

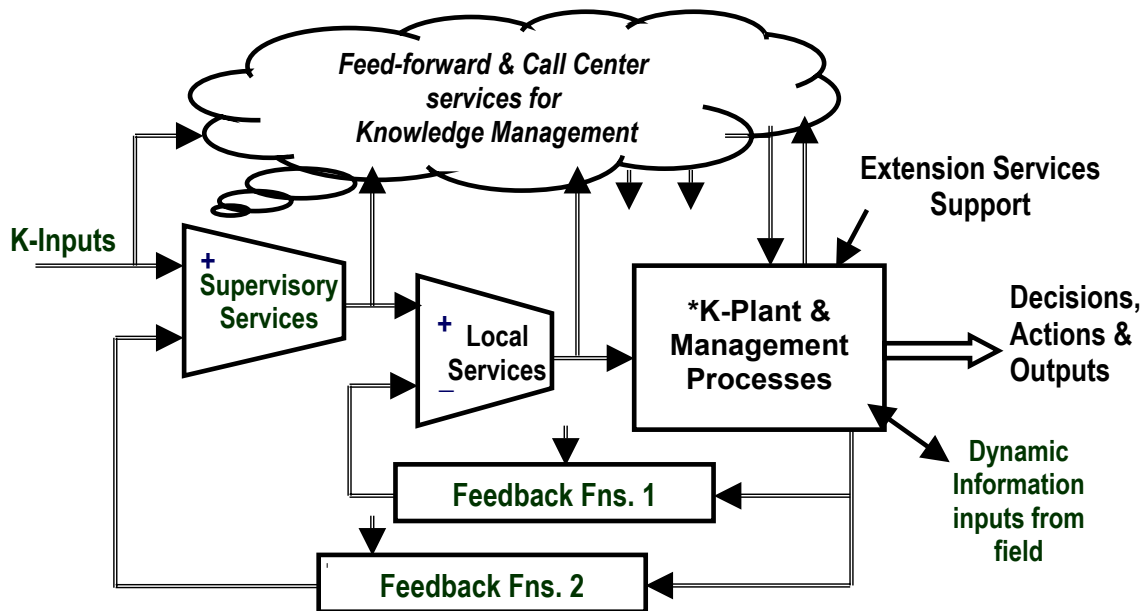
## BUILDING COMMUNITY KNOWLEDGE PLANTS USING TELECOM AND CONVERGENCE

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Where have we put telecom to use for the society, used the vast network it has formed, taken advantage of the massive geographies it can cover? Telecom, in terms of technology, has stabilized over recent years. We have large bandwidths, but the true usage of that has not been achieved yet. Large data sharing and streaming video is just the beginning. There is a humongous buildup pending on the applications that are yet to be achieved. Convergence is one area where things are yet to catch up.

The title of this article may look odd! Building 'Knowledge Plants'? Here we mean that just like we model, build and service power plants or chemical plants, we speak about 'Knowledge Plants'. In a plant, we have some inputs. We set some objectives according to which the inputs are processed and desired outputs are generated. For example, in a chemical plant typical inputs may be raw petrochemicals and power. The outputs may be polymers like the different kinds of plastics. The polymerization is done in controlled chemical reactors. We desire to control the whole plant in ways that production efficiency is high and cost of production minimized. The production is scheduled as per demand and raw material supply constraints. Similarly in a thermal power plant, the inputs are coal and water. Output is electric power. Characteristic of a plant are its complex control systems. There are multiple feedback loops and feedforward watchdog systems to provide alerts and preventive steps on potential problems.

Control theorists look at plants having a set of observables and controllables. Sensors, signal processing and computations over measured data give the observables. They provide the inputs that are compared with the set points or objectives and the controller generates the necessary actions to control the various systems in the plant to achieve the desired plant behavior. A general plant control model is shown in Fig. 1. The only change is that the word K-Plant is used instead of 'Plant' to signify the term Knowledge Plant.



**Fig. 1: A General K-Plant Model**

The central plant that we wish to control here (like a Chemical Reactor in a Chemical Plant, or a Turbine-Generator set in a Power Plant) is the K-Plant (for Knowledge Plant). Every plant has a number of component systems, like pumps and conveyor belts for feeds into the plant, heater, other feeds input controllers, etc. Each such system is usually controlled by its own closed loop systems and their

references are provided as set points by the plant controller. For simplicity of representation, we have indicated the plant controllers by the trapezoidal comparators in the figure. The plant measurements and necessary observables are generated from the sensors inside the plant through the feedback functions - 1. Usually there are many inner closed loop feedback systems for controlling different components systems. The overall plant is managed by the supervisory control or services (set point control) that forms the outer closed loop with a different set of feedback functions – 2 that is governed by the overall plant function and performance objectives. Generally the whole supervisory outer feedback system is implemented as '*Supervisory Control And Data Acquisition*', or, SCADA system.

Now we may wonder what the connection between the above broad model of control of plants, telecom and convergence is. Here we illustrate a K-Plant for community empowerment services by an example that brings out a striking similarity between the above model and IT enabled knowledge management. The example is based upon the KISSAN (for Kissan Information Systems, Services and Networking; visit: [www.kissankerala.net](http://www.kissankerala.net)) – Kerala and e-Krishi ([www.e-krishi.org](http://www.e-krishi.org)) experience that were developed and run by a team at IIITM-K working with the author.

### **K-Plant for Farmers**

This is about a hypothetical case of how a group of small or medium farmers producing the same kind of crop may run collectively a Virtual Agribusiness and Enterprise (call it VABE Ltd.) using the above K-Plant model. The farmers participating all have some shares in VABE Ltd. We may call it FSOP (like ESOP, it is Farmers Shareholding Option). The study has the following scenario and objectives.

- (i) The farmers are spread out over a region (say a district) and not necessarily contiguous. They all are cultivating the same crop – say organically cultivated horticultural produce for exports. They decide to form VABE Ltd.
- (ii) VABE Ltd. is engaged in aggregating the produce, process, package, build a brand through regular certification of both the cultivation and processing practices of its organically cultivated products. The company does e-marketing for clinching advance orders for the perishables before they are harvested.
- (iii) VABE Ltd. sets up a cold storage, processing and packaging facility tied up with pickup trucks for collecting produce from the farms and transporters to customers like retail chains and exporters.

The innovation of VABE Ltd. is that it builds a K-Plant for its enterprise as shown in the figure earlier. Here we show the different components of the K-Plant of VABE Ltd. This K-Plant is built on systems, telecom and convergence in the following way.

At the core of the K-Plant is the 'InfoCom Reactor' (or ICR for short), like the Chemical Reactor in the Chemical Plant. This is a services portal with both forward links to the VABE community members, their assets (i.e. the farms), and backside network of services experts, farm input suppliers and customers to the VABE products and services. This 'Information Reactor' portal supports dynamic information, interaction, collaboration and decisions support to the K-Plant. It may typically use services oriented architecture, web 2.0 links to 'sensors' and 'controllers'. ICR has both front and backend. At the backend, different functional teams manage the mix of services needed to run the VABE Ltd. – the management, virtual communities of scientists, experts with decision support systems who provide critical knowledge inputs to the different activities in the farms, associated farm input supplies, alerts on situational problems and opportunities, market promotion, etc. From the farms and fields we have sensors like soil test instruments providing parameters for soil health management, nutrient management at different stages of the crop concerned, weather measurement and forecast inputs, knowledge on types and quantities of the relevant crops planted and their positions in the crop life cycle, farmers entering information over SMS on requests for expert assistance and expected quantity and time of the harvest they are ready to supply for VABE Ltd. processing area, etc.

Here is a typical scenario: Farmers declare the quantity of crop (say sweet potato for a noodles making plant) two weeks in advance through SMS to the ICR. ICR aggregates the inputs from the several farms and alerts the plant managers on the expected quantity for processing. The agri-processing plant making noodles schedules production accordingly. Using ICR, plant managers alert individual farmers how much produce would be collected from each of them. The pick up truck route is prescheduled using GIS based route scheduling system in the ICR and farmers are informed through SMS when a pickup truck would come to take the produce from the farm. The farmers receive the truck, load the produce and receive the payment by mobile payment transactions.

On the other side, VABE Ltd. markets and gets orders in advance of production (because the farm produce supply is available in advance) for the noodles they had planned to produce from the advance information received from the farms. The same system is also used for crop care by taking preventive steps on anticipated problems due to weather, potential or anticipated pest attack or disease, etc. Thus the entire ICR K-Plant provides crop assurance, enhances market assurance and thereby supports credit assurance also. The supervisory services or control is provided by the management of VABE Ltd. supported by the observables from the ICR and external inputs.

The key points in this hypothetical example of the VABE Ltd. K-Plant, a 'futuristic' agricultural extensions and agribusiness scenario that integrates almost all aspects of telecom and convergence. We have the Internet, mobile devices, m-commerce, sensor networking, mobile phones (supported by a VABE Ltd. Call Center), enterprise integration, knowledge management, knowledge empowerment and thereby enhancing agrarian prosperity of the farmers. Mobile field devices and information inputs from the farmers act as sensors and provide necessary feedback. There is a qualitative difference between the K-Plant and the conventional plant. Unlike the almost totally mechanized plant control system, here people in charge of specific tasks like the farmers, extension experts and similar others are also part of the K-Plant control system and automation.

It is about time that we use such imaginative applications of telecom, convergence, virtual enterprises and knowledge empowerment as part of our Indian rural scenario. One may envisage similar K-Plants models for health assurance, education, watershed management, rural development projects, e-governance and other such scenarios. Such developments built over broadband and mobile communications have the scope of becoming major economic engines for the rural sector in the emerging knowledge economy.

Are our industry, educational institutions, R&D organizations and Government ready to come together and build such Virtual K-Plant Enterprises? To make these happen, we need to change our mindsets, learn to work across institutional boundaries and ensure the coming together of appropriate mixes of organizations, institutions, trade and finance and sections of government to come together to service such converged enterprise paradigms.

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