

Research

Industrial Structure Change in Agriculture

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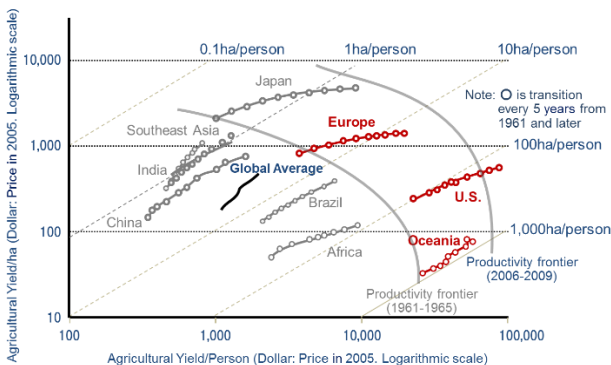
While demand for food is expanding exponentially due to the growth of the global population and increase in individual calorie intake, agricultural resources are becoming fragile due to climate change and the sudden advance of urbanization. As a result, stably securing agricultural products through increasing agricultural productivity is becoming a global challenge. Hitachi Research Institute regards agriculture as an industry consisting of a series of value chains from procurement, production, processing, and distribution to consumption, and we have been studying structural changes and future outlook.

1. Agricultural Productivity Improvement as a Global Growth Challenge

1.1 Productivity for Rice and Vegetables Requires Further Improvement

Agriculture is a global growth industry, and the value added globally to agriculture increased at an annual rate of 8.8% from 2000 to 2012. The value added is expected to grow at an annual rate of 6.9% until 2020.

Looking around at different countries and regions, corn, wheat, and soybeans account for approximately 60% of all agricultural products in the highly-productive U.S., European, and Oceania regions. In other regions such as Asia, these cereal crops account for 14% of all agricultural products, and there is plenty of room for improving the productivity of rice and vegetables, etc.



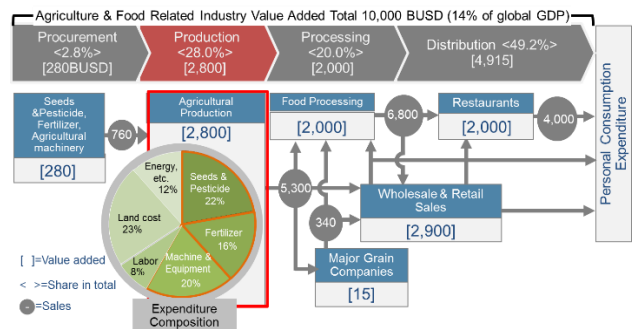
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Figure 1: Agricultural Productivity by Country and Region

1.2 Agriculture Industry with High Presence of Manufacturing and Distribution Industries

The total value added of agriculture and food related industries is 10 trillion dollars, accounting for 14% of global GDP. Of this, agricultural production accounts for 28%, while processing accounts for 20% and distribution occupies 49.2%. These facts demonstrate the significant presence of the manufacturing and distribution industries in agriculture.

On the other hand, small and medium-sized farms account for the largest portion of agricultural production after major grain companies. This means that there is plenty of room for entry of new enterprises, for productivity improvement.

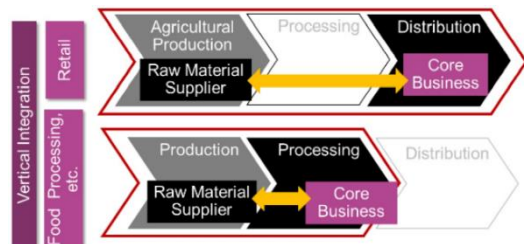


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Figure 2: Global Agriculture Industry Capital Flow

2. Agricultural Production Seen from the Manufacturing and Distribution Supply Chain

Currently, an increasing number of manufacturing and distribution companies consider the procurement of agricultural products to be a global strategic challenge. These companies are working on the vertical integration of their value chains, with agricultural production located in the upstream.

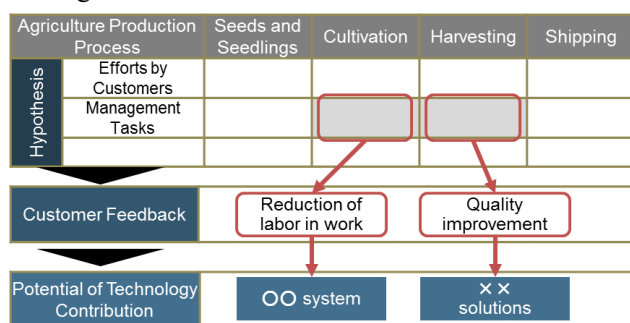


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Figure 3: Movement toward Vertical Integration in the Manufacturing and Distribution Industry

For example, securing the stable supply of raw materials and maintaining and improving their quality are directly connected to the competitiveness of the core businesses of manufacturing companies that use agricultural products for processing as raw materials. Therefore, they require specific models for vertical integration, such as streamlining of company-owned farms and enhancing coordination with contract farmers.

Based on our observation of these signs of change in industrial structure in agriculture, and following on from the value chain example in the manufacturing industry, Hitachi Research Institute has been working on collaborative approaches through process analysis of agricultural production. We collaboratively examine in workshops, etc. hypothetical challenges devised by applying our analysis results on the business environment and management policy to each process, to seek opportunities for collaboratively creating value.



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Figure 4: Collaborative Approach Based on Production Process Analysis

3. A New Trend in Large Scale Agricultural Complexes

3.1 Advances in the Development of Agricultural Complexes in Various Countries

Enhancement of scale and sophistication of agricultural production has been spreading not only in cereal crops but also in vegetables and has been expanding in emerging countries as well as advanced countries.

In Mexico, against the backdrop of the increasingly fierce competition in trade and commerce with the U.S. and Canada under NAFTA, a large-scale sophisticated agriculture complex facility is already under development as a government initiative.

Meanwhile, China has positioned food self-sufficiency as a top priority item for its security. China is carrying out a policy of establishing a small number of national Agricultural High-

Tech Industries Demonstration Zones and deploying their achievements to national agricultural science and technology parks in 116 locations across the country.

Table 1: Increasing Scale of Agriculture in Various Countries

| Country& Region | Trends in Increasing the Scale of Agriculture |
|-----------------|---|
| Netherlands | Netherlands is a model case for agricultural development (enhanced scale and sophistication), as shown by its industry-academia-government collaborative “Food Valley” agricultural cluster and base for exports. |
| U.S. | Increase in scale is progressing mainly for cereal crops for export. High profitability has been achieved by corporate management and precision farming. |
| Canada | Enhanced sophistication and scale of greenhouse horticulture in tomato cultivation, etc. under NAFTA. |
| Mexico | Construction of 16 agricultural complexes including Queretaro Agropark (approx. 300ha) is ongoing by government initiative under NAFTA. |
| Southeast Asia | Entry by foreign capital mainly in highland areas of Malaysia and Vietnam in anticipation of trade liberalization and Asian economic growth. |
| China | Food self-sufficiency has been positioned as a top priority item for security, and agricultural investment is being supported along with urbanization. |
| Japan | Policy challenges include reform of agricultural cooperatives, farmland consolidation by a public intermediary organization for farmland consolidation, and utilization of regional energy resources, etc. |

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Increasing the scale of agricultural production requires a large amount of capital investment and heavy operational costs, and producers assume great management risks. Hitachi Research Institute is focusing on new approaches to reduce upfront investment and management costs for producers.

3.2 Utility Service Sharing

In the background of the sharp rise in natural gas prices, geothermal power generation has been receiving attention in the Netherlands. In Westland, an area where greenhouse horticulture is concentrated, the agricultural producers’ union played a major role in the establishment of Green Well Westland, a geothermal energy company, and heat and electricity are being shared.

Similarly, in the Agriport A7 (1,300ha) agricultural complex north of Amsterdam, 10 complex user producers and

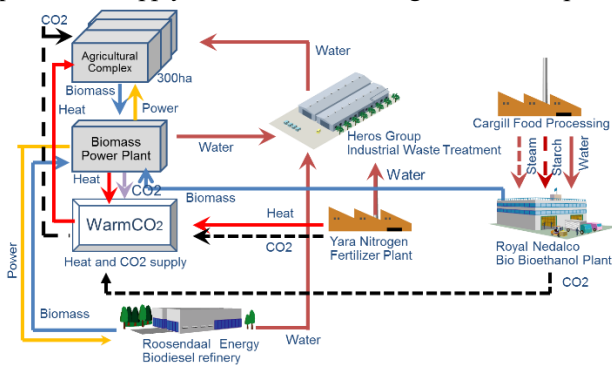
agricultural complex developers have jointly established a geothermal energy company. Furthermore, an outsourcing company for packaging work has also been jointly established, and diversification is progressing in the sharing of utilities and services in the complex.

3.3 The Netherlands are Striving for Industrial Complexes with Resource Recycling

OCAP, a joint venture by a local gas company and construction company in the Netherlands, is a utility service provider that supplies CO₂ to horticultural facilities by recycling pipelines for transporting crude oil. OCAP widely distributes CO₂ discharged from Shell and Abengona (bioethanol production) to approximately 500 horticultural facilities (total area: 1,300ha) across an area from Rotterdam to the northern part of Amsterdam.

In addition, Terneuzen, located in the southwest area of the Netherlands is an industrial complex for the agriculture and manufacturing industry devised under a development concept of a “sustainable seaport.” It is an example of an advanced agricultural complex. Various types of resources including heat and CO₂ discharged from the 2,100ha industrial complex, waste mainly from biomass power generation, and power and water are being recycled not only in the industrial complex but also in the 150ha agricultural complex (scheduled to expand to 300ha).

WarmCO₂, which is a joint venture by a port management organization (80% share) and nitrogen fertilizer company Yara International (20% share), acts as a utility service provider to supply heat and CO₂ to the agricultural complex.



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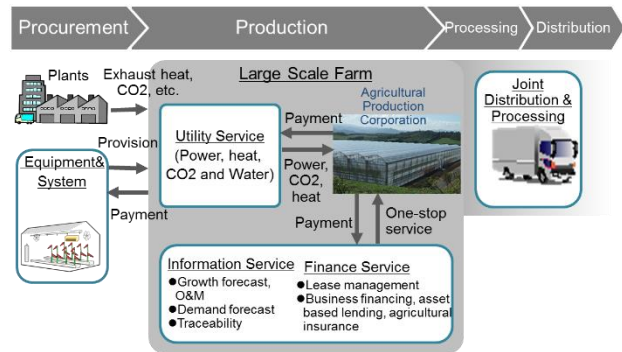
Figure 5: Agricultural Complex Resource Recycling Model Example

4. Structural Change in the Agricultural Industry, seen in terms of the Value Chain

Sharing of the production, processing and distribution

process chain, and equipment and services, as well as mutual accommodation of resources with non-agricultural industries, etc., encourage further improvements in agricultural productivity. Structural change in the value chain enhances the potential for industrial innovation in agriculture.

Hitachi Research Institute will continue to monitor these trends and proceed with its research.



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Figure 6: Future Model Example of the Agriculture Industry Value Chain