

A Study on the Cultivation Plan Service at the Preliminary production phase based on bigdata analysis

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Abstract— This focuses on the Cultivation Plan Service at the preliminary production phase is critical in that it supports agricultural producers' decision by providing related information such as predicted crop production or expected profits for consulting or other agricultural information when they plan to cultivate. This paper describes the reference architecture of the farming sector will benefit immensely from the implementation of farming data in farming contents repository which will serve as the knowledge base for the Cultivation Plan Service at the pre-production stage based on Bigdata analysis.

Keywords— Smart Farming, Agriculture Information Repository

I. INTRODUCTION

Current issues in the agro-industry of the world are as follows; First, the issue of manpower shortage has emerged due to rapid aging and feminization of manpower in farming areas. Second, a global food crisis occurred owing to failure of crops caused by global warming and extreme weather events. If the heat wave, drought, and sea level rise continue due to the climate change, it will lead to decreases in the crop productivity and consequently, increases in the number of impoverished populations by minimum 3.5 million up to 122 million by 2030. Third, increasing the food production is inevitable to meet the needs from the growing population. It is forecasted that the world population will increase from 7.6 billion in 2017 to 9.6 billion in 2050

The cultivation plan service model is required to derive necessary service features that support these missions. Therefore, the service model for the Cultivation Plan Service including reference architecture, service requirements, and related capabilities is described in the farming skill, farmer's experiences and know how, etc. The information related to farming knowledge is supposed to current activities, farming product and from the experience of farmer on the field. The core component of the automation process for the smart farming is the creation of a data store which will be a repository for the information of the smart farming

Cultivation Plan Service of Smart farming provides the information about farming related to farming knowledge

related to the control information of farming technology, farming skill, farmer experience and know-how. The Smart farming service is to provide the information of farm operation control of Farm as a Service and the farming about farming knowledge those are the farming technology, farming skill, farmer's experiences and know how. The service information to be provided by Farming Service consists of farmer's experiences in the field and information related to farming related activities. Through the smart farming service, the user can interact with the farming management function, farming content. This paper deals with the Cultivation Plan Service at the preliminary production phase stage.

II. CONCEPT OF CULTIVATION PLAN SERVICE AT THE PRELIMINARY PRODUCTION STAGE

In the preliminary production phase, as is often reported in media reports, price falls due to overproduction of agricultural products have been an important issue, and agricultural producers need services to provide weather data, previous agricultural market trend data, and big data analysis based on expert knowledge

The Smart Farming at the preliminary production phase is very critical because it aims to increase the final profit to the agricultural producer. Agricultural producers' plan at the preliminary production phase the pre-production stage on crop type, seeding time, seeding area could cause success or failure after the cultivation. These decisions on cultivation plan can be based on agricultural information or cultivation plan consultation provided by service providers. Therefore, Cultivation Plan Service can help the agricultural producers in cultivation plan by providing agricultural information or cultivation plan consultation based on demand. This service could be provided in two ways namely; agriculture information and cultivation plan consultation, according to the role deciding the cultivation plan in response. Agricultural information is provided to service users when agricultural producers decide the cultivation plan. Or cultivation plan consultation is provided to service users when service providers decide the cultivation plan. These aspects of the Cultivation Plan Service are shown in Figure 1.

The cultivation plan consultation could be provided based on the big data analysis by collecting Measured Data, Log

Data, and Expertise Data via network. Big Data in the Agricultural Information Repository are analysed by applying available analysis methods. Then the analysed results need to be provided to the service users. The following information from the Agricultural Information Repository can be provided to help service users to make decisions which are with Current status of the cultivation for the intended types of the crops, expected monthly and yearly weather and market status of the intended types of the crops.

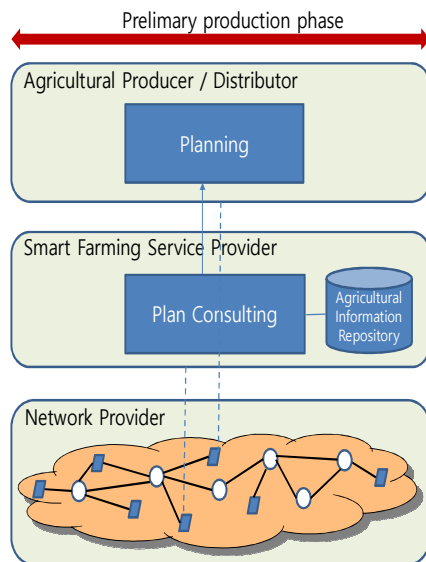


Figure 1. Conceptual diagram for Cultivation Plan Service at the preliminary production phase

In addition, service providers could provide cultivation plan consultation to service users on the following items those are the suggested types of the crop for seeding, the suggested time for seeding and suggested area for seeding. It also provides has the expected amount of production from the minimum to the maximum and the expected profits from the minimum to the maximum.

The Big Data Analysis in the Figure 1 utilizes various types of data such as production cost, market status, and cultivation to analyse them and attain the expected profit or other information for cultivation plan consultation. It requires a model for prediction and calculation which inputs the data of production cost, market status, and cultivation, such as machine learning and regression process. The resulted output of the analysis will be used for cultivation plan consultation.

III. REFERENCE ARCHITECTURE FOR CULTIVATION PLAN SERVICE

It is composed of Data Analysis Function, and Plan Consulting Function for Cultivation Plan Service as shown in figure 2.

The Data Collection Function consist of Environment Functional Entity, Data Accumulation Functional Entity, and Knowhow Base Management Functional Entity. Environment Monitoring Functional Entity gathers and delivers the Measured Data including Cultivation Data such as temperature, humidity, and pH, etc. The Measured Data also includes Market Status and Production Cost. Data Accumulation Functional Entity gathers all information related to with the past service processes, such as the past cultivation records, and final profits per varieties of crops, etc. to form Log Data. The knowhow Base Management Functional Entity gathers and delivers Expertise Data from experts, skilled service users or service user communities. All this gathered information are stored in the Agricultural Information Repository, then transferred to Data Analysis Function which analyses the gathered data and produces meaningful results that will help the service process. The Agricultural Information Repository and related surrounding functions are required to be assured for their security, especially for the data transferred and processed in these functions. The analysed results are transferred to Plan Consulting Function that interacts with the service users, Agricultural Producer, that inquires agricultural information or requests cultivation plan consultation via network owned by Network Provider to help the service users to make decisions. The Information Repository, the Data Analysis Function, and the Plan Consulting Function, which collects the data presented baseline configuration consists of the Data Collection Function

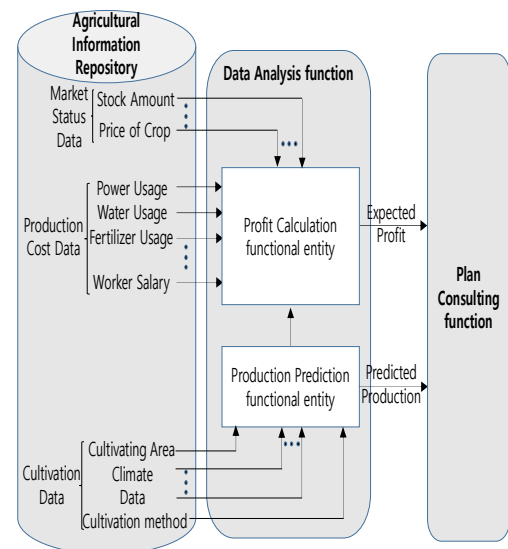


Figure 2. Reference architecture for the Cultivation Plan Service at the preliminary production phase

Agricultural Data collection functions consist of Environmental Monitoring Functional Entity for measurement data collection for each type of data collection, Data Accumulation Functional Entity for log data collection, and Knowledge Management for expert data collection. The data analysis function also consists of a Prediction Functional

Entity which is responsible for predicting techniques such as machine learning, and a Calculation Functional Entity which performs calculations between the predicted and calculated values. These features enable service providers to provide information about various cultivation needs from service users and provide advice on farming plans such as selection of planting crops, timing of sowing, and area of cultivation, in response to requests for services from service users.

Table 1. Classification and types of data for Cultivation Plan Service.

Types		Attributes	Usages
Measured Data	Cultivation Data	Cultivating area Growth cycle Status of growth (color, size, no. of leaves, etc.) Predicted climate data (temperature, humidity, etc.) Soil data (soil nitrogen concentration, vapor concentration, pH, etc.) Cultivation methods (hydroponics, soil cultivation, transplantation, direct planting, etc.) etc.	- Grasping the current status of the crop cultivation
	Market Status Data	Stock amount Price of crops Market demand etc.	- Aligning with the market trends
	Production Cost Data	Power usage Water usage Fertilizer usage Worker salary etc.	Grasping the total production cost
Log Data		Past consultation Past cultivation records Yearly final profits per varieties of crops, etc.	Grasping the total Feedback from the previous consulting cases, etc.
Expertise Data		Expected production per cultivation area Expected profit per cultivation area Necessities for Biennial cultivation etc.	Establishing agricultural information base, etc.

The data used in the service is classified as measured data (Measured Data) collected from sensors and various instruments, log data collected from previous farm planning advice, and expert data (Expertise Data) containing expert information from agricultural experts which again reflects the current agricultural market conditions. Each classified data type has a different functionality for data collection. The functional requirements presented to establish functions for each type of data.

IV. CONCLUSIONS

These features enable service providers to provide information about various cultivation needs from service users and provide advice on farming plans such as selection of

planting crops, timing of sowing, and area of cultivation in response to requests for services from service users.

This provides ~~the service model~~ of the Cultivation Plan Service at the preliminary production phase. Therefore, agricultural data to be converged and managed based on ICT and IoT is key foundation that Agricultural data is the key foundation for Smart Farm models, in which a wide range of Information and Communication Technology (ICT) such as IoT and Big Data is converged to be operated and managed.

Every state in smart farm model from crop growing to selling requires appropriate data and it is very crucial to have a well-established service model for data collection and its provision. Given the fact that every single stage in Smart Farm models from crop growing to selling requires appropriate data, it is crucial to have a well-established service model for data collection and its provision.

That is smart farming service which assists farmers to develop proficiency in the management of farms. Smart farming service disseminates to the farmers for the farming contents and perform farmers problem back to service system for solution to help farmers make decision in farm management.

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