Institution: SOAS

Unit of Assessment: 19 Business and Management Studies

Title of case study: Chinese Agricultural Transition: Trade, Social and Environmental Impacts (Laixiang Sun)

1. Summary of the impact (indicative maximum 100 words)

How Chinese policymakers shape and progress agricultural policies against the backdrop of domestic population growth, rapid urbanisation, rising affluence and decreasing self-sufficiency in food production will have profound consequences for both China and its global trading partners. Agricultural transition and the transfer of resources from agriculture to industry has been a key factor underlying China's exceptional economic growth. Professor Laixiang Sun's research impacts upon the business and policy environment in which food producing and trading enterprises operate in China by contributing to the creation and development of the largest, most detailed predictive modelling tool for the Chinese agricultural sector, CHINAGRO II. His research has transformed policy makers' understanding of the future sustainability of Chinese agricultural development and had a significant impact on policy design and implementation. Facilitated by his research professorship at the Chinese Academy of Sciences in particular, Professor Sun has influenced Chinese government policy at the highest levels.

2. Underpinning research (indicative maximum 500 words)

Laixiang Sun is Professor in the Department of Financial and Management Studies at SOAS where he has worked since 2001. Since 2005, he has been Research Professor at the Institute of Geographic Sciences and Natural Resources Research (IGSNRR) and the Centre for Chinese Agricultural Policy (CCAP) in the Chinese Academy of Sciences (CAS), the country's most prestigious professional science organisation and top think tank, providing central government in China with expert advice.

Sun has more than 100 publications in economics, business and management studies, integrated modelling, ecology and environmental studies, and agricultural planning and risk management. The following will focus on the impacts of his achievements stemming from research undertaken as Leading Scientist on two international projects, partly funded by European Union Framework Programmes 5 and 6, that resulted in the creation and development of the CHINAGRO and CHINAGRO-II modelling tools, which provide detailed, multi-faceted representations of the Chinese agricultural sector, enabling the most comprehensive simulation of the Chinese agricultural economy up to 2030.

The first project, Policy Decision Support for Sustainable Adaptation of China's Agriculture to Globalization (CHINAGRO, October 2001-January 2005), examined the challenges China's agricultural sector was facing just after the country's accession to the World Trade Organisation in 2001. A linchpin of the project was the creation of a highly sophisticated modelling tool to assist policy analysis and making. In both versions, the tool spatially represents more than 2,800 counties in China, thereby taking account the ecological and social diversity of the county. It allows for the testing of myriad scenarios influencing the agro-ecological conditions at local, regional, national and global levels. Simulations can incorporate and manipulate vast amounts of data relating to labour force trends, consumer behaviours including the demand for more animal protein, the growth of corporate/factory farming, the need to import ever larger quantities of animal feed, food prices, political and social factors and more. In all, the model comprises around 50,000 endogenous variables.

In the first project, Sun and his colleagues undertook a series of modelling experiments to simulate the consequences of several major policy variants responding to the key concerns of Chinese agricultural development: The impact of trade liberalisation should it exceed agreed levels; the impact of economic growth and urbanization; the impact of technological advances on crop and livestock production; and the impact of expanded development of irrigation systems. The overriding

aim was to support informed decision-making through the injection of robust, quantified research findings into policy dialogue.

The second project, *Chinese Agricultural Transition: Trade, Social and Environmental Impacts* (CATSEI, January 2007-November 2011), extended the CHINAGRO model to include the effects of China's agricultural transition on international trading partners. CHINAGRO-II also takes account of more nuanced social and household data and generates quantified measures of environmental pressures including those resulting from intensified livestock and crop production and increased usage of fertilizers and pesticides. Modelling experiments can now simulate a new range of scenarios simultaneously taking account of China's external trade environment, a more comprehensive collection of social factors, environmental pressures and ecological costs.

3. References to the research (indicative maximum of six references)

a. (2010) Sun, Laixiang. "Who Will Feed China's Livestock?" *The Twenty-First Century Review* (Chinese University of Hong Kong), No. 121 (Oct 2010): 39-41 (in Chinese).

b. (2009) Fischer, G., T. Ermolieva, Y. Ermoliv, and Laixiang Sun. "Risk-adjusted Approaches for Planning Sustainable Agriculture," *Stochastic Environmental Research and Risk Assessment*, 23 (4): 441-450.

c. (2005) Hubacek, Klaus and Laixiang Sun. "Changes in China's Economy and Society and Their Effects on Water Use: A Scenario Analysis," *Journal of Industrial Ecology*, 9 (1-2): 187-200.

d. (2004) Liu, H., X. LI, G. Fischer, and Laixiang Sun. 2004. "Study on the Impact of Climate Change on China's Agriculture", *Climatic Change*, 65 (1-2): 125-148.

e. (2001). Fischer, Günther and Laixiang Sun. "Model Based Analysis of Future Land Use Development in China," *Agriculture, Ecosystems and Environment*, 85 (1-3): 163-176.

External Funding that Supported the Above:

Sun was co-Principal Investigator in a Major International Joint Project of the National Natural Science Foundation of China and IIASA – "Assessing the Impact of Climate Change and Intensive Human Activities on China's Agro-Ecosystem and its Supply Potentials", Jan 2010-Dec 2012 (Contract number: NSFC-40921140410; RMB 1.2 million + EUR 100,000). Funds were managed by Shanghai Meteorological Bureau and Centre for Chinese Agricultural Policy (CCAP) of Chinese Academy of Sciences.

Sun was Principal Investigator and Sponsor of Newton International Fellowship, 2009-2011, awarded by British Academy, Royal Academy of Engineering, and Royal Society, on "The Economics of Biofuel Production: Social and Environmental Impacts in China" (GBP 198,000: two years of full fellowship plus 10 years of collaborating visits). The two-year full fellowship was managed by SOAS. The collaborating visits are managed by the British Academy.

Sun was Leading Scientist of the SOAS Team in the EU 6th Framework Project on "Chinese Agricultural Transition: Trade, Social and Environmental Impacts" (Contract number: 44255-CATSEI), Jan 2007-June 2010 (EUR 874,000). The coordinating institution was Centre for World Food Studies at the Free University of Amsterdam.

Sun was Leading Scientist in the research project of Chinese Academy of Sciences on "Human Activities and Changes of Terrestrial Ecosystems in China". December 2005-June 2009. Host Institute: Institute of Geographic Sciences and Natural Resources Research (IGSNRR), Chinese Academy of Sciences (RMB 6 million).

Sun was Leading Model-Builder in the EU 5th Framework Project on "Policy Decision Support for Sustainable Adaptation of China's Agriculture to Globalization (CHINAGRO)" (Contract number:

ICA4-CT-2001-10085), Oct 2001-Jan 2005 (EUR 800,000). The coordinating institute was International Institute for Applied Systems Analysis (IIASA) in Austria.

Professor Sun was awarded the title "Academician of the Academy of Social Sciences" (UK) in February 2010.

4. Details of the impact (indicative maximum 750 words)

The modelling made possible by CHINAGRO-I and II has resulted in a cascade of novel findings and well-substantiated predictions of direct relevance to Chinese national agricultural policy, planning and approaches to foreign trade. Presented by Sun on at least 20 occasions since 2008, at events involving the direct participation of government policy makers, the research findings have informed understanding of the future of Chinese agriculture and its challenges at the highest level (3, 4, below). In some cases, presentations have resulted in invitations from Chinese government ministries to draft briefing and policy papers on specific topics.

For example, output a, which highlights the risks of China's heavy reliance on imported soya, mainly from South America, to feed its growing population of livestock, was presented at policy forums in Beijing in 2010 and in Shanghai in 2011. The article and presentations elicited the interest of the China National Science Foundation (CNSF), representatives of which asked Sun to draft a policy brief with the same title for the State Council, the highest executive body of government power and administration in China (1, below). The policy brief was submitted to the State Council in October 2011 where it received great attention from the Vice-Premier in charge of food security and was circulated and discussed across several ministries. State policy on promoting domestic animal feed production and further facilitating of the import of Dried Distillers Grains with Solubles (DDGS), a by-product of bio-ethanol production from maize and a high-nutrient, high-protein animal feed were then announced and implemented in 2012 and early 2013, as a part of the implementation of China's 12th 5-year Plan (2011-2015) for the Feed Industry.

Other elements of the research that were subsequently drawn into government policy since 2008 include: (a) a policy briefing submitted to China Meteorological Administration in August 2011 on "The Status of Nationwide Excessive Fertilizers Application and its Implications to Environment and Climate Change", and (b) a policy briefing submitted to Shanghai Municipal Government in May 2011 on "Assessment of the Status of Excessive Fertilizer Application and its Impact on the Environment of Shanghai" (2, 9).

Important to understanding Sun's impact on Chinese national policy making is recognition of the ways high-ranking research institutes and think tanks operate in China. Their creation was modelled in the 20th century on Soviet research institutes and most remain today closely affiliated to the State Council, individual government ministries or the Communist Party. They are government-funded and since the 1980s have been primary conduits for the commissioning and delivery of focussed research with direct applications to policy-making.

As a Research Professor at two government-sponsored public policy research institutes, the Institute of Geographic Sciences and Natural Resources Research (IGSNRR) and the Centre for Chinese Agricultural Policy (CCAP) within the Chinese Academy of Sciences (CAS), which refers to itself on its website as, "the top think tank for central government," Sun's work informed by CHINAGRO II regularly receives the attention of key policy makers.

Notably and somewhat unusually, articles featuring the work of Sun and his collaborators are available directly from the websites of China's Central Government and several government ministries and organisations. An article of February 2013, examining the potential long-term harm to the environment resulting from excess nitrogen from fertilizer in China's soil as demonstrated by the research of Sun and his colleagues, has featured on the websites of the Central Government (3), the Ministry of Agriculture (4) and the China Meteorological Administration (5). It quotes Sun and another team member on the project's prediction of increased agro-climatic resources and the need for policy responses to (a) provide incentives for farmers to extend multi-cropping practice to

increase total output and (b) address the consequent strain on water resources.

The website of China's National Science Foundation published an article the following month, in March 2013, detailing the research findings of the same project, as well as those published in output a, and highlighted the attention both projects have received from China's leadership including the Vice Prime Minister (6).

An article produced in both Chinese and English in September 2012, "What Are the Ecological Costs of China's Future Food Imports?", is posted on the website of the Department of Science and Technology of the Guangdong Provincial Government (7) as well as on the bilingual website of China Dialogue, an independent, non-profit organisation based in London and Beijing, "devoted to the publication of high quality, bilingual information, direct dialogue and the search for solutions to our shared environmental challenges." (8)

*Please note that translations used to produce this case study were made by a neutral translator, not by Professor Sun.

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. Vice-President of CNSF between 2003 and 2013

2. Director of Shanghai Climate Centre, Shanghai Meteorological Administration

3. Official website of China's Central Government featuring "Predicting the Development of Chinese Agriculture until 2050": http://www.gov.cn/gzdt/2013-02/27/content_2340798.htm [Most recently accessed 18.11.13].

4. Official website of China's Ministry of Agriculture, which reported a policy forum of the CHINAGRO project. The title of the report was "Predicting the Development of Chinese Agriculture until 2050": http://www.moa.gov.cn/fwllm/jrsn/200501/t20050119_308476.htm [Most recently accessed 18.11.13].

5. Official website of China Meteorological Administration featuring an article entitled, "Climate change Will Lead to an Increase in Multi-cropping Index and Northward Extension of Multi-cropping Zones," which cites Laixiang Sun:
http://www.cma.gov.cn/2011xwzx/2011xqxxw/2011xqxyw/201302/t20130227_206237.html [Most recently accessed 18.11.13].
http://www.cma.gov.cn/2011xwzx/2011xxxfw/2011xbz/xbzzy/201302/t20130227_206306.html [Most recently accessed 18.11.13].

6. The official website of China's National Science Foundation featuring an article entitled, "The Project 'The Carrying Capacity of Agricultural Ecosystem and Food Security of China under the Impact of Climate Change' Has Made Great Progress" of 22 March 2013:
http://www.nsfc.gov.cn/Portal0/InfoModule_375/51408.htm [Most recently accessed 18.11.13]. .

7. The website of the Department of Science and Technology of the Guangdong government featuring article "What Are the Ecological Costs of China's Future Food Imports?":
http://www.gdcct.gov.cn/agritech/feature/jlz/b/201210/t20121026_735342.html#text [Most recently accessed 18.11.13].

8. The website of China Dialogue featuring English language version of the same article: https://www.chinadialogue.net/article/show/single/en/5154-What-are-the-ecological-costs-of-China-s-future-food-imports- [Most recently accessed 18.11.13].

9. Mandarin language letter from the Deputy Mayor of Shanghai commending the work of Sun and his colleagues and highlighting its importance to environmental planning in the city.