New Communication Methodologies in an Innovative Digital Extension System in Egypt

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Introducting technologies in Egyptian Agriculture

The challenge today is to be able to integrate independent components of the agricultural management systems. The goal of proper agricultural management is traditionally to provide a mechanism for decision-making shared by all stakeholders in farm management, and consideration should be given to information and communications technology on the grounds that they are essential tools to achieve this.

And it is anticipated that the technologies underlying any system of agricultural management should undertake the following tasks:

- Due to the change in the weather, it is constantly required that the development and field procedures should change with the related changes in operational plan.
- Stakeholder management: all detailed information related to all stakeholders on their behavior in the use of resources should be provided in order to achieve the use of resources in an intelligent way and to lower costs and maximize economic efficiency.
- Pollution control: protection from pollution and quality testing and reduction of the use of pesticides should be achieved.
- Monitoring for the prevention of disasters: the prevention of extreme climatic waves that is currently occurring in all levels, should include the ability to deal with such disasters as quickly as possible. A current example of storm floods over northern part of the Nile Delta in the end of 2015 and in several other places in late 2016.
- Information management: access to multiple data sources in real time should be a corner stone for such a system. These include a range of solutions through applications that report incidents on direct and indirect weather-related risks.

There is a need for innovative system that could maximize the added value of new technologies. Although Egypt has passed through several stages of communication innovations and applications of computer and internet in agriculture since 1996, the appropriateness of such technologies were overoptimistic.

Background of information technology in Egypt

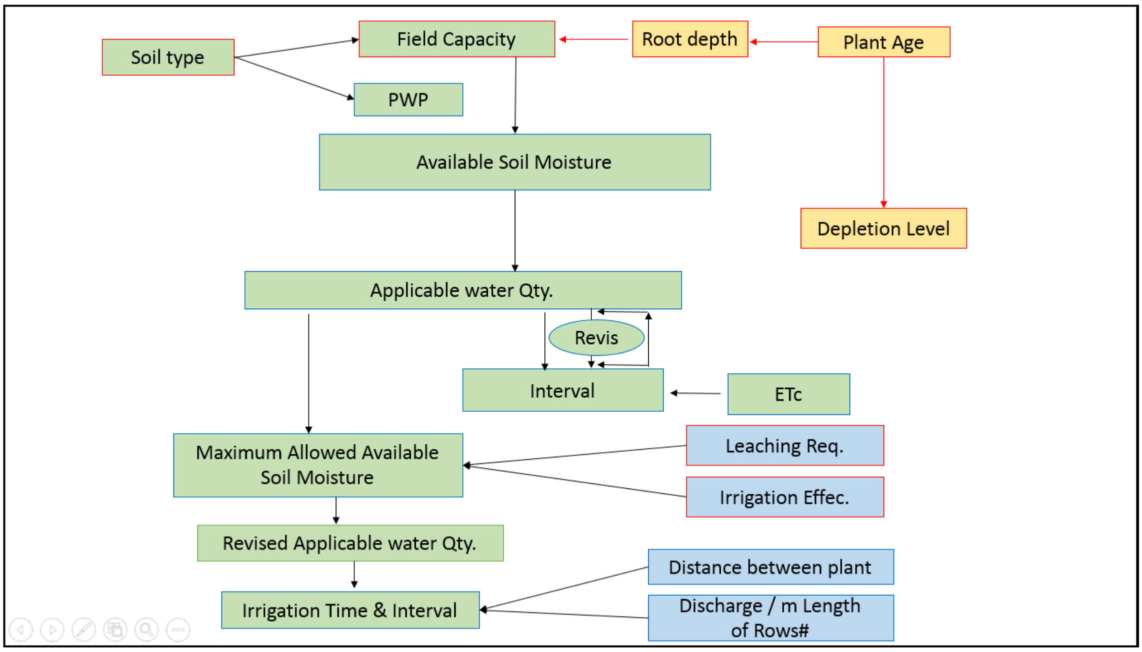
Irrigation Requirement Information system

After the establishment of the Central Laboratory for Agricultural Climate in 1996, a small project was designed to utilize the power of the new emerging communication tool: the internet (www.clac.edu.eg). The system was called: Irrigation requirement Information System, aiming at giving a crop what it requires, and saving as much as possible (Figure 1). This was to train the staff and extension service to be ready for the anticipated water shortage in the near future, at least due to population increase.

It was thought that the emergence of a greater role for ICT in water management, will make effective and efficient water management become guaranteed, and that the use of information and communication technology to develop a system of proper management of irrigation would provide the needed support to the farmers, while improving irrigation management through the identification of sufficient quantity and quality of appropriate water in order to achieve optimal use of water resources.

This hypothesis was not correct. Systems technologies or computerized systems cannot guarantee alone proper water management, but should be combined into the implementation and management of an integrated comprehensive system for realistic water management.

Figure 1
Information system for Irrigation Management Framework



Medany, 1995

Agriculture expert systems

In parallel to the application of agroclimate in agriculture, that was mainly utilizing data in a set of models, including water management, planting dates of major field crops, chilling requirements, growing degree days for major economical insects, etc., there was another technology based on information-base, instead of database. That was the emergence of agriculture expert systems (*www.claes.sci.eg*).

The majority of staff was computer scientists and knowledge engineers. The outside financial support helped in constructing several expert systems for several crops, i.e. greenhouse cucumber, orange, etc.

The knowledge was mainly collected from crop experts, then tested by stalkholders of the crop. As the knowledge was programmed into a software, a year later, the expert himself was not happy as some cucumber varieties were obsolete, while others came up in the market. The same was true with pesticides, and even later the greenhouse constructure was much improved to prevent the introduction of the insects to the greenhouse. In other words, the system could not follow the pace of vast changes on the ground.

Again, the system was designed to reach all extension offices around the country (e.g. VERCON project). The system was a trial of linking small-scall Egyptian farmers through the continuous flow of information from agricultural research through extension and ultimately to the end-users: farmers themselves. There were several weaknesses in the system:

- Problems related to the input side: any new information has to go through a programming phase; did not solve new problems such as heat waves; some researchers lost interest, etc.
- Problems related to the linkages: instability of internet connections; maintenance and upgrading of recipient computers were not appropriate;
- Problems related to the end-users side: extensionists were unable to attract the farmers with new information; the central office was unable to link all farmers; lack of promoting the system in all levels.

With struggles of updating the system itself, the system was unable to ensure hardware stability and connectivity, nor to attract the farmer's needs.

Accordingly, the above mentioned problems made the expert system unable to make it the way it was planned. Being too ambitious, or not meeting real demands from the end users, in this case the farmers, was a considerable weakness.

The forecasting and early warning system

The forecast of possible pests and diseases in plant production is another application that requires a constant and reliable flow of weather data. The losses of yields due to pests and diseases are enormous and could well be controlled in many cases if the proper prediction and forecast existed (Figure 2). One example is the late blight, caused by Phytophthora infestans, that has emerged as the most destructive disease of potato and tomato in South India since 2008. One hundred and fifty-seven isolates of Phytophthora infestans, 63 from potato and 94 from tomato, were collected from major potato and tomato production areas of South India between 2010 and 2012.

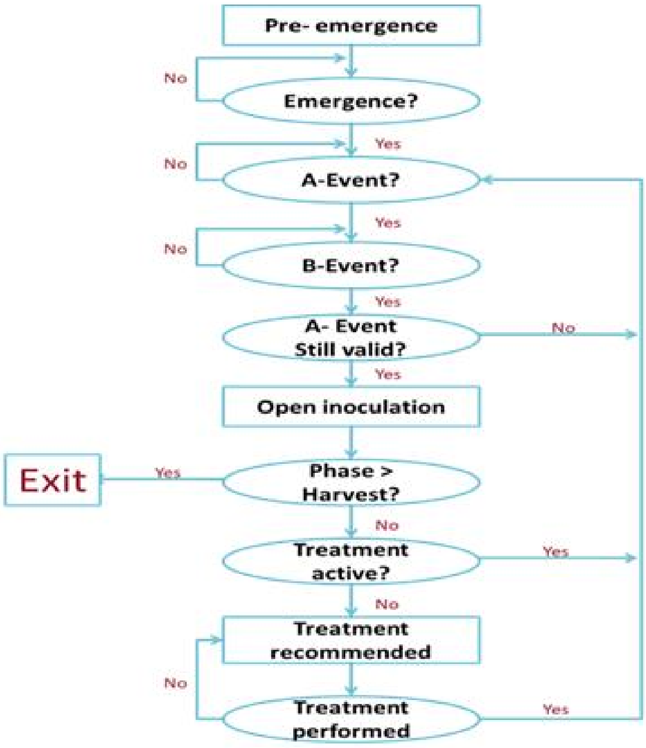
Therefore, the forecasting and early warning system, within the Plant Pathology Research Institute of the Agricultural Research Center, was established in the same period of expert system and climate application for agriculture.

Forecasting the pest and disease incidence and development based on weather data would be of great assistance in planning and adjusting of control measures.

Availability of transportable and relatively inexpensive weather stations makes was one of challenges to gather weather data at the field level. Modeling of pest and diseases for practical use in IPM programs was always a dream, which is somehow different from modeling pests or disease for science. Downy and powdery mildews, late and fire blights, as well as wheat rust were used as examples to demonstrate the different types of pathogen climate interactions and their transformation into different types of disease models.

The major obstacle was the lack of integration of the forecasting system into the field production function as a holistic approach. Insects and weeds are still independent from plant pathogens, with minimum attentions. The establishment of an integrated early warning and forecasting system is, therefore, necessary.

Figure 2
General overview of the forecasting model



Zayan, 2016

Knowledge Economy Foundation (Bashaer)

The challenges of linking farmers to the vast growing flow of information and current communication facilities, have encouraged the private entities to become frontiers in this regard. The Knowledge Economy Foundation (Bashaer) is one of the leading entities. The main objectives of Bashaer is to link buyers and suppliers with market information; and support value chain integration through small farmers bottom up development.

Figure 3
Value Chain demonstration linking small farmers to their markets

www.bashaier.net

Bashaer has three main approaches: i- empowering small farmer communities (COOPs – NGOs) through direct marketing linkages (Figure 3); ii- ICT tools for marketing channels and knowledge dissemination (www.bashaier.net); and iii- managing the network of small farmer communities with a business oriented approach to secure sustainability.

Bashaer has linkages to Market Buyers and Data Partners in Europe such as the Dutch association of horticulture producers & importers/exporters; the Italian Agriculture Online market exchange related to Federation Chamber of Commerce; and ICT arm of French Agriculture Cooperatives.

Although the setup is on the knowledge edge, the required flow of information is based on the knowledge generation pool, mainly research institutes. In this regard, a strong commitment between different research institutes such as Horticulture Research Institute; Plant Pathology Research Institute; as well as climate related institutions. The frequent update of the mobile message system is another challenge. Promotion of the system requires continuous involvement of beneficiaries, especially individual farmers.

Challenges and opportunities

According to the scattered long experiences of information and technologies, none of them proved to be practically attractive as was planned. Nevertheless, the gained experiences and advancements made in the field of weather data availability and communication facilities make it a positive opportunity to a stronger integrated system from the service providers to the farmers.

The challenges occurred during implementations could be summarized as follows:

- The ideas were brilliant, with minimum attention to the involvement of end users: rural communities.
- The communication business was not involved in the design and implementation.
- The science of applications and its relation to the majority of crops was premature, especially modelling of pests and diseases.
- The dependence on donor's financial assistance, with limiting requirements focusing on budget distribution, rather than tasks to be implemented.
- Limited expertise and trained personnel, either insufficient educational background related to IT in agriculture, mathematical modeling, software development, electronics maintenance, etc.
- The extension service was reluctant to accept the new development in the technical tools rather than the printed materials. There were limited funds to upgrade the service in terms of computers and communication facilities.
- Lack of long term vision.

Currently, most of the challenges are clearer and considered in any new project. The experience gained are good base for the implementation of a new phase of integrated system.

The existing prototype for digital information

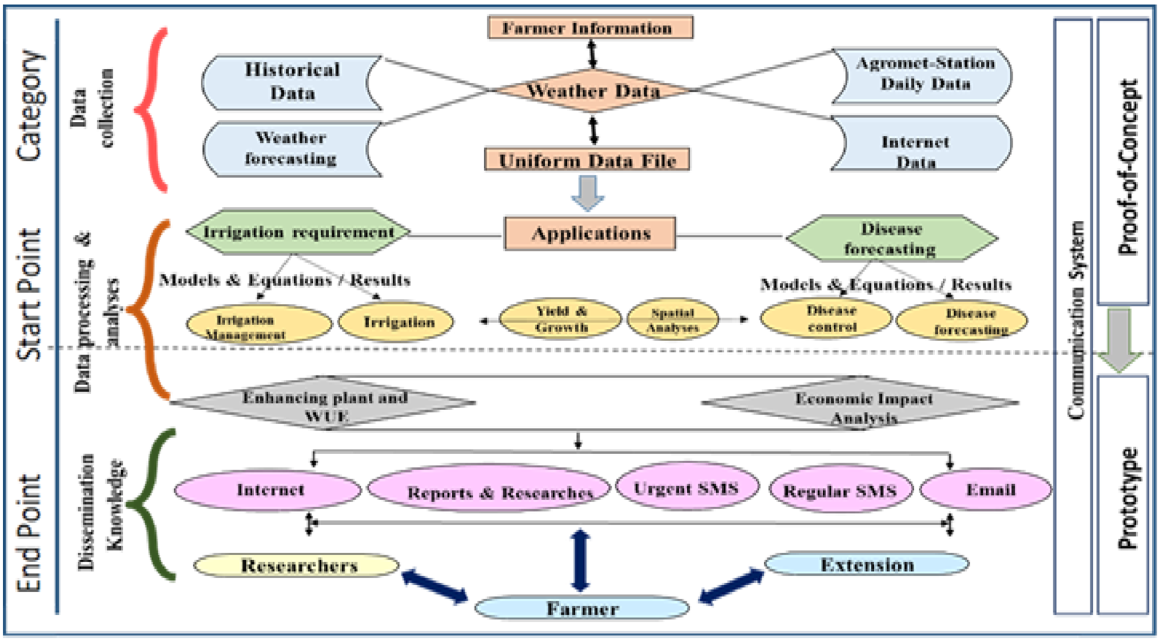
A prototype of integrated communication system was designed in order to utilize the existing facilities in the fields of irrigation and pest forecasting, as well as the communication system between farmers and the private system (Figure 4).

The overall objective of the proposed system is to introduce successfully technology at the level of the small farmers, which represent as well the "bottom of the pyramid", thus contribute to both increase their income and establish in this key sector, the basis of the knowledge economy. The major objectives of the system are (i) water rationalization, (ii) reducing the use of pesticides, (iii) increase crop productivity, (iv) resources conservation, (v) protection from pollution, (vi) marketing improvement, (vii) improved farmers livelihoods.

The positive background of the proposed system is that it builds upon a well-established collaboration between its consortium members that includes the Climate Change Information Center and Renewable Energy (CCICRE), Forecasting and Early warning unit, Plant Pathology Research Institute, (ARC) and Knowledge Co. for Sustainable Development, and its affiliated NGO, Knowledge Economy Foundation for Local Society Development (KEF), which have developed and operate the first agriculture online marketing network linked to the small farmers communities.

The CCICRE is presently the sole or main source of information for the agriculture technology to be provided by the farmer. The KSD/KEF is presently the sole entity operating a comprehensive mobile/web platform in the area of agriculture and specifically targeting the farmers to establish their missing linkages with their ecosystem. The proposed system will build upon an existing platform well tested in terms of knowledge dissemination, as well as on the basis of a farmer's database structure, allowing the customization of messages. Moreover, the focus of the present agriculture marketing digital network developed by KSD/KEF, have enabled to map already all target customers, both the farmers and their cooperatives and NGOs on one hand, as well as the companies which will sponsor the service on the other, e.g. the state agencies, the input suppliers and the exporters, on the other hand .

Figure 4
Suggested prototype system flow and modules



The core component of the system is to communicate effectively with the farmers, using information and communication technologies to provide them in a "user friendly manner" the wealth of technological knowledge gathered in simple language and tools using an elaborated platform combining web and mobile applications, as well as the range of social media tools fast expanding among the farmers communities such as "facebook" and "what's app", in addition of course to urgent and regular SMS services and applications.

The consortium members have extensive experience in intelligent communication and related farmers services. The system research team is responsible for collecting baseline climatic data and agricultural production data for various regions in Egypt.

CCICRE owns a model to calculate irrigation requirements which is applied at the research level. The model will be applied at the practical level for improving its output. Hence, CCICRE will carry out the following activities: climate data collection and will calculate and analyze evapotranspiration (ETo) data and irrigation requirements through models. Forecasting and Early warning unit will be responsible for analyzing the collected data and applying plant disease forecasting models which are already estimated for the specified diseases. This will be conducted using the software applications developed through the system for these models.

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