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The experiences of China's agricultural extension system in reaching a large number of farmers with rural advisory services

Background paper to the SDC face-to-face workshop "Reaching the Millions!" in Hanoi, March 2015

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Summary

This desk study analyses the Chinese rural advisory service (RAS) system with the goal to derive learning from its successes and challenges in reaching millions of farmers in a poverty oriented, ecological, and sustainable way. The study provides a description of the public extension system, and analyses a range of private and civil society RAS providers, which are representative for ongoing RAS initiatives throughout the country.

Cornerstones of the Chinese RAS system

The agricultural sector

- The agricultural sector contributes 10% to the national GDP
- 300 million persons, respectively 20% of the Chinese population are farmers
- The average farm size is 0.6 ha, most of it is private land
- Since 1980, the country's grain production increased four times and reached over 500 million t / year.
- China is among the countries with the highest fertiliser use / area

The worlds' largest system public extension system

- In 2006, 787,000 extension workers provided services to 637,000 villages. (one extension staff per 283 farm households) (Hu: 2012)
- Public extension is offered in every county and township of the country, irrespective of how remote they are (Binswanger: 2012)
- Large number of public private partnerships (PPP) at county level, mainly for the sales of inputs, The rational of PPPs is to complement public finances for RAS and to increase the outreach of private input providers.

Key learnings from the Indian RAS system

- China shows clearly that also in a pluralistic RAS system with strong involvement of private RAS stakeholders, the backbone of the extension system remains public extension, in particular when it comes to outreach.
- By allowing extension workers to sign contracts with private input suppliers, the Government of China (GoC) strengthened the public RAS system's financial sustainability and introduced a business mode of thinking into the public extension system. This also fostered a shift of the extension focus away from advisory towards input supply.
- Through the direct farm programme, the GoC successfully supports supermarkets to integrate their supply chains and to directly offer inputs, credits and advisory to collaborating farmers. To this end, the GoC facilitates linkages and offers incentives for direct farm companies.
- The demand of consumers for safe food, as well as public concerns about environmental and human damage through misuse of agro-chemicals led to increased private investments into advisory on the correct use of chemicals.
- The farmers' house system puts the public extension workers in the role of advisors, while the private input suppliers act as sales agents. This combination enables farmers to access advisory services and in the same time agricultural inputs.
- Cooperatives' right to enter business relationships is crucial for that 1) agricultural cooperatives evolve, and 2) operate in a business oriented way.

Major challenges

- Sales of agricultural inputs are the only financial incentives for public extension workers. This leads to a shift of the extension focus from advisory services to the sales of agro-chemicals and improved seeds.
- Public extension workers have to cover a range of services besides extension. Depending on state priorities, agricultural extension is neglected.
- In the case of China, decentralisation of agricultural extension activities did no go along with a decentralisation of public funding and the fiscal system. This significantly weakened the public services.
- The focus of private and public RAS is productivity increase through intensified agriculture, which results in excessive use of agro-chemicals.

Acknowledgement

I am grateful to the Swiss Agency for Development and Cooperation, in particular to Felix Fellmann, Focal Point of the Global Programme Food Security, for providing the mandate, the resources and thoughtful inputs for this broader learning exercise. I would like to express my thanks to Peter Schmidt for the joint elaboration of the research framework, the inspiring discussions, and the valuable comments on the draft report. I am equally thankful to the resource person Xiangping Jia, Professor at the Northwest Agriculture & Forest University, who gave me his time for valuable inputs, discussions and feedback.

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Abbreviations

AESTF	Agriculture extension special task force
ATE	Agriculture and Technology Extension (the public extension system)
ATESC	Agriculture and Technology Extension Service Centre
DBN	Da Bei Nong group
GoC	Government of China
NATESC	National Agriculture and Technology Extension Service Centre

Research framework and methodology

The study at hand analyses the institutional framework of the Indian agricultural extension system. It describes the public extension system with its diverse links to private sector and civil society, and discusses extension delivery and financing methods of the selected RAS providers.

The study is part of a broader learning exercise to capitalise experiences (CAPEX) in SDC financed RAS projects and country RAS systems in Asia. The goal is to search for innovation and learning to reach a large number of farmers with RAS in a poverty oriented, ecological and sustainable way.

The learning exercise encompasses the following studies:

- CAPEX RAS: Public Service for Agriculture and Rural Development Programme – Vietnam
- CAPEX RAS: Sustainable Soil Management Programme – Nepal
- CAPEX RAS: Samriddhi Local Service Provision – Bangladesh
- CAPEX RAS: Laos Extension for Agriculture Programme – Laos
- CAPEX RAS: Kyrgyz-Swiss Agricultural Project – Kyrgyzstan
- CAPEX RAS: Country RAS system in India
- CAPEX RAS: Country RAS system in China

All analyses are desk studies based on project reports, thematic publications, and interviews with 1-4 resource persons. The studies follow the research framework as shown below. Whereas the two country RAS studies use only the second, highlighted part of the research framework, project studies first describe the project's background and analyse the project contributions to the RAS system, their effectiveness and efficiency.

Finally, by analysing the institutional setting of diverse RAS systems and their effects on agricultural producers, all studies search for innovative approaches in public and private extension delivery to reach out to a large number of farmers in a poverty oriented, ecological and sustainable way.

Research framework

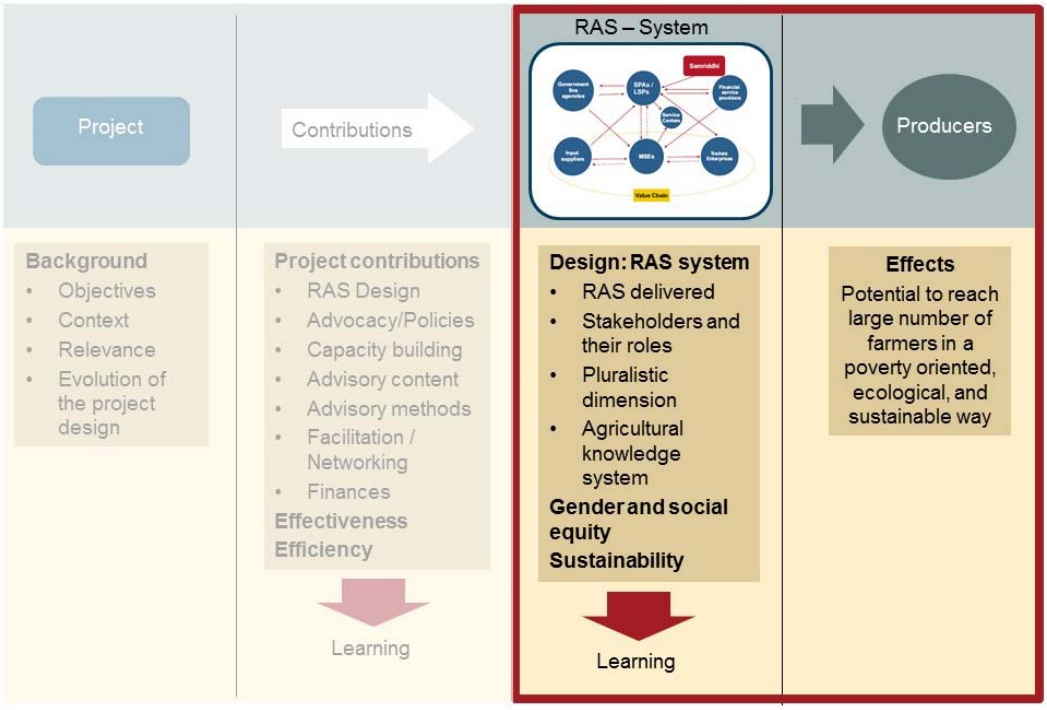

Figure 1: Research framework for the study to capitalise experiences in SDC financed RAS projects and country RAS systems (Stefanie Kaegi and Peter Schmidt: 2015)

1. Introduction

In China, the agricultural sector is with a contribution of 10% to the national GDP of great importance for the country's economy. It employs more than 300 million farmers, thus about 20% of the total population. Although China is considered a communist state, land has been privatised and distributed among approximately 200 million households, with an average land allocation of 0.65 hectares per household (Qamar: 2012). Since the opening of China's economy in the 1980s, the country's agricultural production has made extraordinary achievements: the country's grain production increased four times and reached over 500 million tons per year. Today, China produces food for 21% of the world's population on only 10 percent of the world's total arable land. The increase in agricultural productivity is reflected in farmers' per capita income, which has increased by a factor three since 1978 (NATESC: 2011).

China has the largest extension system in the world: the so-called Agricultural Technology Extension (ATE) system. The ATE system has played a considerable role in increasing the country's agricultural productivity (Huang and Rozelle (1996).

In the last 40 years, the system has faced a range of policy reforms and system-wide changes in agriculture, whereas the main change is seen in the transition from a planned to a market-based economic system. This transition has shifted the Chinese extension system from administration-oriented to an income-generation system (Shao: 2002).

Private sector involvement combined with broadly evolving economic farmer cooperatives play an increasingly important role in the agriculture extension and marketing system. While in the beginning, private sector agencies concentrated on input provision and simple service contracts for embedded services, they are more and more involved also in integrated value chains or large public-private partnerships.

While the former public service provision still remains the main pillar of the Chinese extension system, the involvement of private actors provides a range of insights on how public private partnerships for extension are organised, and the possible roles of private sector agencies in agricultural extension.

This desk study first describes the policy framework of the country extension system. It then gives an overview of the major reforms and development phases of the public ATE system. Further on it gives examples of private sector agencies, civil society and farmer cooperatives involved in agricultural extension. By analysing the various ways of extension service delivery, the study aims at defining innovative practices that allow public and private extension service providers to reach out to broad populations in an inclusive and effective manner.

2. Agricultural subsidies, policies and programmes

This chapter provides an overview of the institutional framework for agricultural extension in China. They tackle the public as well as the private extension service provision.

12th National Modern Agriculture Development Plan 2011-2015

The National Modern Agriculture Development Plans define the agricultural strategy for each a period of 5 years. The objectives that tackle public extension services are:

- **Establish a mechanism to ensure steady increase in agricultural investment** through 1) a higher government investment into agriculture, and 2) improved financial services for the rural population.
- **Strengthen support and protection for agriculture** through 1) an improved agricultural subsidy policy, 2) an intensification of agricultural research and technology extension, and 3) an improved market system for the major agricultural crops.
- **Open agriculture wider to the outside world** through enhanced international cooperation and exchange, as well as international trade. The underlying motive is: Agriculture going global.
- **Foster agriculture reforms** mainly regarding the seed industry. The Government of China (GoC) will intensify its support to national demonstration of modern agricultural technologies. (MoA: 2015)

Farm subsidies

Although agricultural growth has been impressive in the last decades and farmers substantially increased their income, the growth of farm income in China struggles to keep up with the growth of non-farm income in urban areas. Farmers feeling themselves left behind, which poses a threat to the country's socio-political stability. This problem of relatively low farm income has been recognised as a prime policy challenge and was a major issue of the last three five year plans. As response to the farm income problem, China has increased its subsidies from 100mio Yuan in 2002 to 122.8 Billion Yuan in 2011 (approx. USD 19 Billion). (Barrett: 2013) This results in a subsidy of approx. 60$/farmers/year.

Legal status for cooperatives

A new generation of cooperatives emerged in the last twenty years, but did not have a legal status until the GoC released the Farmer Specialised Cooperative Law in 2007. The law was adopted to create a legal framework for the establishment of cooperatives allowing them to act as market players. It highlights cooperatives' rights to provide services, such as purchasing agricultural inputs, marketing, processing, transportation, storage, agricultural technology and information provision (Jia et al., 2012). The granted legal status for registered cooperatives also allows them to sign contracts and to act as legal business partners. (Garnevska et al: 2011).

The Dragon Head Companies Programme, issued in 2002

The Dragon Head Companies Programme promotes agricultural industrialisation through contract arrangements between large agribusinesses and small scale farmers organised in economic cooperatives. Under the Dragon Head Companies Programme, the GoC grants special „Dragon Head status" to companies that meet criteria related to their potential to improve the technology status, productivity and income of small farms. In addition, Dragon Head Companies are granted special tax status as well as access to loans with favourable terms through the China's Agricultural Development Bank.

In return, Dragon Head firms develop systems that improve farmers' access to markets, credits, and technology. In 2013, over 60,000 firms participated in the Dragon Head Programme (Zhang: 2013, in Michelson et al. 2013) and 27% of 157 sampled farmer cooperatives had linkages to Dragon Head Companies in 2008 (Jia et al. 2012).

Direct Farm Programme

In 2008, the GoC announced the "Direct Farm Pilot Programme" with the goal to promote traceability and to increase farmers' income by eliminating intermediaries.

To reach this, the GoC selected nine supermarkets as pioneer enterprises and supported them to create linkages with farmers and farmer cooperatives, e.g. through conferences, local government support to establish cold chain storage or distribution centres. At the early stage, the Direct Farm program involved a handful of the large supermarkets as pioneer enterprises (e.g., Carrefour, Lianhua, Metro, Nong Gong, Walmart, etc.).

In 2009, a certification and financial incentive programme was announced to strengthen the involvement of farms and companies in the direct farm pilots in 13 provinces. Certified companies are eligible to receive financial incentives up to two million Yuan (approx. USD 300'000). (Michelson et al.: 2013)

3. Stakeholders of the country RAS system

The following figure provides an overview of the major stakeholders in the Chinese RAS systems and the interactions among them. The depicted stakeholders are described in the following of this chapter.

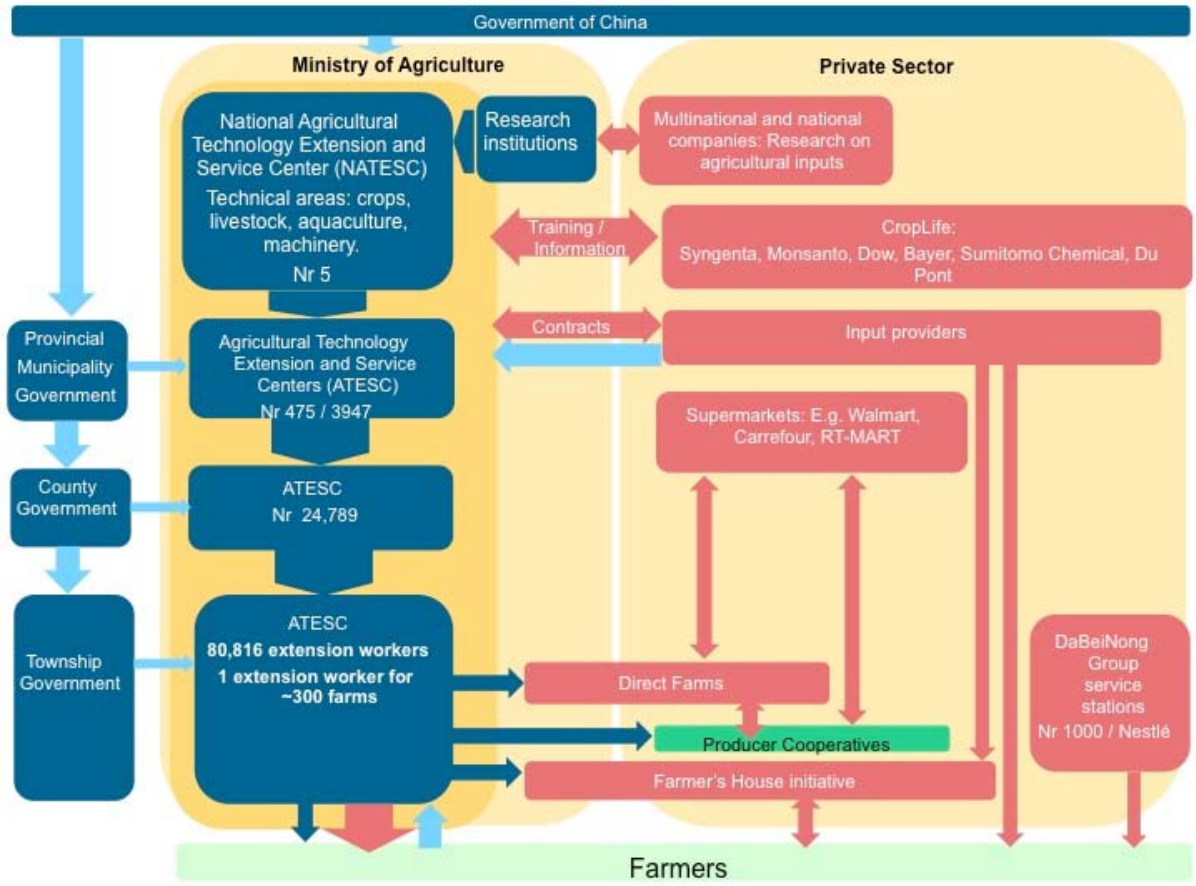

Figure 2: The country RAS system: Blue = public institutions; turquoise = fund flows; green = farmers and cooperatives; red = private sector agencies. (Author's own figure / indication about the number of extension staff for the year 2006 (NATESC: 2011))

3.1. The Public Agricultural Technology Extension (ATE) system

The Chinese ATE system is a government organisation under the MoA with the aim to provide public agricultural extension services. The main features of ATE is

1) to communicate and implement the policies of the Communist Party of China,
2) to serve research and technology development, and
3) to contribute to increase agricultural productivity as planned by the GoC.

It is considered an achievement of ATE that China's crop production increased to 500 million tons per year (NATESC: 2011).

The ATE system is operating in every county and township of the country, irrespective of how remote they are (Binswanger: 2012)

In 2006, the MoA through the ATE employed a total 787,000 extension workers, which provided services to about 637,000 villages. That is one extension staff per 0.81 village or per 283 farm households (based on information of several studies in Hu: 2012)

Learning: Also in a pluralistic extension system as in China, the backbone of the extension system is public extension.

Since the 1980's the ATE system has faced basically three phases, characterised by a commercialisation of the system and decentralisation of decision power and financing mechanisms. The following chapter describes the major changes and derived learning.

Development of the ATE system

Up to the 1980s, the GoC invested into a high coverage of the public extension service providers. By begin of the 1980's, the country employed more than one million extension workers from which 70% graduated from higher agricultural education institutions. The ATE operated offices at the five administrative levels – national, provincial, prefectures, counties and townships. ATE was operational in every township, whereas the central administration's planned the content and way of service provision (NATESC: 2011).

Since the 1980s, China's government gradually re-established this ATE system. (NATESC: 2011)

1) The Commercial Reform

Since the 1980s, the large number of public extension centres was more and more seen as a financial burden for the government. The GoC hence issued a Commercial Reform in 1985 and decreased state funding for extension services. This resulted in an overstaffing of the extension centres, compared to the available salaries. Thus extension staff either stopped their work, or focused stronger on input supply that allowed for an additional income generation (Shao: 2002 Hu: 2012). The commercial reform aimed at increasing the earnings of the public extension centres through improved services, but in particular through increased sales of inputs (Hu: 2012). Along with the reform, the MoA allowed the public extension offices at district and township level to directly sign service contracts with private input providers and to obtain a bonus of the increased production. Both the bonus and the service contracts are supplementary income for the public extension workers: the farmers were expected to pay the bonus in the case of increased production, and input providers paid commissions on the sold inputs (FAO: 2015). In fact, farmers in China did not change their attitude towards public services and rarely paid for the services. Thus, the reform of this stage affected mainly the incentives of extension staff for commercial activities and did not evoke a change on the relationship between farmers and extension workers (Jia: 2015).

Learning: Allowing extension workers to contract with economic entities, fosters the system financial sustainability and introduced a business mode of thinking into the public extension system.

This all turned free public extension services into a commercially oriented extension system, in which benefits of extension technicians depend on production and sales of agricultural outputs. This "Chinese experiment" is particularly interesting because the function of the commercial scheme is not so much to recover the costs of extension but rather to provide incentives to increase production. In this scheme, farmers and extension technicians are closely associated with rights, responsibilities and economic interests that are defined in contracts between farmers and technician" (FAO: 2015).

Learning: China introduced an incentive system to its ATE. The joint interest of extension worker and farmers is to increase production: they share the benefits resulting from increased production.

2) Decentralisation of the ATE system

A second phase was initiated in 1990 with the **Decentralisation Reform**. The reform shifted the administrative rights from county to township governments, thus left the major decisions regarding extension to the township governments. A further decrease of state funding and a shift of priorities in public service delivery away from extension were the consequences of the decentralisation process. Furthermore, the linkages between the township extension centres and extension agents at higher administrative levels were further weakened (Hu: 2012).

Learning: In the case of China, decentralisation of decision power for agricultural extension system did not go along with a decentralisation of public funding or tax systems. This significantly weakened public RAS provision.

Both, the commercial reform and the decentralisation reform fostered township technicians to focus on non-extension issues, such as sales of inputs, family planning, or administrative management – issues that had either not been decentralised in the same way as extension, or - in the case of input provision – issues that have been privatised (Hu: 2012). Thus, the commercial reform and the decentralisation reform weakened the public ATE system and left millions of farmers without ATE services (Hu et al.: 2010). However, by leaving the financing of RAS with the counties and linking it with private input providers the reforms introduced a business mode of thinking into the state extension system (Qamar: 2012).

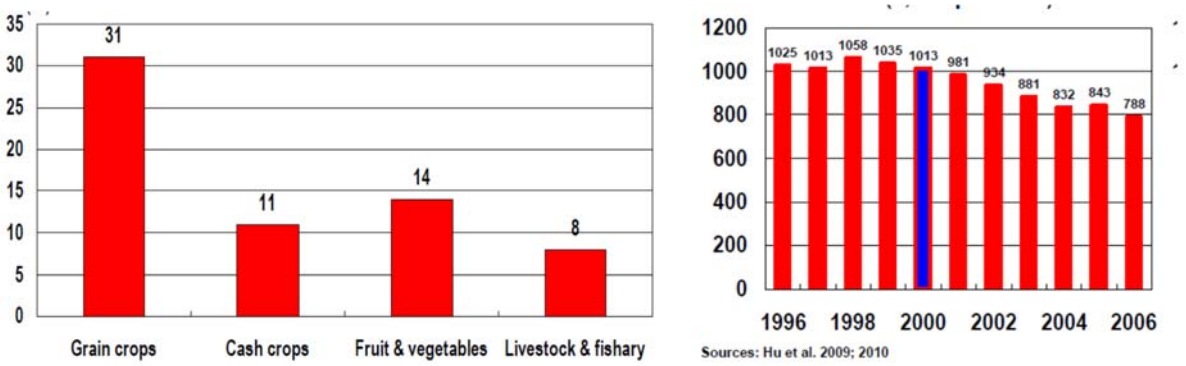

Figure 3: Left figure: Percent of farmers that received public extension services in China, 1996 - 2002; // Right figure: Staff under the government extension system (1000 person): Hu: 2012

3) Innovation and pilot phase*:* The inclusive extension reform pilots

In a third, so-called innovation phase, the MoA launched a nationwide innovation pilot programme for inclusive agricultural technology extension at grassroot level. According to the Communist Party of China's declaration of 2012, some of these pilot reforms, in particular such, allowing for further collaboration with the private sector, are now to be up-scaled to the entire country. (NATESC: 2011)

The inclusive extension reform pilot initiatives had four distinctive features:

1. to include all farmers as targets for public extension service,
2. to identify local farmers' needs for extension services in a participatory way,
3. to increase accountability of extension agents towards farmers,
4. to provide incentives to the extension agents for service provision.

A major initiative was the "responsible agent programme" for which, the experiment team randomly selected treatment and control villages in five regions. In the treatment villages, selected extension agents were trained in a broader range of extension functions than just technology for food grain production. The farmers receiving extension services of "responsible" extension workers had to rate the performance of extension staff according to 1) their availability, 2) their acceptance among farmers, and 3) the adoption of the proposed extension content. The "responsible extension workers" were offered a

bonus up to 4000 Yuan per year if they performed well, whereas the “conventional” extension providers were not promised such bonus.

The following learning were derived from the pilot projects:

- Targeting all farmers and assessing farmers’ needs are necessary conditions for that the public RAS system becomes inclusive.
- Incentives in form of a bonus that bases on a n annual evaluation of the services
  - increased the quality, accessibility and adoption of agricultural services.
  - increased the accountability of service providers towards farmers.
- Providing incentives is not without costs, what hampers scaling up of such reform-initiatives. Extension agents’ attention for high quality service provision and related incentives diminished when the system was scaled-up: Accordingly, the farmers under the initial pilot initiative were more likely to receive, accept, and adopt the agricultural extension services than those under up-scaled reform initiatives. (Hu et al.: 2010)

Learning: Incentives for extension workers clearly improved the service delivery. However, the required monitoring and evaluation activities could not be kept at a required level during scaling up of the initiatives, and incentives lost their positive influence.

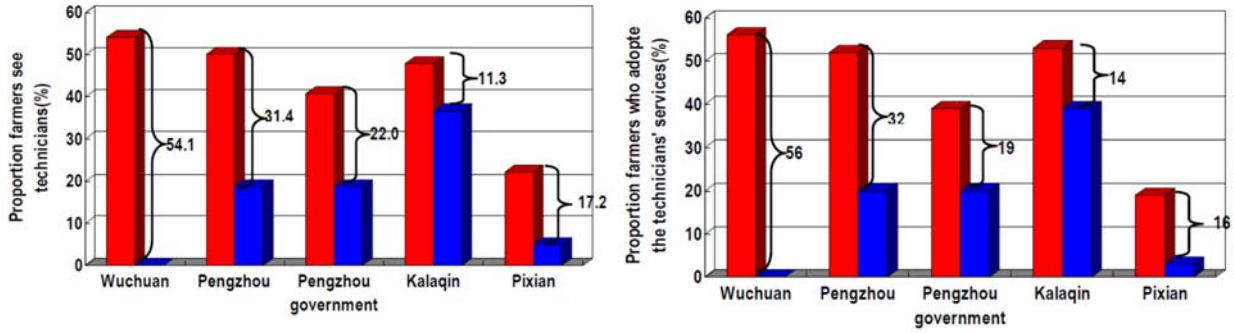

Figure 3: Changes in availability of service providers with the introduction of incentives. The chart shows the percentage of farmers that met technicians, respectively that adopted the services. Red/left bar - with incentives; blue/right bar - without incentives. (Hu: 2012)

3.2. Multinational development actors involved in agricultural extension

There are only few multinational actors involved in agricultural extension in China. An example is the United Nations Development Programme (UNDP) that has jointly with the GoC initiated an agricultural extension programme in 1998: **The china agriculture extension special task force (AESTF).**

The AESTF initiative sets up profit-sharing schemes to improve agricultural productivity, enlarge market access, and promote rural enterprise development. It therewith seeks to reform the traditional supply-driven government efforts in agriculture extension and introduce demand-driven and market-oriented mechanisms to link farmers to modern technology and new marketing channels.

Learning: The AESTF intervention introduced a benefit-sharing component into the public extension system.

Usually AESTF extension workers were selected from public extension centres, agricultural schools or research institutions according to their skills, knowledge and experiences. They established demonstration sites to show farmers the benefits of new agricultural products and technologies. AESTF extension workers support farmers to identify markets for the concerned product, and sign contracts with farmers to support them introduce the selected products. Most of the contracts guarantee minimum profits based on market price estimates of the products, as well as shared benefits.

Learning: The project was organised and implemented jointly with the NATESC, without generating additional costs for the state budget. This allowed for nationwide up-scaling.

Starting with a local initiative in 1998, the programme was scaled up nationwide by UNDP and the GoC to 1800 counties, and is now benefitting to over 60% of the rural population. Between 2006 and 2009, the average annual income of farmers benefitting from the AESTF services increased by 67%, which is 24% higher than the national average increase of farmers' incomes during the same time period.

3.3. Private actors in the Chinese extension system

Private agricultural companies play a mixed, but increasingly important role in the Chinese ATE system. Many of them are involved exclusively in the promotion and sales of agricultural products, and do not provide advisory services (Qamar: 2012). Other private agencies significantly contribute to agricultural extension. Selected examples are described in this chapter.

3.3.1. Da Bei Nong Group – An example for embedded services

Figure 4 DBN service stations in China. (Zhao: 2012)

A major provider of embedded services is the Da Bei Nong group. The company's professional technology extension team constitutes of 9600 promotional staff working in more than 1'000 service stations and 500 specialised stores at county level. They promote products, provide annually over 500 trainings, and investigate on markets. (Zhao: 2012). Da Bei Nong does agricultural trials jointly with customers e.g. on new methods of feeding, crop cultivation and disease control in order to directly demonstrate

the benefits to the clients. With this, Da Bei Nong aims at strengthening reliance of the customers, promotes its technologies and collects first hand data in order to convince more farmers. (Zhao: 2012)

Learning: Da Bai Nong calls its extension workers "promotional staff". With its trainings and advice it has the goal to sell as much inputs as possible and to find new clients.

Da Bei Nong is just an example of a broad range of private input providers offering embedded services in China.

The high degree of private sector involvement regarding to input supply is probably best described by the fact that China is with an average of 340kg mineral fertiliser / ha among the countries with the highest fertiliser use of the world – most of these inputs are provided through private agencies (Barrett: 2012).

3.3.2. Nestle – An example of private sector investment into research and extension

Another example of private sector involvement in agricultural extension is Nestlé with its integrated coffee and dairy value chains. Alone in 2011, Nestlé trained 17'000 dairy farmers by its own agronomists, it distributed through the government line agencies 1000 milking machines free of charge, and initiated jointly with the Province Shuancheng the construction of a high tech dairy farming institute in Shuancheng to strengthen research and trainings on dairy production (Nestlé: 2012). Nestlé invested in total CHF 30 million for the construction of the institute and the various test and demonstration farms around. The institute was inaugurated in 2014 and celebrated as China's largest research institute for dairy products. It has the capacity to accommodate and teach 700 students on dairy production (NZZ: 2015). The overall goal of Nestlé is to modernise the Chinese dairy production (Nestlé: 2012), and – as a matter of course – to secure supply for the continuously growing dairy sector in which Nestlé plays a major role.[1]

Similar as for dairy produce, Nestlé trains coffee farmers in Yunnan Province since 1997 (Forbes: 201). Nestlé signed a memorandum of understanding with the provincial Government of Yunnan, in which both parties agreed on the establishment of an experiment and training centre for Nescafe. Therefore Nestlé invested totally $16mio (WSJ: 2013). The institute has the capacity to train annually 5000 farmers, agronomists and coffee business professionals. The trainings and advice for farmers are free of charge. According to Nestlé, almost all national coffee companies are represented in Yunnan Province trying to source coffee. This allows farmers to sell their coffee to their preferred company (Forbes: 2014). Up to date 2000 farms joined the Nestlé programme, from which most sell to Nestlé. (Swissinfo: 2012).

Criticism on such large scale investments that serve only to private interests comes from diverse NGOs, e.g. from the Berne Declaration (2011): The organisation criticises Nestlé for intransparent investments into coffee production that strive to influence the countries' subsidy policies in favour of a coffee production as preferred by the company. Further, the Berne Declaration (2011) describes, how Nestlé creates oligopolies in coffee production areas on the basis of which it pressures on coffee prices. In total, Nestlé invests CHF 500 million into worldwide coffee production in the frame of the so called Nescafe Plan.

[1] Milk consumption in China has grown 5% annually since 2011. (Swissinfo: 2015)

3.3.3. Syngenta / CropLife – Public Private Partnership

Syngenta jointly with CropLife, the association of BASF, Syngenta, Bayer, Monsanto, Dow, DuPont, FMC, and Sumitomo chemical established a public private partnership with the GoC**.** The local stewardship team assists the NATESC of Ministry of Agriculture (NATESC) with training projects on adequate use of pesticides in over 20 provinces. Since the program was launched in 2000, about 200 million farmers have received training on adequate management and use of distributed pesticides. In the frame of the programme, about 10,000 guides, 8,000 sets of personal protective equipment, and over 5,000 safe use posters were distributed annually.

Learning: The driver of this public private partnership is the fear of negative health effects based on misuse of pesticides and correlated image damage for the input companies.

Syngenta also collaborates with the Centre for Agrifood Quality & Safety, where it trained over 3000 food safety auditors. In collaboration with CropLife China, the company conducts integrated pest management trainings for suppliers of direct farm programmes.

Learning: Finally, consumers' demand for safe food products and public concerns about environmental and human risks through misuse of agri-chemicals, led to increased private investments into RAS.

Another public private collaboration between Syngenta, CropLife China and the NATESC, is an ongoing secure storage education project that is implemented by the NATESC. Up to date, 2500 farmers have received training. (Syngenta: 2013)

3.3.4. Farmers' Home – Public Private Partnership

A governmental pilot project has transferred the conventional public county ATESC into a community information centre called "Farmers' Home". It is run by government entities with the contribution of private input providers. In Farmers' Home farmers can purchase agricultural inputs, sold by private input providers. These inputs they wouldn't access otherwise. While shopping, visitors obtain information and extension services from trusted public extension workers, and receive information about real-time market prices. The Farmers' Home is considered a win-win situation for farmers, the ATESC as well as for the private input providers: "it enables the private sector to promote its products and the public sector to recoup some costs of running the centre and provide the community with information and products." (FAO: 2015b)

Learning: The farmers' house system puts the public extension workers in the role of advisors, while the private input suppliers act as sales agents. This combination has the potential to foster farmers access to neutral information and thus their informed decision making regarding to agricultural inputs.

3.3.5. Supermarket Value Chains

Driven by increased incomes in urban areas, growing urbanization and state investment in food retail markets, the number of supermarkets involved in agricultural value chains has increased rapidly in in the last twenty years (Michelson et al.: 2013): in mid-2000, supermarkets provided 30% of the urban food consumption with increasing tendency. The main supermarket actors are Walmart, Carrefour, RT-MART, and China Resources Enterprise; together they account for 36% of the country's total supermarket retail revenue in 2012. Since most of these supermarkets, respectively their clients, are concerned about food safety, in particular with regard to fresh vegetables and fruits, they increasingly prioritise product traceability, thus bringing farms closer to wholesale markets.

Learning: With the Direct Farm Programme, the GoC aims at bringing supermarkets closer to farmers with the goal of economic growth in rural areas and secured food supply in urban areas. The joint interest of farmers and supermarkets is to increase and secure agricultural production.

Challenges for supermarkets to source produce directly from farmers remain. The country is immense and accordingly high are the transportation costs. Farm size is small with an average of 0.6 ha. Whereas

in other countries, NGOs and farmer cooperation are able to organise bulk sales of products in order to limit transaction cost to supermarkets, in China such structures yet remained weak.

Supermarkets therefore organise so-called supply companies (direct farms) that are situated in production areas and responsible for the organisation of production, collection, storage and transportation of the produce. As mentioned in chapter 2, the GoC supports the establishment of direct farms with favourable credits, tax reductions, investments into infrastructure, and a direct farm label of the produce.

In the frame of direct farm programmes, farmers are asked to produce a certain product meeting criteria deemed acceptable by the supermarkets. In return, these farmers receive trainings on modern production technologies, initial investments such as seeds, or possibly credits. The supermarket then purchases the produce at a set price from the farmers.

In 2012, 17% of 463 townships had a direct farm that sold to domestic and international supermarkets. This is equal to around 1% of all townships. Typically, direct farms sell to a range of companies and not to one supermarket exclusively. (Michelson et al.: 2013)

Example: Walmart's operates Direct Farms for the supply of fresh vegetables, fruits, meats, grains and seafood. In the Walmart stores these products are labelled with a Walmart direct farm logo and sold in a special section. As of the end of 2011, Walmart's direct farm program was sourcing products from 81 direct farms in 23 provinces. (Michelson et al.: 2013)

3.4. Farmer cooperatives involved in extension

Since the late 1990s the number of farmer cooperatives has rapidly grown. The adoption of the Farmer Cooperative Law in 2007 has led to increased government support for the establishment and management of farmer professional cooperatives (Gadevska: 2011). As result of the adapted Law, the number of agricultural cooperatives reached almost one million in 2013 with 73 million of farmers participating; or in other words: 28.5% of the total national farmer households participated in at least one cooperative (Liang et al.: 2015).

Learning: The adoption of the law for cooperative was the starting point for the wide development of new generation farmer cooperatives.

In most cooperatives some lead farmers have substantial capacities in management and marketing. They are the main holder of income rights and decision power, whereas the common members are rarely involved in decision-making procedures. These lead farmers, Liang et al. (2015) calls them core elements of cooperatives, use their social networks to access inputs and marketing opportunities, which are then made available to all cooperative members. The potential of cooperatives to network among stakeholders, extension and input providers thus mainly depend on the social networks of the cooperatives' lead farmers. (Liang et al. (2015))

In general, farmer cooperatives play a major role when it comes to organising agriculture extension from the private sector. Cooperatives enables a reduction of transaction costs through bulk sales and contracts to access embedded services. Most of the above mentioned direct farm programs work through farmer cooperatives – the cooperative organises the production and bulking of the produce, whereas the direct farm through the supermarket organises all logistics and provides extension.

3.5. Civil society organisations involved in agricultural extension

By and large, the GoC maintains control over non-governmental organizations (NGOs) in China. Unlike in many other countries, Chinese NGOs are not only required to find a government or ruling party sponsor for registration, but also directly funded by the government. Accordingly, the term GONNGO (government-organised NGO) evolved. With the time, however, some GONNGOs have attained relative independence and do not anymore receive financial support from the government. There are no specific

NGOs, which focus on agricultural extension per se, but extension activities are implicit in certain NGOs' programmes of rural community development. Three examples of relevant Chinese NGOs are given below. (GFRAS: 2015)

The China Foundation for Poverty Alleviation (CFPA) is a GONNGO that was established in 1989. The foundation's programs include water and livestock management, terracing, rebuilding houses, rural education, rural technology training, as well as health and disaster relief. CFPA also operates some micro-finance projects.

The Amity Foundation was established in 1985 by Chinese Christians to promote education, social services, health and rural development in China. The NGO conducts a one-year training course for village health workers and it has implemented more than a dozen long-term large integrated rural development projects in at least eight poor provinces.

The Rural Women Knowing All Association is a NGO that was founded in 1993 to publish the magazine *Rural Women Knowing All.* The magazine focused on the prosperity and destiny of rural women in China. Complementary, the association has established three non-profit centres to spread basic literacy among rural women and to provide information on health, sanitation, agriculture and livestock. The magazine also runs mini-credit programmes for women in poor rural counties. (GFRAS: 2015)

Due to the small number and size of civil society organisations, their outreach is expected to be limited. However, society organisations set inclusiveness criteria and are thus more poverty-oriented than public and private RAS providers.

4. Pluralistic dimension and agricultural knowledge and innovation system

4.1. Pluralistic dimension

The following table shows the pluralistic dimension of the Chinese agricultural extension system. It becomes evident that the extension system is either financed by the government or the private sector, with farmers, donors and NGOs playing a minor role.

Regarding the delivery of the services, one observes the characterising interaction between public and private service providers: E.g. private input suppliers employ public extension workers in the frame of service contract, or the GoC supports private companies to interact with farmers through input and output markets, as well as extension (direct farms, dragon head).

The interest of private and public stakeholders that finance the extension system is about the same: the increase of agricultural production and productivity. This is reflected in the content of extension that is offered almost exclusively in combination with input supply for increased production.

Source of finances	Service Providers					
	Public sector	Private Sector			Civil Society	
		Input supplier	Processors / traders	Private RAS providers	NGO	Farmer Coop.
Public	**ATESCs / AESTF**	**Direct Farm programme / Supermarkets**			Very few GONNGOs	
NGO/Donors /Multilaterals	UNDP AESTF Programme					
Private companies	Input suppliers using ATESCs as distributions channels Public Private Partnerships e.g. CropLife/Syngenta Stewardship The “Farmer House”	National and international private input suppliers	Supermarkets working with cooperatives Nestlé in Yunnan and Shuangcheng			
Farmers / Farmer Coop.		1 million agricultural cooperatives				

Table 1: Pluralistic dimension of the country extension system (adapted from Anderson and Feder (2004))

4.2. Agricultural knowledge and innovation system

The agricultural knowledge and innovation system bases on linkages between the diverse RAS stakeholders. In China, the major linkages are those between universities, research institutes, and the ATE system. These research-extension linkages function well for what concerns innovation for productivity increase of major crops, (Jia: 2015).

Regarding to vegetable and fruit production, or specialised seed for grain production, input and output market actors have a private interest in providing information and innovation to farmers. Examples are Nestlé that establishes research institutions and training centres, or supermarkets operating direct farms and transmitting knowledge and innovation to farmers. These linkages between private RAS actors focus on innovation for interests, which in the case of China often reflects also the government’s interests to increase agricultural production.

Except the growing number of agricultural cooperatives, there is little to none networks among farmers to develop and share agricultural technologies.

5. Effectiveness of the RAS system

5.1. Outreach

The Chinese ATE system works in all counties and townships of China, irrespective of how remote they are. In 2006, there were 787,000 public extension workers employed in the ATE system, including 560,000 technicians, serving about 637,000 villages. That is, one extension staff per 0.81 villages or per 283 farm households (Hu: 2013).

Although there is no exact data about the private input providers operating throughout the country, the in average high use of chemicals let assume, that these input providers reach out to a large part of the country. Private agencies on their own don't reach scale when looking at the entire country. They work in selected counties of selected districts and are far from having an outreach as the public extension system have – however, they are to be seen as a complement to the public extension system in areas attractive to private investments.

On the other hand, civil society organisation involved in RAS are almost inexistent, whereas farmer cooperatives, working as economic entities operate throughout the productive areas of the country.

5.2. Effectiveness of the RAS system

Economic effects

In general, there is almost no impact analysis on the RAS system, and the insufficiency of evaluation studies constrain policymakers and researchers to assess the system and make further development (Jia: 2015). All in all, China has considerably enhanced its agricultural production and productivity in the last decades. As a major indicator, one may mention the grain production that has doubled since 1978 and increased to over 600mio t in 2013, whereas in the same time, the total area planted with grains has decreased from 1.2 to 1.1 billion ha. Further, between 1980 and 2013 the following productivity achievements have been made (China Stat.: 2014):

- Cotton productivity has increased from 0.445 t/ha to 1.45 t/ha
- Cereal productivity has increased from 4.2t/ha (in 1991) to 5.9t/ha
- Peanut productivity has increased from 1.3t/ha to 3.6 t/ha
- Beetroot productivity has increased from 8.1t/ha to 50.9t/ha

There is no evidence about the contribution of the extension system to this productivity increase. Clear is that this time period was characterised by a fast development and increased availability of improved inputs, combined with one of the world's highest use of chemicals.

Effectiveness of the public extension system: Although the public extension system is still the major player in the extension landscape, and compared to other countries relatively well staffed, the traditional approach of providing technological support to farmers is considered non efficient and non-effective (Jia: 2015, UNDP: 2011). A major reason for that is seen in the fact that extension workers are government employees, also tasked to perform other duties in the villages, such as levying fees and taxes, as well as enforcing family planning policies (UNDP: 2011). The decentralisation of decision power and financing of extension to the county and township levels is another explanation for the weak performance of the system, which lost its former strong centralised commands. And last but not least, the ATE system lacks incentives for extension workers – except what concerns service delivery that is combined with input supply, or profit sharing (Jia et al.: 2015).

Social and ecological effects

The primary goal of agricultural extension from private as well as from public stakeholders is production increase based on an intensification of agriculture.

Jia et al. (2015) reveal that excessive use of chemical fertilizer in crop production is becoming pervasive and a severe ecological issue in China. They claim that Chinese farmers rely on their experience from the Green Revolution (1960–1980), which suggests that more fertiliser use always leads to higher crop yields. Further, they show that training and scientific guidance can lead to decreases in fertiliser applications of 20% in maize and rice production with no loss of yield. (Hu et al.: 2007, in Jia et al.: 2015). These trainings are found to be more effective if conducted by scientists as part of scientific studies, than if delivered in a routine fashion by extension agents. The public extension system is not considered an effective way to face the growing challenge of chemical overuse.

No studies were found that show the social effects of the RAS system, respectively its inclusiveness. Not being an issue neither of the public extension system, nor of private investments the author assumes that most RAS providers don't actively aim at reaching out to disadvantaged groups or women. However, the relatively high coverage of the public extension system and the fact that services are offered free increases access of RAS providers to farmers, also small scale farmers. Nevertheless, RAS that affirmatively seek to cater to disadvantaged groups or women seem to be left to the few NGOs, to some private social responsibility initiatives, or to larger poverty reduction programmes such as the above-described UNDP programme AESTF.

6. Conclusions: Innovation and learning from the Chinese RAS system

China has with 300 million of farmers the worlds' largest target group for extension. The country maintains also the worlds' largest public extension system. This public extension system has depicted several reforms in the last 30 years and became more and more a market-oriented system, in which the private sector plays an increasingly important role. The derived learning from these recent developments are in the following classified in 1) learning from the reform activities, 2) strategies to foster involvement of the private sector in extension, and 3) approaches to create incentives within the extension system.

Learning from the public ATE reforms

The high coverage of the public extension system that is available in every county and township of the country leads to a relatively high accessibility of extension services for farmers. Combined with a free of charge service delivery how it was the case in the 1980s, the public ATE system had the potential to reach out to poor farmers, too. This system was financed by the central government and had access to substantial funds to deliver high quality services (Hu: 2012). In the case of China, decentralisation as well as commercialisation of the services weakened the quality of the system over time. The learning or the reform is:

1. Decentralisation of extension administration without aligned decentralisation of government funds and the fiscal system, leads to a decrease of available funds for extension.
2. With the decentralisation of extension administration, the focus of local authorities shifted away from agricultural extension towards other administrative subjects.
3. Commercialisation of extension led to increased private interests compared to public interests. This weakened the delivery of extension in form of advisory and trainings, and thus weakened the quality of the extension system as a whole.

Government strategies to involve private sector in extension

To limit the financial burden of maintaining the large public RAS system, and to reach the set production goals aiming at food sovereignty, the GoC successfully fostered private sector involvement in extension. Thus, what one may learn from the Chinese extension system, are strategies to enhance private sector involvement in extension.

1.) The GoC allows the public ATESCs to contract with private input providers and to arrange a profit sharing between extension workers, companies and farmers.
2.) The GoC fosters collaboration between public ATESCS and input suppliers through inviting private sector to sell their products in and around the public extension offices: e.g. the farmers' house initiative. In return, input suppliers pay part of the extension office, whereas public extension workers provide "neutral" advice to farmers.
3.) The GoC supports companies via the direct farms and dragon head company programme to contract with farmer cooperatives with regard to input provision, extension provision, and output sales. The GoC operates as an initial networking agent that facilitates linkages.
4.) The GoC formed the legal framework for farmer cooperatives in a way it allows farmer cooperatives to contract with private sector agencies regarding input, outputs and extension. Based on this legal framework, the number of farmer cooperatives increased significantly, and business relationships became possible.

Strategies to create incentives within the extension system

When employing extension workers, both, the private and the public actors strive to introduce an incentive system for extension workers. Both assume –based on their experiences - that incentives for extension workers increase the quality of the services. The private and public institutions applied the following strategies to create incentives within the extension system:

1. Benefit sharing between farmers and public/private extension workers if production increases through collaboration between the extension worker and farmers. (e.g. private/public input supply / Da Bei Nong)
2. Fixed minimum profits for farmers in the contracts. Extension workers are made responsible that farmers reach the minimum profit – everything what is above, will be shared with extension workers (e.g. AESTF).
3. Evaluation of the extension delivery and related bonus payments. Such systems are considered too expensive to be maintained in the long run; e.g. public pilot reform projects for inclusive ATE system.
4. The opportunity of extension workers to keep their job depends on how well he/she contributes to increased production (e.g. Nestlé coffee production / direct farms). As a result, the company employs only extension workers most motivated and capable to support farmers in increasing their production.

Objectives for social and ecological effects of RAS, respective are necessary

The Chinese RAS system including both, public and private stakeholders, primarily aim at a productivity increase and does not foresee specific poverty reduction goals or activities to mitigate negative ecological effects of increased use of chemical. Without such goals little assessment on ecological and social effects will be done, and the chance that RAS will be ecologically sustainable and poverty oriented remains small or at least unassessed.

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