Analysis the necessity of applying block chain on agriculture

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***Abstract*— Analysis the necessity of applying block chain on agriculture and implement a suitable smart contract. Design a DAPP for farmer, consumer to oversee the data, sent the order by a transparent block chain system, so we can fix the most important problems that the agriculture facing now.**

Keywords— agriculture, block chain, smart contract, DAPP

I. PROBLEMS

Nowadays, may applications on block chain only follow the trend, without actual needs, or understanding the basic problems. So there are few successful block chain applications.

Block chain have been used in many different fields, for example: financial, transportation, medical, voting and so on. Many farmers also using this technology to improve the production and sales history, transportation, and sales information. However, most of the applications didn't analysis the needs of farmers, only using the new technology on agriculture.

Currently, many blockchain applications do not require a blockchain, and it might work better without blockchain. So I want to analysis farmers' problems in detail, and implement a suitable block chain application on agriculture.

Choosing agriculture for our study, there are three reason, first, there are few research about block chain application on agriculture. Second, agriculture is the basic needs of human, so it will be a long-lasting industry, if we can improve this industry, our future will be better. Third, there are many issue about food safety recently, we think it can be solved by block chain.

Blockchain infrastructure are immutable and distributed ledger systems for record management, baseline agricultural environmental data integrity is safeguarded for those who participate in transparent data management. So apply blockchain and smart contract on agriculture must have some positive influences.

However, how to design the smart contract and the way we use block chain is very important, it is hard to combine the traditional agriculture with a new technology, that is why we need to analysis the problem in detail, to find the best way to use this application.

II. MOTIVATION

To analysis this problem, we can start with these two aspect, from consumer and farmer.

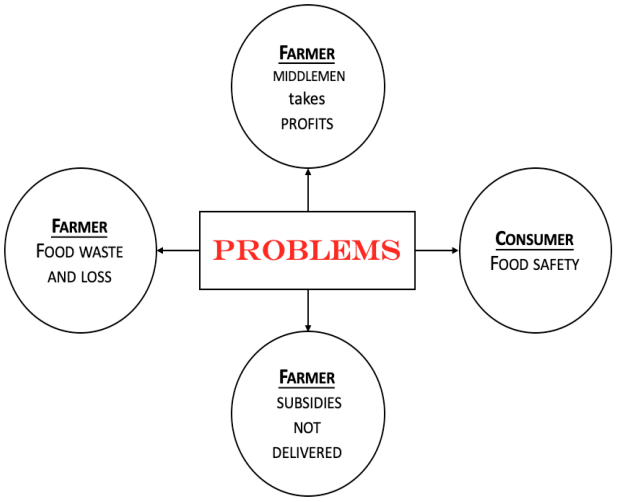
First, we can start with consumer, what they really care is food safety. The consumer want to check the information on block chain, select supplier by themselves, understating agriculture production resource, food processing and transportation process, to ensure the food safety.

Second, we look at farmer, there are a lot of problems that exist in the field of agriculture for a long time:

1. Most farmers are unable to sell their products on the regular market at a reasonable price because the middlemen accept agricultural products at low prices and enjoy unreasonable profits.

2. Uneven distribution of food causes waste, this problem almost happened in the rich country. According to the statistics, at least 30% to 50% suffer from waste and loss.

3. Many Countries have some subsidies to the farmers, helping them to sell their products, but in many developing or low-developing countries, subsidies are often not delivered due to the greed of the system.



(Figure 1)

For example, the food safety problem contains chemical fertilizer, pesticide, land pollution and many resource issues. Most of the farmers can't sell their product directly, they need to through the large market or farmers association. However, through the third party there must have some compromise or being control by them. About uneven distribution of food problem, last year, the overproduction of banana cause 3 bananas only takes 10 dollars.

To solve these problems, for consumers, we can provide them a reliable system, in this system, they can check the information, chose the farmer, buy the products directly after knowing the detail of this product. By this way, we can give a chance to consumer to check the food safety by themselves. However, it is hard to judge by the numerous data, so we use provide an indexation data, by giving a safety index, consumer can easily find the best product, and they can also check the original data.

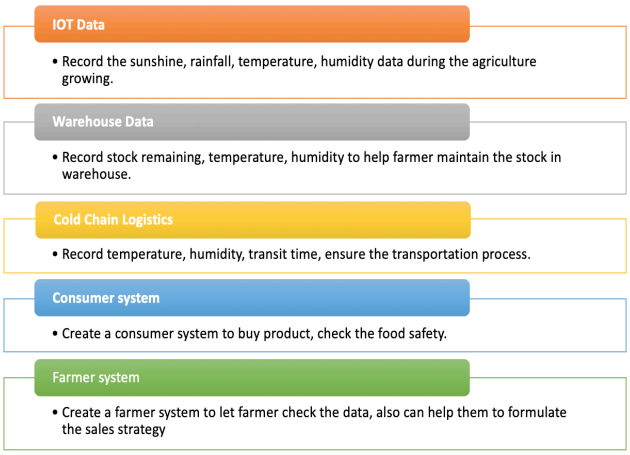
For farmers, the decentralization of the block chain is exactly what they need, which reduces transaction costs and open new markets. By the application of block chain, farmers can sell their products directly to consumer without a middleman taking lots of unreasonable profits.

With data collections on block chain, we can analysis the needs of market, and develop a production strategy and sales strategy, solving the food waste and loss problem. And by the transparent data of block chain, the subsidy process is expected to become more transparent and prevent farmers from being crushed. They can also use these data to apply government subsidy and production and sales history.

Currently, it takes a lot of time and human resource to get a production and sales history, in Taiwan, we have TGAP (Taiwan Good Agriculture Practice), however, the process is long and check by human being, which might have some errors and human can't test all the product, they check by random sampling. With block chain, we can record the data of all the product, and check them automatically, by this way, we can not only save human effort but also test every product and process.

III. HYPOTHESIS AND IDEA

Our idea is to create a smart contract on block chain, which collect a lot of data from different apartment, and combine many system can be used by different user. First, we design a smart contract with five layers:



(Figure 2)

IOT DATA:

We put a lot of sensor between the crops, recording the sunshine, rainfall, temperature, humidity data during the agriculture growing. And the menger will upload the data those sensors collected. The farmer can access these data immediately, helping them to control the situation of their crop even when they aren't at that location by this block chain.

Warehouse DATA:

In the warehouse, we also reocrd data and upload to block chain, like stock remaining, temperature, humidity to help farmer maintain the stock in warehouse.

Cold Chain Logistics:

About transportation, we also collect data during the process. For crops, the transportation is important which will cause different quality of a product. So we upload temperature, humidity, transit time, ensure the transportation process is under control.

Consumer system:

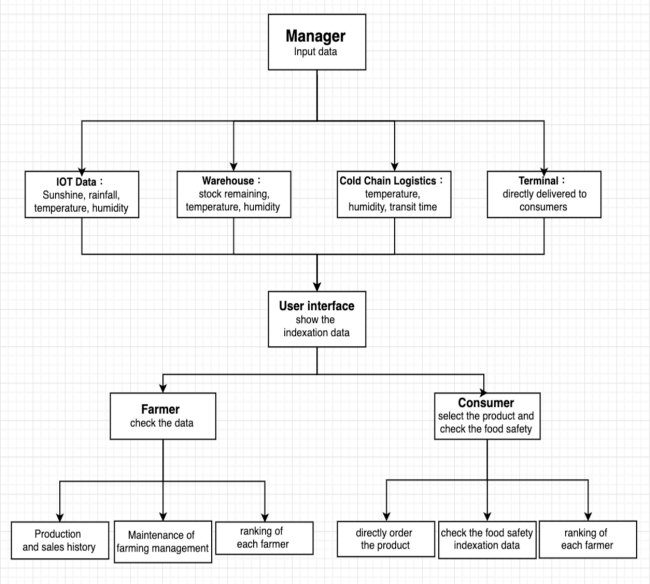
This is a system for consumer to access the data during processing of the product they buy, like created day, planting environment or transportation temperature…, and so on. And we use a indexation data to help them judge food safety easily because of reading original data takes lots of time and is hard to compare different product. With user interface, they can easily get the data they want and order the product.

Farmer system:

For farmer, they also need a system like consumer, but the data will be more detail and helping them to formulate the sales strategy. They will have a order infromation by buyers, so this block chain also like a sales platform. With user

interface, they can easily get the data they want and order information.

With these five layers, we design our smart contract that collect the IOT, warehouse and cold chain logistics data. The user and farmer can use this system and check these data by user interface. The design flow chart:



(Figure 3)

By this design, we have a manger, who will input the data and maintain the system. After construct the database of IOT, warehouse, cold chain logistics and order system, we create a userinterface for farmers and users to access these data and using this system easily.

For farmers, they can use these data to apply production and sales history, in Taiwan we have TGAP, and they will also have a great maintenance of farming management by check the data anytime, and anywhere. They will get the ranking of each farmer, so the farmers can know the safety level of their product, and improve themselves.

For consumers, they can directly order the product and contact with farmers without middleman. They can check the food safety by indexation data, and also the original data, so they can chose the farmer by themselves. Consumers will have the ranking of each farmer, which is the same one farmers get, helping consumer to chose the farmer with best quality.

IV. EVALUATION

After design and implement the smart contract, we can evaluate the correctness of this solution by the fellowing way:

Asking farms face to face, understanding their actual needs.

Invite some farmer and consumers the use this smart contract, asking them is it convenience or easy to use.

Recheck the problem we want to solve is auctlly solve by this smart contract.

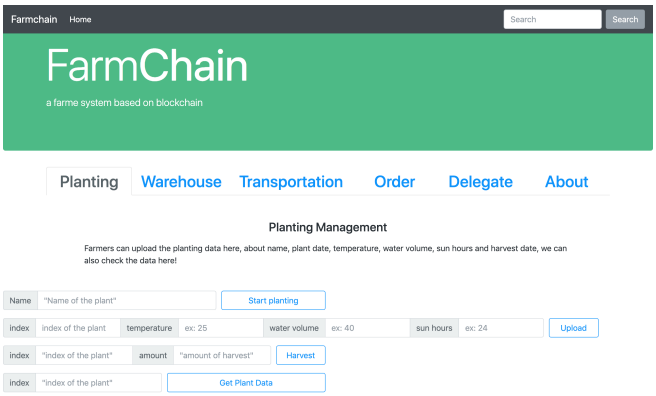
Compare the advantages and disadvantages by using block chain and original data base on agriculture.

Testing the block chain on test net. We will use Soildity to implement the smart contract, and deploy to the test net like Ropsten Testnet. And we will use IDE Remix (http://remix.ethereum.org) to test our smart contract, because it is easy to use.

V. RESULT

Contract address :
0xba3cb6faa1bb1ab6b8f9a3c83c75b78156f9a5e9

DAPP link: https://farmchain.herokuapp.com/



Planting:
Farmer can start planting and upload the planting data like temperature, water volume, sun hours, also can harvest the plant by index. Both of user and farmer can access plant data by index.

Warehouse:
Farmer can upload the warehouse temperature. Both of user and farmer can access warehouse data (include temperature and stock) by index.

Cold Chain Logistics:
Admin can upload the Cold Chain Logistics temperature, and the farmer can start the shipment of some order. Both of user and farmer can access Cold Chain Logistic data (include shipment date and temperature) by index

Order:
User can order the product here, and get the info of product. when the product arrival, user can click the arrival button.

Delegate:
Admin can delegate the farmer to upload the data.

This smart contract is based on Solidity and Remix, and deployed on the test net Ropsten currently. And the DAPP is connected with smart contract by Meteor, and deployed by Heroku to have a public link. Everyone can use the DAPP by an address on Ropsten test net.

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