

Development of Agricultural Mechanization in China

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Outline

Introduction

The evolution/development of agricultural mechanization

Evolution of agricultural mechanization cooperatives and services

Major government policies for agricultural mechanization and agricultural cooperatives

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Introduction

- ▶ Agricultural mechanization, as the big transformation in agricultural sector, is vital in agricultural productivity, rural employment, and rural income/poverty.
- ▶ The most important factors in determining agricultural mechanization development are:
 - ✓ *land tenure*
 - ✓ *farm size*
- ▶ As in other countries with economic transition, China underwent the land reforms in last several decades.

Background: Rural land reform in China

Maoist organization of the rural economy (1950 –1980)

- Lands are equally allocated to farmers
- collectivize the land ownership



China's Household Contract Responsibility System(1981 –Current)

- Allowed households to contract land from collective organizations.
- Land rights split into: contracted management rights, ownership rights
- Farmers have the “contracted management right” without ownership rights



Three rights Separation of Rural lands (2016–Current)

- Land rights split into: Land right ownership, contract rights and management rights

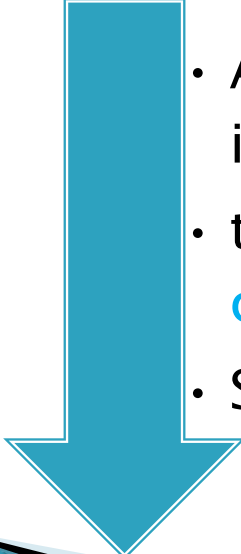
Two Puzzles in China's agricultural sector



Puzzle 1:

- Agricultural output and yields have steadily increased, despite small farm size and land fragmentation.
- Partly can be explained by **increasing mechanization** (Yang et.al 2013)

Puzzle 2:

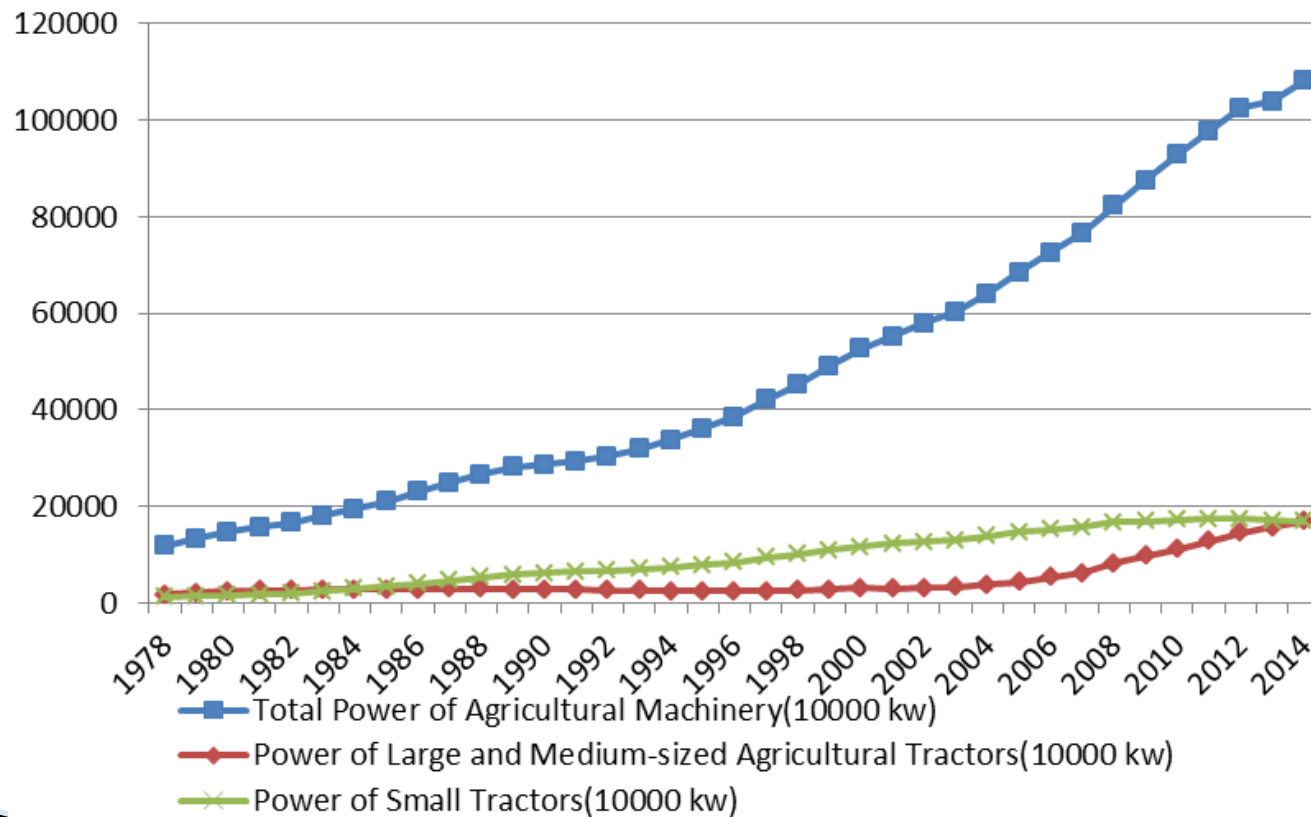
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- Agricultural mechanization has dramatically increased under the fraction of farm land.
 - the development of **agricultural mechanization cooperatives and services;**
 - Support of **agricultural policy and subsidies**

Research objective

- ▶ To understand the nature, speed and extent of agricultural mechanization development in China using data-based evidence.
 - ▶ To analyze the evolution/development of agricultural mechanization cooperative and agricultural machinery service.
 - ▶ To review supportive policies with the development of agricultural mechanization in China.
 - ▶ To provide some implications for other developing countries.
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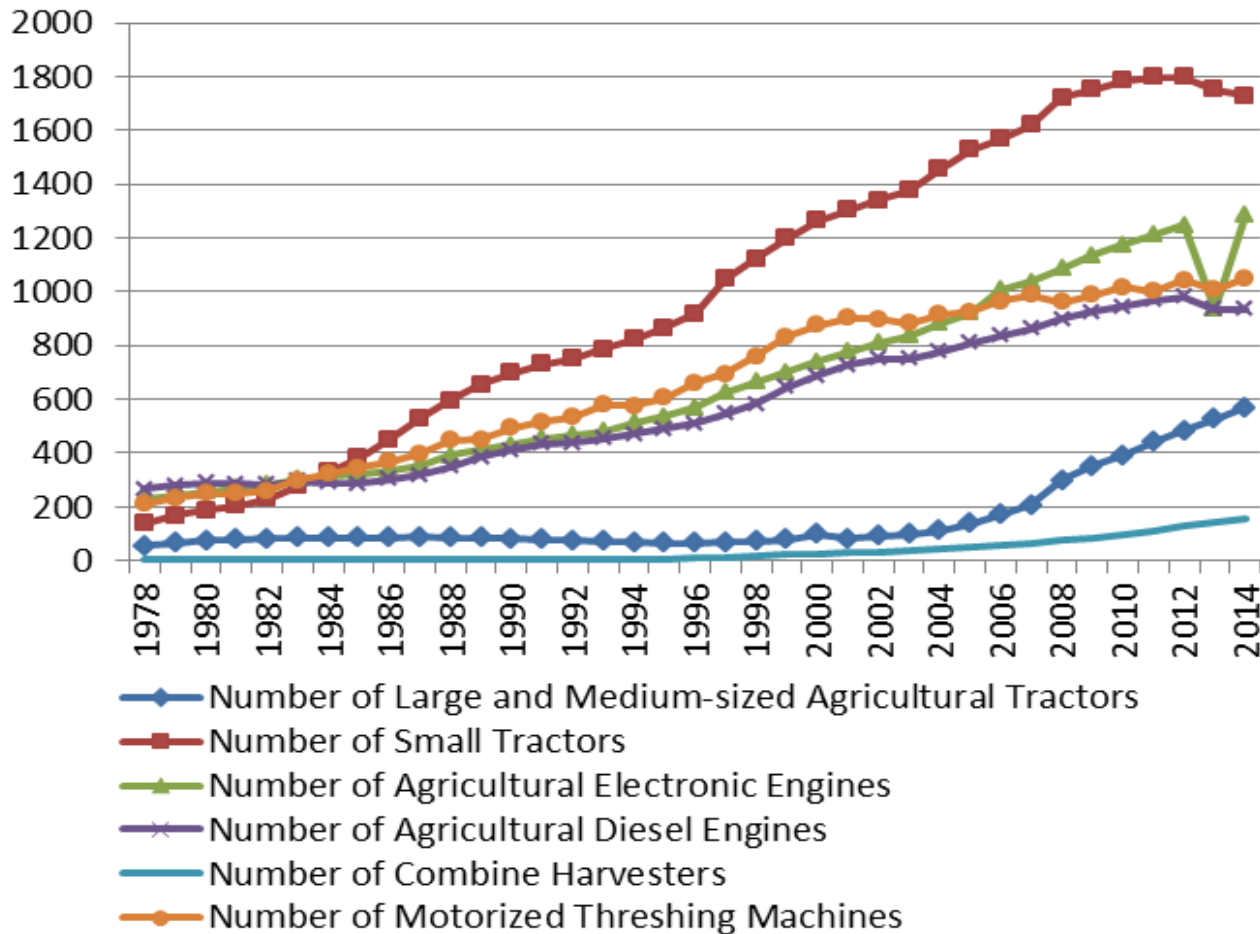
The evolution/development of agricultural mechanization

▶ Growth of Major Agricultural Machinery



The evolution/development of agricultural mechanization

► Growth of Major Agricultural Machinery



The evolution/development of agricultural mechanization

▶ Growth of Major Agricultural Machinery

- Agricultural machinery is under high demand in China.
- The annual growth rate of total agricultural machinery power is 6.38%.
- The growth rate of Medium and large agricultural tractors is much larger than small tractors since 2006.
- Agricultural electronic engineering holds the largest proportion, followed by motorized threshing machines, agricultural diesel engines and combine-harvesters.

The evolution/development of agricultural mechanization

▶ Agricultural machinery operation

Item	Integrated Mechanization rate	Mechanical plowing	Mechanical sowing	Mechanical harvesting
2014				
Crops	59.5%	76.0%	48.8%	48.2%
Wheat	93.7%	98.9%	86.7%	93.8%
Rice	73.1%	95.1%	36.1%	80.9%
Maize	79.8%	97.7%	84.1%	51.6%
2004				
Crops	32.7%	48.90%	28.84%	20.36%

Sources: 2000-2015 China Agricultural Machinery Industry Yearbooks.

- Integrated mechanization rate in China is 59.5% in 2014, nearly 2/3 of the crops are planted by mechanization.
- The integrated mechanization rate of wheat is the highest(93.7%).

The evolution/development of agricultural mechanization

▶ Agricultural machinery operation

Terms	2014	2013	2012	2011	2010	2004
1. The overall situation of agricultural machinery operation						
<u>Total</u>	403.99	388.75	373.18	357.33	336.33	224.50
(1) Mechanical ploughing area	117.42	113.76	110.28	106.88	100.60	63.59
(2) Mechanical sowing area	83.96	80.31	76.79	72.92	69.16	44.28
(3) Electromechanical irrigation	83.27	77.42	71.17	66.01	59.85	46.21
(4) Mechanical plant protection	65.66	64.10	62.64	59.71	57.36	39.97
(5) Mechanical harvesting area	53.69	53.16	52.30	51.81	49.36	30.45

- From 2004–2014, the planting area operated by machinery increased substantially.
- Mechanized Harvested area grows fastest, with 8.6% annually growth rate from 2010–2014.
- Maize, rice, wheat and soybeans are the principal crops under machinery operation in China.

The evolution/development of agricultural mechanization

▶ Development of Agricultural Machinery Cooperatives (AMC)

Terms	2015	2014	2013	2012	2011
Agricultural Mechanization cooperatives (1000 unit)	54.0	47.4	42.3	31.0	28.0
Enrolled Member (Millions)	1.9	–	–	–	1.0
Covered household (Millions)	38.87	45.00	–	–	24.22
Covered household per cooperative	–	985	–	–	–
Covered planting area (Million hectares)	47.47	51.67	–	–	43.33
Share in total Machinery operation area	12%	13%	–	–	12%
No. of Agricultural Machinery (Millions)	3.17	3.09	2.79	–	–
Proportion in total agricultural Machinery	25%	25%	–	–	–
Total income (Billion dollars)	117.97	109.71	80.58	–	42.32
Income per cooperative (Thousand dollars)	218.84	214.28	195.65	–	–

Evolution of agricultural mechanization cooperatives and services

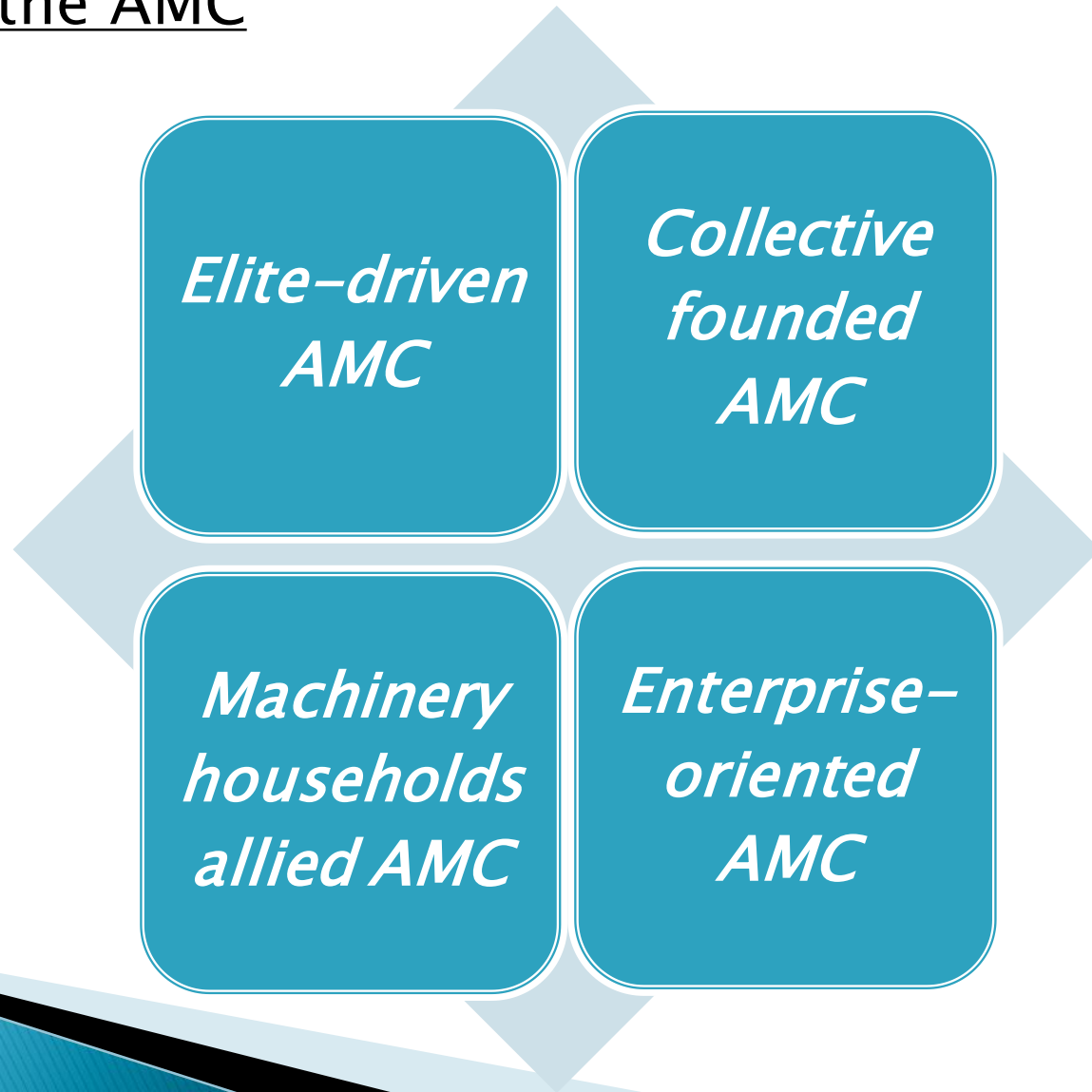
- ▶ **Development of Agricultural Machinery Cooperatives (AMC)**
 - The number of AMC increased from 28,000 to 54,000 from 2011–2015, with growth rate of 15%.
 - The enrolled AMC members were almost doubled from 1.0 million to 1.9 million from 2011–2015.
 - The numbers of served households by AMC increased from 24.22 million to 38.87 million from 2011–2015.
 - On average, each AMC served 985 household in 2014.
 - The covered planting area served by AMC in 2015 estimated at 47.47 million hectares, accounting for 12 % of the total machinery operation area.

Evolution of agricultural mechanization cooperatives and services

- ▶ **Development of Agricultural Machinery Cooperatives (AMC)**
 - The total agricultural machineries owned by AMC in 2015 was 3.17 million, about 25 % of the total agricultural machineries.
 - The total income in 2015 was 117.97 billion dollars, around 3 times more than that of 2011.
 - The average income per AMC was 218.84 million dollars in 2015.
 - The income of cooperatives mainly derives from machinery services (82.18 million dollars in 2015) and a small share from repair services (11.59 million dollars in 2015).

Evolution of agricultural mechanization cooperatives and services

- ▶ Types of the AMC



Evolution of agricultural mechanization cooperatives and services

▶ Types of the AMC

Type 1: *Elite-driven AMC*

- led and funded by one or more elites, who generally have both experience and resources.
- Advantages: Efficient to organize the agricultural mechanization operations within their cooperatives.

Type 2: *Collective founded AMC*

- built by village-based collective organizations, or by township agricultural machinery management departments.
- Advantages: Integrate superior resources, facilitate connections with governments

Evolution of agricultural mechanization cooperatives and services

▶ Types of the AMC

Type 3: Machinery households allied AMC

- usually constituted by machinery households
- Cooperatives are run jointly and all benefits and risks are shared amongst households.

Type 4: Enterprise-oriented AMC

- Dominated either by agricultural leading enterprises or agricultural mechanization companies.
- Advantages: strength in technology employment and management, more competitive and profitable

Evolution of agricultural mechanization cooperatives and services

▶ *Patterns of agricultural mechanization services*

Pattern 1

- **Trans-regional** mechanization operation service (TRMOS)

Pattern 2

- "**Dishes-ordering**" mechanization operation service

Pattern 3

- "**One-stop**" mechanization operation service.

Pattern 4

- "**Land leasing and contracting**" mechanization operation service.

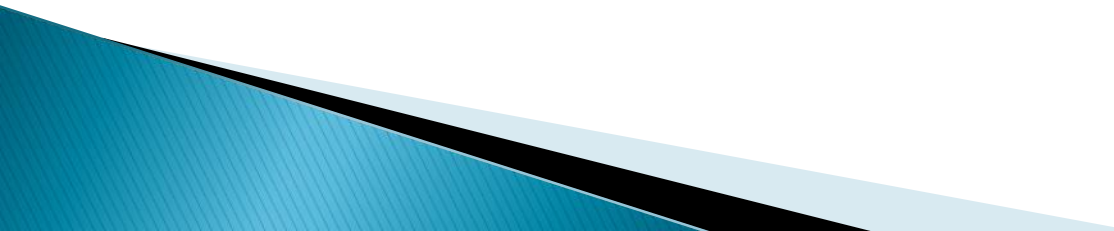
Evolution of agricultural mechanization cooperatives and services

▶ *Pattern 1: Trans-regional mechanization operation service (TRMOS)*

- ✓ Initiated in 1996, is developing for over 20 years.
- ✓ The size has been greatly expanded.
- ✓ The scope extends from intra-provincial regions to external-provincial regions.
- ✓ Represents a creative pattern of agricultural mechanization operation service.
- ✓ Plays an important role in rush-harvesting and rush-planting.

Evolution of agricultural mechanization cooperatives and services

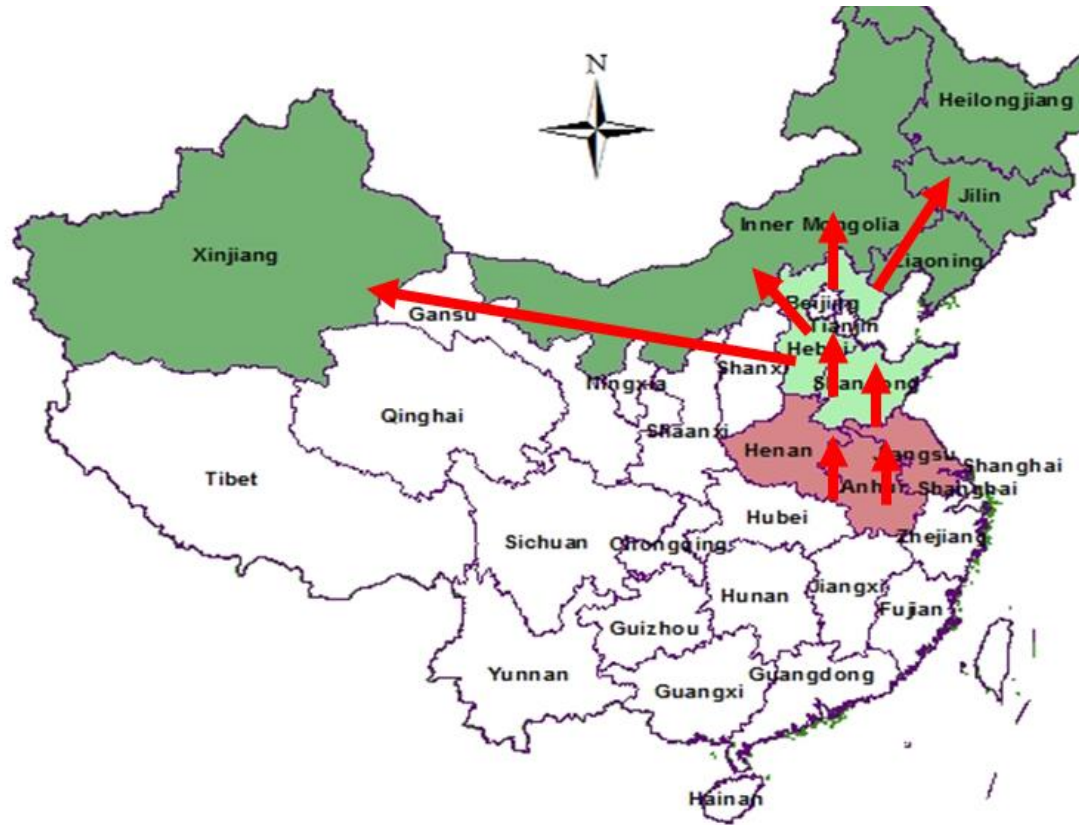
▶ *Pattern 1: Trans-regional mechanization operation service (TRMOS)*

- ✓ Optimize the allocation of agricultural machineries resources
 - ✓ Provide services to regions lack of agricultural machinery resources.
 - ✓ Significantly improves agricultural productivity, farmer income and agricultural competitiveness
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Evolution of agricultural mechanization cooperatives and services

▶ Pattern 1: Trans-regional mechanization operation service (TRMOS)

Case 1: The routine of trans-regional operation on maize



→ : The routine of trans-regional operation on maize.

Evolution of agricultural mechanization cooperatives and services

- ▶ Pattern 1: Trans-regional mechanization operation service (TRMOS)



Certificate of Trans-regional mechanization operation
(Authorized by Ministry of Agriculture of China P.R.)

Evolution of agricultural mechanization cooperatives and services

- ▶ *Pattern 1: Trans-regional mechanization operation service (TRMOS)*



Note: Transporting agricultural machineries among regions

Evolution of agricultural mechanization cooperatives and services

- ▶ *Pattern 2: "Dishes-ordering" mechanization operation service*
 - ✓ Farmers can freely choose the mechanization operation on some key producing procedures, like ordering dishes in a restaurant.
 - ✓ Farmers only pay for the service fee of the selected mechanization operation procedure.
 - ✓ partly free the laborers from agriculture producing, and broadly used by those households who have off-farm employment in nearby regions.

Evolution of agricultural mechanization cooperatives and services

▶ Pattern 2: "Dishes-ordering" mechanization operation service



Source: the survey conducted in Sichuan Province in May of 2017

Evolution of agricultural mechanization cooperatives and services

- ▶ *Pattern 3: “One-stop” mechanization operation service*
 - ✓ Cooperatives provide the full-process mechanization operation services during agricultural production.
 - ✓ Farmers pay the service fee, and all the harvest crops belong to the farmers.
 - ✓ In recent years, the “one-stop” service also extended from production to market, indicating that cooperatives could also be in charge of crop selling for farmers.

Evolution of agricultural mechanization cooperatives and services

- ▶ *Pattern 4: “Land leasing and contracting” mechanization operation service*
 - ✓ farmers lease their lands directly to cooperatives, and sign a land leasing contract.
 - ✓ After integrating the lands, cooperative could heavily operate on the land with machineries.
 - ✓ The cost of agricultural production would decrease dramatically and the crop would be more profitable.
 - ✓ Farmers who lease lands will get the revenue in the form of crops and cash from cooperatives.

Evolution of agricultural mechanization cooperatives and services

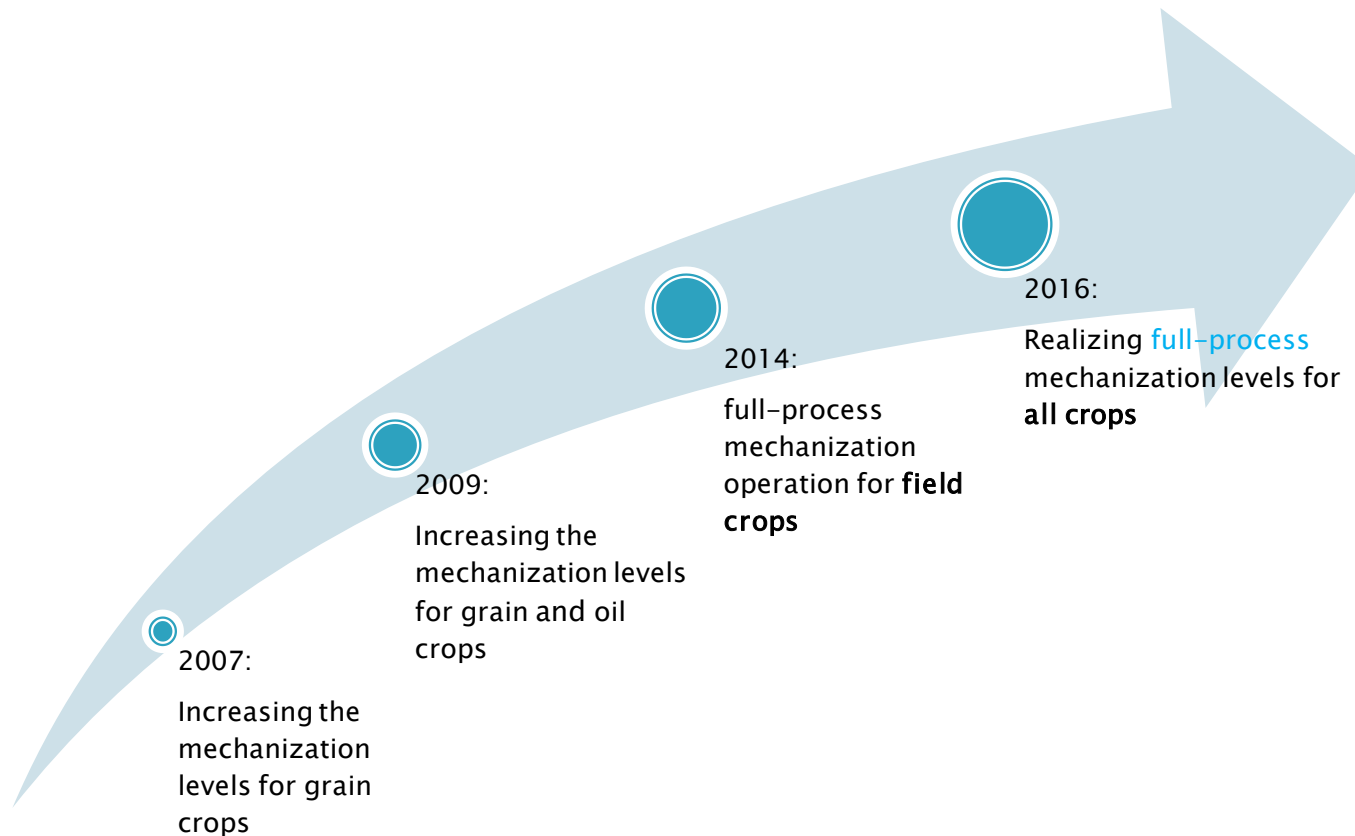
- ▶ *Challenges in mechanization cooperatives in China*
 - ✓ The coverage period is limited.
 - ✓ The regulation of cooperatives is incomplete.
 - ✓ The members of cooperatives do not enjoy a high level of training.
 - ✓ The relative low farm size raises mechanization operation costs.
 - ✓ China mechanization cooperatives are numerous but not competitive.
 - ✓ Insufficiency policy support and financing.

Major policies for agricultural mechanization and agricultural cooperatives

- ✓ China has shifted away from taxing to subsidizing its agricultural sector when China joined the WTO in 2001.
 - ✓ China's agriculture support policies expanded rapidly in size and scope after an initial set of direct payments and price supports in the early 2000s (Gale 2013).
 - ✓ **No.1 central document**, released in 2004, 13 successive documents mentioned agricultural mechanization and agricultural cooperatives, which are the best representation major government policy towards agricultural mechanization.
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Major Government Policies for Agricultural Mechanization and Agricultural Cooperatives

▶ Major policy traits of agricultural mechanization



The evolution of the agricultural mechanization targets

Major Government Policies for Agricultural Mechanization and Agricultural Cooperatives

▶ Major policy traits of agricultural cooperatives

- ✓ The financial support and tax preference has strengthened in recent years.

Tax preference

- 2005-2006,2008,2013-2014:tax relief and preference.
- 2009: Enrolling in tax registry system and free of charge for registry fee.

subsidies and projects inclining

- 2008:Being authorized to apply projects from the government.
- 2009: The agricultural subsidy should incline to agricultural cooperatives.
- 2012: Subsidies on Pretreating and storage facilities.
- 2013: Inclining the new subsidies and the projects to agricultural cooperatives; Increasing the fund for cooperatives development.

financial and credit support

- 2008: Local goverment should provide finical support .
- 2009: loan guarantee should be given to agricultural cooperatives .
- 2012: Increasing the loan to agricultural coopertives.
- 2013: Supporting the subsidized loan;
- 2014: Assuring the related project fund comes to cooperatives ;
- 2016: Increasing the trial Pilots of government purchases of agricultural services.

Major Government Policies for Agricultural Mechanization and Agricultural Cooperatives

▶ *Major policy traits of agricultural cooperatives*

- ✓ Constantly providing the social service and technical training to agricultural cooperatives.

2007: Providing the services for Cooperatives
2008: Leading the standardized agricultural production, and training the heads of the cooperatives.

2009: Training the members of the cooperatives.
2012: Participating the services of the full agricultural chains.

2013: Fostering the agricultural commercial services organizations, such as mechanization cooperatives.
2016: Boosting the development of the agricultural production-oriented services.

Major Government Policies for Agricultural Mechanization and Agricultural Cooperatives

▶ Major policy for agricultural mechanization cooperatives

2017: Supporting and fostering the operational services organizations such as mechanization cooperatives to carry out agricultural mechanization operations, and supporting the building of integrated service platform of agricultural mechanization.

2015: Encouraging the professional agricultural operational organizations (such as mechanization cooperatives) to provide mechanization operation services.

2016: Encouraging farmers voluntarily join the cooperatives by pooling of land as shares and ensuring the revenue for farmers; Structuring the exemplary construction of cooperatives.

2014: Credit aid on purchasing of large and medium agricultural machineries.

2008: Supporting the development of agricultural mechanization cooperatives.

Major Government Policies for Agricultural Mechanization and Agricultural Cooperatives

▶ Major policy for agricultural land reform

Before
1993

- 1982: Land transformation was strictly forbidden.
- 1988: Land was allowed to transfer based on China constitution

1993-2003

- Allowing the land transformation legally, voluntarily.
- But the land transformation market is lack of regulation.

2003-2007

- More regulations were released on land transformation.
- Government encouraged the accelerating of land transformation.

2007-2015

- Leading the land transformation from accelerating transformation to rational transformation

2016-

- Land right was initially separated into land-use rights, contract rights and operating rights.

Conclusions and implications

- ▶ Despite the constraints of land tenure and small farm size, China underwent rapid development in agricultural mechanization:
 - ✓ rapid increase in agricultural machinery,
 - ✓ wide implementation of agricultural machinery operation for major crops,
 - ✓ substantial substitution of machinery for labor in agricultural production, with labor/land productivity significantly improved
- ▶ Rapid development in agricultural mechanization cooperatives is one the major driving forces.

Conclusions and implications

- ▶ Agricultural policies, in particular,
 - Agricultural machinery purchase subsidy
 - Agricultural mechanization services policies
 - Technology innovation supporting policy
 - Financial support and tax preference policy
 - Agricultural machinery cooperatives
 - Land tenure reform.
- ▶ Significantly influencing the development of agricultural mechanization.

Conclusions and implications

- ▶ Long-term practical experiences show that agricultural machinery cooperatives have numerous advantages in prompting the agricultural production:
 - provide the service in different crop planting process, and free up more labor from agriculture sector.
 - the intensive, well-organized and specialized services can essentially lower the production cost.
 - play an important role in prompting the new technology
 - extensively serve to increase the productivity of agricultural production processes and overall supply chains.

Thank you very much!!

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