An Introduction to The Project:

APPLICATION ENGINEERING OF AGRICULTURAL EXPERT SYSTEM (AES) IN CHINA

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Problems faced China in Rural Development (RD)

- Short of cultivated land resources and water
- Environmental pollution caused by unreasonable use of fertilizer and pesticide
- High agricultural production cost and low benefit
- Farmers face the Challenges from WTO.
**BACKGROUND**

*IT as a tool to give a solution for RD*

信息技术为农村经济发展提供了有效工具

- To transfer agricultural technology
- Help farmer to adopt the market
- Enhance the level of Decision-making for production & management, increase the yield, decrease the cost and pollution.
- Increase the income of farmers
- Improve the traditional Agri. by IT
The IT Foundation for RD in China

中国在信息技术设施方面具有一定基础

- The basic information facility & installation improved
- Concerned counties, villages and towns, and also in sweeping farms with a certain condition and specialized farmers have installed Computers.
- Many Agricultural & IT experts
- The approaches provided much more tech. support
- Having a party of extension workers with the combination knowledge both in agronomy & IT.
## BACKGROUND

Tab. 1 the agricultural website of China (1999-2000)

中国农业网站建设情况（1999-2000）

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BACKGROUND

The China government pay more attention for IT in RD (中国政府部门关注农村信息技术的发展)

- To set up the plan for IT in RD
- To invest more to improve the information facility
- to carry out projects of IT in RD both in the different national program and the province local program
BACKGROUND (背景)

What is the AES (关于电脑农业)

AES: Application Engineering of Agricultural Expert System (AES), one important project of National High-Tech R&D Program (NHTRDP) of China.

AES is being carried out from the early 1990 till now, about 21 provinces to implement
What is an Expert System? (关于农业专家系统)

An Expert System (ES), also called a Knowledge Based System (KBS), is a computer program designed to simulate the problem-solving behavior of an expert in a narrow domain or discipline.

In agriculture, expert systems unite the accumulated expertise of individual disciplines, e.g., plant pathology, entomology, horticulture and agricultural meteorology, into a framework that best addresses the specific on-site needs of farmers. Expert systems combine the experimental and experiential knowledge with the intuitive reasoning skills of a multitude of specialists to aid farmers in making the best decisions for their crops.
Chinese farmers need Agricultural Expert Systems to support

Agricultural production has evolved into a complex business requiring the accumulation and integration of knowledge and information from many diverse sources. In order to remain competitive, the modern farmer often relies on agricultural specialists and advisors to provide information for decision making. Unfortunately, agricultural specialist assistance is not always available when the farmer needs it. In order to alleviate this problem, expert systems were identified as a powerful tool with extensive potential in agriculture.
The OBJECTIVE

To enhance the level of decision-making for production, increase the yield, decrease the cost and pollution.

To help farmer to adopt the market.

To increase the income of farmers.

To cover the information gap in rural area.

To improve the traditional agriculture by IT.
The TASK

电脑农业的主要任务

- To build up the AES platforms to transfer agricultural knowledge, technologies & information for agricultural technicians
- To develop the valid Agricultural Expert System for farmers
- Demonstration and Application
The IMPLEMENTATION

Key Technologies

Tool for development Ag. Information System

Soft&Hard Prod.

The technical Schedule for AEAES

Demonstration District

The Second Development of AES

Local AES

Application
The IMPLEMENTATION

To Develop AES platform 开发农业专家系统平台

- Five AES platforms are developed for the purpose of secondary development of agricultural expert system with national brand and high quality.
The structure of AES platform
The IMPLEMENTATION

To develop practical AES 開發本地化系統

- About 200 practical agricultural expert systems which related to grain, vegetable, livestock, aquatic production to be developed on AES platform.
The IMPLEMENTATION

The Function of AES（农业专家系统的功能）

The expert system of field crop:

• draw up scientific production goal and design measure scheme in terms of the production
• select variety
• choose rational planting density
• design scientific and rational fertilizer quantity, element proportion and its’ spatio-temporal allotted map
• design the technical scheme for water-saving irrigation
• select scientific and rational technique for planting, prevention and cure the diseases and insect pests etc
The IMPLEMENTATION

The Function of AES

The expert system of vegetable (cucumber, tomato etc) :

• planting
• environment controlling
• variety selecting
• Fertilization
• water-saving irrigating
• plant protecting and rotating schedule
• improve the technique level of vegetable farmers.
The IMPLEMENTATION

The Function of AES

The expert systems of fruit tree (apple, pear, peach, grape etc)

- To diagnose physical disease of the fruit tree according to the symptom that the user describe;
- To confirm prevention and cure measures of the plant diseases and insect pests
- To manage water and fertilizer rationally based on climate, soil and variety
- To decide the chemical controlling time and dosage according to the fruit tree’s growth status and physical index.
The IMPLEMENTATION

*ES Integrated with other IT* (专家系统集成其他信息技术)

- The transportable agricultural information systems
- The greenhouse control systems
- ES integrated with GIS
The Results

浏览推理过程
The IMPLEMENTATION(4)

Demonstration & Application

The schedule of demonstration & application
To set up 23 demonstration & application districts of AEAES in 22 provinces on three levels

- experiment plots
- demonstration district
- extension area
Demonstration & Application System

**Experiment plots** (试验区)
- To experiment and demonstrate Under the different conditions, set contrast
- To accumulate scientific data
- To confirm and improve AES.
- To get the scientific experience for AES extension and application.

**Demonstration district** (示范区)
- To demonstrate the application of AES on large scales
- To summarize the experience and the model of IT service agriculture.

**Extension area** (推广区)
- To apply AES extensively based on the result of experiment plot and demonstration district
The distribution map of AES in order

1st: Beijing, jilin, Anhui, Yunnan

2nd: Hunan, Hebei, Shandong, Yangli, Gansu

3rd: Shanxi, Tianjin, Sichuan, Chongqing, Xinjiang, Heilongjiang

4th: Henan, Liaoning

5th: Ningxia, Guangxi, Hainan

6th: Neimenggu, Shanxi, Guizhou
The IMPLEMENTATION (4)

Demonstration & Application

To set up the computer network for AES application & extension, the remote users can use AES and get the different information service from database on website.
The computer network provide farmer information as

- weather information
- soil information
- varieties information
- fertilization information
- irrigation information
- chemical control information
- plant protection information
- agricultural machinery
- agricultural resource

- agricultural machinery
- agricultural resource
- dynamic information of agricultural production
- potential production of crops
- multi medium management
- new technologies and achievements
- agriculture technology training
- information release,
- statistical analysis of agricultural experience.
- dynamic information of market.
The IMPLEMENTATION(4)

Training & popularization program

To train the administrator how to manage the project and the organization skills of application & extension of AEAES

To train agricultural technicians the skills of secondary development of AES

To train farmers how to use AES software
Popularization activities（推广活动）

- Set up model samples (建立应用示范样板)
- Technical activities (技术指导与检查)
- Showcase & workshop (现场经验交流会)
- To train administrators (培训管理者)
- To train the technicians (培训农业技术人员)
- To train farmers (培训农民)
- To summarize experiences (总结与表彰)
The RESULTS

**Technology Progresses (1996-2003)**

- Developed 5 platform software products with self-ownership copyright
- Developed more than 200 practical agricultural expert systems of about 80 crops and husbandry animals
- Significant progresses in 10 key technologies for AES
The RESULTS 实施效果


- 23 demonstration & extension districts were established in 22 provinces
- 5 levels Extension networks were set up from national, provincial, county, town, to village
The RESULTS 实施效果

Considerable Economic Outcome (1996-2000)

- Application area: 3 million hectares
- Increased yield: 2.48 billion Kg
- Increased economic output: 280 million $
- Decreased product cost: 77.6 million $
- Total Economic benefit: 357.8 million $
The RESULTS 实施效果


• 1,7000 technicians were trained of computer technologies
• 8 million farmers were trained
• Provided 3 million pieces of technical datum for farmers
• 7 million farmers in 800 counties and farms have benefited from the project
• Enhanced the scientific & technical level of farmers, managers, agricultural technicians and extension workers
The EVALUATION
对中国电脑农业的评价
The evaluation from farmers
农民对电脑农业的评价

- We can find expert in home
- Computer can tell me what and when to do
- AES can help us for ever
The evaluation from national leaders
国家领导对电脑农业的评价

The evaluation from administrators
地方行政官员对电脑农业的评价

The comments of Agricultural Experts
农业专家的评价
The evaluation from International
国际上对中国电脑农业的评价

• 1st International Symposium On Intelligent Information Technology in Agriculture
• 第一届智能化农业信息技术国际学术会议
• 2nd International Symposium On Intelligent Information Technology in Agriculture
• 第二届智能化农业信息技术国际学术会议
• Best e-content, WSA, WSISI, UN, 2003.12
• 2003年中国电脑农业获得联合国世界信息峰会最高成就奖
**THE CONCLUSIONS** 主要结论

- AES is a powerful tool for farmers
- 农业专家系统是农民的好帮手
- AES should combine with local RD
- 农业专家系统的推广要与当地农村经济发展相结合
- Local government will take important roles in the application of AES
- 要充分发挥当地政府的作用
- To take different extension model & extension method on different conditions
- 不同地区采用不同的推广模式和手段
IT in RD is important both for farmers and government
• The farmers both in rich area and in poor area need IT to support their production and market management

• 中国富裕和贫穷地区的农民需要信息技术服务他的农业生产和市场经营

• China now has a certain foundation of IT in RD, Both in facilities and in technologies, information resources

• 中国农村在基础设施、技术和信息资源方面已有一定基础。
The IT in RD in China is now in the stage of developing, need international cooperation to promote.

Integrated IT

- 1980-1985: Model Statistics
- 1985-1990: Database MIS, DSS
- 1990-1995: Expert System Comp. network
- 1995-2000: Comp. network RS, GPS, GIS
- 2001:

... is Developing

农村信息技术的发展
需要国际合作

The IT in RD in China is now in the stage of developing, need international cooperation to promote.