THE LAND GRANT MODEL:
A LESSON FROM THE PAST, AN INVESTMENT IN THE FUTURE
CHINA AGRICULTURAL UNIVERSITY
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ABSTRACT:

China Agricultural University and other agricultural universities around the world have a critical role to play in feeding a world population that could exceed 8 billion by 2050, addressing environmental concerns, and stimulating the economy in their nations and across the globe. A model that has served the United States well for more than 140 years is that of the land grant university. By providing a seamless continuum from basic research to applied research to outreach, the land grant universities solve problems and develop strategies to benefit growers, allied industry, consumers, and the environment. University-based research provides a unique, integrated or "systems" look at the needs of agriculture. At the same time, the land grant structure provides a mechanism for technology transfer, moving research from the laboratory to the field or to private enterprise for commercialization. As a result, agriculture has benefited from the latest advancements in genomics, global positioning systems, computer guided irrigation networks, and other emerging technology. Agricultural research is an exceptional investment: the U.S. Department of Agriculture has estimated a 20 percent annual rate of return on public investment in agricultural research and, at the University of California, researchers generate an additional $4 for every $1 in state funding.

KEYNOTE

Good afternoon. I want to thank President Chen for so graciously inviting me to address you at this wonderful forum for discussing the future of agriculture and the vital role of research and education. I would also like to acknowledge Reg Gomes, Vice President for Agriculture and Natural Resources for the University of California system. It is indeed an honor to be here.

President Chen is to be congratulated for bringing international attention to this topic at such a critical and thrilling time in China's development. China is revolutionizing agriculture at the same time that the country is redefining itself and its position in the world. The China of today is not the same China of even a

generation ago. Per capita income has doubled twice in two recent and successive decades (*1978 to 1996*). By contrast, it took the UK 58 years (*1780 to 1838*) and the U.S. 47 years (*1839 to 1886*) to double per capita income just once.[1] China's agricultural sector has participated in this phenomenal growth, at a rate of six percent per capita for two full decades.[2]

China is looking to a new future. With progress, however, come challenges: As agriculture advances, questions arise related to environmental degradation, sustainability, and ethical and social concerns surrounding the use of agricultural biotechnology. There are other pressures, too. For every 20 new automobiles in China, an estimated .4 hectares of land is lost to parking lots, streets, and highways. In 2003, the sale of two million new cars meant the loss of nearly 40,500 hectares.[3] The competition for water is even more fierce. According to Worldwatch Institute, the residential demand for water is projected to increase more than fourfold during the next quarter century. During the same period, water demand by industry is expected to grow even faster, increasing from 52 billion tons in 1995 to 269 billion tons in 2030.[4]

Greater wealth also means changing patterns of food consumption, including increased demand for grain-fed livestock products and specialty crops. China must feed 10 persons per hectare of arable land, compared to the world average of 4.4 persons per hectare. While China's population is about four and a half times that of the United States, its cropland is only 75 percent of the U.S. total. Nevertheless, China out-produced the U.S. in crops and livestock by about 30 percent in 2001.[5] How can China continue to improve on an already productive ag sector? And how can this occur in an environmentally sustainable manner while, at the same time, realizing the demands of the growing urban sector?

In answering these challenges, China has the opportunity to learn from the experiences of other nations. As China looks forward to a promising (if slightly daunting) future, it would do well to also look to the past. One model in particular bears close scrutiny: the highly successful land grant university system of the United States. Established by the Morrill Act and signed into law by President Abraham Lincoln in 1862, the land grant system is still relevant today. This continued relevance is largely due to the time-tested, tripartite mission of these universities: teaching, research, and public service.

The Morrill Act itself created the teaching mission by donating federal lands to the various states and universities for purposes of building a public university focused on agriculture and the mechanic arts, the mainstays of the economy at that time.

For the first time, a college education became accessible to the average person. In 1887, the Hatch Act established the research mission by founding an agricultural experiment station in conjunction with each of the land grant universities. The final piece was put in place in 1914 with the passage of the Smith-Lever Act, creating the Cooperative Extension system – a county, state, and federal partnership aimed at dissemination of knowledge from the university to the end users of research. Thus, the public service mission was born.

The University of California is a land grant university, sharing in the three-part mission. The University of California Riverside – the institution for which I am chancellor – was in fact founded as a Citrus Experiment Station in 1907. Now, on the verge of our 100th anniversary as an agricultural experiment station, we continue to share in the rich heritage and tradition of the land grant mission.

UC President Bob Dynes refers to this as "RD&D," for research, development, and delivery. The land grants focus strategically on the second "D," targeting research to deliver results of importance to our agricultural clientele. And it has worked: The prosperity and productivity of U.S. agriculture may be attributed in large part to the land grant universities, which have helped to create one of the safest, least expensive, and most plentiful and diverse food supplies in the world. Using less than one percent of the world's agricultural workforce, U.S. farmers and ranchers now produce nearly one-quarter of the world's food supply.

So what can China learn from the land grant system? With approximately 60,000 scientists in 400 research institutes and 70 agricultural universities, the country already has the largest publicly funded and administered agricultural research system in the world.[6] Further, China has developed its own National Agricultural Technology Extension Service, formed under the auspices of the Ministry of Agriculture and focused at the county and township levels. This system was created in 1995 by merging the National Agricultural Technology Extension Station, National Pest Control Station, National Seed Station, and National Soil Fertility Station.[7] Traditionally, the nation's agricultural universities have not been part of China's extension model.

In contrast, Cooperative Extension is embedded in the land grant universities. This model provides a seamless continuum from basic research to applied research to outreach, which results in solving real problems experienced by growers in the field. Not only does the U.S. system extend laboratory-based science to the field, it also allows growers to bring their problems to the university to be addressed.

Thus, University-based research enables scientists to take an integrated, systems look at the needs of agriculture. Results that appear promising in the lab are not always feasible in practice, but the research-extension continuum ensures that laboratory findings are adapted to take into account the unique circumstances found in the field. Because growers are an integral part of this equation, best practices are established in a collaborative rather than top-down manner, thus virtually ensuring their adoption.

Industry is also an important factor in the equation. The land grant model provides a mechanism for technology transfer, moving research from the laboratory to industry for commercialization. Consequently, agriculture has benefited from the latest advancements in genomics, global positioning systems, computer guided irrigation networks, and other emerging technology. Technological innovation, fueled by research and entrepreneurship, has been a driving force in U.S. agriculture during the past century, leading to both higher yields and lower prices. This is evident in what is called the "productivity index," derived by dividing total farm production outputs by total farm production inputs. In California, the productivity index doubled between 1949 and 1991,[8] based largely on advances made possible by university research and extension programs.

As this would indicate, the land grant system also serves as an economic driver for agriculture and related industries. A recent report by the U.S. Department of Agriculture stated, "We estimate that public agricultural R&D and infrastructure accounted for 75 percent of the growth in agricultural productivity from 1949 to 1991." Agricultural research is an exceptional investment: the USDA has estimated a 20 percent annual rate of return on public investment in agricultural research and, at the University of California, researchers generate an additional $4 for every $1 in state funding.[9]

In addition to having an impact on food production, environmental protection, technology transfer and, ultimately, the economy, the land grant universities have a unique role to play in the area of public policy. They can serve as honest brokers in public debates about controversial topics, and can provide objective, science-based information to help inform decision makers. Ideally, our land grant institutions can ensure that both agricultural practice and agricultural and environmental policy are founded on sound science.

To provide a concrete illustration of the potential role of the land grant university, I would like to use the example of biotechnology. California is home to more than one-quarter of the biotechnology industry in the U.S. One in four U.S. biotech

firms is within 35 miles of a University of California campus, and one in six was started by a UC scientist. Within the state, one in three biotech companies was founded by a UC scientist; of these, 85% employ UC graduates with advanced degrees.[10]

The first wave of biotechnology was in pharmaceuticals; agriculture is poised to be next. The land grant universities are in the forefront of genomics-based discovery, leading to safer and more nutritious foods, stress-resistant crops, disease resistant animals, foods with prolonged shelf life, and novel bio-based products such as plastics, alternative fuels, and pharmaceuticals. Biotechnology may also hold the key to feeding our burgeoning world population.

Biotechnology, in fact, has the potential to transform the agricultural industry. This opportunity may not be realized, however, if public perception about the risks of genetically engineered crops overwhelms scientific reality. At the same time, scientists must ensure that their work does not produce unintended consequences that could adversely affect human health or the environment. Pressure already is mounting; we are at a crossroads where we could fail to capture the full power and value of agricultural biotechnology unless the public and policy makers are well informed and science and industry act responsibly.

Again, the land grant university has a role to play. At UC Riverside, we responded by forming the Biotechnology Impact Center, with a mission to promote research and education on all aspects of the social, economic, political, environmental, and ethical consequences of biotechnology. The Center serves as an honest broker to identify relevant policy issues; acts as a clearinghouse for credible information by disseminating sound, science-based information to both the public and decision makers; and initiates research to explore the potential impacts of biotechnology. Finally, the Center assists in educating both undergraduate and graduate students on policy issues related to bioethics, scientific responsibility, and the controversy surrounding genetically modified organisms.

Thus, the university plays a critical role in stimulating the economy, informing the public and policy makers, and educating an increasingly sophisticated workforce. Today, more than 140 years after their establishment, there is a land grant university, an agricultural experiment station, and a Cooperative Extension Service in every state in the nation. The system is not a perfect one—it must be flexible enough to evolve with the times and the changing needs of the people it serves—but the land grant system remains a model with much to offer to a dynamic society such as China's. The next wave may very well be working cooperatively to

improve our global community; this approach is exemplified by a collaboration between China Agricultural University and UC Riverside in the area of plant stress and genomics. With the many opportunities and challenges faced by China and the world today, with the vigor of the country's economy and its ambitious vision for the future, there is a vital role to be played by our universities in global RD&D.

I would like to close with a quote from Abraham Lincoln, upon signing the Morrill Act: "The land grant university system is being built on behalf of the people, who have invested in these public universities their hopes, their support, and their confidence." This simple but eloquent statement gives us the standard to which we must aspire – the incentive to serve the public good. It is, in the end, a statement of our mission.

President Chen, esteemed guests, thank you.

I gratefully acknowledge the contributions of Cynthia Giorgio, Assistant Chancellor at the University of California Riverside.

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[5] Economic Research Service, U.S. Department of Agriculture. China: Basic information. www.ers.usda.gov/briefing/china/basicinformation.htm

[6] The World Bank Group, OED Précis, Number 108, Agricultural Research and Extension: Lessons from China, March 1996. http://wdsbeta.worldbank.org/external/default/WDSContentServer/IW3P/IB/2004/05/04/000011823_20040504130618/Rendered/PDF/28677.pdf

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[9] Alston, Julian M., Philip G. Pardey, and Harold O. Carter, Valuing UC Agricultural Research and Extension, Agricultural Issues Center, 1994.

[10] Yarkin, Cherisa, and Andrew Murray, Assessing the Role of the University of California in the State's Biotechnology Economy: Heightened Impact Over Time, March 2003.