

# Design of a Breeding Common Technology Service Platform based on Industrial Internet

Yuanhang Zhang, Yan Wang, Yanzhen Bi

Inspur Industrial Internet Co., Ltd., Jinan, Shandong 250000, China

---

## Abstract

**This paper proposes a solution for designing and constructing a high-performance common technology service platform for the seed industry. By integrating industrial internet technology with the common technology service capabilities of the seed industry, it provides technological support for computationally intensive common technology services in the seed industry, thereby improving innovation efficiency, promoting the transformation and upgrading of the breeding industry. Furthermore, it aims to offer the most suitable and cost-effective high-performance common technology service solutions for seed industry-related laboratories, pharmaceutical companies, research institutes, and enterprise research institutions, helping them better accomplish research and industrialization tasks, achieve technological breakthroughs, product upgrades, and contribute to cost reduction and efficiency improvement in biological breeding and the promotion of superior seed projects.**

## Keywords

**Industrial Internet; Breeding; Common Technology; Service Platform.**

---

## 1. Introduction

In recent years, with the rapid development of technologies such as whole-genome sequencing and molecular biology, the volume of data in the breeding industry has expanded rapidly, and the sources of data have become more abundant. There is an urgent need to leverage information technology for data collection, accumulation, and analysis in breeding. The rapid development of digital technology has enabled innovative technologies such as the Internet of Things, big data, and cloud computing to be applied to the forefront of breeding production.

The Industrial Internet, as a new generation of information and communication technology deeply integrated with industrial economy, provides a new infrastructure, application model, and industrial ecology by comprehensively connecting people, machines, objects, and systems. It establishes a new manufacturing and service system covering the entire industry chain and value chain, providing a pathway for the development of industrial digitization, networking, and intelligence.

## 2. Platform Construction Value and Characteristics

Current issues in technological innovation in the breeding industry mainly include:

- (1) The collection and protection of germplasm resources are accelerating, but the efficiency of innovative utilization is not high. There is a need for precise identification and mining applications of a large amount of genetic data and crop phenotype data.
- (2) There is a coexistence of a large number of research and breeding personnel, high investment, and low output transformation efficiency. The construction of a modern breeding system that is industrialized and assembly line-oriented urgently needs to be strengthened.

(3) There is a coexistence of rich species and lagging development in characteristic crop breeding. The development of characteristic crop varieties and the production of seeds urgently need to be strengthened.

(4) There is a coexistence of many small and medium-sized breeding enterprises, fast development, and weak core competitiveness. The innovation capability of enterprise technology urgently needs to be strengthened.

The integration of industrial internet technology with common biological breeding technology can effectively address the above issues. Based on foundational technologies of the industrial internet such as identification resolution, blockchain, artificial intelligence, the Internet of Things, edge computing, etc., it provides a basic platform and effective support for data collection, processing, and analysis for common biological breeding technology applications. By fully releasing and utilizing the value of data in various technology service applications and stages, it achieves cross-system, cross-enterprise, and cross-industry data interoperability. It connects fragmented data systems in traditional data processing, enhances data value, removes barriers caused by data non-interoperability between enterprises and industries, and helps breeding enterprises achieve cost reduction and efficiency improvement throughout the entire chain.

The design of the high-performance common technology service platform for the seed industry is mainly divided into two major modules: platform portal and application market. It revolves around two main themes: breeding management and the extension of germplasm resources. It deploys common technology applications in the breeding industry, such as breeding management, germplasm resource data, accelerated life science analysis, smart agriculture, agricultural product processing, and regional brand services. It links technologies and services throughout the entire chain, providing efficient, flexible, and customizable solutions for the entire lifecycle of seeds.

### 3. System Architecture and Function Design

The design of the high-performance common technology service platform for the seed industry is based on industrial internet technology, integrating various software and hardware services, and can be divided into four levels. The first level is the industrial internet platform as the foundation, integrating basic technologies of the industrial internet such as identification resolution, blockchain, the Internet of Things, artificial intelligence, and edge computing. It integrates with the hardware devices of the second level, including FPGA chips and high-performance integrated machines, to support the common technology service capabilities of biological agriculture, such as liquid phase chips, life science analysis, and cultivation enhancement. The platform portal of the high-performance common technology service platform for the seed industry serves as the bridge for the third level, combining the fourth level of gene detection, molecular breeding, growth model, and other technical service products, achieving the integration of software and hardware in the breeding industry and flexible deployment capabilities.

The homepage of the platform portal of the high-performance common technology service platform for the seed industry includes the following sections:

(1) Banner: Showcasing the platform's social responsibilities, such as biodiversity protection, germplasm resource protection, soil improvement, and the transformation of the "Two Mountains" initiative. Highlighting the core advantages of the platform, emphasizing new agricultural infrastructure construction, technology support for the entire agricultural process based on the seed industry, and integration of agricultural resource platforms. Using platform data resources, mining data value, integrating local agricultural resources, and assisting local seed industry transformation and upgrading along the entire chain.

(2) Products and Services: Signing contracts with seed research companies and leading companies in bioinformatics analysis, listing major common technology products and services in the seed industry, including but not limited to liquid phase chip services, gene detection services, molecular breeding services, germplasm enhancement services, and growth model services.

(3) Solutions: Introducing implemented and ongoing solutions in the breeding industry and the agricultural field. Showcasing the platform and team's capabilities in smart breeding, industry integration, digital transformation, and application promotion through actual cases. Emphasizing the provision of precise services through the form of supporting personalized custom solutions.

(4) Big Data Center: Collecting and sorting the latest phenotype and genotype data related to germplasm, tracking and updating the database system dynamically. Classifying, identifying, and filtering the data to be displayed. Using a one-stop technical architecture for big data visualization, with rich components such as graphs, tables, and curves, achieving on-demand display of genotype and phenotype data. Using a germplasm resource map to present the distribution structure of species in a map format, realizing functions such as statistical analysis of germplasm resource big data, map distribution, and germplasm evaluation. Helping users intuitively see statistical analysis results and resource distribution for corresponding germplasms, providing strong support for the protection and utilization of germplasm resource data.

(5) Collaboration Ecosystem Module and Industry Information Module: Regularly releasing platform project progress, breakthroughs in breeding cooperation, and the latest industry information in the breeding field. Providing platform users with recent technical and project progress information.

#### **4. Common Technology Services and Applications**

(1) Crop Breeding Management System: Includes services such as germplasm management, inventory management, breeding management, variety testing, and gene analysis. It provides industry data, breeding data, phenotype data, image data, environmental meteorological data, and gene data to assist in more scientific and efficient production or research.

(2) Livestock and Poultry Breeding Management System: Provides variety and strain management, breeding management, and material management services for various poultry and livestock breeds such as broilers, ducks, geese, cattle, and sheep. The visual pedigree supports an overview of individual and family for poultry and livestock. The gene and data systems provide multiple functions such as whole-genome selection, breeding recommendations, and breeding value analysis.

(3) Aquaculture Breeding Management System: In addition to basic services such as base management, workshop management, and system management, it further provides breeding management, production management, whole-genome selective breeding, and breeding database services. The database includes data such as environmental data, germplasm resources, trait management, and breeding processes, assisting research and production work of research institutes, breeding, and production-related enterprises and institutions.

(4) Seed Industry Internet of Things Platform: Based on the industry attribute IoT gateway platform, it connects the hardware part of the system, combines software system function modules, and collects planting production data in multiple dimensions.

(5) Germplasm Resource Visualization Platform: Adopts a one-stop big data visualization technical architecture for the dynamic tracking and timely update of the latest phenotype and genotype data related to relevant germplasms. It classifies, identifies, and filters the data to be displayed. Using rich components such as graphs, tables, curves, and according to business needs, displays data on demand.

(6) Harvest Trading Application: The system is oriented towards intermediaries, breeders, farmers, and enterprises, adapting to various harvest trading scenarios. It provides mobile harvest trading record services, supports transaction information Bluetooth printing vouchers, and the system interfaces with blockchain for data certification. Regulatory authorities can statistically count transaction data based on regional divisions and calculate whether there is a situation of external inputs based on the scale of breeding and farming. Based on harvest trading business data, it can interface with the settlement platform within the product line for asset settlement.

(7) Smart Scheduling Platform: Used for intelligent management of crop seed products and intelligent management of agricultural product processing. It configures order production boards, inventory

coordination boards, and realizes intelligent scheduling of teams, production lines, and materials. Production line personnel can be dynamically configured and scheduled according to product information in real-time control.

(8) Digital Certification: Provides data encryption and traceability services for breeding companies and products based on identification resolution and blockchain technology. It offers an application channel for digital certification, allowing companies to submit documents such as company information, product information, relevant standards, and test reports. Relevant certification agencies can evaluate the company's information online, and certified companies can publicly announce on the portal website.

## 5. Extension Services of Industrial Internet Technology

(1) Design and Construction of New Agricultural Industry Infrastructure: By building new agricultural intelligent sensors and ensuring data flow through a connected network, a unified authentication system based on identification resolution is established. It achieves the construction of the entire agricultural industry chain infrastructure based on seed industry resources, empowering the development of the entire agricultural industry chain.

(2) Technical Support for the Entire Agricultural Industry Chain: Through the construction of big data centers and industrial internet platforms, continuously collect massive data on the entire process of the seed industry, including gene analysis, good seed breeding, production cultivation, processing transportation, variety promotion, and agricultural services. Accumulate and optimize mechanistic models in various links such as life science research and development, good seed breeding, and planting promotion, creating an integrated solution for the entire life cycle of the seed industry and providing technical support for the development of germplasm resources.

(3) Operation of Integrated Agricultural Resource Platform: Based on the platform, build a high-performance seed industry common technology service product line, providing a series of platform services such as biological information analysis, molecular breeding applications, genetic trait innovation, germplasm resource creation, variety testing evaluation, and seed big data management. Drive the frequency of platform use in the industry, make full use of platform data resources, mine data value, integrate local agricultural resources, and assist local seed industry transformation and upgrading along the entire chain.

(4) Integrated Customization of Software and Hardware: Based on the platform's integrated solution for the entire life cycle of the seed industry, locally deploy FPGA chip accelerator cards and high-performance integrated machines, deploy cloud-based acceleration software, and flexibly deploy software. Provide users with the most suitable and cost-effective high-performance common technology service products based on actual usage conditions.

## 6. Conclusion

The design of a common technology service platform for breeding based on industrial internet technology creatively integrates industrial internet technology, common breeding technology, and advanced computing acceleration technology. It can provide dozens of high-performance common technology services for the entire chain of breeding enterprises based on interconnected computational resources, computational acceleration technology, and application interconnection. It is currently a relatively innovative service model in the industry. It will greatly promote the integration capability improvement, technological breakthrough capability improvement, and product innovation capability improvement of related industries in the seed industry, helping the rapid development of related technologies and services in the field of agricultural breeding.

## References

- [1] Lv, X., & Wang, Q. (2023). Analysis of Factors Affecting the Willingness of Small and Medium-sized Enterprises to Proactively Share Data on Industrial Internet Platforms. *Information Exploration*, (11), 20-26.
- [2] Luo, Y., Wu, W., & Gu, W. (2023). The Construction of "Digital Bridges" for Communication between Cities through Industrial Internet Platforms. *Communication World*, (21), 24-25.
- [3] Xiao, L., Guo, C., & Xia, Y. (2023). Measurement and Evaluation of China's Industrial Internet Platform Development Index. *Enterprise Management*, (11), 46-52.
- [4] Shao, Z. (2023). Comprehensive Remote Measurement and Control Laboratory System Based on Industrial Internet Platforms. *Technology Wind*, (31), 46-48.