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Enhancement of Education in Farm and Food Industry With Adoption of Computer-Based Information Systems

[1]Z. Raftani Amiri, [2]Pratima Khandelwal and [3]Navid Sahebjamnia
[1]Department of Food Science and Technology, Mazandaran University, Sari, Iran
[2]PG Department of Biotechnology, Brindavan College, Bangalore University, Bangalore, India
[3]Young Researchers Club, Islamic Azad University, Babol Branch, Iran

Abstract: This study describes an information system to enhance farm and food industry. The model involves using electronic technology to collect a large amount of data from distributed farm industries. Major issues in the implementation of this model include interpreting the huge amount of data collected with different quality attributes. In this study, we developed a structured profile for higher agriculture education to distinguish the quality profile of food industries based on agricultural product attributes. The producer currently measures process key parameter and performance to improve quality of production. This information system manipulates those data to explore the optimum quality profile. This model is being able to propose sound strategies for variability management in farm and food industries.

Key words: Farm; food industries, information system, quality profile, agricultural education

INTRODUCTION

An adequate information supply together with land, labor, capital and management is required for a successful agricultural business. Information management may become easier, timelier and generally provide greater value through computerized information system use (Amponsah, 1995; Thapa and Murayama, 2008; Perini and Susi, 2004; Fountas *et al*., 2006; Saroinsong *et al*., 2007; Murakami *et al*., 2006; Marvin *et al*., 2007). However, encouraging farmers to change their information management has not been as straight forward and as easy as expected. For instance, farmers have shown a low rate of management software adoption and its effective use relative to farmers' adoption behaviour of technical innovations.

While the penetration of computer technology into farm and food industries is quite extensive in some countries, but the use of information system, as a key component in a agricultural education, is not as extensive as might is be expected.

Since, the farmer is usually an essential component of the farm information system, the choice of information technology is an individualistic process that is usually governed by the farmers' characteristics, such as personality, experience, age, education and goals. These features are highly personal features, so, there may be a considerable variation in the choice of the information technology and system configuration among farmers.

Past researches have identified factors believed to operate as software adoption barriers. In these studies, some refer to management information systems in a broad sense, while other studies focus on Decision Support Systems (DSS) (Cox, 1996; Hoskinson *et al*., 2007; Santé and Crecente, 2007; Perini and Susi, 2004). The main barrier is the failure of developers to address the real problem.

Other problems include the complexity in design and presentation of DSS and the difficulty in assessing the largely intangible benefits of information system improvements. If a clear perception of the economic benefit derived from software were available, this would be a major contributor to encouraging farmers' adoption.

The lack of integration among the different components of many information systems is another problem. Pre computerized information systems were usually automatically integrated within the farmers' mind. Finally, it is obvious that for the use of computerized information systems, a certain level of computer literacy is required. While this restriction appeared to be significant at the beginning of the 1990s, it is now less relevant given the current trend in computer uptake. However, especially for developing agricultures, this barrier still exists. However, on the more positive side, the factors identified as being associated with on-farm computer adoption have been business size, education and age. A positive correlation between farm size and computer uptake was found in almost all reviewed studies.

Corresponding Author: Z. Raftani Amiri, Department of Food Science and Technology, Mazandaran University, Sari, Iran

Similarly, a positive correlation between the farmers' education level and computer adoption was also found in the majority of reviewed studies. Farmer age was the third factor reported to be correlated with computer uptake. The younger the farmer, the more likely was computer adoption. That is, young, better educated farmers operating larger farms are likely to represent the future expansion of the industry and these are the farmers most likely to adopt computers. It has also been found that farmers who owned an off-farm business were more likely to adopt a computer. Other studies have found a positive relationship if farmers have off-farm employment. Off-farm employment is thought to expose farmers to new technologies, to broaden their perspective on management and to increase their willingness to adopt computers.

In addition, those farmers who previously applied formal approaches to record keeping and who used off-farm services were more likely to adopt a computer. Also, off-farm employment may expose farmers to new technologies and broaden their management perspectives resulting in greater adoption and use.

While computer uptake is a pre-condition, an important issue is whether farmers using a computer believe that they have improved their information management. Several of the reviewed studies addressed this issue (Amponsah, 1995; Agostinho *et al*., 2008; Ramírez-Rosado *et al*., 2008; Fang and He, 2008; Alvarez and Nuthall, 2005). Earlier research concluded that managers' perceptions of system performance (system usefulness) were significantly correlated with actual information system use and presumably, with system value. These studies have tested associations between farmers' opinions of system usefulness and similar factors used to explain computer uptake, such as farm and farmers' characteristics (Amponsah, 1995; Agostinho *et al*., 2007; Ramírez-Rosado *et al*., 2008; Fang and He, 2008; Alvarez and Nuthall, 2005). However, other factors that may be related to system development were not included. Undoubtedly, the studies reviewed have helped in understanding farmers' computer behavior.

Competition between different interests for the same land should be resolved through selection of the most appropriate land-use. There are three main aspects that need to be taken into account when planning for sustainable use of land resources: environmental, economic and societal. In difficult scenarios where there are complex decision-making considerations and a variety of goals that are sometimes conflicting, the use of a multi-criteria analytical approach can be beneficial. Multi-criteria analysis is a methodology by which the relative merits of different options can be compared using a range of quantitative and qualitative criteria. The approach thus can help evaluate transparently a variety of land-use options according to a variety of criteria that are measurable and form an assessable basis for decision-making. When planning occurs from the standpoint of a multi-criteria analytical approach seeking the sustainable use of land resources in an agricultural landscape, the objective is to identify land uses that are ecologically friendly, efficient and profitable, are accepted by society and meet social needs. In this study, the objective is to design a new quality control system for food products. This quality control system receives the required information from different products by an e-based real time system. Next section presents the description of the proposed real time quality control information system.

E-BASED REAL TIME QUALITY CONTROL INFORMATION SYSTEM

Here, the e-based real time quality control information system for food industry product has been provided. According to the widespread domain of e-base information system in recent years the model could manage the cycle of final food industry product from farm to customers in market. In this model three interfaces (1) for the farmers in their farm, (2) for the food industries in their industry and (3) for the customers of the market has been designed. Based on the domain of the implementation, we can use global or local network. The farmers interface includes the new knack of the farmers and agriculture researchers, the standard of raw products and personal page for each farm. In the personal page, each type of product and some attributes for each of them have been provided that the farmers should fill the specifications of their raw products and the quality value of each attributes on products. The information transfers to the data base and stored for analysis and compared with other farms.

In the food industries, the quality of the raw material has been checked. The specialist of the quality in the food industries by login in the food industries interface fill the quality value of the products on each attribute.

One of the most important part of the system is gathered, the information from customers whom consume the final products. The customers could propose their idea about food products by connecting to the network. Customer interface has been designed to collect the quality value of the attributes that proposed by the consumers and saved in the corresponding data base. e-based real time quality control information system model has been shown in Fig. 1.

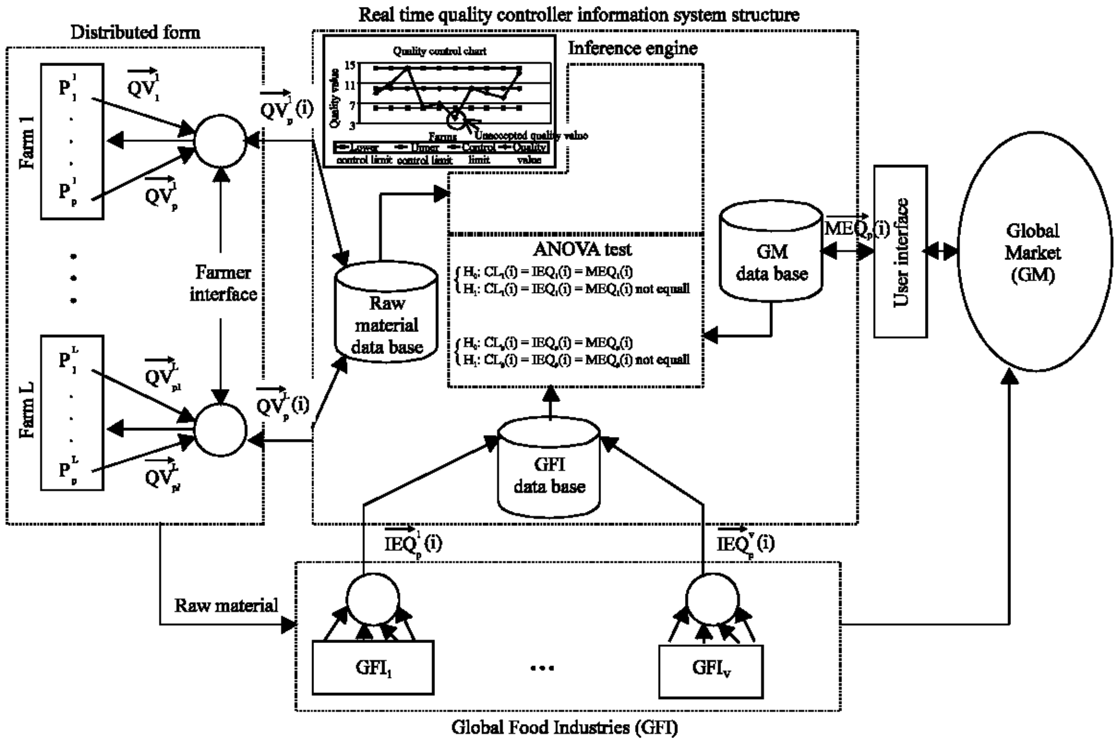

Fig. 1: E-based real time quality control information system model

Notations:

QV_{ij}^{l}	:	Quality value of raw material j from location l on attributes i
P_{j}^{l}	:	Raw material j from location l
m	:	The No. of attributes
p_p	:	The No. of raw material of farm p $\overrightarrow{QV}_{j}^{l} = (QV_{1j}^{l}, QV_{2j}^{l}, ...QV_{mj}^{l})$
IEQ_{p}^{v} (i)	:	Food industry (v) expect quality attribute i of product p
IEQ_{p} (i)	:	Market expect quality attribute i of product p

Model definition: The computer based information system has been designed to evaluate and to improve the quality of the raw material which has been produced in distributed land against the global market and food industries expectation. Thereby, an integrated data base with real time controller could help the farmers at 3 stages such (a) producing qualified raw materials, (b) preparing the raw materials in food industries and (c) the customers needs in global market.

In the proposed approach L lands have been considered, where in each of them p raw material has been produced. P_{j}^{l} Means, raw material j is produced in location l. For each raw material m attribute was considered. $QV_{j}^{l}(m)$ means that the quality value of the raw material j from location l on attribute m. In each location vector $\overrightarrow{QV}_{j}^{l} = (QV_{j}^{l}(1), QV_{j}^{l}(2), ...QV_{j}^{l}(m))$ has been defined that consist of the quality value of m attribute on each P_{j}^{l}. All the information has been collected from different locations and transfer to the central data base.

To provide the food industry expectation and needs, the system gathered similar information from each plant. Generally in the food industries the raw material has been tested from special quality stand point before going to the cycle of production. The food specialists investigate the raw material and announce the quality of the raw material and their accepted quality level which has been called Industries Expected Quality (IEQ). IEQ_{p}^{v} (i) means that food industry (v) expects quality on attribute i and for each product vector IEQ has been defined as $\overrightarrow{IEQ}_{p}^{v} = (IEQ_{p}^{v}(1), IEQ_{p}^{v}(2), ...IEQ_{p}^{v}(m))$. This value of quality on each attribute i of raw material p have been collected and transferred to the designed information system too.

Moreover, after the procedure of the producing in the food industry was completed and the final products will be transferred to the global market by the designed user interface based on the web application Hyper Text Markup Language (HTML), the sight of the customers about each product was collected. In the user interface some information about raw materials and procedure of producing in the food industries are provided. After recognizing the whole procedure of preparing final product for the customers, they would propose their idea about raw material and production methodology. The customer's idea has been transferred to the data base as a vector $\overrightarrow{MEQ}_p = (MEQ^1_p(i), MEQ^2_p(i), ...MEQ^G_p(i))$.

Quality attributes control for each attribute of raw materials all over the farms: After collecting the quality value from the sources, the means of quality value (control limit of the quality value) for each attribute of the raw material will be calculated by Eq. 1.

$$CL_p(i) = \frac{\sum_{l=1}^{L} QV^l_p(i)}{L} \qquad \forall p,i \tag{1}$$

From Eq. 1 the lower and upper control limits will be obtained as Eq. 2 and 3.

$$LCL_p(i) = CL_p(i) - \sigma_p(i) \tag{2}$$

$$UCL_p(i) = CL_p(i) + \sigma_p(i) \tag{3}$$

where, $\sigma_p(i)$ are derived from process standard deviation for all over of the locations (estimated according to sample data).

After obtaining the quality control limit $\lfloor LCL_p(i), CL_p(i), UCL_p(i) \rfloor$ in the inference section of the designed system it is comprised with quality value $QV^l_j(i)$ of each farm. We expect that the amount of the $QV^l_j(i)$ is between lower and upper bound of the control limits for each location, otherwise the attribute system of the product which is out of the control limits will be specified and it would be announced to that location that its product quality is not as same as the producer in other places from attribute view point. The quality control chart has been shown in Fig. 2. The farmers can refer to this system and identify the innovations in other places to achieve better quality of the products. After investigating the quality of the products among the primary farmers, it is proposed to compare the qualitative requirements of the farmers and the customers that consume the products in different places.

Quality attributes control for each attribute between farmers, industries and food markets: Here, another aspect of the proposed system has been considered. After smoothing the quality of raw material between farmers, now the differential between $IEQ_p(i)$, $MEQ_p(i)$ and $CL_p(i)$ should be minimized. We expect these values to be equal or near equal. So, in the other section of the inference engine by ANOVA test approach, we investigate the equality of the parameters.

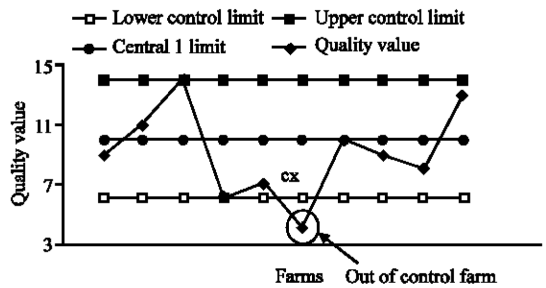

Fig. 2: Quality control chart of different attributes of farm products

We find the expected quality value of the food industry and markets by considering Eq. 4 and 5, respectively.

$$IEQ_p(i) = \frac{\sum_{v=1}^{V} IEQ^v_p(i)}{V} \qquad \forall p,i \tag{4}$$

$$MEQ_p(i) = \frac{\sum_{g=1}^{G} MEQ^g_p(i)}{G} \qquad \forall p,i \tag{5}$$

By applying ANOVA test to consider the equivalency of the quality value between farm, food industry and market as formula (6) by F statistic in formula (7)

$$\begin{cases} H_0 : CL_p(i) = IEQ_p(i) = MEQ_p(i) \\ H_1 : CL_p(i), IEQ_p(i), MEQ_p(i) \text{ Not equall} \end{cases} \qquad \forall p,i \tag{6}$$

$$F = \frac{SST/2}{SSE/3(n-1)} \tag{7}$$

where, SST is sum of squared treatment and SSE is sum of squared error with each parameters while F statistic is a Fisher distribution with safety interval of α and 2 and $3(n-1)$ degree of freedom ($F_{\alpha,2,3(n-1)}$) and n is the number of the sample that considered. If $F \geq F_{\alpha,2,3(n-1)}$, then H_0 is rejected and there is significant difference between the obtained quality values of the farm, food industry and market; otherwise H_0 will be accepted.

CONCLUSIONS

In this study a new model of quality control for farm lands based on different attributes has been proposed. The approach can help evaluate transparently a variety of land-use options according to a variety of criteria that are measurable and form an assessable basis for decision-making. When planning occurs from the standpoint of a multi-criteria analytical approach seeking the sustainable use of land resources in an agricultural landscape, the objective is to identify land uses that are ecologically friendly, efficient and profitable, are accepted by society and meet social needs. The advantages of the proposed approach are assisting the food industries to choose the better supplier (farmers) which has produced more qualified raw materials, enhancing the e- knowledge of the farmers, recognizing the market needs, integrating the supply chain information flow and achieving the productivity and create educational aspects to improve the role of the IT in real time quality control.

REFERENCES

Agostinho, F., G. Diniz, R. Siche and E. Ortega, 2008. The use of emergy assessment and the geographical information system in the diagnosis of small family farms in Brazil. Ecol. Modell., 210: 37-57.

Alvarez, J. and P. Nuthall, 2006. Adoption of computer based information systems the case of dairy farmers in Canterbury, NZ and Florida, Uruguay. Comput. Elect. Agric., 50: 48-60.

Amponsah, W., 1995. Computer adoption and use of information services by North Carolina commercial farmers. J. Agric. Applied Econ., 27: 565-576.

Cox, P.G., 1996. Some issues in the design of agricultural decision support systems. Agric. Syst., 52: 355-381.

Fang, H. and Y. He, 2008. A Pocket PC based field information fast collection system. Comput. Elect. Agric., 61: 254-260.

Fountas, S., D. Wulfsohn, B.S. Blackmore, H.L. Jacobsen and S.M. Pedersen, 2006. A model of decision-making and information flows for information-intensive agriculture. Agric. Syst., 87: 192-210.

Hoskinson, R.L., R.C. Rope and R.K. Fink, 2007. Using a decision support system to optimize production of agricultural crop residue Biofeedstock. Biomass Bioenergy, 31: 186-194.

Marvin, H.J., G.A. Kleter, A. Prandini, S. Dekkers and D.J. Bolton, 2007. Early identification systems for emerging foodborne hazards. Food Chem. Toxicol., 10.1016/j.fct.2007.12.021

Perini A. and A. Susi, 2004. Developing a decision support system for integrated production in agriculture. Environ. Modell. Software, 19: 821-829.

Ramírez-Rosado, I.J., E. García-Garrido, L.A. Fernández-Jiménez, P.J. Zorzano-Santamaría, C. Monteiro and V. Miranda, 2008. Promotion of new wind farms based on a decision support system. Renewable Energy, 33: 558-566.

Santé, I. and R. Crecente, 2007. LUSE, a decision support system for exploration of rural land use allocation: Application to the Terra Chá district of Galicia (N.W. Spain). Agric. Syst., 94: 341-356.

Saroinsong, F., K. Harashina, H. Arifin, K. Gandasasmita and K. Sakamoto, 2007. Practical application of a land resources information system for agricultural landscape planning. Landscape Urban Plann., 79: 38-52.

Thapa, R.B. and Y. Murayama, 2008. Land evaluation for peri-urban agriculture using analytical hierarchical process and geographic information system techniques: A case study of Hanoi. Land Use Policy, 25: 225-239.