Whilst, when confronted with the philosophical and technological leaps mankind has made in recent centuries, one could easily be mistaken in thinking that we already have all the answers in today's era of instant communications and mass connectivity. It is quite curious that universities are really the only institutions investigating these basic questions. With their roots in the renaissance period, universities stand out today as the leaders in our on-going quest to transform what was unknown yesterday, into what is known today.

Perhaps none of this would be possible, however, without the most basic essence of what a university is - a place where we can freely question what is around us, and what is

presented to us. Whilst breakthrough discoveries in the hard sciences more often than not capture headlines, there is a fundamental force that underpins all activity at a university; our own curiosity.

The Shanghai Jiao Tong Top 500 Research Universities Encyclopedia shares in this curiosity. A book of this type has never been produced before, with direct interviews conducted the world over to bring the most important features of the world's leading universities to an international audience of those most connected to these wonderful institutions. Principally this book is for anyone that is curious, however three distinct groups arise - young aspirational people interested in attending a leading university, interested stakeholders in the global research and development community and universities themselves.

The ambition of the Shanghai Jiao Tong Top 500 Research Universities Encyclopedia is great, perhaps too much for a single book; but certainly acts as a very clear first step towards bringing together the core strengths, cultures, learning environments and philosophies of the world's leading research universities together in one single volume.

For young people around the world, university is an enormous opportunity. Not just as the next step in a career, but as a platform to fulfil one's curiosities about the world of ideas and natural phenomena around us. At the dawn of the 21st century, university offers you the opportunity to take the first steps as tomorrow's global citizens. Regardless of where you call home, there are incredible universities the world over eager to attract the brightest, most imaginative and hardest working. From Japan to Brazil, via Europe and the United States there are unique institutions that could be best suited to your interests and aspirations. We present the leaders to you in this book.

With the opportunities of globalization however, there are also very clear challenges. Whether that be in finding the right career or developing a way of living sustainably into the future; university offers an excellent platform to make a positive contribution both to ones own chances, as well as making a broader contribution to the incremental growth in humankind's understanding. One can now expect to get directly involved in research, develop entrepreneurial skills and have the opportunity to make contributions to both society and the economy through the options available at university. The well-trodden career path is far from the only choice in today's world.

On the one hand, the Shanghai Jiao Tong Top 500 Research Universities Encyclopedia aims to inspire young people the world over to see university not just as a traditional step towards a career. Whilst generations before were able to rely upon career opportunities that arose from university, today's students are increasingly focused upon making new discoveries, contributing towards society and developing into entrepreneurs. Through university, young people are increasingly able to pursue their curiosities with freedom and flexibility, contributing to the continued development of human knowledge internationally.

Whilst without a doubt, young people constitute the world's richest resource of imagination and curiosity; they are far from the only group with interests in the world's leading research universities. The student population may be the heart and soul of any university campus, but vital sources of funding are increasingly shifting to external partners in a

mutually beneficial, symbiotic relationship with knowledge and funding at its heart.

For key stakeholders in the global research and development community, whether that be in the public, private sector or donor community, universities are undoubtedly at the centre of this international network. Changing funding dynamics, a growing appetite for relevance and industry experience amongst the student community, combined with a very clear strategic focus upon translating discoveries into society have made universities increasingly open to collaborative research operations. Naturally, university approaches and successes in collaborative arrangements vary enormously across borders and between cultures. Many universities based in the same city, province or state also have very different approaches.

The Shanghai Jiao Tong Top 500 Research Universities Encyclopedia presents the world's leading research universities' core strengths and their different approaches to working on collaborative projects, as well as to translating new discoveries into the real economy. There remain clear differences in the ways that issues such as intellectual property rights are managed and shared that are also touched on throughout. What is clear is that whilst remaining our most profound research institutions, driven undoubtedly by human curiosity; leading research universities are becoming more open to partnerships, and are key pillars in the continued shift towards a knowledge-based economy with the development of exciting new technologies and discoveries.

Universities have to continue to adapt to the changing dynamics of government policy, globalization of research, study and funding sources amongst many other changes in the external environment. From the approach to research and translational strategies, through to the development of multi-disciplinary learning opportunities, the strategic approach varies enormously between leading institutions around the world. By conducting direct interviews with the world's leading universities, we present the varying approaches to help continue to inform the context of your own direction.

Finally, the Shanghai Jiao Tong Top 500 Research Universities Encyclopedia aims to inspire. The process involved in its production has been epic, with direct interviews conducted the world over to bring the cutting edge research programs and teaching philosophies of the world's leading universities into the grasp of those most interested in their developments and distinguishing points. Our aim is to help the global community, both young and old to better understand who is actually working towards a cure for cancer and a solution to global climate change; whilst at the same time to demonstrate who is undertaking inspirational work in helping us better understand the origins of the universe, the nature of human consciousness and a means for us to guarantee a safe and sustainable food, energy and water supply for future generations. Without a doubt, many of the pioneering institutions in these fields are discussed in this volume.

