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Construction and Management Status of Agricultural Traceability Information System of Korea

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In Korea, there are separate traceability management systems for agricultural, livestock, and fishery products. In particular, the traceability management system for agricultural products (Farm2table) was developed and operated by the Korea Information Center for Agriculture, Forestry and Fisheries (KICAFF). This system is a representative information management system for agricultural products. The system has supported linked entries and inquiry services for related traceability information by developing open API linked services.

The user satisfaction in the traceability management system for agricultural products is showed that 69.1% of the users were generally satisfied. Moreover, complex work processes (32.7%), the manpower shortage and cost incurrence (33.7%), etc. were appeared as major difficulties in recording and managing the traceability information. In order to promote the usability of the traceability management system in the future, simplification of traceability information on the home page of the "Farm2table" and the provision of user incentives are required. In addition, there is a need to unify each traceability management system that is operated independently. The integrated system can help users easily access all information provided in the systems by viewing single web–site.

INTRODUCTION

Recently, as the standard of living is improved and the life expectancy is lengthened by social and economic growth, demands for the safe food have increased to satisfy customer's values such as the well–being, LOHAS (Lifestyles of Health and Sustainability) etc.

As the food safety problems are emerging as social issues, the taste and quality (37.1%) and the safety (24.4%) are represented as the first considerations rather than the cost (6.1%) when customers purchase agricultural and livestock products (CRIC, 2009). As the food safety is critically considered by customers, certification systems such as GAP, HACCP, traceability management etc. have been introduced and operated to guarantee the food safety in foreign developed countries as well as in Korea. Among such certification management systems, the most fundamental method would be the traceability management system (Choi and Baek, 2009).

In particular, after international outbreak of mad cow disease (BSE), developed countries such as European countries, Britain, and Japan etc. have promoted the traceability management system focused on livestock products, and are gradually expanding it toward agricultural products, fishery products, and processed food etc. Korea has followed the examples of these developed countries by promoting traceability management systems. The traceability management system for agricultural products was introduced through the amendment of Agricultural Product Quality Control Act in August, 2005, for systematically managing exact traceability information for each production process, distribution process, and sales step of agricultural products. Subsequently, the traceability management system for agricultural products was constructed in 2006 and has been operated up to now (MAF and MMAF, 2005). It is expected that the traceability management system for agricultural products could further improve customer's reliability by securing the safety, quickly investigating the causes and taking emergency measures when problems arise.

This study attempted to examine the construction of the traceability management information system to guarantee the safety of agricultural, livestock, and fishery products from production stage to consumption stage, and to describe the operation status. From the results of survey, the traceability management system for agricultural products currently operated and managed will be evaluated.

MATERIALS AND METHODS

1. Construction a status of the traceability management system for agricultural, livestock, and fishery products in Korea

The Korea's traceability management system covers the traceability management scheme for overall areas from the production stage to the distribution and sales stage. The information system is constructed to be able to systematically manage the traceability information of

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entire stages such as production, distribution, sales etc. for various items such as agricultural products, fishery products, livestock products, processed products, salt, liquor etc. Customers could inquire and check the traceability information on purchased products via the information system. In addition, the information system is expanding in order to minimize possible damages by quickly recalling the products if any food accident is occurred.

The traceability management system for agricultural, livestock and seafood was constructed and operated for specialized items by each local government as well as the central government (Table 1). The Ministry of Food, Agriculture, Forestry and Fisheries (MIFAFF) constructed and has been operating the traceability management system for areas such as agricultural products, seafood, livestock products etc. Moreover, each local government has also been operating the traceability management system independently for specific products. This system contributes to improve the income of farmers and the safety for customers by expanding distribution and sales through differentiated strategies. Major region–specific items are rice, garlic, schizandra, oriental melon, green tea, persimmon, and chili etc. (KICAFF, 2009).

2. Comparison of typical traceability management systems for agricultural, livestock, and fishery products

MIFAFF was introduced to operate the traceability management system to guarantee the safety of agricultural, livestock, and seafood from the production stage to the consumption stage.

The traceability management system for agricultural products records and manages information on agricultural products of from each stage (production stage to the sales stage). When agricultural products have safety issues, this system identify the causes and takes appropriate actions by tracing the problems to the corresponding agricultural products.

The traceability management system for fishery products is the system that provides information to the customers to help them select seafood without anxiety by recording and managing the traceability information of fishery products from fishing grounds to tables. In addition, the traceability management system for livestock products is operating separately to relieve customers by recording and managing the information from each stage of production (slaughter, processing, and distribution process of cattle and beef) When problems arise it can quickly identify the causes and take measures after tracing back to their origin. For example, the information system was constructed and has been managed for distribution traceability management of imported beef after introducing distribution traceability system for imported beef in 2010.

The traceability management system for agricultural products is operated and managed for all items of agricultural products by the KICAFF. The traceability management system for seafood is operated and managed for 12 kinds of seafood by the Korea Maritime Institute (KMI). The traceability management system for livestock products and site information are operated and managed for cattle or beef by the Animal Products Grading Service (APGS) (Table 2).

The traceability information management for agricultural products records and manages the traceability information such as basic information, cultivation information, shipping information, warehousing and releasing information. Seafood post–harvest for the traceability information is managed by dividing into production, processing, distribution, and sales stage, and the product information, introduction and movement information etc. are recorded and managed. Traceability information management of livestock products, records each person responsible for information of breeding, slaughtering, processing, and selling stage. Also, traceability information records and manages individual information of cattle, slaughter inspection information, brand information etc. The traceability information for agricultural, live-

Table 1. Construction status of the traceability management system for agricultural, livestock, and seafood in Korea

Area	System Name	URL	Main Items
MIFAFF(4)	Agricultural traceability system	http://www.farm2table.kr	agricultural
	Seafood traceability system	http://www.fishtrace.go.kr	seafood
	Beef traceability system	http://mtrace.go.kr	beef
	Imported beef distribution traceability system	http://meattrace.go.kr	imported beef
Gyeonggi–do(1)	Super oning agricultural traceability system	http://www.cypap.net	rice
Gyengsang–buk–do(4)	Uiseong–gun garlic traceability system	http://www.ustrace.net	garlic
	Gyengsangbuk–do traceability system	http://www.gbtrace.net	agricultural
	Moongyeong schizandra traceability system	http://www.redim.or.kr/	schizandra
	Seongju–gun agricultural traceability system	http://sjmelon.go.kr/trace/	melon
Gyeongsang–nam–do(3)	Hadong–gun green tea traceability system	http://www.teatrace.net	green tea
	Sancheon–gun medicinal herbs traceability system	http://www.hsnc.or.kr	medicinal herbs
	Persimmon traceability system	http://www.gamtrace.co.kr	persimmon
Chungcheong–nam–do(1)	Chung Nam traceability system	http://trace.chungnam.net	agricultural
Chungcheong–buk–do(1)	Red pepper traceability system	http://www.gsgochu.com	pepper
Jeollanam–do(2)	Naju–gun school meals system	http://www.najufood.co.kr	green–agricultural
	Goheong–gun green produce traceability system	http://u–goheung.or.kr	local produce

Table 2. Comparison of the traceability management systems for agricultural, livestock, and seafood in Korea

Division	Agricultural	Seafood	Livestock(Beep)
URL	www.farm2table.kr	www.fishtrace.go.kr	www.mtrace.go.kr
Operating	KICAFF	KMI	APGS
Applicable law	Agricultural products quality control act, article 5 section 7	Fisheries products quality control act, article 8 section 2	Cattle and beef traceability management act
Control number	Total 12 numbers: Register No. (5), shipment year (2), Lot No. (5)	Total 13 numbers: Unique No. (4), Item No. (2), shipment year (2), Lot No. (5)	Total 12 numbers: Expansion cords (2), Cord division (1), Lot No. (8), Check No. (1)
Items	All items	12 seafood items	Cattle and Beep
Traceability information	○Production step –production information: produce, item, area, information of using fertilizer, pesticide, etc. –Sale information: date, item, post–harvest management facilities, shipment location, quantity ○Distribution information, warehousing, delivery, etc. ○Sale information: warehousing or sale information	○Required information –information of produce and farmer, area, item, warehousing date or quantity, etc. –processing: company information, warehousing, delivery, etc. –distribution information: warehousing, delivery, etc. ○additional information: company info, certification information	–Identification number of object of slaughter, processing, sale step –DNA information of Identification No. on slaughter step –earmark management information
View method	Internet, Mobile(267) or 2–dimensional bar cord, Kiosk	Internet, Kiosk	Internet, Mobile(6626) or 1–dimensional bar cord, Kiosk

stock, and fishery products can be checked by directly accessing each web site. Users can easily view the information any time by inquiring via the kiosk installed at the store or through mobile access.

3. Construction of the traceability management system for agricultural products

The traceability management system for agricultural products (Farm2table) constructed and operated by the MIFAFF is designed and constructed to systematically record and manage the production process, distribution and sales traceability information for every kind of agricultural products. Producers can record and manage major traceability information such as managing crop's growth for each cultivation area, distribution history and even sales stage by using the traceability management system for agricultural products. In addition, the stored traceability management information DB is offered through various methods such as the web site, mobile service, open service, and kiosk etc. any time. The trace-

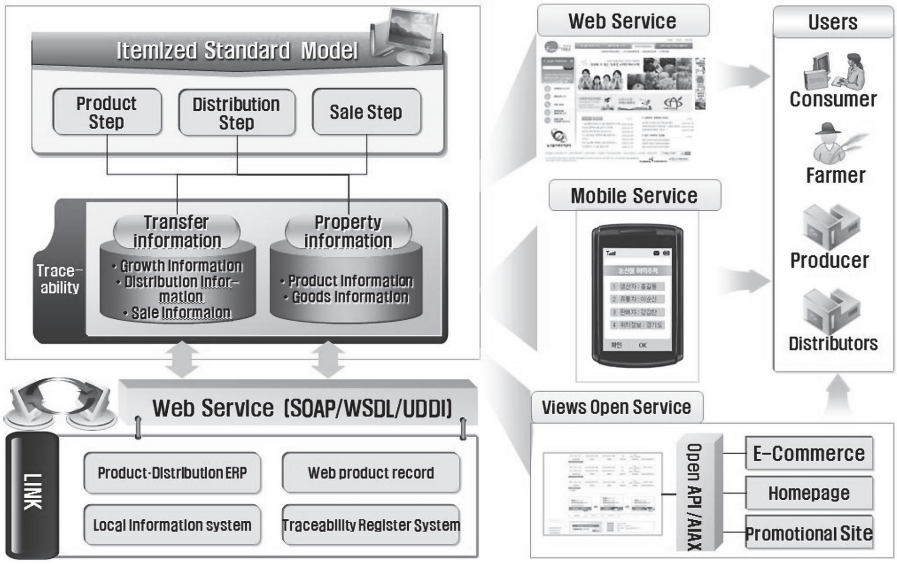

Fig. 1. Structure diagram of the agricultural traceability management system.

ability management system for agricultural products is composed of information for each stage (production/distribution/sales), construction of traceability information DB, inquiry of traceability information, and information linkage (Fig. 1). The traceability management system (Farm2table) is currently operated and managed on consignment by KICAFF, and has operated with ties to the GAP system and traceability registration system of the National Agricultural Products Quality Management Service (NAQS). In addition, it manages systematic traceability information following the information linked with the traceability management system, GAP certification facility, ERP of distributors, web management accounts etc. of each local government.

RESULTS

1. Introduction to the screen of the traceability management system for agricultural products

The traceability management system (http://www.farm2table.kr) is the typical traceability management system operated by the MIFAFF, which can be used by distribution management enterprises, farming groups, producers (farmers), distributors etc. regardless of regions and items. If anyone wants to use it, he/she can distribute and sell product by submitting information after becoming a member, entering and managing the traceability information, and acquiring the traceability management number and certification mark. Figure 2 shows the main screen of farm2table, which producers, distributors, and sellers etc. can record and manage the traceability information of agricultural products, and customers can inquire the traceability information in order to trace and purchase agricultural products. Through the system, customers can obtain systemically organized information about transportation information of agricultural products such as the production and shipment, distribution warehousing and releasing, sales warehousing and releasing etc. and the product information for agricultural products such as the safety certification information, inspection information, standard, price, trademark property etc.

2. Mobile services and kiosk inquiries of the traceability information for agricultural products

The traceability information inquiry of agricultural products is provided via various media such as Internet, mobile devices, and kiosk etc. In particular, customers can easily inquire the traceability information of agricultural products on Farm2table by pressing the number of 267 (wink service) and an access button on cell phone. In addition, through the camera on cell phone, the two–dimensional bar code (mobile code) the product is recognized, the traceability can be more easily inquired without pressing number buttons (Fig. 3). Installing kiosk terminals in department stores or supermarkets helps customers check the safety of the product. Customers can look for the history of agricultural products through the kiosk during grocery shopping and purchase reliable and safe agricultural products (Fig. 4).

3. Developing and supporting open API technology for the traceability management system of agricultural products

The traceability management system for agricultural products (Farm2table) supports the open service so that every web site could provide the traceability information through free access to the constructed pre–designed form in the Farm2table at any time. The open service is

Fig. 2. Typical main screen example of the agricultural traceability management system.

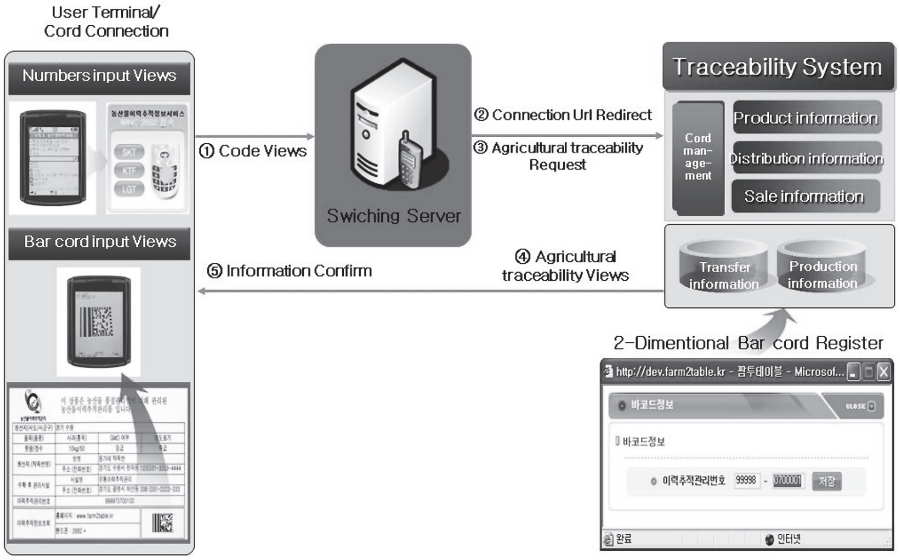

Fig. 3. Construction diagram of mobile service for agricultural traceability information management system.

Table 3. Status of connected open service to send agricultural traceability information management system (Dec. 31, 2009)

Area	Link System Name (URL)	Link Date	Numbers of Link Information
Gyeonggi–do (1)	Mushheart (http://www.mushheart.co.kr)	'08.11.28	3,840
Gyengsangbuk–do (2)	Uiseong–gun garlic traceability system (http://www.ustrace.net)	'07.12.29	4,659
	Gyengsangbuk–do traceability system (www.gbtrace.net)	'08.02.20	1,547
Gyeongsangnam–do (2)	Hadong–gun green tea traceability system (http://www.teatrace.net)	'07.11.08	59
	Sancheon–gun medicinal herbs traceability system (http://www.hsnc.or.kr)	'09.04.16	1
Chungcheongnam–do (2)	Farmson (http://www.freshia.com)	'07.11.16	0
	ChungNam traceability system (http://trace.chungnam.net)	'08.12.01	104
Chungcheongbuk–do (1)	Chungju locations APC	'09.11.27	158
Totals (8)			10,368

Fig. 4. Screen example of traceability information inquiry using the kiosk in supermarket.

composed of the linked open service and the inquiry open service, and four schemes of standard code systems such as Web service, Java API, JSP–XML, and JSP–HTML. By using these standard code systems for agricultural products, anyone enter information on Farm2table and use the inquiry service to trace products.

The connected–open service is for using and connecting the locally based work system including management information of traceability for agricultural products, and this information is transferred to the Farm2table. The service is based on the standard technologies of Web service, Java API. On the other hand, the inquiry open service is for inquiring the traceability information on the Farm2table from web sites providing, product Web service, Java API, JSP –XML, and JSP–HTML are also used in the inquiry–open service (Fig. 5).

To use the open service of the Farm2table, it is necessary to get approval by the administrator after requesting the permission on the web site. Currently, eight traceability management information systems have used the open service, and the requests are rapidly increasing, due to popularity of smart phones from many institutions and organizations for developing applications (Table 3).

4. Statistics and survey of the agricultural traceability information system

Overall, 91,020 farms have registered in the agricultural product's traceability management system by the end of 2009, however, majority of the registrants manage the traceability of agricultural products by handwriting (Table 4). Thus, there were only 16,776 registered farms that manage the traceability information through the information system (Farm2table) (Table 5). It was attributed to the poor computer skills of producers and unfa-

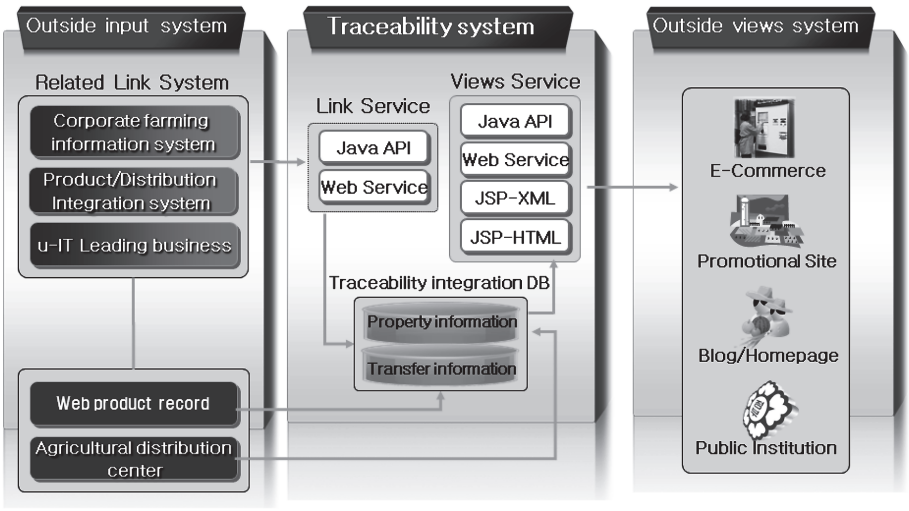

Fig. 5. Composition of the open service of agricultural traceability management system.

Table 4. Status of yearly new registrants for traceability (Dec. 31, 2009)

Division	'06	'07	'08	'09	Total
Producer Groups (farmer)	578 (6,194)	768 (14,222)	1,039 (13,743)	1,656 (56,861)	4,041 (91,020)
Distributors	148	421	223	226	1,018
Dealer	469	102	39	117	727
Total	1,277	1,311	1,323	1,806	5,786

Table 5. Status of yearly new information administrators for the farm2table (Dec. 31, 2009)

Division	'06	'07	'08	'09	Total
Producer Groups (farmer)	136 (888)	288 (4,065)	227 (731)	349 (11,092)	1,000 (16,776)
Distributors	35	116	41	88	280
Dealer	20	20	3	17	60
Total	191	424	271	454	1,340

miliarity of using several other reasons for preventing active uses of the system such as substantial costs–to manage the computer systems and no recognition for the advantages–which can be acquired by using the information systems.

To examine and analyze the status of users utilizing the traceability management scheme and system, survey was conducted with producers and distributors among traceability information administrators related to agricultural products. Total 686 subjects were randomly selected (producers: 426, distributors: 262) from a list of 2,853 farm managers (producers: 2,169, distributors: 683), and then telephone survey was conducted from June 17 to June 19, 2008.

The ratio of traceability items among annual sales showed that 'below 10%' was the highest (35.3%), and as the rests were '10~30%' was 18.8%, '30~50%' (11.8%), '50~70%' (6.1%), and 'above 70%' (18.8%). This represented that, the items managed with traceability systems among agricultural products have not yet been placed as major sales. Furthermore, the degree of preference for 'handwritten books' (46.1%), 'computerized record' (45.6%), among the method to manage the traceability information. Among computerized records, the 'Microsoft Excel' was the highest as 24.4%, 'Web farm managing books' was the second as 12.9%. The participants had difficulties in recording the traceability information because of 'complex work procedure' (32.7%), 'manpower shortage' (23.8%), 'insufficient understanding for the system' (15.7%), and 'additional cost incurrence' (9.9%). Finally, survey on satisfaction for participants of the traceability management system for agricultural products indicated that they were generally satisfied (69.1%), and the dissatisfaction level was low – (dissatisfaction 9.4%, very dissatisfaction 1.4%).

Based on the survey results, the priority to promote computerization of the traceability management would be the support for using computerized records through simplification of traceability management system, improvement in convenience of the Farm2table system etc.

CONCLUSION AND DISCUSSION

In Korea, traceability management systems have been developed and operated for agricultural, livestock, and fishery products individually by MIFAFF. In addition, each local government also constructs and independently is operating the traceability management system to improve the brand value for region–specific products. In particular, the traceability management system for agricultural products (Farm2table) operated by the KICAFF is a representative information management system for agricultural products. The System was implemented to connect the traceability information, which have been operated individually and separate input systems. The open API connected service can make a link to

traceability management systems distributed nationwide. In addition, customers can acquire information of the products through the mobile service by using two dimensional bar code or WINK service (267).

The survey on user's satisfaction of the traceability management system for agricultural products showed 69.1% of general satisfaction. The difficulties in recording (32.7%) and the manpower shortage cost (33.7%). Therefore, it could be suggested that the simplification of traceability management and incentives are required to facilitate uses of the system.

In the future, the traceability management system for agricultural products could be continuously improved by the simplification of input procedures on the home page and the development of the automatic entry system for the traceability information by using several applications. Although integration of the traceability management systems which have been independently operated and served would be very difficult, the integrated inquiry web site needs to be developed for customers to provide several pieces of traceability information.

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