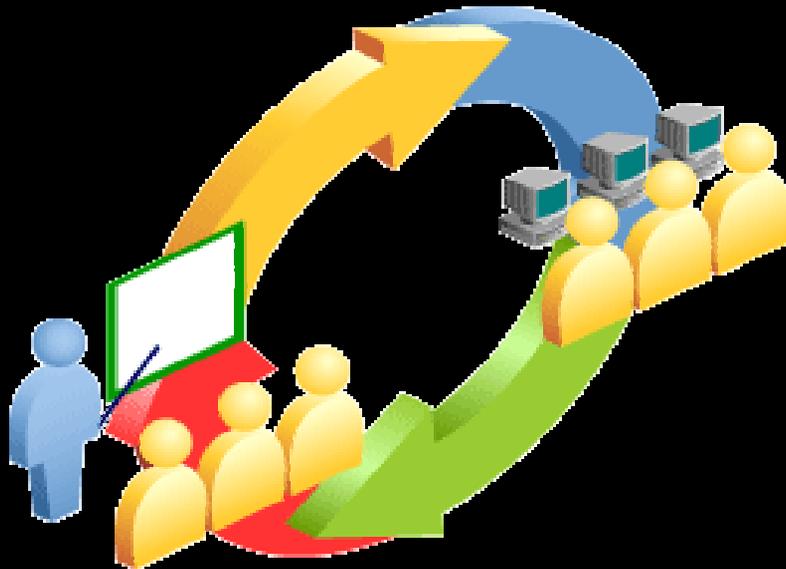


Experience of Agricultural Engineering development in China



Zhu Ming
President & Research
Professor

Introduction

- At the beginning of this century, the Chinese Government placed top priority on the issue of agriculture, rural area, and farmers, calling for coordinated economic and social development of both urban and rural China, building up the well-off society in an all round way, and constructing new countryside and modernizing agriculture. These provide unusual opportunities and challenges to agricultural engineering.

Introduction

- sufficient modern, applicable equipment and technologies;
- agricultural mechanization and electrification modifies agricultural production;
- modern water conservation facilities and projects secure agricultural stable and high yield;
- protected agriculture provides fundamental solution to urban vegetable supply;
- more rural bio-gas and energy efficient oven application helps improve farmer living standards and protect environment;
- agro-processing functions as an effective means to add value to farm produce, increase farmer income and generate job opportunities in rural area;
- agricultural information engineering technology is rapidly applied to agricultural animal farming and automation control of farming equipment, and as a most dynamic science application, serves agricultural market.

Introduction

- improved agricultural workers' capacity, industrial operation of agriculture and the quantity, quality and value of farm produce.
- helps to provide jobs for more than 200 million working age rural people.
- advance urbanization, lay a solid foundation for integration of agricultural operation, modernize agriculture, and contribute to food security and sustainable development in China.
- Agricultural engineering higher education system is established within certain colleges in China, and thousands of people have received training and education on this subject.

Government Initiative and Policy Support : **Vital to Agricultural Engineering in China**

Government initiative and policy support

- In 1980's, to facilitate rural reform and agricultural development, the Central Government of China issued five annual No. 1 Documents successively from 1982 to 1986, optimizing household contract responsibility system as a basic rural economic policy, These policy measures gave farmers plenty of incentives for agriculture and production increased dramatically.
- In the new century, the central government issued another four annual No. 1 Documents successively from 2004 to 2007.

1982

2007

Government initiative and policy support

In January , 2007, the central government circulated opinions on modernizing agriculture and steadily advancing new socialistic countryside development

Calling for building new socialistic countryside

Proposals to improve agricultural comprehensive productivity

- consolidating agricultural infrastructure
- speeding up scientific research process
- addressing other major and urgent issues for higher productivity
- subsidizing grain production, quality seeds, machinery purchasing

Proposing policy measures to stimulate income growth for farmers

Removing agricultural tax

Removing farm produce unified purchasing system

Household contract responsibility system as a basic rural economic policy

1982

2007

Government initiative and policy support

Vital to agricultural engineering in China

- 1980's : Vegetable Basket program
 - To address the vegetable shortage
 - Greenhouses boomed and protected agriculture developed rapidly
 - the acreage increased to 2.5 million ha., ranking world No. 1 in 2006
 - Protected farming solves the long time difficulty—the annual fluctuation of vegetable supply
 - Production can satisfy demands despite of the seasonal change.

Plastic House

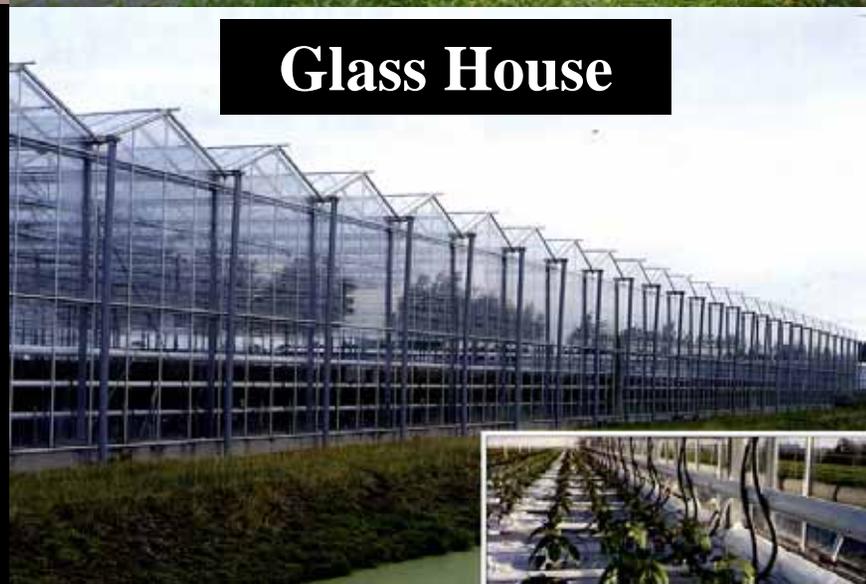


Plastic House



- The total area of horticulture facilities such as greenhouses for vegetable production ranking **the first in the world**
- The **energy-efficient greenhouses** with Chinese characteristics have been developing rapidly

Glass House





- Traditional operation is developing into scale and intensive model, and animal-farming capacity increases.
- Poultry farming, swine, cattle, sheep and goat scale production are taking greater share and become the dominant supply.
- The per capita availability of meat and egg in China is among **the top level in the world.**

Government initiative and policy support

Vital to agricultural engineering in China

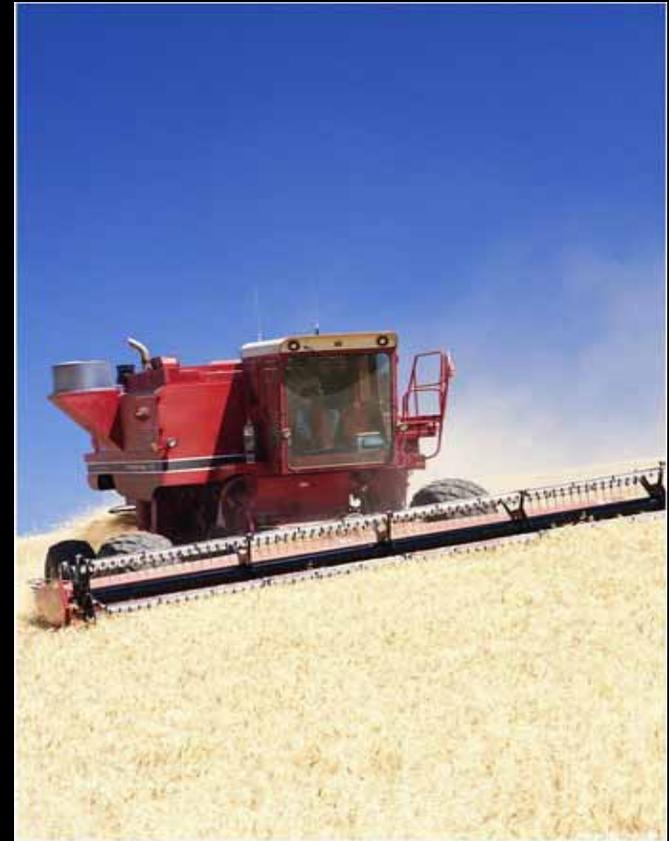
- 1990's: Seed Project
 - To ensure quality seed production, application and higher productivity for agriculture, effectively promoted agro-processing equipment development
 - By now, all major crop seeds are dried, cleaned, and coated by machines and stored in special houses. Professional production and industrial operation promotes quality seed application and brings considerable social and economic benefits



Government initiative and policy support

Vital to agricultural engineering in China

- 20 century's ends : Cross-region machine harvest of wheat program
 - Realized historical breakthrough in machinery application in agriculture
 - From single unit to set machine
 - From production to whole process
 - For the first time whole process machinery applied to major crop wheat



Government initiative and policy support

Vital to agricultural engineering in China

- 20 century's ends : Cross-region machine harvest of wheat program
 - Machine operation is promoted for major crops
 - 2004: P. R. China Agricultural Machinery Promotion Law
 - Government supportive policy measures are escalated to legal provisions, further defining the role of agricultural machinery application in agriculture, and rural economic development

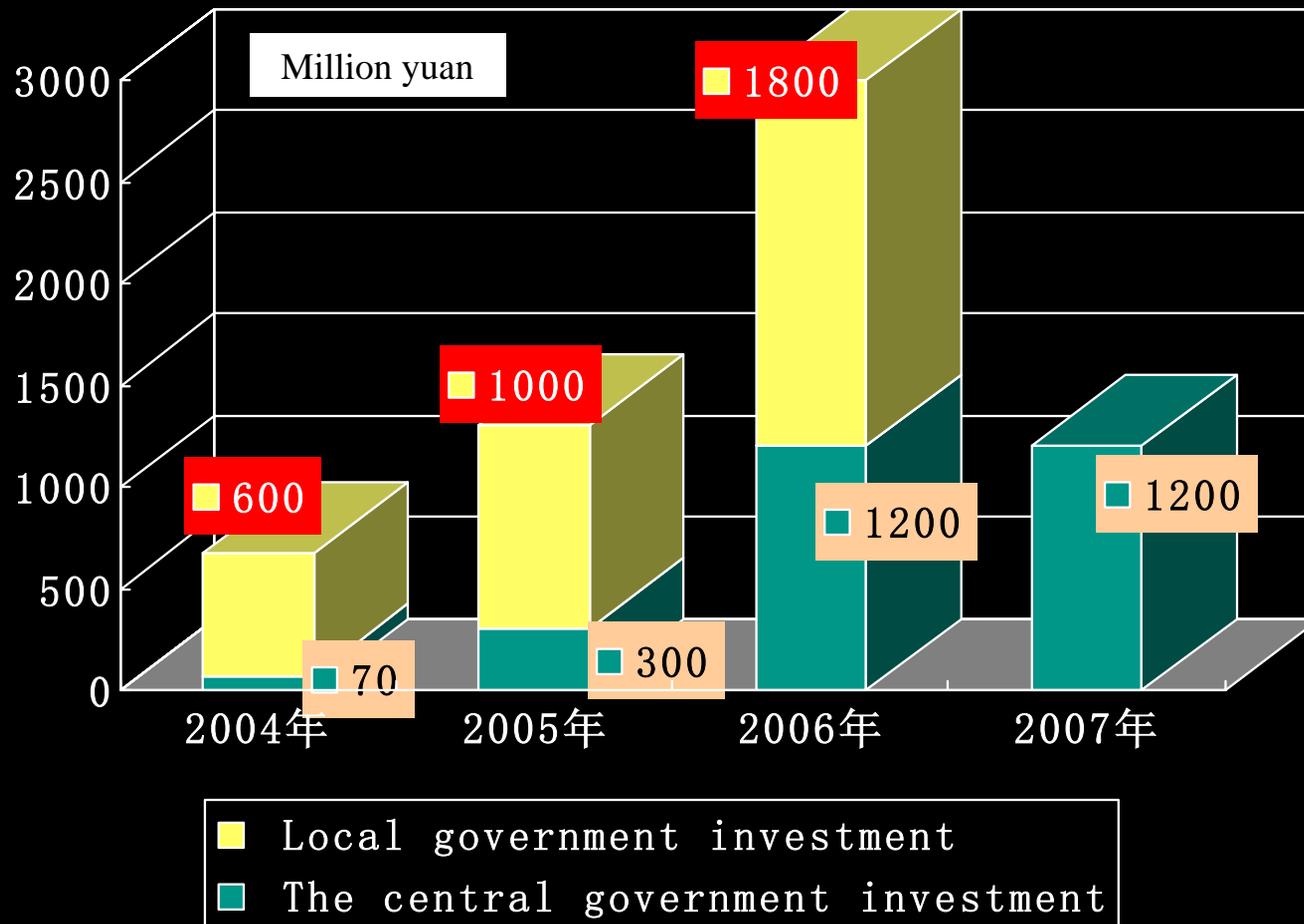
Government initiative and policy support

Vital to agricultural engineering in China

- 20 century's ends : Cross-region machine harvest of wheat program
 - Machine operation is promoted for major crops
 - The central government leased specified supportive policy to subsidize the purchase of agricultural machines

Government initiative and policy support

Vital to agricultural engineering in China



Government initiative and policy support

Vital to agricultural engineering in China

- 2001: Eco-homeland and Enriching Farmer program
 - Build on rural bio-gas application, tap resource potential with eco-farming and renewable energy technology, and promote efficient planting and animal farming to enrich farmers
 - Solar energy, wind power, efficient oven, and micro hydro power renewable energy facilities were constructed, to make a full use of land, solar energy, and biomass

Government initiative and policy support Vital to agricultural engineering in China



Straw Gasification Plant



Between 2001 and 2005, the central government invested **3.4 billion** yuan for rural biogas application and beneficiary households increased by **11.12 million**. **93.85 million** yuan was invested for the construction of **98** major biogas projects.

ns with biomass
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sification-based
operation

Government initiative and policy support

Vital to agricultural engineering in China



Solar Heating Project



Solar House

By end of 2005, national biogas pools totaled **18.07 million** (household), animal farm biogas projects totaled **3556** (location), municipal sewage biogas purification pools totaled **140** thousand (location), fuel-efficient oven users **189 million** (household), solar energy ovens **6.856 billion**, solar energy power generators **86200**, micro hydro power generators **81200**, small wind power systems **105600**, and stalk gasification for biogas supply **539**



Distilling Department for Fuel Ethanol

More investment will be made in 2007

Fuel Ethanol Refine Distilling Equipment

Cost: 4000 Yuan/T



Government initiative and policy support

Vital to agricultural engineering in China

- 2004: Quality grain industry program, fertile farmland program, current agricultural modernization and new countryside development



Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

Technical Experts and Technical Innovation:

key Factors in R&D for Agricultural Engineering in China

- Agricultural engineering has formed a primary shape with multiple tier education system in pace from high school, college, bachelor degree study, master degree study, to PhD degree study

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

- This development is generally among the leading position in developing countries
 - agricultural engineering bachelor degree program is set up in over 70 higher education institutions
 - PhD degree is conferred as first level discipline in four universities, as secondary discipline in 17 sites of 11 universities, mater degree is conferred as secondary discipline in 62 sites of 38 universities and research institutes
 - five secondary disciplines in four universities are approved as national key laboratories..

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

- In recent ten years, academic exchange and cooperation is very dynamic both within China and internationally with certain impact
- **73** kinds of literature and journals on agricultural engineering, including **14** core journals
 - Survey shows that in 2005, 9149 papers on agricultural engineering were published

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

- The research fields of agricultural engineering can be summarized into the following aspects
 - Agricultural mechanization engineering
 - Agricultural soil and water engineering
 - Agro-biological environmental engineering
 - Agricultural energy engineering

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

- Agricultural electrification and automation
- Agricultural products processing engineering
- Land use engineering
- Agricultural system engineering

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

- The development of agricultural engineering and wide application of advanced science and technology of agricultural engineering have made great contribution to agricultural efficiency promotion, farmer's income increase, the development of agriculture and rural economy, and the transformation from traditional agriculture to modern agriculture

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

- In the past ten years, Chinese government greatly increased its investment on scientific research in the field of agricultural engineering
 - Ninth Five-year Plan :
Industrialized High-efficient Agricultural Demonstration Project

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

– Tenth Five-year Plan :

- Technological System of Modern Water-saving Agriculture and the Research and Development of New Products
- Research and Development of the Technology and Equipment for Further Processing of Agricultural Products
- Research and Demonstration of Key Technology for Industrialized Agriculture
- Research and Development of Key Technology for Agricultural Mechanization
- Research and Development of Key Technology and Equipment for Modern Agriculture

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

– Eleventh Five-year Plan :

- Agricultural and Forestry Bio-energy Project
- Research and Demonstration of Technology for Modern Agriculture and Mechanized Farming
- Research and Development of Multi-functional Agricultural Equipment and Facilities
- Technology and Equipment for Precision Agriculture
- Technology and Products for Modern Water-saving Agriculture
- Digital Agriculture

Technical Experts and Technical Innovation: key Factors in R&D for Agricultural Engineering in China

- 21st century, the rapid development of biological and information technology is leading to a revolution for agricultural science and technology. In China, agricultural engineering technology has broken through the traditional mode. Its fields of study are widening and the content of research is becoming more penetrating and precise.

Industrial Development and Farmers' Feeds : the Driving Force for the Development of Agricultural Engineering in China

Industrial Development and Farmers' Feeds : the Driving Force for the Development of Agricultural Engineering in China

- China is a country with poor water and soil resources
 - per capita cultivated land area is 0.094 hm², which is only 40% of the average level for the world
 - per household is 0.487 hm², which is only 1/400 of that in the United States
- China is much lack of water resource
 - per capita water resource is only 28% of the average level for the world

Industrial Development and Farmers' Feeds : the Driving Force for the Development of Agricultural Engineering in China

- Every year, Chinese agriculture is short of about 30 billion m³ water
- The area of soil erosion is as much as 3.56 million km², accounting for 37% of the total area of China
- Every year, about 5 billion tons of soil is lost because of soil erosion, accounting for 1/5 of the world

Industrial Development and Farmers' Feeds : **the Driving Force for the Development of** **Agricultural Engineering in China**

- **Income gap between the residents of urban and rural areas keeps widening**
 - In 2006 the ratio was as high as **3.28:1**, and it has become more and more difficult for the farmers' income to increase
- **Agricultural labor productivity is quite low**
 - only equals to about 1/8 of that of the Second Industry, or about 1/4 of that of the Third Industry in China
 - only equals to 1/108 of that in Canada, or 1/120 of that in the United States

Industrial Development and Farmers' Feeds : the Driving Force for the Development of Agricultural Engineering in China

- **It is very difficult for the surplus labor force in rural areas to seek for employment**
 - Now there are 150 million surplus labor force in rural areas
 - every year there add 6 million labor force in rural areas of China

Industrial Development and Farmers' Feeds : **the Driving Force for the Development of** **Agricultural Engineering in China**

- Traditional mode of agricultural production cannot solve the above-mentioned problems
- China must take the road of agricultural industrialization and enhance the organizational level of farmers, which brings forward objective requirements and urgent needs for the development of agricultural engineering in China

Industrial Development and Farmers' Feeds : the Driving Force for the Development of Agricultural Engineering in China

- **A typical example**
 - In recent years, organizations and individuals that provide agricultural machinery services have been developing rapidly in China
 - By 2005, the total number of various kinds of agricultural machinery cooperative organizations had reached **33.863 million**, and the total income from agricultural machinery services had reached **260.6 billion yuan**

Industrial Development and Farmers' Feeds : **the Driving Force for the Development of** **Agricultural Engineering in China**

- The use of agricultural machinery has effectively enhanced output rate per unit area of land
 - For example
- The use of agricultural machinery has greatly reduced the labor cost for the production of agricultural products
 - For example

Industrial Development and Farmers' Feeds : **the Driving Force for the Development of** **Agricultural Engineering in China**

- The use of agricultural machinery may effectively save water, fertilizer, seeds, medicine and energy, realize integrated utilization of resources, and promote sustainable development of agriculture and the development of recycle economy in rural areas
 - For example

Industrial Development and Farmers' Feeds : the Driving Force for the Development of Agricultural Engineering in China

- Facility agriculture has become an important industry with the highest benefits in agricultural production
 - For example
- The great potentiality of post-harvest processing of agricultural products has provided more jobs for farmers besides farm-work, created new channels for the employment of farmers in relevant second and third industries, and promoted the transference of surplus labor force in rural areas

Industrial Development and Farmers' Feeds : the Driving Force for the Development of Agricultural Engineering in China

- Every year in China, these produce more than 700 million tons of crop straw, 200 million tons of forest wastes, 600 million tons of livestock and poultry feces and a large amount of organic wastes. There is also more than 100 million hectares of marginal land.
- By 2020, the potentiality for China to use marginal land to plant energy crops and to produce liquid fuels can reach more than 50 million tons, among which there is more than 28 million tons of fuel ethanol and 24 million tons of biological diesel.
- The utilization of agricultural bio-energy is becoming a new way to reflect multi-functional agriculture and to increase farmers' income.

R&D

in

Chinese Academy of Agricultural Engineering

R&D in Chinese Academy of Agricultural Engineering

- Since establishment in 1978, Chinese Academy of Agricultural Engineering (CAAE) has made many unprecedented efforts on research, technical extension and engineering construction of agricultural engineering

R&D in Chinese Academy of Agricultural Engineering

- Since foundation, CAAE has undertaken over 3000 agricultural engineering research projects
 - more than 580 key projects of national or ministerial level
 - 152 research and design awards
 - six national awards for invention, and science and technology progress
 - 58 provincial or ministerial awards.
 - During the tenth Five Year Plan, it undertook 30 more projects under National High-Tech Program, national science and technology breakthrough program, and agricultural sector standards drafting or revision

R&D in Chinese Academy of Agricultural Engineering

- Chinese Ministry of Agriculture (MOA) sets several centers in CAAE
 - The Technology Development Center of Energy and environmental protection, MOA
 - General Station of Agricultural Resources Monitoring, MOA
 - Seed Processing Engineering and Technology Center, MOA
 - Biomass Engineering Center of Ministry of Agriculture
 - Beijing Designing Institute of Ministry of Agriculture

R&D in Chinese Academy of Agricultural Engineering

- CAAE has China Center for Rural Energy Research and Training (CCRERT) and Agricultural Engineering Science and Technology Mid-test Base
- Chinese Society of Agricultural Engineering (CSAE) and China Association of Rural Energy Industry (CAREI) are attached to CAAE

Sum up

- It can be concluded that the development of agricultural engineering has effectively promoted the construction of modern agriculture in China
 - Promoting the development of agricultural industrialization;
 - Promoting the development of cooperative organizations of farmers;
 - Promoting the popularization and application of advanced agricultural technology, and integration and collaboration by using agricultural scientific and technological achievements;

Sum up

- Enhancing farmers' capacity;
- Promoting the efficiency of resource utilization;
- Enhancing labor productivity;
- Promoting the transformation of modes of agricultural production;
- Enhancing competitiveness of agricultural products;
- Promoting on-the-spot transference of surplus labor force in rural areas and the increase of farmers' income;
- Promoting environmental protection and ecological construction.

Sum up

- China is now trying to build new countryside and construct modern agriculture, and is in great need of the support of agricultural engineering technology. Establishing United Nations Asian and Pacific Centre for Agricultural, Engineering and Machinery (UNAPCAEM) in Beijing will certainly help to promote the development of agricultural engineering technology in China and Asian-Pacific Region. This conference is a good example. We are pleased to have the opportunity to discuss relevant issues with our colleagues in Asian-Pacific Region, and we also expect to have close cooperation with each other and to develop together.

Thanks



Add:41 Maizidian Street, Chaoyang District, Beijing
E-mail: mingzhu@agri.gov.cn