A Web Strategy for Cultural Inheritance Centered on Agriculture Case Study Approach: The Olive Project in Shodoshima Japan

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Abstract. The olive culture in Shodoshima has the 100 years history, yet faces to the crisis when looking at the century ahead. In modern society, it is assumed that there has been a strong link between food culture and two kinds of aspects which consist quality necessary for cultural succession. One is the promotion of target products and the consideration of consumer behavior and quality requirements from consumers. The other is the creation of cultivation recipe which clarifies the method and component necessary for the production of products fulfilling the required quality by consumers. Therefore, we attempted to construct the strategic website for consumer driven food culture extension and to make cultivation recipe by the installation of Field Server in agricultural field and its data utilization. This paper shows the case that adopted the ICT in both consumer-led promotion and agricultural production for passing food culture down the generations.

Keywords: Consumer-led promotion, cultivation recipe, Field Server, olive, food-culture, Shodoshima.

1 Introduction

In Meiji era, Japanese government introduced cultivation of foreign vegetables to Japanese agriculture in order to cope with the increase in food demands resulting from the population growth. In other words, they began assimilating foreign food culture and merging it with Japanese food culture. Olive was first introduced at the time. Foreign vegetables such as cabbage, tomato and onion were well adapted. However, olive was not since olive cultivation purpose was unclear. It was just one part of government policies that nebulously introduce fruits, vegetables and grain from leading countries and adopt crops, which may be helpful for Japanese agriculture, among the options. Hence, olive cultivation could not be focused.

T. Ishida (Ed.): Culture and Computing, LNCS 6259, pp. 200–213, 2010.

After Russo-Japanese War in 1904 to 1905, Japan conquered broad fishing grounds at northern region and huge amount of fish haul of fish and seafood became available. As for the avenue available for storing and transporting the fish and seafood, marinating was adopted. And so, full-scale olive cultivation was implemented under the government in order to fulfill the oil demands. The cultivation was attempted in Mie-Pref., Kagawa-Pref. and Kagoshima-Pref., but only olives grown in Shodoshima Kagawa-Pref. remained due to the environmental conditions and so on.

Thus, the olive cultivation in Shodoshima is the symbolic representation that brings down the changes in Japanese food culture, and also the memorial token that represents a fusion of traditional Japanese and foreign food cultures. Therefore, the inheritance of unique culture in Shodoshima, which is the olive cultivation going on for 100 years is very meaningful and absolutely important.

However, there are tasks that should be implemented for olive culture succession when looking at the century ahead. Figure 1 shows the conceptual diagram for inheritance of food culture. At first, information on Shodoshima and Shodoshima olive should be spread out over a lot of people. For food culture extension, consumer and their demands are important parameters to be taken into account since consumer generated media (CGM) such as blogs and BBS has positive influence on other consumer's behavior. In addition, products should meet the strong quality requirements from consumers in order to popularize the product even when the time changes. Along with that, production of primary products with the required quality becomes necessary, yet there are issues in agriculture. For instance, the persons engaged in agriculture decreased rapidly from 14.54 million to 2.98 million in past 50 years [1], and there were over 60 % of the persons aged over 65 in 2008 [1]. Moreover, there are a lot of quality requirements and regulations that should be satisfied shown in Figure 2, and primary food production has become difficult due to unstable and varying climate. Therefore, cultivation recipe that clarifies methods and components for primary products with required quality level is significant.

However, the question remains: how to satisfy these requirements? The development of modern technology in recent years enables to answer the question, and that is the introduction of information and communication technology (ICT) to each field. The construction of a website assists the extension since the number of internet users has been increasing [2], and the introduction of an IT device in cultivation enables the collecting essential data for the production. As just described, the introduction of ICT makes different aspects overlap each other and creates common gateway leading to the solution. In fact, ICT has been introduced into a lot of different fields such as culture and tourism [3] [4], education [5] and agriculture.

In 2008, Shodoshima marked its 100th anniversary for olive grass establishment and the "Olive Food Industry Board" was established for the purpose of the regional improvement of Shodoshima centered on olives. Mie University Japan helped establish the board with AEON RETAIL Co., Ltd. and they have implemented the supportive approach for the inheritance of regional food-culture and the cultivation by the use of IT device.

Therefore, the aims of this study were the construction of website enabling consumer driven food culture extension and making olive cultivation recipe for cultural succession necessary for relaying olive culture to future generations.

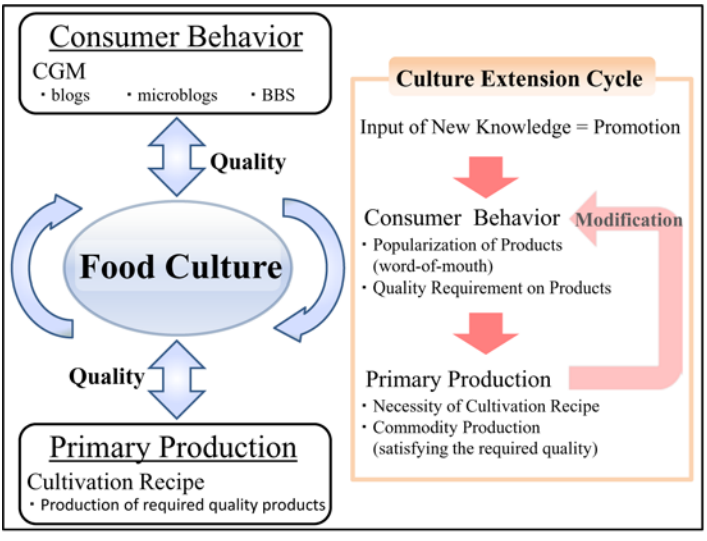

Fig. 1. Conceptual Diagram for Food-Culture Inheritance

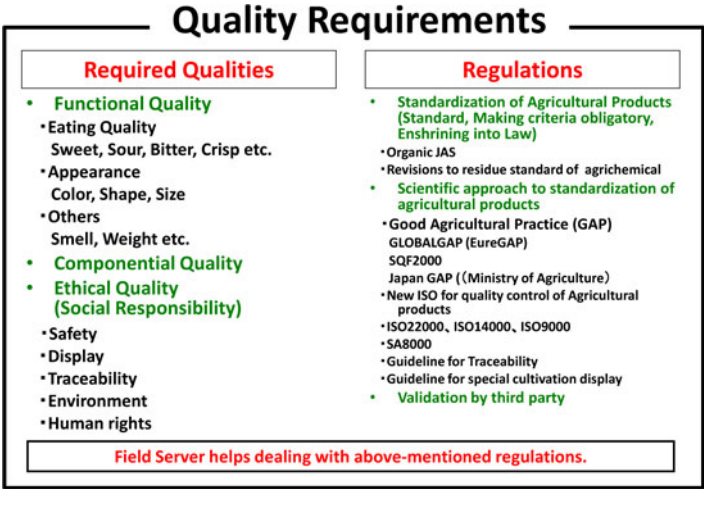

Fig. 2. Quality requirements for food production in modern society

2 ICT Application for Olive Culture Promotion

There is a fact that inheritance of olive culture was carried out since olive has been cultivated for 100 years in Shodoshima. However, in the world changing from day to day, cultural succession cannot be expected when looking ahead to the next 100 years.

For instance, olive growing area and the amount of crop decreased rapidly in past 50 years [6] [7]. Therefore, It is absolutely necessary to consider "quality" consisting of two aspects for inheritance of food culture. One is the quality of products required by consumers. The consumption behavior of modern customers can be expressed as AIDEES, which is the abbreviation for Attention Interest Desire Experience Enthusiasm Share, and the adoption of Consumer Generated Media (CGM) such as blogs and BBS when considering popularization and edification of products as a part of conserving culture is indispensable for the system that cognizes the customer demanding quality varying across the ages. Moreover, the structure that stimulates their shopping behavior by correct understandings and knowledge providing through education and experience will also be requisite.

The other is the satisfaction of the strong quality requirement on primary products. Today, when issues of food mislabeling and residual pesticide are often on mass media, there have been increasing in the number of integrants making up the quality that fulfill the requirements by modern society on primary products. Moreover, even the cultivation of crop itself is becoming difficult due to the unstable climatic change. Therefore, the informatization of the integrants and method for primary products satisfying the required quality level is essential. Furthermore, olive and olive cultivation in Shodoshima will not disappear if passing the integrants and methods down the generations.

Just like CGM mentioned earlier as the example, the informatization, information conservation and management of quality consisted of above-mentioned two aspects are becoming impossible without using ICT in an increasingly complex world. Therefore, as the tactics for relaying olive culture to next 100 years, we attempted to construct the structures fulfilling the quality required by each aspect by website and ICT devices.

2.1 Consumer Driven Food Culture Extension

Regarding the popularization of the olive and its food culture, the consumer behavior and the perception of food quality are major parameters to be taken into account [8]. On top of this, the consideration of a marketing strategy is imperative. With the advent of the internet era, internet communication tools such as blogs, microblogs such as Twitter, social networking service (SNS) and bulletin board system (BBS) have appeared and AIDEES that is the marketing model to adequately apprehend consumption behavior of consumers in modern society was advocated in 2006. This model refers to the process of the behavior that customers detect products, have interests, conceive buying motivation, purchase and experience, become wildly enthusiastic fans, and encourage others through their experiences. And the recent scientific research on the social relationship between word-of-mouth (WOM) senders and receivers showed that the information transmitted by customers has positive influence on consumption behavior of other customers [9]. Therefore, providing CGM, which is the website becoming the new media by compiling a database of transmitted information, makes a huge contribution to acquire consumer needs and prevalence of food culture. Additionally, nowadays, when everyone is able to provide information on the web, provision of precise and reliable information and knowledge on food and food culture, and the education to younger generations are critical prerequisites.

Therefore, the webpage development to construct a strategic website fulfilling the requirements as previously stated was implemented. In this regard, following four points were considered. The points are; (1) website design for olive extension, (2) the selection of target website audience and human interface, (3) the approaches to Web2.0 and (4) the linkage between the website and the database.

2.2 Making Olive Cultivation Recipe for Cultural Succession

As for passing olives down the generations in Shodoshima, what becomes important and should be considered is “quality” of products. Nowadays, there are a lot of integrants that makes product’s quality as is shown in Figure 2. Each integrants should be fulfilled. Otherwise, products are replaced by foreign products of the same kind and therefore the culture would be lost. Thus, the satisfaction of demanded quality in the modern world is the key. However, questions are rising when considering the demanded quality. How to do it? What can be the tool? This is when ICT comes on stage. The powers of ICT are informatization, information conservation and management, and so on. Therefore, the informatization of the components and methods for producing the products that satisfy the demanded quality and passing on the components and methods to the next generation by the beneficial use of ICT are the possible answer. To put it plainly, it means the development of "cultivation recipe", which is similar to recipes in cooking. Thus, the development of cultivation recipes and passing it down from generation to generation will be the essence for cultural succession, and the acquisition and the improvement of required quality level of primary products lead to the improvement of processed foods and to the contribution of inheritance of food culture. In addition, under increasingly complex conditions and in the world, achievement of the goal cannot be expected without using ICT.

Approach to Cultivation Recipe. As for developing a cultivation recipe, it should deal with variety of requisites as is mentioned, and they are the stable production under unstable and varying climate such as global warming, floods and droughts, sustainability which means it has low impacts on environment and energy consumption, cultivation of high quality and functionality products which contain high nutrition and good taste, and food safety and reliability. This means that the paradigm shift from maximization implemented in 20^{th} century, which is the non-sustainable agriculture based on chemistry and engineering, to the optimization is indispensable for the cultivation recipe and cultural succession.

With regard to the optimization, ICT helps the optimization in many aspects. First of all, it enables cost reduction and competitive agriculture. It means optimal farm planning and efficient management of large number of fields are possible. Secondly, robust and stable farm production under extreme weather and global warming can be implemented in next 100 years. Next, sustainable agriculture by optimal agrochemical application is also possible. Fourthly, food safety and reliability by monitoring cultivation and tracing farming records can be gained. Lastly, visualization of quality by image analysis and data analysis will make it possible to produce high quality products. However, in order to achieve the goal mentioned above, four approaches should be carried out. One is that data collection to know what is happening in each

field quantitatively is imperative. Second one is the efficient knowledge transfer. Most of often, long term experience and intuition are required for cultivation. Therefore, quantifying invisible empirical knowledge and transferring tacit knowledge to explicit knowledge are absolutely necessary. And also the case base reasoning is significant. Third one is the optimization and risk management to support making decision during cultivation based on acquired data and knowledge. Last one is the framework to support decision making. Thus, in agricultural field, the construction of ICT-aided cultivation support system that enables collecting local data becomes important.

Field Server for Environmental Information Monitoring. In relation to the construction, there is a strategic device called Field Server (FS). Figure 3 shows a Field Server developed for a long-term monitoring in a field [10] [11] [12] [13]. As it can be seen in the figure, various kinds of data such as ambient temperature, relative humidity, amount of insolation and soil moisture can be acquired as well as growth situation imageries by its onboard network camera. In addition, other environmental data such as carbon dioxide can also be acquired if the sensor is attached to the Field Server. Those data can be collected from remote locations by the use of wireless LAN.

In this study, we have considered the utilization of data acquiring at two locations taking modern-day farm conditions into account. One is the internet-enabled site, which is online site. The other is where internet connection is not available, which is offline site. The types of data we have acquired includes ambient temperature, relative humidity, amount of solar radiation, soil temperature and soil moisture as growth situation data as well as images focusing on olive tree, fruits and trunk near ground. Figure 4 shows the schematic diagram of field monitoring system introduced in Shodoshima. As is mentioned above, data can be collected via internet at online site. However at offline site, data is stored at the data storage of the Field Server. And then, it is manually collected and transported regularly to the data storage at online site. After that, it is collected via internet to the data server at the computer center for

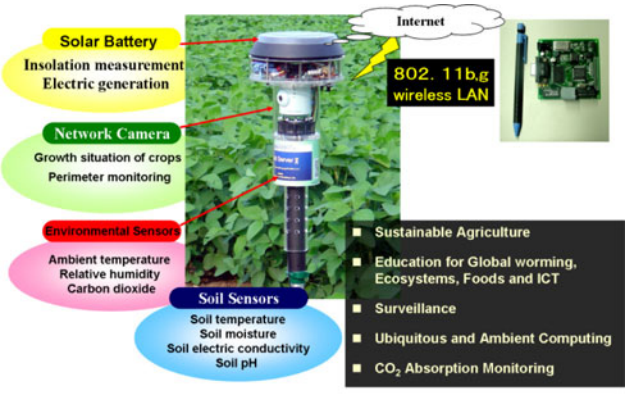

Fig. 3. Field Server and the acquirable data

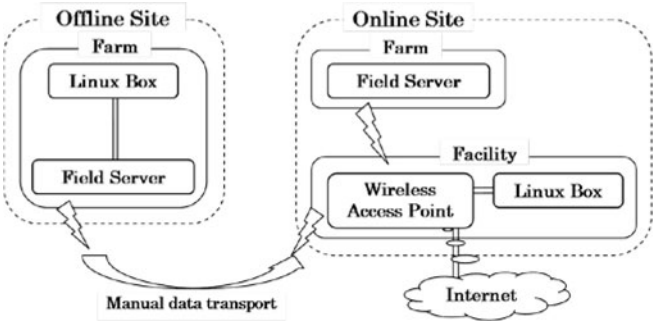

Fig. 4. The schematic diagram of field monitoring system introduced in Shodoshima (Motonaga et al. 2008)

Agriculture, Forestry and Fisheries Research. Finally, it is stored and managed by the data server at the computer center. Motonaga et al. [14] constructed the above-described storage and management system. Therefore, the strategies of Field Server for this study consist of two parts as the part of developing the cultivation recipe. One is "the measurement and control by Field Server software on the web", and the other is "Image utilization and application on Field Server images". In addition, in the case when immediacy is necessary, the data at the online site was used. If it is not necessary, the data at the computer center was utilized.

3 Results and Discussion

3.1 Consumer Driven Food Culture Extension

The construction of webpage for consumer driven food culture extension was implemented with the consideration of four points as is mentioned. In this section, results are presented and current problems and tasks will be discussed.

Website design for olive extension. In order to spread out information and provide precise and reliable knowledge on Shodoshima and their olive culture, the enhancement in both amount and quality of information should be considered to gain more of the user attention. Therefore, the project website was constructed with six contents that are project summary, Agriculture and Environment, food and culture, tourism, Education and English, and most of the sources of information were cited as proof. In food and culture section, we have prepared cultural contents of Shodoshima olives such as history, tradition and centenary celebration being held, and contents relating to olives as cuisine culture such as olive oil, health effect of olive oil, and a broacher of unique cooking using olive oil that consumers are able to meet only at Shodoshima.

The selection of target website audience & human interface. It is significant to consider the selection of intended website audience and human interface in order to convey information easier, make more users to visit the website and preserving the

traditions and cultures of Shodoshima olives. Therefore, farmers, children and general users were selected as the target according to our project objective.

With regards to human interface, reconsideration of information expression was implemented. For instance, the display of numerical data from sensors for farmers was redesigned. The redesignation includes the translation of language from English to Japanese since a lot of farmers cannot understand English, and the elimination of data which does not mean anything to farmers in terms of avoiding any confusion. In addition, various kinds of information expression were adopted such as movies and a quiz game created by macromedia flash. Figure 5 shows the example of information expression. Left hand side of the figure is the flash content that enables give information visually to users and it presents the footstep of Shodoshima olive in the last 100 years. Right hand side of the figure shows one of the educational contents created for children. It is necessary to consider the way of gaining parents and children's attentions and the way of providing enjoyable contents. Therefore, we have created the quiz game, flash contents presenting the process from olives to olive oil and growing stage of olive.

Fig. 5. The example of information expressions. (a) The flash content presenting the footstep of Shodoshima olive in the past 100 years, (b) The quiz game for children as a part of education.

The approaches to Web2.0. Web2.0 [15] refers to the new generation of web based services and communities characterised by participation, collaboration and sharing information among users online such as YouTube, Amazon, Twitter, blogs and BBS, and social networking services[16]. It can be said that the benefit of the adoption of Web2.0 is not only for upvaluing the website, but also for providing a place to internet users for intelligence sharing and information exchange. Therefore, the applications such as blogs and BBS representing web2.0 are absolutely needed as the web and marketing strategies leading to acquiring consumer's needs for the required quality, the popularization of products, and to improve and assist creating a cultivation recipe, and so to the succession of olive culture. However, in this study, only two approaches were carried out. One is mobile phone contents for farmers that they can send a text and an image to the web and alert system if there is a problem at working site was adopted. The other is the map contents. For general users and

children, some map contents made by the use of Google map were constructed in order to give users rich experience of information handling, to spread out the location of Shodoshima, and to educate children. Thus, these approaches showed advancement of project as the first step, yet more are necessary.

The linkage between the website and the database. With regard to the informatization, it is obvious that the construction of data base, the information storage and management system, and the collaboration between stored information and the latest information on the web will make it possible to create and provide new media to customers and will be very effective from the standpoint of consumer. From the perspective on cultivation on the other hand, databases and the collaboration will contribute to pinpoint the components and the method necessary for the production of products with required quality. Therefore in this study, the precious contents created for the 100th anniversary as the footmark for next 100 years were stored at a server. With regard to the cultivation, data acquired from Field Servers were accumulated and stored at a data server. And also, we have arranged the structure that enables to store the texts and images transmitted by on-site farmers by mobile phones.

Towards the application to CGM & WOM. With regards to the popularization of olive culture, the website was introduced by some mass media [17] and it has been spread via links and blogs on the outside of our website. However, it has become clear that there are urgent and crucial concerns. That is the lack of user generated contents (UGC) such as blogs and BBS. The installation of blogs or BBS enables information transmission, exchange, sharing, and most importantly correction by their feedback function. In other words, it enables information control and management. Moreover, it is also possible to acquire consumer demands. However, on our current version of website, there is no way to correct or stop information even if the information that has bad influence on the extension of food was put on other websites. Therefore, more of the approaches for providing CGM are urgent needs and must. The approaches include the adoption of UGC in order to gain more of the user access, to transmit correct information, and to provide a virtual place for better information exchange and intelligence sharing to users regarding to the acquisition of consumer demands, the satisfaction of required quality and the improvement of products. In addition, a database is necessary for CGM. Therefore, the construction of database should be carried out in parallel with the CGM installation.

3.2 Making Olive Cultivation Recipe for Cultural Succession

The development of the web application enabling the measurement and control as well as utilization and application of images acquired by Field Servers were carried out to support fulfilling the strong quality requirements of primary products. In this section, the results will be presented with the related figures and discussed various issues and tasks for creating cultivation recipe.

The measurement and control by Field Server software on the web. Figure 6(a) shows the webpage displaying the latest images and data acquired from sensors. This page was designed to monitor an agricultural field and an olive tree. Therefore, the access to the data storage at online site was carried out due to the necessity of the

immediacy. As it can be seen in the figure, the thumbnail of images configured on the network camera is displayed. When clicking the buttons just under the small images, larger image can be displayed at the field next to the thumbnail. In addition, when clicking a small image by itself, much larger image is displayed on a new window of web browser.

The graph of data acquired from sensors is shown in Figure 6(b). As it can be seen in the figure, the ComboBox that enables users select year and month, and day, was adopted to refer past data. In addition, for farmers to compare their selecting data with Shodoshima's past mean temperature, the mean temperature of selected month can be automatically displayed. For the mean temperature, the data from 1979 to 2000 were used.

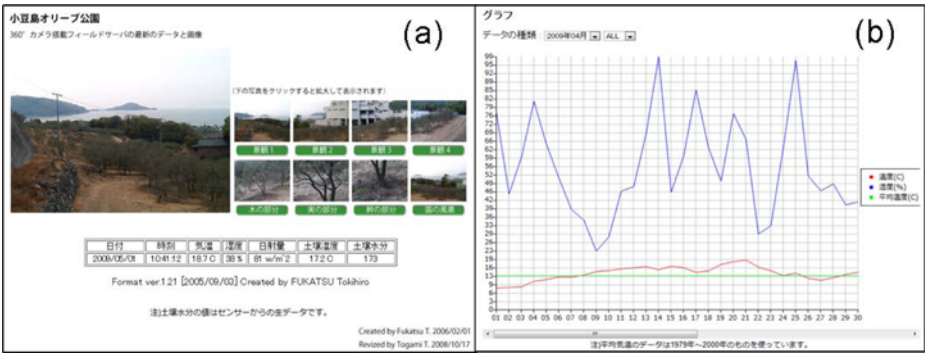

Fig. 6. (a) The web page displaying the latest images and data acquired from sensors. (b) The graphs of data acquired from sensors.

We have arranged the past numerical data for farmers to draw upon the data for decision making in cultivation management shown in Figure 7(a). From the information utilization point of view, we have designed the page that allows users download their selecting data in CSV format so that users can use the data on other application software and analyze. The reason for the adoption of the data format is because it has broad utility, which means a lot of software supports the format.

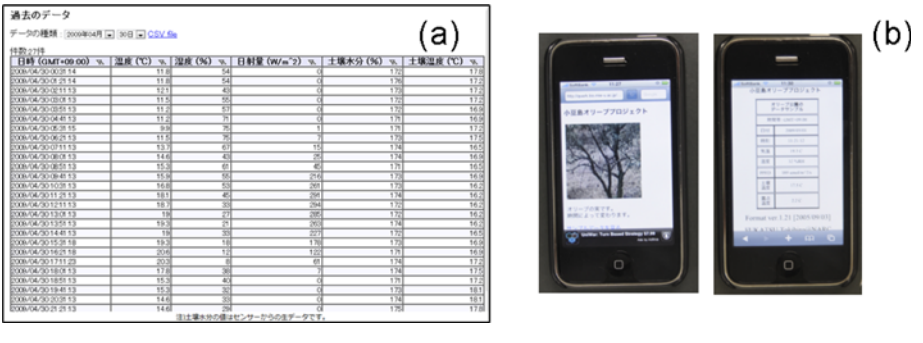

Fig. 7. (a) The past data reference and download in CSV format. (b) The latest image and sensed data displayed on a mobile phone.

The latest image and sensed data could successfully be displayed on a mobile phone shown in Figure 7(b). The posting and mailing system were also adopted so that users can send a text and an image to the web while working at a field and they can send an alert to all the registered users if there is a critical situation. Therefore, it can be said that the construction of mobile contents, posting and mailing system have created more flexibilities in monitoring and cultivation management for farmers.

Image utilization and application on Field Server images. Figure 8 shows the conceptual diagram for the utilization of Field Server images. As is shown, by the figure, the images can be utilized by three ways that are the image combination, archives, and real-time images. In this study, the image utilization by the image combination and archives has been attempted.

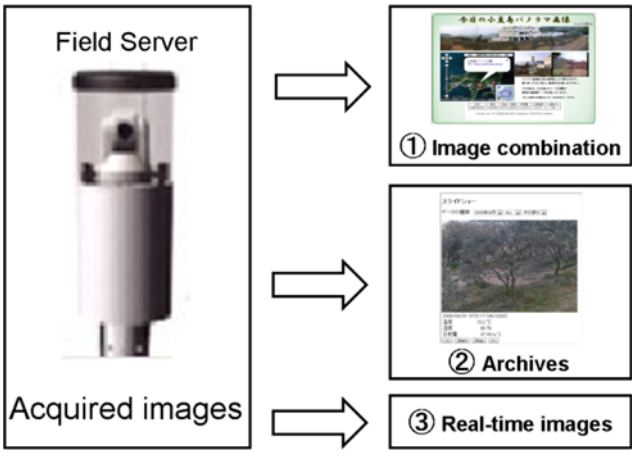

Fig. 8. The conceptual diagram: The utilization of FS images

The example of the image utilization by an image combination is shown in Figure 9(a). The panoramic image on the top of the figure was created by the combination of acquired images from the support system. In this study, interesting approach to urge user's understandings of significance of scientific cultivation technology was implemented. The images have been used not only for the purpose of monitoring an agricultural field and olives, but also for providing an opportunity to users to meet the data acquired by the system. And so the map and sensed data were adopted on the page.

Figure 9(b) and 9(c) are the examples of image utilization by archives. The images were used for the reference of past growth situation of an olive tree shown in the Figure 9(b). As for the reference and cultivation support, the field information such as ambient temperature, relative humidity and amount of solar radiation were displayed with the image. On the other hand, stored images were put in chronological order and used for the creation of the educational content that presents the growing stages of an olive.

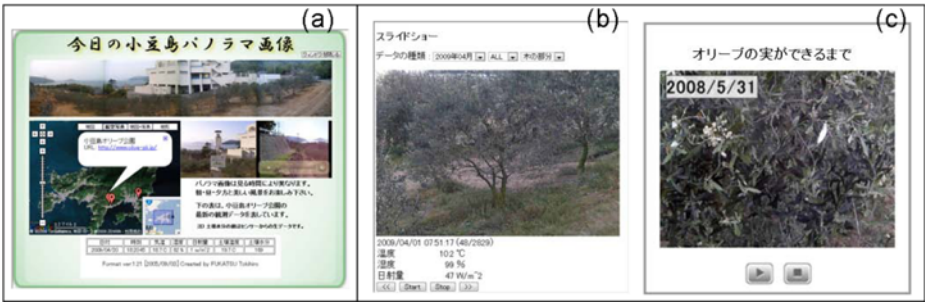

Fig. 9. (a) The example of an image combination (Panoramic image). (b) The example of image utilization by archives: the reference of past growth situation. (c) The image utilization by archives: the educational content.

For the creation of cultivation recipe. It became clear that there had been data precision problems on Field Server when developing the web application. Hence, only data acquired by sensors were put on the Web. However the data acquisition and utilization of information related to agricultural crops and growth environment information from a cultivation perspective are very important to keep a stable cultivation and obtain the quality of products, and also to improve the productivity. For that reason, the data preparation for data analysis on cultivation is absolutely necessary and the data includes accumulated temperature, accumulated amount of solar radiation, amount of rainfall and mean temperature. In addition to the data, the stabilization of data precision by the parallel use of our cultivation support system and Automated Meteorological Data Acquisition System will also be necessary. Moreover, web application that equip the mathematical model for the estimation of growing stages such as the time of bloom based on cultivation index are very much needed at cultivation sites, and it should be user-friendly especially for farmers to handle data for operation.

With regards to image utilization and application on Field Server images, it has been affirmed that images are valuable as information. However, it has become clear that the current system has difficulties in data handling of imageries such as processing for secondary contents and sorting out images. In addition**,** website design that allows users easier operation should be reconsidered since it has still some difficulties for farmers to use the website for decision making during cultivation.

Thus, web application that possesses cultivation recipe and function of guidance visually for better cultivation will be necessary. This means “Guideware” is necessary. In addition, Cultivation guidance and registration that specify cultivation period, cultivation method, picking season, nutrition and health effect will be necessary for consumers.

4 Conclusion

In this study, we showed the case study approach that adopts ICT for the promotion of food culture extension, and the creation of cultivation recipe in agriculture. We

attempted to construct the strategic and integrative website along with the adoption of CGM, but the approaches to CGM is the action assignment and urgent. Furthermore, the construction of databases is imperative in regards to the provision of CGM. In relation to CGM and databases, they should be adopted in agricultural sector to satisfy and improve the quality required on primary products, and to bring the cultivation recipe mentioned in earlier section to the next generation. From making the recipe point of view, the utilization of data acquired by Field Servers was implemented as the first step. In the future, the preparation of the data acquisition system with the cultivation perspective and data which will become major factors of the recipe such as accumulated temperature and accumulated amount of solar radiation are must. In addition, more of the efforts on quantifying invisible empirical knowledge and transferring tacit knowledge to explicit knowledge are very much needed since the aging of the persons engaged in agriculture has been becoming even more serious issue. At that time, the development of a faked object that can be criterial by touching the object will be necessary since meaningful data acquisition by ICT in everything is almost impossible. In other words, apprehending the human as a sensor and implementation of the informatization will be significant.

As the next step, the website with blogs will definitely need to be merged with cultivation recipe and made them into one and small packet as the guideware mentioned in earlier section in order to satisfy strong quality requirements and better cultivation.

Finally, we focused on a virtual experience in this case study, yet an actual experience for consumers such as farming experience for primary productions and food processing for secondary products will be necessary. It means putting consumers through farm works such as pruning and ingathering throughout a period of time, and through food processing such as olive extraction. This will surely generate a synergistic effect between virtual and actual world and more of the outcome of food culture extension can be expected.

The URL for the official website for Shodoshima olive project is shown below.
http://www.quark.bio.mie-u.ac.jp/olive/en/index_en.html

Acknowledgement. We would like to express our sincere gratitude to Dr. Masayuki HIRAFUJI, Dr. Tokihiro FUKATSU and Mr. Takuji KIURA who have contributed to this project.

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