Challenges for Higher Education: A Reflection of My 100 Trips to China since 1981

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Preface

Thank you so much for giving me the honor to speak here today. There is a famous story about a blind person trying to figure out what an elephant looks like. When he touches the tail, he said the elephant looks like the tail. When he touches the ears, he said that the elephant looks like the ears. The reason is because the elephant is huge and unless you can examine both closely and afar, with open eyes, you may not see the whole picture.

Indeed, trying to describe Chinese higher education is akin to the blind man describing the elephant. It is easy to give a biased and maybe even wrong description. Therefore I want to state from the outset that this is my impression of the "elephant," right or wrong.

In the past quarter of a century, I have made 100 visits to China. During this critical period for China, it has emerged from one of negligible global influence to one of major international importance. A quarter of a century ago, having only a small number of institutions and burdened with extremely limited resources, the mission of Chinese higher education was to serve a tiny portion of its population. Thus their impact was limited and questionable. Today, with increased wealth and vast expansion of institutions, in qualities and number, the mission of Chinese universities has also vastly expanded.

Universities of today are no longer merely intellectual engines of the nation, but the economic engines as well. This is true not just for China but all nations. Indeed, in China, the shift from "teaching universities" to "research universities" is obvious. It is also not surprising that with this expansion, new models of higher education began to mushroom, thus creating the understandable excitement and confusion. Indeed, I would venture to say that Chinese high education landscape is still very much in a state-of-flux, and how it will look like when the dust settles is still very much a speculation. My talk will discuss this transformation and some of my personal views and biases of how this transformation may affect the nation and the world in the 21st century.

In September of 1981, with an invitation from the Institute of High Energy Physics of the Chinese Academy of Sciences, I made my "first" visit to China since the People's Republic was established. I call this my "first" visit because the last time I was in China, it was in 1950!

Little did I know that for the next quarter of a century, I would be going to China one hundred times. In each visit, I learned a bit more about this fascinating country, deepened relations, developed new relations and friendships. Each visit, I saw China inched forward, impacting the world a little bit more than my previous visit. Each time I saw China changing, some for the good and some not so good. All in all, I saw a nation literally reinventing itself before my eyes, and the eyes of the entire world.

Since my talk is devoted to a description of my impression of how Chinese higher education has evolved, as a scientist I must give you a sense where the origin of my coordinates are from which I measure progress or the lack of it. To this end, I have to tell you about my immediate impression of China

when I landed in Shanghai that October in 1981. I think this defines my coordinate system.

Shanghai's Hongqiao Airport (now a domestic airport, sort of like Love Field in Dallas, Texas) made a deep impression on me. My trip began from JFK Airport, which was one of the largest, if not the largest airports, modern airports at that time in the world. Some 20 hours later, I landed in Shanghai. I recall when I looked out the window as the plane was descending on Shanghai, I saw nothing but darkness, a very unusual sight for what was a city of at least 10 million. That darkness defined China at the time.

The darkness outside the plane window was my first encounter of the remnants of the "cultural revolution," which ended merely four years before. What I saw was an airport badly, in fact desperately, in need of maintenance. Since China's open-door policy was still at the beginning stage, the airport had very low usage. The only airport I could compare Hong Qian to which I now have some familiarity with was Bulgaria's Plovdiv airport which I visited some nine years later just before the tremendous turnover of Eastern Europe.

As I entered Hongqiao, I had difficulty convincing myself that this airport was supposed to be the entry point of one of the world's most populous nations! Imagine this in your mind, 20 hours before, I was at one of the most modern and plush airports in the world, the JFK airport, serving the largest metropolitan area of the United States: New York City. 20 hours later, I was in Hongqiao airport, serving the largest city of China, the most populous country in the world. The contrast could not be more acute!

Unquestionably, the most vivid memory I had during those two hours of lay-over before I flew to Beijing was the sole low-wattage light bulb hanging from the ceiling in the toilet. Darkness in the toilet made "aiming" a real challenge.

China was a different country then. So was its higher education.

Some comments of Chinese universities prior to 1950

My young age in 1950 obviously prevented me from having much memory and precluded me from developing an in-depth understanding about China. Suffice to say that during that period, the Asia-Pacific region was hardly one

that projected confidence about its future. Poverty and wars ruled the day. Indeed, country after country, from the Korean Peninsula to Malaya Peninsula, to the islands of Philippines and Indonesia, there were pervasive violent confrontations. Some were due to volatility arising from mixing nationalism with colonialism, some were struggles between peoples of different beliefs, while others were racial tensions and conflicts. China of course was no exception. Frankly, I cannot fathom the devastation in China in 1950. After eight years of war-of-resistance (*ba nian kang zhan*) and four years of civil war (*nei zhan*), Chairman Mao proclaimed on Tiananmen on October 1, 1949, that "Chinese people have stood up".

I have very limited knowledge of Chinese universities before 1949, except to note that during my parents' generation, there were a relatively small number of outstanding universities. Some of these universities had religious affiliation, the most well-known being Yanjing University and St. Johns University (SJU). In fact, one of my wife's cousins, Alpha Chiang, a renowned mathematical economist and the author of a standard textbook on the subject, was an alumnus of SJU. Other elite national universities included Tsinghua University, Peking University, Peking Union Medical Colleage, Zhongshan University, Jiaotong University and the National Central University. These universities had consistently produced high quality and highly motivated students before WWII. Many became not only pillars of China, but the world.

Of course, during the war-of-resistance, one must underscore the contribution of the famous *Xi Nan Lian Da*, or South West Union University (SWUU). Due to wartime necessity, SWUU amalgamated several outstanding universities, including Tsinghua University, and moved to the remote province of Yunnan. Despite operating under enormously difficult conditions, SWUU managed to gather "under-one-roof" the best teachers and students China could muster. It became the breeding ground of some of the truly most exceptional students the world had known. Many distinguished Chinese intellectuals who had an impact on the world scene in the 20th century received their early education or taught at SWUU. A few instantly come to mind: T. D. Lee and C. N. Yang, two Chinese who won the physics Nobel Prize in 1957, their teacher the late Ta You Wu, commonly known as "father of physics" of China and the late S. S. Chern who became known to the world as the "father of modern geometry."

Despite sporadic and limited successes, I think it is fair to surmise that in the first half of the 20th century, higher education as it is defined today was still in its infancy in China. What we refer to today as graduate education, for example, was at best rudimentary in nature, at worse non-existent. A small number of universities did offer masters degree programs (for example C. N. Yang did his masters degree in statistical mechanics from SWUU,) but doctoral education/training, as far as I am aware of, was virtually absent. With Europe and North America being the center of gravity of modern science and technology at the time, it is no surprise that China, and indeed Asia in general (with the exception of Japan) lags far, far behind in these areas.

In addition, since the number of universities was vastly inadequate to provide "universal higher education" for the large population (in 1950 the number was approximately 400 million, which is a factor of 3 lower than what it is today,) and the nation was suffering from extreme poverty, I suspect that as a whole the intellectual and economic impact of these universities on China, especially in science and technology, was minimal.

There was another interesting by-product that came out of China's inadequate higher education system. It created a new generation of "abroad-studying-students." In Chinese, these students are referred to as *liu xue sheng*. Interestingly, even though advanced training was at a minimum in China, Chinese educators in particular and Chinese society in general recognized the importance of obtaining such training. Therefore, many Chinese families, especially the educated and/or well-to-do families did encourage their children to go abroad to pursue advanced degrees. Indeed, thousands upon thousands went abroad, to Europe and North America. Both my parents belong to this category. I can say that this generation of *liu-xue-sheng*, upon completion of their education in the West or (after 1949) in the Soviet Union, became the backbone of Chinese science and technology in particular and all forms of intellectual pursues in general of the latter part of the 20th century! I would say that the best example of students studying in England is Kun Huang who did legendary work with Max Born at University of Bristol.

I do not want to give the (wrong) impression that universities in China ONLY emphasize science and technology. In fact, I think it is important to point out that one of China's great universities, *Bei-Jing-Da-Xue* or Peking University, is as much known for its humanities as it is for its sciences. One

of the first presidents of PKU was a man whom I believe is not well known in the West (although he should be). His name is *Cai Yuan-Pei*. PKU would not be what it is today if it did not have Cai at the helm in its beginning. Indeed, with Cai's leadership, PKU became not just the soul of the Chinese university community, but in fact Chinese history and culture of the 20th century. In this context, I should mention the dilemma of university rankings, which Chinese universities across China are very much in tune with. Indeed, how do we measure the "intangible impact" of PKU on China, with the effort of *Bai-Hua* (modern Chinese) movement, the May 4th movement, and so on and so forth? Is it even logical to consider that PKU is not a "World Class University" when it has had a profound impact on China, with nearly a quarter of humanity, for a century?

Back to 1980

Chinese higher education made a "disruptive transformation" in 1954 by carrying out what was called "colleges and departments realignments" or *Yuan Xi Diao Zhen*. I suspect that some realignments were due in part to the Soviet Union's influence on Chinese Government in the early 50's. Many outstanding comprehensive universities, such as *National Central University* (NCU) in Nanjing, were dismembered. For example, NCU's arts and sciences departments became the basic building blocks of what is today Nanjing University (for which I am a very proud honorary member of its board of trustees) and its engineering school became first Nanjing Engineering College (NEC) and later Southeast University (*Dong Nan Da Xue*). Interestingly, not all the engineering departments in NCU became NEC. If I am not wrong, its aeronautical engineering department became what is today's Nanjing Aeronautical University, a so-called single-discipline institute, which of course is fairly common in the Soviet Union.

One may trace the dismemberment carried out across the land in the early 1950's to be one of the root causes of the many "mergers" of universities across China today. The two most spectacular mergers, which turned two medium size national universities into mega-size national universities is Jilin University and Zhejiang University. Due to my many years of association with it, and the fact that one of UTD's Nobel laureate in chemistry Alan MacDiarmid has an institute named after him there, I am quite familiar with Jilin University. After merging five universities in Changchun city under a massive central administration of Jilin University, the campuses of the

university are literally dotting the entire city. In fact, there is now a saying in Changchun:

Mei Li De Chang Chun Zai Ji Lin Da Xue Xiao Yuan Li

or

The beautiful Changchun is in the campus of Jilin University.

This merger reminded me of the mega-merger of the Department of Homeland Security in the United States after 9-11. By literally "forcing" many human organizations with different cultures, and in this case, many levels of standards, together, there would be inevitable human and logistical complications and difficulties. Since most of these mergers were carried out only quite recently, it is probably still too early to ascertain whether they can produce the intended outcome.

For me, even though there was only scant information about China in Singapore before I left for the United States in 1964 and little or no information reported in the United States about China prior to China opening its door to the outside world in 1978, I was fortunate enough to learn enough about China to initiate my personal interactions with this vast nation for the next quarter of a century, which began in October of 1981.

There were several reasons for this.

First, I did know that since 1972, when Nixon made the historical visit to China, Asia was on the move to economic transformation. Indeed, when I visited my hometown of Singapore in 1979, one could already palpably feel that the island country was well on its way to become one of the economic tigers of Asia. And indeed that did happen!

Second, while I was a postdoctoral fellow in the University of Manchester in England in the early 70's, I noticed that there were far more journals in the library from China than in the United States. Careful reading some of them gave me a sense of what was happening in China, something which I found absent in the United States.

Third and more important as far as I am concerned, was that in the fall of 1979, I had the opportunity to spend a year as a visiting professor at the then

global center for nuclear physics, the Niels Bohr Institute (NBI) of University of Copenhagen. As a nuclear physicist, this was a dream come true, an opportunity to learn from maestros of the field. I went to Denmark, full of anticipation.

The scientific depth of NBI did not disappoint me. However, little did I know that something even greater than science was awaiting me in Copenhagen.

1976 was a defining year for modern China. Chairman Mao died on Sept. 9, followed immediately by the spectacular collapse of the so-called "Gang of Four", thus bringing closure to ten painful and devastating years of "Cultural Revolution", and ushered the nation into a new era. Someday, historians will undoubtedly consider the new era as the "miracle of the world in the 20^{th} century". In 1976, China was at the verge of a complete "meltdown", economically, technologically and intellectually. Having a quarter of humanity, and a land size spanning nearly half of Asia, such a meltdown would have had horrifying global implications!

Because of the strong and sustained connections even during the cultural revolution period between China and the father and son of the Bohrs, Niels and Aage, both Nobel laureates, and the fact that after the cultural revolution China was wailing about utilizing "science" to save the nation (*ke xue jiu guo*), one of the first batches of the best and the brightest Chinese intellectuals sent aboard, landed in the Niels Bohr Institute. They were

- **Cheng-Li Wu** of Jilin University,
- **Yong-Siu Chen** of the Institute of Atomic Energy (IAE or known commonly in China as the 401 Institute),
- **Zhan Xu** of Tsinghua University,
- **Cheng-Lie Jiang** of IAE,
- **Ding-Chang Xian** of the Institute of High Energy Physics in Beijing,
- **Gen-Min Jin** of the Institute of Modern Physics in Lanzhou, Gansu and last but not least,
- **Fujia Yang** and his wife.

At that time, Yang was the head of the Nuclear Physics Department of Fudan University, already one of China's best universities.

Together with Choy-Hin Lay, a fellow Singaporean and now Vice Provost of the National University of Singapore who had just completed his Ph.D. from the University of Chicago and was spending his postdoctoral training at the NBI, this group of Chinese scientists and I became good and life-long friends. In fact, Cheng-Li Wu and I became close scientific collaborators for the next decade and a half!

It should be underscored that most of these scientists went on to great careers. For example, Yang became President of Fudan University, an academician of Chinese Academy of Science (CAS) and now Chancellor of United Kingdom's Nottingham University. Xian became a leading expert in synchrotron radiation and was elected also to be an academician of CAS. The work of Zhan Xu became known in the field of particle physics as the "Tsinghua-trick." The list goes on and on.

I learned from this group the hardship they went through (I still remember the long night discussions with Xu about extreme difficulties he endured and how even without physical freedom, he continued to think about science.) All of them had horror stories to tell about their experiences in those ten years. In the next two decades, of the hundreds of scientists I became friends with in China, I would say that none were spared during this period.

Through my friendship with this group of unusual individuals, all of whom have achieved far greater successes than I could ever envision for myself, I had a glimpse of why China after cultural-revolution, with its economy in nearly total disarray, did not simply collapse into the abyss. I hope someday, historians will say that it was because the tens of millions of intellectuals in China, while suffering personal and physical humiliation, never lost sight of the future. Even at its worst, they continued to remain hopeful for themselves, for their families, for their professions and for their nation. Their inner strength was the source of China's profound strength.

Of course, four years before 1981, the ten years of "Cultural Revolution" in China came to a grinding halt and suddenly, China seemed to be on the road of recovery. In August of 1981, the very first batch of four Chinese graduate students, all from Jilin University in northeast China, and two faculty members, one from Nanjing University and one from Jilin University, came to pursue graduate studies as well as research collaborations in the university where I was a faculty member. The same scenario was repeated in nearly every university across North America.

Across the United States, there was indeed a deep sense of anticipation in the air, people were all wondering what this "new beginning" between United States and China would mean in the decades to come.

This was my preparation for entering China for the first time.

To end this section, I should point out that some professional schools, such as law, have not been developing with the same degree of robustness, as in, say, science and technology, in the history of Chinese higher education. In its most fundamental level, a nation is of course a collection of people interacting with each other. The definition of a civilized society is to have dynamically changing but clear, transparent, well understood and well accepted rules and regulations which citizens can follow and improve. To this end, the impact of not having a strong and robust legal community in China is clear. Prior to the Communist reign of China, only a handful of universities, such as Suzhou University, had law programs. Even today, legal education is still a small part of the higher education landscape, although I understand that its influence is growing. This is a good sign.

Challenges of Higher Education in the decade of 90's and beyond

I am a firm believer that universities must be relevant to the society they "serve."

Perhaps few people in China, or for that matter even in the world, would argue against the observation that there was enormous and rapid societal transformation for China in the decade of the 90's. The most spectacular of these transformations, for whatever reason or reasons, was a lift-off of China's economy. Not being a social scientist, nor an economist, and not even a philosopher, I could only speculate about the reason or reasons as to why this occurred. Many would say that this was due to clear directives from China's leadership for accelerating the open-door policy. There is also speculation that this was due to the rapid ease and rise of communications between people at the grass-roots level, such as the rapid growth of usage of the internet in China. Still there are those who say that provincial leaders were given more responsibilities to make economic and other decisions.

The outcome is clear. There is wealth generation in China.

From my personal, albeit limited observation, I did notice that the residence of my friends in China seemed to "increase in size" every time I visited them. In fact, not only did their apartments increase in size, but the apartments were better equipped with luxury items such as wood paneling or even carpeted floors. I also noticed that while in US dollars, faculty salaries are still low, faculty salaries towards the end of the 90's was significantly higher than at the beginning of the 90's. All this increase in wealth implies that "life *is* getting better," as one of my friends would say.

China of the 90's and the 21st century is fundamentally a different country from the days when the Communists first took power in 1949. China of the 50's gave the perception of fear. Indeed, when I was growing up in Singapore, what we were constantly reminded about was the "Red menace" from China. Today, the perception of China around the globe is a nation profoundly interested in becoming economically strong and intellectually robust. Indeed, today, all across Southeast Asia, there is palpable recognition that it is quite inconceivable to have a robust regional economy without an equally robust, forward-looking and out-reaching Chinese economy.

As I see it, China in the 21st century has at least the following challenges which did not exist in the 50's.

First, there are unquestionably vast increases in international commercial activities. While there were none in the 50's (at least not from the West) and considerably less before the 90's, the amount ballooned significantly in the 90's and beyond. With a large internal market and large and reasonably well-trained workforce in the hundreds of millions, one would expect that there will be no slow-down of this trend any time soon.

Second, while the percentage is still small, but because Chinese population is so large, *in absolute number* there is now a sizable middle-class, and it is growing rapidly. For example, even if the middle class makes up as little as 10% of the population (which I am sure could be an underestimation), in absolute number it is around 130 million, which is a third to a half of the US population. It is well known that the middle class will demand a better environment, better health care, better education for their children, and a higher standard of living. All of these demands will place significant

pressure on China's soft and hard infrastructure. There is no doubt in my mind that this sector of the population will significantly impact China.

Third, there is a growing private sector and it is undeniable that the wealth in the nation is slowly flowing into the hands of that sector. In fact, in my interactions with China in the past decade, I find that the percentage of friends who work for and/or started private businesses are increasing quite rapidly. For example, I was told that as high as 80% to 85% of the wealth generated in Zhejiang Province now arises from the private sector. This to me is a welcome sign not just for China but for the world as a whole.

Fourth, fast and at times uncontrolled and unstructured economic growth can bring undesirable elements to the society, such as degradation of the environment and shortage of the necessary resources to propel the growth. The former can significantly lower the quality of life and the latter could lead to conflicts, national or international.

Fifth, as in all modern nations in the 21st century, one should not rely on the inherent human instincts to be ethical. Confucius said that "*Ren Zhi Chu, Xing Ben Shan*" or "Human at Birth is Ethical." Whether this is true or not, I argue that we should not take this chance and see how each of us may turn out in real life. To this end, modern nations must be nations of law. Some recent spectacular examples in the corporate and academic worlds clearly indicate to us "ethical indoctrination" should never be left to each individual.

I am sure that if you give yourself a few minutes of thought, you can come up with additional features confronting modern-day China. Clearly, all these challenges place enormous pressure on all levels of Chinese society. Since education, from K to infinity, is an inalienable component of Chinese society, how to respond to these pressures will and should be high on the agenda for those who have responsibilities to be the architects of Chinese higher education.

Chinese Academy of Sciences

I should point out also that there was another interesting development after the communists came into power in 1949 which I believe impacted profoundly the development of research landscapes of Chinese universities. That development was the creation of the Chinese Academy of Sciences

(CAS). Without a doubt, CAS is omnipresent in the Chinese research and development landscape.

Although not entirely parallel in nature, the CAS certainly had and continues to have the flavor of the powerful Soviet (and now Russian) Academy of Sciences. CAS has research institutes in nearly all disciplines of science and technology dotting the entire country. Besides CAS, there are also academies in social as well as medical sciences. These academies also had (and continue to have) impact on the higher education landscape.

In my humble opinion, the separation of two basic and massive human organizations, universities and CAS, where both have research as part of their missions, will surely profoundly impact universities' research landscapes. Quite recently, I had the pleasure of visiting Oak Ridge National Laboratory (ORNL) in Tennessee. Perhaps the most important recent development of ORNL is that it has constructed one of the most sophisticated new generations of "Spallation Neutron Source." The price tag of this facility is in the multi-hundreds of million of dollars. With SNS, scientists in US and worldwide universities can study problems with a facility which their respective universities have no hope of ever constructing. In an analogous manner, I suspect that it is probably not possible for individual universities in China to set up a new generation of synchrotron radiation facilities. I see that there is one now under construction in CAS's Shanghai Institute of Applied Physics. Perhaps this will be the new *modus operandi* of interactions between national laboratories or CAS with universities.

I suspect that the juxtaposition of these two massive human institutions, even to this date, remains intriguing, exciting and perhaps problematic. I think that there are quite a number of such studies carried out in China that it would not be prudent of me to speculate here what that would be.

Some Observations

In this short discussion, I have only touched on the tip of the iceberg of the vast Chinese higher education. China has approximately 2000 higher education institutions. Since the nation has a population of 1.3 billion, this is still a relatively small number. For example, if one were to go by the

percentage of higher education institutions vs. population in the United States (around 3500 for 300 million in population) as the norm, then China may need as many as 10,000 higher education institutions. I dare say that no country in the history of mankind has ever attempted to reach this number (nor has there been a nation on the surface of the earth with so many people). I am not sure that even with China's enormous economic expansion, this lofty goal can be attained any day soon, if ever.

However, one thing is for sure, this number almost certainly will increase with increased demands. As long as the Chinese economy continues to expand, with more and more population entering middle-class status, the number of students who intend to receive more advanced education is bound to increase. In addition, for China to become not just a nation of cheap laborers but also knowledge workers, this increase is a must. Thus, how to pay for these thousands of new institutions will be a critical issue. Also, what percentage of these institutions should become "world class universities?" What percentage of the institutions should have a specific mission, such as community colleges in the United States? These are all important and fundamental issues facing Chinese educators in the 21st century.

Finally, there is a trend in the United States which is the decrease of public support of higher education. Many state universities, even truly well-known ones, are experiencing a decrease of support of recurrent funding from the respective States. This becomes a real challenge for university administrators in the United States.

In China, at this moment, nearly all universities (and nearly all are public) are supported close to 100% by the public sector (whether it be by the Ministry of Education from the Central Government, or Provincial Government or even City government and so on). In her recent visit to University of Texas at Dallas, China's Vice Minister of Education, Dr. Qidi Wu gave a succinct discussion about the ambitious national funding programs known as 985 and 211 to significantly uplift the qualities of Chinese research universities. If, as I mentioned earlier, the number of institutions in China were to increase by just a factor of 2 to 3 (4000 or 6000), my suspicion is that these programs would be difficult to sustain. Indeed, how the public sector can or will have the financial resources to support the institutions at the current level will be a serious challenge. Does

that mean that it is inevitable that the support will drop, and that it may drop quite precipitously?

Confronted by this possible eventuality, it may not be too soon to seek ways where there will be public and private partnerships. This is especially suggested because of the increase wealth of the private sector (as I have mentioned earlier.) However, the challenge here is that the private sector in China in particular, and Asia in general, unlike its counterparts in the Western world, does not have a tradition of giving to higher education.

There is no doubt in my mind that sometime in the 21st century, China will be one of the major global economic powers. As such, China must shoulder far greater responsibilities to tackle if not solve the ills of humanity. To this end, Chinese universities, just as their counterparts in the United States and India, must be havens for producing global thought leaders, who could find ways to motivate their fellow human beings to seek ways to mitigate ills, right wrongs and create a better world for all mankind. Universities must be havens where all people can come and learn to work together.

Undoubtedly, in the 21st century, Chinese universities must be human organizations that will serve not just China, but the world.