

# A Study on the Status and Future Directions of IT Convergence Policy by the Ministry of Food, Agriculture, Forestry and Fisheries in Korea

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**Abstract** Research and technology has been transforming the agriculture to agribusiness which encompasses all operations with all the connections from farming per se, to manufacture & distribution of production supplies and farm commodities. Further, with the revolutionary development of information technology in the last two decades, we cannot talk about agribusiness process alone without considering the information technology embedded in the artifact, process, and structure. Despite the emergence of precision agriculture (PA) which is supported by IT based innovations which can not only improve efficiency in farming operations but also contribute to environmental sustainability, the adoption of IT among farmers and in agriculture industry are rather low than expected. Thus, Korean government has been seeking to converge IT into food, agriculture, forestry and fisheries to improve the competency of the agribusiness, and much progress has been made.

This paper investigated the status quo of the current IT convergence with Food, Agriculture, Forestry and Fisheries in Korea, and further proposed future policy directions.

**Keywords** IT Convergence, Agribusiness, Policy Direction, Food, Agriculture, Forestry, Fisheries, Korea

## 1 Introduction

Agriculture has been experiencing fundamental alterations of the entire rural society (Davis, 1956), and rural Korea is not an exception. With the dawn of the twenty first century, emerging crisis of agriculture from both internal and external environments plays a key role as triggers of the transformation of Korean rural society. Among them are the transformations of consumption and distribution, structure of agriculture, the subject of regional agriculture, and global mega trends (Lee et al., 2011).

The transformation of the structure in consumption and distribution embodies in the following four areas. First, the growing uncertainty and instability of agriculture mainly comes from globalization, farmland loss, and climate change. The interdependence between and among countries has been extraordinarily increased through WTO, UR, and FTA, and it not only accelerates the arrival of unlimited competition era but also exaggerates the instability of the international agriculture products market (Park, 2012). Further, urbanization and desertification threatens the degradation of farmland which also affects the international market of agriculture products. In addition, the emergence of venture capital distorts the flow of agriculture spot market, and the climate change and meteorological damage also enhance the instability of the demand and supply of agriculture products. Therefore, a demand and supply forecasting system for agriculture products should be adopted

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to seek market stabilization. More precision of some basic statistics such as major agricultural products acreage and yield, as well as weather conditions should be included in the comprehensive analysis (The Federation of Korean Information Industries, 2009).

Secondly, agriculture food consumption and needs have also been transformed from the original uniformity to diversifications based on different ages, status, and life styles. More and more households are inclined to go eat out, and they concern more about health, taste, convenience, diversifications, and professionalization. These new trends on agriculture food consumption lead to the stratifications of different consumer groups: egocentric sense style, natural simplicity style, and elite style. Consumers with egocentric sense style pay more attention on their egoistic subjective satisfaction, and they care about sense, feeling, beauty, and experience. With the increasing economic power and the trends toward a nuclear family, more and more consumers explosively become egocentric sense style (Kim et al., 2011; Seo et al., 2010).

Thirdly, diffusion of ICT-based agriculture products consumption and distribution structure becomes a new trend, and this trend leads to the change of consciousness of producers on ICT applications. There is a trend that the percentage of the wholesale market on agriculture products are decreasing, while the market power of large scale retailers and direct marketing has been greatly increased, which means that e-Commerce has been settled down as

a new important distribution channel of agriculture products. Further, the ICT-based consumptions and distributions of agriculture products become routine for everyday life. Since e-Consumers are more likely to search and order agriculture products through internet, producers begin to promote and sell their products through homepages. They also adopted blog marketing, SNS marketing, etc (Park et al., 2011).

Fourthly, expansion of export market and IT convergence will provide good opportunities to Korean agriculture industry. During the last decade, the trade volume of world agriculture food products appeared a phenomenal growth with the open policy of market, and the agricultural exports of Korea also increased during the last decade (See Figure 1). However, through the survey on the challenges of agricultural exports faced by farmers and exporters in Korea, we have identified several factors which inhibit their capacity to meet the customers' needs such as lack of information of export market, product, and information of export technology, hardship of exploiting new buyers and foreign market, difficulties in selecting exporting items and in developing new items, intensified price competition among exporters, and difficulties in securing labors for cultivating exporting items. These handicaps make it necessary to converge IT with agricultural export to improve its responsiveness to consumer needs and its fundamental effectiveness (Seo & Kang, 2011; Im & An, 2010).

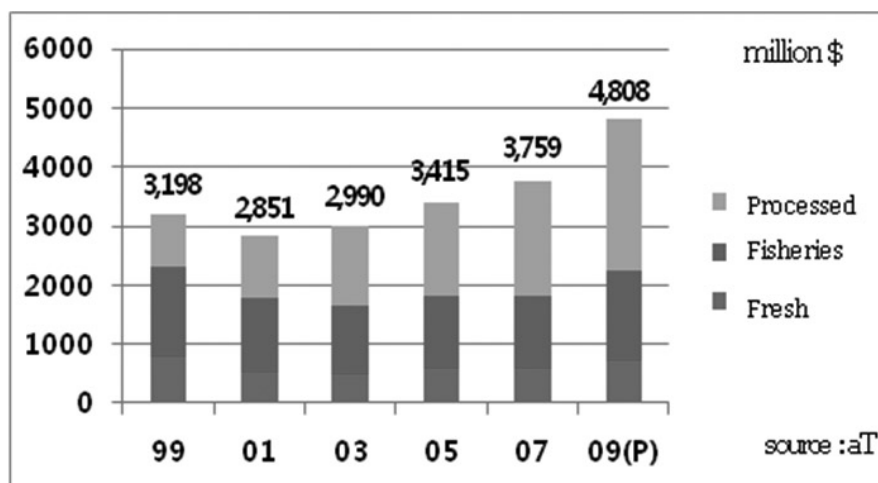


Fig. 1 The Trend of Agricultural Exports of Korea

Next, the transformation of the agricultural structure mainly embodies in the following three areas. First, there is a growing sense of crisis on sustainable agriculture. Continuous withering phenomena of agriculture industry caused by industrialization and urbanization are requesting

various strategic approaches to seek agricultural sustainability. Second, IT convergence with agriculture has been attempted to make it highly developed. Among the IT applications in agricultural sector are management informatization of agricultural technologies, internet and remote farm-

ing consulting service, and IT convergence with BT, CT, and ET. However, the aging rural society and lack of succeeded agricultural workforce are rising as critical limitations of agricultural informatization. Third, vulnerability

of agricultural workforce is another important factor which requires enhancing the agricultural industry competitiveness through IT convergence (The Ministry for Food, Agriculture, Forestry and Fisheries, 2012).

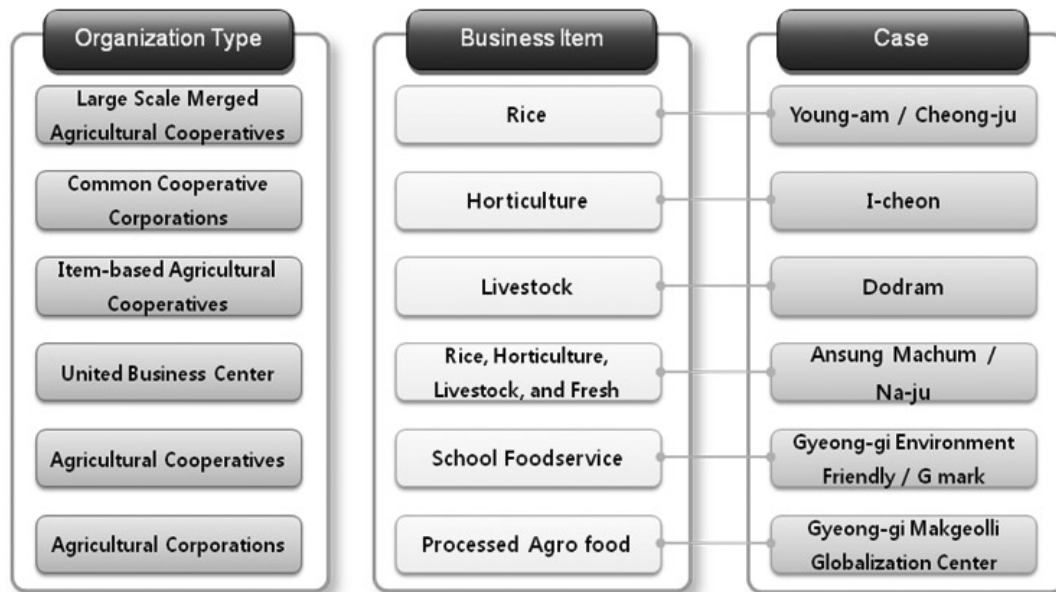


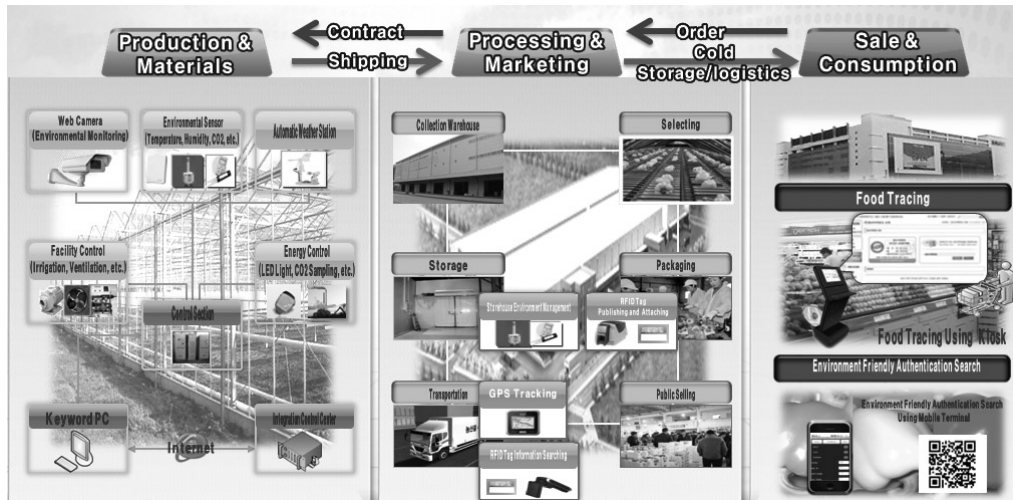
Fig. 2 Distribution Corporation Types, Business Items, and Cases

Further, the subject of regional agriculture has been greatly changed since the year of 2000. First, the growth of market based on the direct marketing has been demanding farming scale promotion and standardization. As a result, agricultural producers begin to have the increasing power to bargain with the large scale retailers. Second, the increasing bargaining power comes from the fact that various distribution corporations are emerging nowadays. The agricultural producers create many different distribution channels such as associations, large scale farming corporation, large scale fresh and convenient agricultural products distribution companies, next-generation businessmen, and professional vendors, and their business items have expanded to the area of agricultural products being used for school foodservice and processed food (See Figure 2). Third, to meet the demands of standardization, high-quality, and farming scale promotion, agricultural producers developed mainly based on the hardware. Therefore, for the lack of software based support and applications, the market responsiveness falls into stagnations. Thus, the development of both hardware and software based convergence should be greatly enhanced (Kim et al., 2010).

Finally, global megatrends such as aging society, global hyper-competition, climate change, development of convergent technologies, and new value orientation also funda-

mentally impact and transform the agriculture industry (Lee et al., 2011).

Above all, research and technology has been transforming the agriculture to agribusiness which encompasses all operations with all the connections from farming per se, to manufacture & distribution of production supplies and farm commodities (Davis, 1956). Further, with the revolutionary development of information technology in the last two decades, we cannot talk about agribusiness process alone without considering the information technology embedded in the artifact, process, and structure. Despite the emergence of precision agriculture (PA) which is supported by IT based innovations which can not only improve efficiency in farming operations but also contribute to environmental sustainability (Aubert, Schroeder, & Grimaudo, 2012), the adoption of PA technology among farmers (Bramley, 2009) and in agriculture industry (Chiasson & Davidson, 2005) are rather low than expected. Thus, Korean government has been seeking to converge IT into food, agriculture, forestry and fisheries to improve the competency of the agribusiness, and much progress has been made (The Ministry for Food, Agriculture, Forestry and Fisheries, 2012). This study simply aims at evaluating the current status of the progress and also at exploring future directions of IT convergence policy by the Ministry of Food, Agriculture, Forestry and Fisheries in Korea.



Source : aT

Fig. 3 Internalization of IT into the Whole Cycle of Production, Distribution, and Consumption

## 2 The Current Status of IT Convergence with Food, Agriculture, Forestry and Fisheries in Korea

IT convergence with food, agriculture, forestry and fisheries refers to the way of creating product, service and engineering innovation and value through the internalization of IT into all the processes including production, distribution, and consumption (See Figure 3). At the production stage, web camera and environmental sensor are used to monitor environment and to control temperature, humidity, CO<sub>2</sub>, etc. Further, by applying LED light and CO<sub>2</sub> sampling technology, energy can also be automati-

cally controlled through Integration Control Center. During the processing and marketing process, storehouse environment management, RFID tag publishing and attaching, as well as GPS tracking technology can be applied to create value. One of the most important values is to provide consumers food tracing information and environment friendly secured food information through their mobile terminals. As we can see from Figure 4, IT is embedded in the products, process, and structure, and how to converge IT with food, agriculture, forestry, and fisheries in Korea has become a critical challenge (The Ministry for Food, Agriculture, Forestry and Fisheries, 2012).

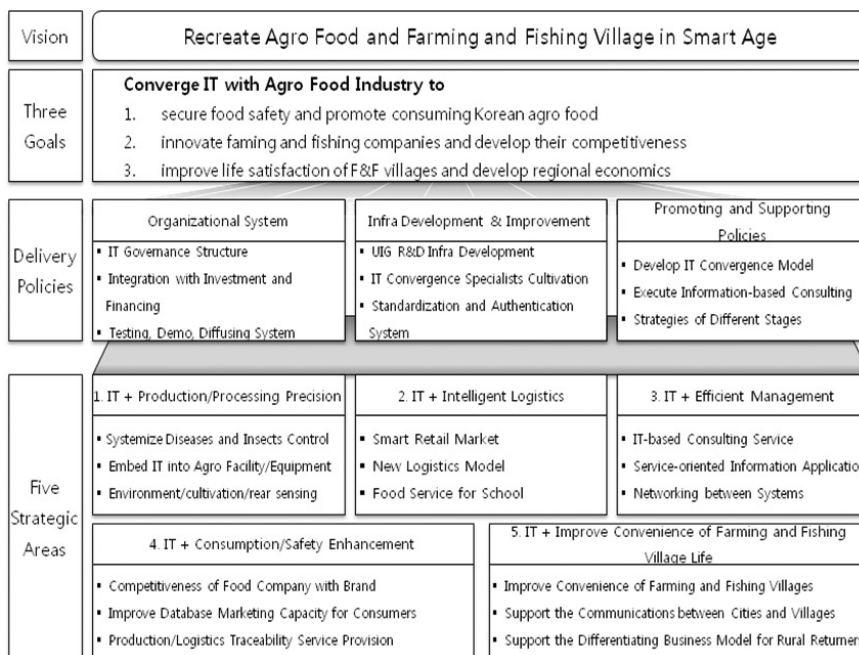


Fig. 4 Vision Map for IT Convergence with Agro Food Industry (The Ministry for Food, Agriculture, Forestry and Fisheries, 2012)

To meet the challenge, Korean government has launched comprehensive plans of informatizing the agricultural society, and they can be divided into two stages. The first comprehensive plan is from 2002 to 2006. To set up the IT infrastructure for rural society in the stage, policies are focused on promoting the knowledge and information by developing the online administrative system (Agrix). By evaluating the performance of the policies, some index has been greatly improved. After the first comprehensive plan by 2006, Korean agricultural sector had made some progress by achieving 69.5% accessibility, 29.1% capabilities, and 36.2% applications (The Ministry for Food, Agriculture, Forestry and Fisheries, 2007).

Greatly increased coverage and accessibility provides a good infrastructure for developing capabilities and applications, while the latter two are relatively low and had potential to grow. The second comprehensive plan for informatizing the agro food industry has been executed from 2007 to 2011. During this period, adopting the IT convergence with agricultural sector has been the major issue by integrating and connecting with Enterprise Architecture (EA). At this stage, although accessibility has continually increased up to 86.2% and some progress has also been made in capabilities and applications, up to 38.2% and 45.0%, respectively, by 2011, there are still great potentials for improving capabilities and applications (The Ministry for Food, Agriculture, Forestry and Fisheries, 2012).

On the other hand, Korean government has also initiated 27 national projects on developing fundamental technologies and applications and 10 on testing and diffusing models of IT convergence in agricultural industry, and some successful cases has been introduced to the public and media. Agro food IT convergence modeling projects have been implemented by both public and private sectors such as bureau, companies, or universities. Public institutes first develop new technologies through R&D and explore new business model, and then they will testify the demonstration project, technology and model (commercialization). After that, the testified project will be diffused throughout the agriculture, forestry and fisheries with investment and financing. Comparatively, private institutes like companies or universities first guarantee the original technologies and realize the technology transfer and commercialization through private finance initiatives so as to enter the market. Despite the progresses that have been made through the two comprehensive plans, the third comprehensive plan for IT convergence with agriculture, forestry and fisheries becomes a must for agro food industry and regional economic development (The Korea Society of Food and Agricultural Information Science, 2010).

### **3 The Vision and Policy Directions for IT Convergence with Food, Agriculture, Forestry and Fisheries**

#### **3.1 Vision**

To set up and design a vision for the new IT convergence, informatization requirements have been collected based on the review of Law on Industrial Convergence and analysis of the policies of IT convergence with other industries. Then, vision, policies, and strategic projects of agro food IT convergence have been derived to effectively deliver the policies of Ministry for Food, Agriculture, Forestry and Fisheries in Korea. The focus of the policies has been greatly changed in the following three areas. First, rather than price, competition, and efficiency, sustainability issues like environment, safety, and recycling structure are more concerned about. Second, production and supply oriented agriculture put more and more emphasis on safety of consumption, quality, and convenience. Third, the pendulum seems to have swung from macro policies toward micro policies. In such an industrial convergence era, the association between industrial policies and science & technology policies should be enhanced to internalize IT artifacts into all the value chains of different industries. Thus, developing competitive business models is the key for survival. From this perspective, we set up the vision as to securely provide safe food to the Korean people and to reinforce the vitality of farming and fishing villages. As for the delivery policies, we proposed the organizational system, infrastructure development & improvement, and promoting and supporting policies by effectively integrating with the Law on Industrial Convergence (See Figure 4). As the strategic projects, we argued that organic cooperation among university, industry, and government (UIG) in agro food industry and praxis-centered model should be developed.

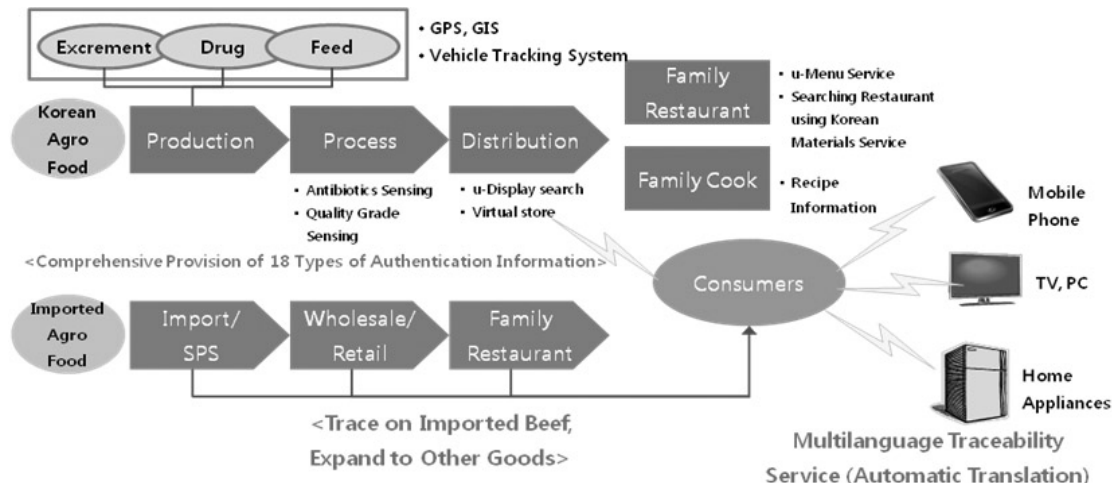


Fig. 5 Strategic Goal of Securing Food Safety and Promoting Korean Agro Food Consumption and Preference

To achieve the strategic goal of securing food safety and promoting Korean agro food consumption and preference, several approaches can be applied in the whole value chains of agro food industry (See Figure 5). With the phenomenally increased diffusion of smart terminals, N Screen service can be provided for consumers to check agro food production & distribution traceability and authentication information in multiple languages anytime and anywhere. Also, the system which can monitor the whole value chains of agricultural and marine products from production to processing to distribution, including import and export process, which can highly develop the quality of digital control of endemic diseases. Further, threatens caused by climate change can be appropriately changed into opportunities by creating good ideas and terminologies. Food mileage which can be attained by multiplying the food’s volume with its moving distance, and the lower food mile-

age represents a more environment friendly local food. Green IT can also be applied to reduce the CO2 emission along with the whole value chains. Expanding Korean agro food export to foreign market has to be supported systematically.

The second goal is to innovate farming and fishing companies and develop their competitiveness (See Figure 6). To achieve that, first, by internalizing IT artifacts into production, process, and distribution process to expand the high precision and intelligence. Second, systematically propagate the need systems to the companies based on different business models to increase the applications. Third, by providing premium information, cropping system and distribution/sale decision making can be highly developed. Fourth, it can contribute to the overseas agricultural development by exporting “Agro Food IT Convergence Service” solutions.

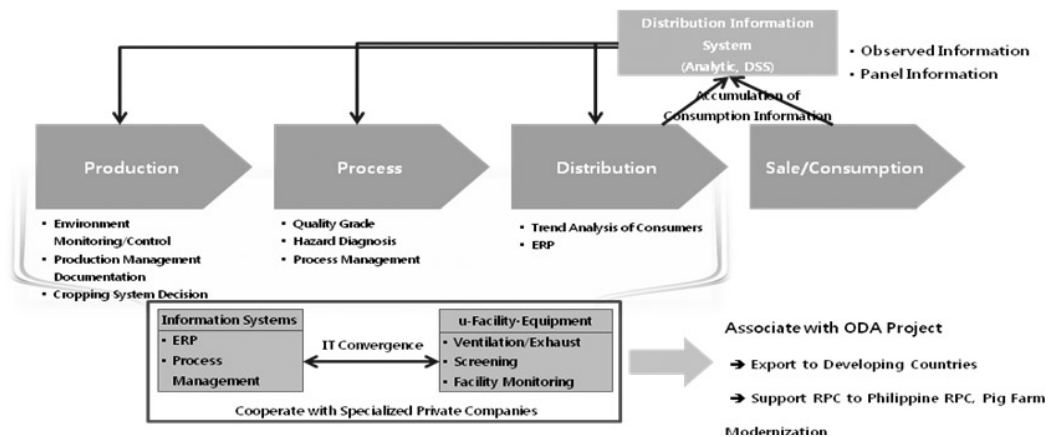


Fig. 6 Strategic Goal of Innovating Farming and Fishing Companies and Develop Their Competitiveness

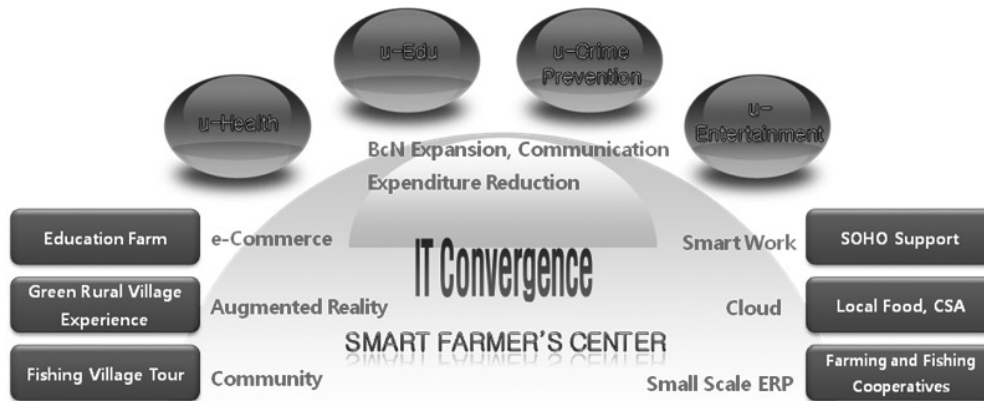


Fig. 7 Strategic Goal of Improving Life Satisfaction of F&F Villages and Developing Regional Economics

The third goal, also an ultimate objective, is to improve life satisfaction of farming & fishing villages and develop regional economics (See Figure 7). Divide between city and village on healthcare, education, culture and crime prevention can be reduced by adopting IT so that increase

life satisfaction of farmers. What’s more, storytelling of farming and fishing villages’ amenity resources, as well as various touching service, can be greatly enhanced. Varieties of rural return business model can also be fully developed through IT convergence.

Table 1 Delivery Policies and Related Policy Projects

3 Delivery Policies	Policy Projects
Establishment of Organizational System (6 Projects)	<ul style="list-style-type: none"> <li>√ Building IT Governance System by Strengthening Agro Food CIO Council</li> <li>√ Systemizing with Focus on Bureau which is in Charge of IT Convergence Execution and Resource Allocation, Management, and Evaluation</li> <li>√ Informatization Project Delivery Organizational System Innovation</li> <li>√ Agro Food IT Convergence Integrated Control Tower Development</li> <li>√ Software-centered Agro Food Investment and Financing Policy Transformation</li> <li>√ Enhancement of Cooperation between Bureau’s to Develop Living Infrastructure for Farming and Fishing Villages</li> </ul>
Infrastructure Development and Improvement (6 Projects)	<ul style="list-style-type: none"> <li>√ Information-based Fundamental Research and Observation, Enhance the Information Infrastructure for Business Analysis</li> <li>√ Promote u-IT-based Convergence Fundamental Technology R&amp;D in Agricultural Universities and Research Institutes</li> <li>√ “IT Convergence Integrated Data Center”</li> <li>√ Field based Research Farm for UIG Cooperation System</li> <li>√ Establishment IT Convergence Technology Standardization and Authentication System</li> <li>√ Cultivation of Farming and Fishing Village Contents related Industry</li> </ul>
Establishment of Applications and Diffusion Models (7 Projects)	<ul style="list-style-type: none"> <li>√ Conducting Informatization Level Research on Agro Food Companies</li> <li>√ IT Convergent Education Farm Development</li> <li>√ Adoption of Authentication System for Private IT Convergence Development Companies</li> <li>√ Delivering Company Informatization with Information-based Consulting and Human Resources Cultivation</li> <li>√ Enhancing the Practice-oriented IT Policy for Cultivating and Supporting Agro Food Companies</li> <li>√ Discovering and Propagate Best Practices and Promote Export of IT Convergent Products</li> <li>√ Leveraging International Regulations such as Emission Reduction Purchase Agreement, Food Mileage</li> </ul>

### 3.2 Policy Directions

To discover highly developed and successful IT convergence models and further propagate them systematically and efficiently, the following three policies should be concomitantly delivered. They are establishment of organizational system, infrastructure development & improvement, and establishment of applications and diffusion models. Table 1 shows us the three delivery policies and list of proposed policy projects to be finished.

To establish an effective organizational system, it is necessary to consolidate information-oriented organization's role as control tower which can plan and manage the whole agro food informatization project. Agro Food CIO Council has been proposed to be the control tower, and it can play a critical role among several institutes, such as Ministry of Agriculture, Food, Forestry and Fisheries, University and Research Institutes, and Rural Corporations & IT software companies. Agro Food CIO Council is mainly composed of experts on collaborations and IT to promote IT convergence project at different institutional levels. Through regular conferences on informatization project and information exchange on the promising project among those different institutes, standardization of convergent technologies and high technologies can be attained to reduce the redundant investment and to use resources more efficiently. As to the efficient management policy of CIO Council, some specific guidelines have been suggested. First, strategic decision making on the project have to be made and delivered by discussions and mutual agreements within the council, while the specific management policies can be customized to the leading subject of the council. Second, institute the specific management policies to share the local needs with the department in charge of and to connect technologies with the delivery policies. Third, improve the important role of Korea Agency of Education, Promotion and Information Service in Food, Agriculture, Forestry and Fisheries (EPIS) as the agro food IT convergence exclusive agency.

On the other hand, building the agro food IT convergence integrated control center is equally important for the establishment of organizational system. To improve the efficiency of the project management, the exclusive informatization projects management/monitoring institute should be established. With the operation of the central data center, it can not only connect distributed systems but also provide data-based high quality service to the rural corporations. The control center has several functions. First, by providing a single integrated management environment for all the IT resources of the corresponding in-

dustry, the control center can play a role of central hub for the connected network. Second, through the commonly shared DB, the control center can provide infrastructure that connects not only both external and internal stakeholders but also rural corporations' IT environment. Finally, the control center can provide many services such as corporations' facility/circumstance control, service monitoring, and process & performance management of related on-going projects.

To deliver the second policy of improving and developing infrastructure, agro food IT convergence research center should be initiated within the university. According to the No. 28 in the Law of Promoting Industrial Convergence, universities specialized in industrial convergence should be designated by the government. In this way, the private collaboration network and capabilities for research and commercialization of universities and research institutes can be greatly enhanced as well. For the innovation of manufacturing process through IT convergence, it is urgent to research and develop the model which can analyze, predict, and control the sensing information.

Besides the research center in university, research farm as the industry-based UIG triple helix collaboration system should be developed. Because of the small scale of IT convergence private software developing companies, they have limited capabilities to develop an integrated system. The superabundance of testing technologies in the field makes them useless even if they have been successfully developed. Thus, we suggest that R&D should be activated by collaborations with private software companies under the direction of IT convergence research institute with specific technology, respectively, and that EPIS can directly promote the initiatives of the research projects and modeling of testing projects.



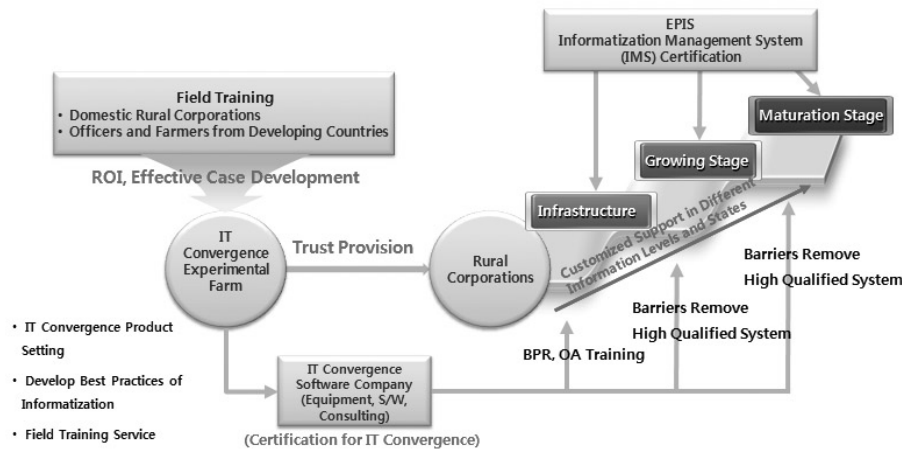


Fig. 8 IT Convergence Applications & Diffusion Model

The third delivery policy is to establish IT convergence applications and diffusion model. Up to now, by adopting the system with high configuration which fails to meet the needs of the corporations, rural corporations have excessive cost for the unsustainable system. Such a result might be caused by the fact that rural corporations cannot get the management consulting service at the priority, and they even don't have the awareness of the necessity for the service. To solve the problem, we proposed the IT convergence applications and diffusion model (See Figure 8). Best practices of informatization can be developed in IT convergence experimental farm, and it can provide rural corporations trust to believe that benchmarking the best practice can help them to achieve competitive advantage. By collaborating with those certified IT convergence software companies, consulting service can be provided at first, and then customized support in different information levels and development stages follows. At all stages, EPIS will provide IMS certifications to control and monitor the IT convergence implementation. In this way, IT convergence best practices can be fully applied and successfully diffused among rural society.

To develop and diffuse successful cases and to promote the agro food export, we suggest the commercialization of the projects of u-Farm with great potential to succeed. Rather than developing new business model, maximizing and upgrading the potentials of the current projects are at the first priority. For those business models which are bound to create value and performance, extra commercialization project can be applied. Secondly, best practices and successful cases can be collected and published in book, and practice manuals for different model commercialization can also be produced. Finally, we can proactively combine agro food IT convergence practice with KOICA's

ODA projects. With the accumulated performance and experiences in farming and fishing informatization, we can help developing countries to build e-Government system and promote farming and fishing companies' informatization projects. In other words, agro food IT convergence practices can create synergy and value when it contribute to the development of agriculture in developing countries.

#### 4 Conclusion

Fundamental transformation occurred on agriculture sector by research and technology has forced Korean government to converge IT into all the aspects of rural society. Although great progress has been made during the first two comprehensive plans for informatization, barriers and challenges still exist. How to converge IT into food, agriculture, forestry and fisheries seamlessly is the key question we have to face and to answer.

This paper first analyzed both inherent transformations of agriculture into agribusiness and macro trends which make it necessary to converge IT into agricultural sector. Then, after describing the status quo of IT convergence with food, agriculture, forestry and fisheries, we proposed the vision and policies for the future agro food IT convergence. Such an effort can contribute all the stakeholders involved in the agro food IT convergence projects by providing both specific guidelines and a visionary blueprint.

However, this research has some limitations by remaining as a descriptive analysis. Future research can be conducted on developing the CSF of IT convergence in different levels like individual farmers, rural corporations, villages, and rural society. Since agro food IT convergence

covers many different disciplines from natural science to socio-economic-political science, multilevel interdisciplinary research methodologies should be applied to tackle more specific interesting research questions. From this perspective, we believe this research provide a good starting point for those future researches.

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