UK-China Sustainable Agriculture Innovation Network

Policy Brief
No. 15
March 2017

Enhancing UK China Knowledge Sharing and Mutual Learning in Agriculture, Food and Environment[1]

David Norse

(University College London, d.norse@ucl.ac.uk)

Effective knowledge sharing and mutual learning (KSML) has been a central element in SAIN's successful promotion of UK-China collaboration on sustainable agricultural innovation. In the space of 8 years it has forged strong links at all levels of government and across the whole agricultural research community (Box 1) and is a unique model of international cooperation. It has had a substantial impact by advancing technical and institutional innovation in three key areas:

- improved resource management;
- introduction of better or more appropriate technologies;
- policy development and implementation.

They are all areas that have or will provide mutual benefits. First, in terms of improvements in the global environment (notably slower climate change). Second, the creation of global goods (especially new technologies that are appropriate for the needs of other developing countries) that raise global prosperity. Third, through the development of advanced technologies that safeguard or improve the sustainability of agriculture in both countries (for example, the development of novel vaccine approaches for avian diseases). Finally, by increasing trade opportunities for agricultural inputs and food. Moreover, these areas were consistent with the priorities of China's 12th Five Year Plan (2011-2015) and are equally relevant to the 13th Five Year Plan. They commonly require policy actions that the UK faced in the past or continues to face and so provide opportunities for knowledge sharing and mutual learning through collaborative research.

This brief will examine two elements of the above. First, the policy implications of the UK-China research cooperation over the past 8-10 years – especially the sharing of the UK's policy development experience with China. Second, SAIN's role in linking researchers

1 This policy brief is based on the findings of the China-UK Project "Applying UK expertise to facilitate sustainable agriculture development in China through enhanced knowledge sharing and mutual learning". The project is funded by the UK's Prosperity Fund through FCO . The project forms part of the UK-China Sustainable Agriculture Innovation Network-SAIN (see www.sainoline.org)

together and providing a communication channel between ministries and policy makers in the two countries.

Box 1. SAIN's links at all levels of the Chinese Government and research community

Central government: MOA, (National Development Reform Commission (NDRC) and MEP

Central government institutions: Development Research Centre (DRC)

Ministry departments and institutions: MOA's Agro-Environmental Institute, Tianjin

Provincial governments: Jiangsu, Jilin, Shaanxi & Shangdong

Chinese Academies of Agricultural Sciences, of Sciences, Agricultural Engineering and Social Science and their institutions and research stations

Provincial Academies of Agricultural Science: Guangdong, Hebei & Jiangsu

China Agricultural University, Peking University, Northwest Agriculture and Forestry University, Nanjing Agriculture University, Nanjing Forestry University, Nanjing Normal University & Universities of Fudan, Hebei, Jilin, and Zheijiang

Policy implications of the UK-China research cooperation

The implications fall into two main groups: shifts in research approaches and policy analysis arising from UK-China cooperation, and SAIN's role in linking researchers together and providing a communication channel between ministries and policy makers

Shifts in research approaches and policy analysis.

Three shifts are particularly important: (a) the adoption of a more holistic approach to problem identification and the selection or development of response options; (b) and often related to the latter, the adoption of multi-disciplinary research approaches that bring in economists and social scientists to work alongside physical scientists and farmers, (c) the need for more quite basic information such as the nitrogen content of manure in order to quantify the importance of an agricultural sustainability problem or opportunity.

The need for a more holistic approach. This is exemplified by the University of Lancaster/Lancaster Environment Centre (LEC)/Centre for Ecology and Hydrology (CEH) work in China on water management since the 1990's and at a more strategic level by SAIN's work on low carbon agriculture. The latter project introduced for the first time the use of life cycle analysis for the assessment of China's greenhouse gas emissions (GHG) from agriculture. It highlighted the importance of nitrogen fertilizer production related GHG emissions and the large contribution that the livestock sector makes to China's total GHG emissions. The former raised the policy issue of large GOC subsidies to N fertilizer production that distort market prices and encourage farmers' overuse of N fertilizer. The latter raised the importance of better manure management, and opened the way for the sharing of UK experience with China on a range of policy and technical options ranging from improved building regulations for Concentrated Animal Feeding Operations (CAFOs) to advanced technological approaches to raising the efficiency of ruminant digestion.

The adoption of multi-disciplinary research approaches. Prior to Dfid supported research in the late 1990s Chinese agronomists seldom worked alongside agricultural or environmental economists in the determination of resource management problems and solutions. In contrast almost all of SAIN's research projects have involved social scientists or economists as part of

institutional innovation as well as technological innovation. This is vital in a number of ways but particularly in understanding farmer's technological needs which are shaped by the availability of labour and the importance of farm income in total household income. For example, the FCO project on low carbon agriculture used farm household surveys to investigated how N fertilizer inputs varied with farm size and off-farm income in an effort to understand why they were overusing N fertilizer and adding unnecessarily to non-point water pollution and GHG emissions. All of the surveys that were conducted in several provinces and included most of the main cropping systems had basically the same message for policy makers and technology developers. Namely that they must take account of the socio-economic situation of famers, when shaping the physical and economic incentives for appropriate technological innovations. This requirement is illustrated by one of the surveys which investigated why many farmers were not using the more efficient spilt application of N fertilizer. It was rejected because farmers found the technique very time consuming, and in the case of maize physically unpleasant, because the second application had to be given when the crop was 5 feet tall. Moreover the cost saving was small – only about 30% of the off-farm employment day rate – and hence there was little incentive for them to adopt it. This raised a number of policy implications regarding slow release fertilizers, small scale mechanisation and land consolidation which the project went on to investigate.

The essential role of multi-disciplinarity research approaches in UK-China cooperation is also apparent in a range of climate change adaptation and mitigation projects. These projects brought together computer modellers, energy analysts, hydrologists, economists, agricultural scientists and other specialists from the UK to work with their Chinese colleagues on a range of critical issues. Their results include:

- a new understanding about China's water-energy nexus, and the recognition that the (i) pumping of groundwater for irrigation is a major source of greenhouse gas emissions and needs to be included in the national GHG inventory and (ii) there are substantial co-benefits from policies and technologies that raise water and energy efficiency in the irrigation sector.
- increased capacity building on cost-benefit analysis and the use of marginal abatement cost curves. These techniques helped to identify the GHG mitigation measures that can be introduced now at low or even negative costs, which should be the focus of policy action in near term, and those that technically effective but costly.
- at the other extreme is the developing collaboration at the microbial or virus level on probiotics, improving ruminant digestion and control of avian diseases which are of vital importance to the UK , China and world agriculture.

<u>The need for more quite basic information</u>. A number of joint projects have tried to relate UK agricultural policy and agri-technology advances to the Chinese situation as a first step towards identifying those that might be applicable in China. They have commonly faced constraints to making these comparisons because some quite basic data was not readily available in China. For example, the FCO and MOA funded project on low carbon agriculture noted the long-standing heavy applications of manure to crops, but there were no guide values available for average nitrogen levels in the main types of livestock manure, and therefore it was difficult to confidently estimate the level of nitrogen fertilizer overuse, although the use of sample/proxy data indicated clearly that there was serious over-use with consequent high GHG emissions and serious risks to water supplies from excessive leaching. Similar problems were a constraint to the Defra and MOA supported project on manure management which was seeking to share UK policy and technical experience with China on

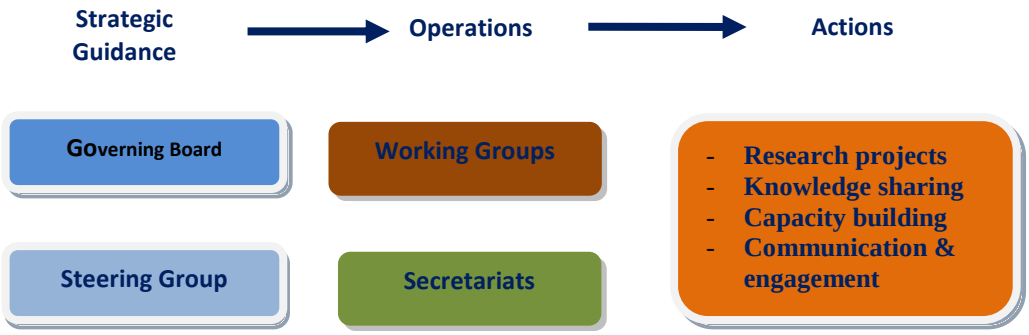
the integration of manure into nutrient planning at the field, farm and regional level. Both projects catalysed improvements in basic data collection.

SAIN's role in linking researchers together and providing a communication channel between ministries and policy makers.

Three features of SAIN's role standout. First, the systematic process for project selection. Second, the wide diversity of its research partners. Third, the use of communication channels appropriate to the target group.

The research programme was developed sequentially starting in 2008 with the UK-China agreement to establish SAIN along the lines proposed in the SAIN Business Plan. The latter had been developed following extensive consultations with potential stakeholders, resulting in a structure that ensured good communication between policy makers and scientists (Figure 1).

Figure 1 SAIN's Operation and Communication Structure



The SAIN Business Plan proposed a step-by-step approach with the initial research programme to be focused on four inter-related activities:

(i) Application of research and better communications tools to improve soil and crop nutrient management and lower non-point source pollution from nitrate, phosphate and greenhouse gases

(ii) Expanding use of agricultural biomass & livestock manure for biogas, liquid biofuels and organic fertiliser production to boost renewable energy generation, and to reduce greenhouse gas emissions and air and water pollution

(iii) Maximising the potential contributions of (i) and (ii) to climate change adaptation and mitigation, and helping to ensure that policies on other agricultural issues also support climate change objectives

(iv) Providing policy advice on how the concept of the circular economy can be applied to agriculture by exploiting the opportunities for greater recycling, waste minimisation, and more efficient of water and other critical resources, as identified by (i), (ii) & (iii).

These foci were agreed by SAIN's Governing Board (GB) and its Vice-Minister level co-chairs because they were consistent with Defra's strategic priorities for the Sustainable Development Dialogue and with China's 12th Five Year Plan. Working Groups (WGs) were established for each of these foci, and internationally renowned scientists from both countries were appointed as co-chairs to assist the initial team selection process. They were responsible for the completion of research gap analysis for each of the four foci to arrive at concrete project proposals for review and endorsement by Defra, MOA and the GB. Further

refinements took place in the membership of WGs, when it was felt that additional disciplines were required. The end result was 14 projects (Box 2) involving over 150 scientists drawn from some 50 universities and research institutions.

The latter highlights the second important feature of SAIN's role as a major catalyst and communication channel for research on sustainable agriculture innovation, namely the diversity of its partners. At the policy development and support level there has been the involvement of Chinese Vice-Ministers and UK Chief Scientists in the selection of research priorities and projects. At the project formulation and review stages there has been involvement of Chinese officials from NDRC and DRC, who play an important role in the formulation of Five Year Plans, and high-ranking provincial officials responsible for the selection and implementation of policy and technological options at the regional and local level. Plus representatives of UK and Chinese agri-business, such as ABAgri and SinoChem respectively. It is this diversity that ensures that SAIN project outputs are relevant to policy development and the technological needs of target groups.

Box 2. SAIN's Joint Research Projects

Improved Nutrient Management in Agriculture - a Key to the Low Carbon Economy (April 2009 – March 2012)

A review of Manure Use in China (MUC) (March 2010- September 2011)

ADMIT: Harmonising Adaptation and MITigation for agriculture and water in China (April 2010 – March 2012)

Estimates of future agricultural greenhouse gas emissions and mitigation in China (April 2010 – March 2013)

Conservation for enhanced utilization of crop wild relative diversity for sustainable development and climate change mitigation (April 2010 – March 2013)

Addressing vulnerabilities and building capacity for adaptation of agriculture to climate change in China (April 2010 – March 2013)

Developing a catchment management template to mitigate nonpoint source pollution in China (January 2011 – March 2011)

The future of food and farming - Foresight Report's implications for China

(September 2011 – December 2011)

Suitability of bio-char in China and sub-Saharan Africa: biophysical and socio-economic "fit" (April 2012 – September 2014)

Collaborative research on the role of trade between the UK and China in supporting innovation for the sustainable intensification of agriculture and the food chain in both countries (May 2014 – August 2015)

Knowledge, policy and practice for sustainable nutrient management and water resources protection in UK and Chinese agro-ecosystems (April 2013 – March 2016)

The final important feature of SAIN's role as multi-level and multi-objective network is its development of communication channels appropriate to the target group (Box 3). First, is the series of short policy briefs it has produced over the past 8 years (14 in total) which summarise the key findings of each project in terms of the R&D outcomes and their policy significance (Box 4). They have been used to brief Ministers and have contributed to important policy shifts. Second, there are 88 papers in international journals from SAIN projects that have been widely cited. Third, are the less formal monthly newsletters which go

out to a large mailing list (with over 750 UK and Chinese subscribers) as well as being posted on SAIN's bilingual website.

In summary, SAIN is a unique model of international cooperation. No other country or the EU has such a coherent approach to research collaboration although some have strong joint research progammes on specific problems and Germany has launched a communication programme with some SAIN like features.

Box 3 SAIN's main communication tools:

- *Policy Brief* – bilingual, communicates SAIN project findings and policy implications to non-academic audiences and policy makers.
- *China Agri-food News Digest* - monthly newsletter, focusing on policies, S&T and environment, trade and business of China's agri-food system.
- *UK Agriculture Brief* - monthly newsletter reports policy development, S&T progress, business and trade, and agri-food industry profile of the UK. The *Brief* is in Chinese.
- *Information Sheet* - produced irregularly to share the major policy innovations in China and the UK. For example Info sheet No. 1 was about 12th FYP and other policies/regulations; No. 2 was about the Chinese government No1 Document in 2013; No. 3 was a Chinese summary of UK Strategy for Agricultural Technologies;
- *SAIN Update* - Published quarterly, reports on SAIN progress
- *SAIN Websites* - bilingual

Box 4 SAIN's Policy Briefs

No. 1 (2010, updated 2011). Improved Nutrient Management in Agriculture – A Neglected Opportunity for China's Low Carbon Growth Path

No. 2 (2010). Greater food security and a better environment through improved nitrogen fertilizer management

No. 3 (2011). Greenhouse-gas emissions from energy use in the water sector

No. 4 (2011). The importance of China's crop wild relatives for the future of food and farming

No. 5 (2012). Policies and technologies to overcome excessive and inefficient use of nitrogen fertilizer: delivering multiple benefits

No. 6 (2012). Improving manure nutrient management towards sustainable intensification in China

No. 7 (2013). How do farmers respond to climate change risk?

No. 8 (2013). Economic Potential of Greenhouse Gas Mitigation Measures in Chinese Agriculture

No. 9 (2013). Technical options to reduce greenhouse gas emissions from croplands and grasslands in China

No. 10 (2013). Technical options for reducing enteric methane emissions from livestock production

No. 11 (2014). The status and suggestion of fertilization

No. 12 (2015). Inefficiency and environmental risks associated with nutrient use in agriculture within China and the UK

No. 13 (2015). Delivering improved nutrient stewardship in China: the knowledge, attitudes and practices of farmers and advisers

No. 14 (2016). Mitigation of diffuse water pollution from agriculture in England and China, and the scope for policy transfer