# Integrating the Transfer of Technology to Users

Ron Olson, Mosaic Crop Nutrition, LLC
8813 Highway 41 South, Riverview, FL 33578
ron.olson@mosaicco.com

Marc Vanacht, AG Business Consultants
2245 Kehrs Ridge Drive, St. Louis, MO 63005
marc@van8.com



Please allow me to start with a quick and brief history of Information Technology in Agriculture.

In the very early days, the 1960's and 1970's, I.T. was dominated by mainframes & minis. Did they have an impact on agriculture??? Are you kidding? In the early to mid 1980's we saw the emergence of the Personal Computer, the P.C. Some farmers started to use them, but then grain export markets to the Soviet Union closed, there was no more money, and adoption stalled. In the late 1980's there was a strong emphasis on models and simulations. Most of these came out of distinguished universities and research centers, but were mostly user unfriendly, written in FORTRAN, or were not practical for use, reflecting the Ivory Tower they often came from.

In the 1990's GPS & GIS emerged. Initially GIS was too 'heavy' for P.C.s, and GPS was too 'clunky' to be practical. That changed in the mid 1990's when ESRI made GIS realistic, and dGPS made "spatial operations" workable. And add to that the World Wide Web. All this made for high enthusiasm, experiments and mistakes. But then, commodity prices fell, and adoption stalled again ....

For the past few years there is money! Contractors and farmers eagerly buy navigation tools, light bars, Auto steer equipment and even dabble in telemetry. We have access to satellite images. Service companies are integrating software, software services and data services. We even enjoy the emergence of Web2 Technologies like Google maps, Facebook, the i Phone from Apple, shared calendars, access to school grades from your child through the schools web site.

So ... have all farmers now are been converted to Information Technology, GPS and GIS? Are all agronomy, plant protection and fertility decisions now made based on strictly rational & scientific analysis? Have virtual "coffee shops" replaced the more traditional ones as the dominant source of innovation? Do farmers & dealers now exchange all sorts of data to build powerful databanks?

Sure ... In our dreams. Why is it we are still chasing our dreams of information based agriculture?

The first reason is that Adoption Cycles in agriculture are slower than the innovation cycles in technology. So we keep innovating, but hardly ever "finish the job". That often leaves behind disappointed customers and obsolete systems. Additionally, adoption of I.T. in agriculture has been stunted several times by cyclical economic pressure on farmers.

The second reason has to do with Complexity. We're trying to manage unpredictable weather and complex biological pathways. Interactions are extremely complex. GIS is good in spatial dimension, but does not easily help in the time dimension.

The third reason has to do with Human Interaction. In a very well documented study, Pete Novak, Professor Rural Sociology, at the University of Wisconsin measures and concludes that adoption of I.T. in agriculture and Precision Agriculture is "lumpy", high in some places, low in others. He attributes that to factors like difference in training and corporate drive in different dealer and coop organizations, the attitudes of 'leader farmers' who don't share because they want to stay ahead, difference in agronomic fit and need for technology.

This phenomenon of "lumpy" adoption of I.T. is not limited to just farmers. For decades the medical profession has been thought to be ready for fast I.T. adoption. The clerical aspects of healthcare adopted I.T. without problems. The Medical professionals however have proven to be more reluctant. What do Physicians and Farmers have in common? What is it that holds them back from faster adoption of I.T.?

Information technology can not be successful in a vacuum. It has to fit the changing structure of Agriculture.

First and foremost we witness the Expanding Role of agriculture. Agriculture now produces not only the four F's, but each "F" in turn has two important separate dimensions. Agriculture produces *Food*, not just for survival but also for pleasure and health reasons. Agriculture produces *Fiber*, not just for clothing, but also for fashion and statement. Agriculture produces *Feed*, not just for production animals (meat and dairy) but also for pets. Actually the $ turnover of pet food in the US exceeds that of feed. Finally, and more recently, agriculture also is expected to produce *Fuel*, not just for independence from OPEC, but also to avoid further tampering with the climate.

While having to do more, agriculture at the same time faces more challenges. We are running out of *Water*, both in volume and in quality. Our valuable *Soil* is often mined to exhaustion and gets encroached on by houses, roads and factories. Agricultural *Labor* has become an issue, economically and politically. it is hard to get enough good people, at an affordable cost. Demands from consumers, regulators and retailers are continuously piling on. An because of its shrinking share of our national GDP, the political influence of agriculture is waning.

All these changes, opportunities and challenges, force us to reconsider how we look upon the agricultural value chain.

In the past the agricultural value chains were simple and straightforward. Some companies made stuff for farmers, like equipment, seeds and chemicals. Other companies like dealers and coops then sold that stuff to farmers. Farmers then used all that stuff to produce food, fiber and feed, commodity stuff. Some companies bought that stuff from farmers, passed it on to other companies that transformed these commodities into food and that sold it to yet other companies like retailers that sold that food to consumers.

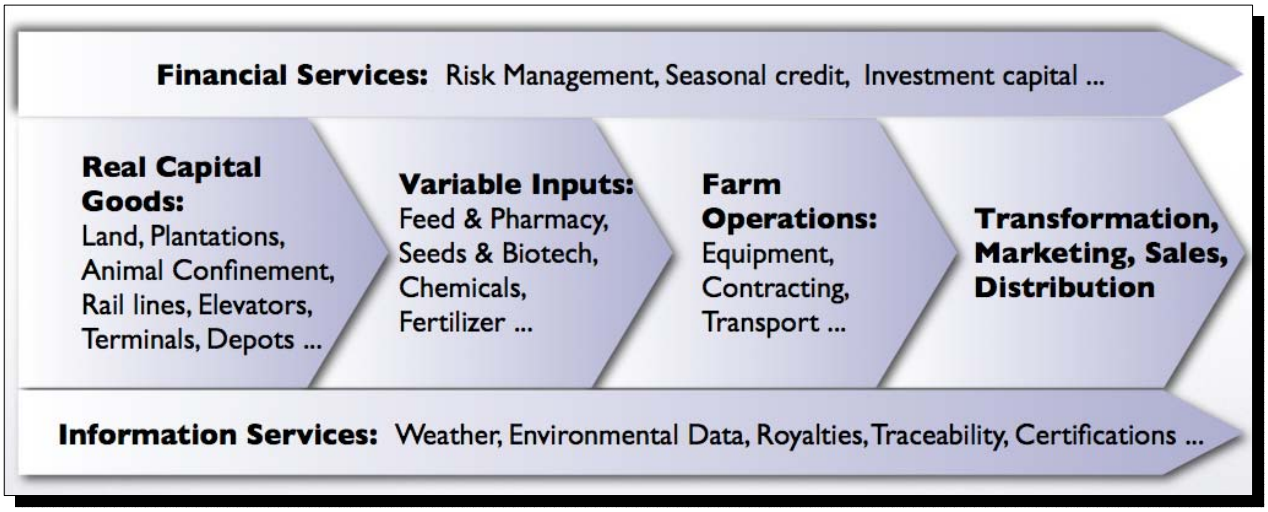
These past views of the agricultural value chains had weaknesses. They were linear, with little or no feed back loops. Also each chain was different for the different vertical chains. That old view sometimes worked on a local scale, but sure does not fit todays' global economy. They did not recognize Multi-functional players that sell to, and buy from farmers. They were Farmer

centric - NOT consumer centric. Nice if you're a farmer, but not really realistic in our day and age.

Today we have different concepts of the agricultural value chain. Actually there are many new concepts of value chain. We are still sorting it out. But all of these concepts take technology and globalization into account. They put more emphasis on "Services" as opposed to "Goods". Unfortunately they leave the issue of "Quality" vs. "Commodity" unresolved.

One example of such a new concepts of agricultural value chain is the one used by analysts at a major "Private Banking" company. The step in level is € 1.5 M. minimum investable assets. So they cater for the rich and wealthy.

They see six major functions contributing to agricultural production, each with different




areas and technologies being involved: real capital goods, variable inputs, farm operations, financial services, information services and finally the companies that transform, market, sell and distribute the agricultural production.

Question: What functions does a fertilizer dealer perform? Is it strictly supply of variable input, or also farm operations through contracting, real capital goods through infrastructure, financial services through credit, and information services through soil sampling and fertility maps?

That leads to a second question: should a fertilizer dealer perform multiple functions, does he really treat every one of the functions as a profit center, or merely as a cost line on the income statement? Guess what Wall Street financial analysts expect the fertilizer dealer to do?

It is time to go back to the core of this analysis. Integrating the Transfer of Technology to Users. In a first step we'll describe the different forms Information Technology takes to service agriculture. Some might come as a surprise. Or maybe not.

We all know about "Big Iron" Systems, big back room operations that support the I.T. backbone at major corporations. IBM services the 'back room' I.T. function at Cargill and Monsanto. EDS services the 'back room' I.T. function at Del Monte. HitachiSoft services the 'back room' I.T. function at major food importers in Japan. There are more examples.

In some areas, I.T. has achieved very high numbers of adoption, although not necessarily expressed by numbers of P.C.'s on farmer's desks. In Tokachi Prefecture, Hokkaido Island, Northern Japan HitachiSoft runs the GIS, agronomy, planning, inputs systems for local coops representing over ten thousand individual farmers. Across Europe, amongst grain, animal, vegetables and wine growers ISAGRI software on farmer's P.C.s runs accounting, GIS, agronomy, and traceability systems for forty five thousand farmers.

Sometimes market penetration is more important than absolute numbers. HitachiSoft in Tokachi, Hokkaido, and the cooperatives have nearly 100% market penetration. Regional policies and an aging farm population drive adoption. The AgroAmigo web-based GIS, agronomy and downstream marketing system in small grain cereals in Chile is used by leading farmers that cover and operate the majority of crop acres.

In quite a few cases a small I.T. company discreetly runs part of the "back room" agronomy and farm service systems of major players in the market. Examples: ZedX services Wilbur Ellis, GeoSys services Mosaic, SST services Helena...

Sometimes I.T. services can be part of a broader product and services offering like GrowingPoint at Pioneer, or FieldInSite at Mosaic. Some companies like SST and Farmworks are highly focussed on agricultural software. And past failed attempts are remembered for their audacity, and their premature timing. That boneyard includes names Infielder from Monsanto and VantagePoint from Deere.

How can we structure the Integration of the Transfer of Technology to Users? A good way might be by starting with the Principles of Fertilizer Best Management Practices laid out by Dr. Terry L. Roberts, President, International Plant Nutrition Institute, published in Better Crops with Plant Food, IPNI, 2007, # 4. The principles can be simplified as: the Right Product, the Right Rate, the Right Time and the Right Place.

Maybe we can consider taking these principles in a different order: Right Place, Right Time, Right Rate, Right Product when we try and link Fertilizer Best Management Practices with Information technology to maximize benefits for the farmer.

Obviously, the use of GPS and GIS make sense when we want to get to the Right Place. We can provide library data about soils, boundaries, images ... We need to capture the rich farmer's experience through yield maps, crops history, soil samples, moisture, OM, ... Technology is now available that allows the farmer (and the dealer) to automate data capturing wherever possible. It is important to get away from the 2.5 acre (= 1 ha) grid. That concept is based more in theoretical mathematics than in the operational and biological realities in a farmer's field. It is much better to define management zones that make agronomic sense, are operationally feasible and ultimately economically profitable.

The Right Time principle has a long term strategic component with "nutrient & soil capital" build up. On that path we need to benchmark yearly outcomes and track and correct deviations. The short term and tactical component has to do with yearly yield targets and the approach for nitrogen use. We can learn a lot from year to year and crop to crop comparisons. It also is time to prepare for and learn about on-the-go sensors that can help with Nitrogen management on the growing crop. It has been a long wait, but finally we seem to have workable solutions.

The Right Rate does not come out of Google, books or magazines. "Right Rate" has to be looked at in relation to space and time. And there is variable rate. There are several ways to

manage ‘variable rate’, some with a high technology component, others with simple operational measures. To set rates one should use use yield response and nutrient use efficiency models. Economists and financiers call it the laws of diminishing return, and point of maximum elasticity. Good old tricks like spoon feed, and split applications will help avoid over fertilizing and indigestion to the soil. Also, one can now get and should use ‘as applied’ feedback from all that fancy equipment we bought with the high commodity prices!

How to make choices about the Right Product. The time of a simple formula is gone. Download product catalogues and specs. Think like for feed rations, menus, shadow prices and cost optimization. Think like an athlete, basics energy (NPK) and vitamins (micronutrients). Fertilizer Science is evolving. Learn about and try new formulations and mixtures!

Many of the decision we will help farmers make depend on data sets. That means that managing data the “Right” way has become important. You know... the thing about garbage in-garbage out. Most software packages can manage data so they get you and the farmers most of the way. One needs to adapt data ‘service level’ to the skills, attitudes and fears of farmer customer. Some are technology minded, some are less so. To that end it is crucial to develop team work between the agronomist, the farmer, the equipment operator and the I.T. specialist. Learn from Google: hide complexity. Make it simple. The ‘duh’ factor still works.

In all this combination of I.T. and farming, still, after all these years, we need to have a session with Mythbusters. Here we go. Data ownership and data physical storage are independent decisions. One can own the data on someone else’s server! No hard drive is blessed with perpetual life! None. Moisture will affect maps produced by ink jet printers. Use plastic sleeves, or buy a laser printer. Terabyte hard drives and RAID systems (Redundant Array of Independent Drives) will fill up, sooner or later, probably sooner than later. Network! Not just in the coffee shop. Do you have video instant messaging? If not, ask your teenager to set you up.

Before we conclude with a peak at the future, allow me to tell the story of a corporation that in a few years strategically re-defined itself. And the nice thing about this story is that it could be illustrative of changes possibly happening to each dealer, or each farmer in this country. The company is Pitney Bowes.

Initially, Pitney Bowes *sold* ‘machines’ to automate ‘mail room’ functions. Then Pitney Bowes *leased* ‘machines’ to automate ‘mail room’ functions. Next Pitney Bowes *serviced* the mail room, which expanded to include the print shop.

Pitney Bowes then moved beyond the mail room, and serviced ‘the entire *building*’. Next Pitney Bowes managed all *assets* IN the building. But not all assets are IN buildings, so Pitney Bowes started managing *mobile assets* as well. Now comes the real strategic breakthrough.

To manage mobile assets... one needs GIS. Pitney Bowes owns GIS. Pitney Bowes bought MapInfo Software. The new Business of Pitney Bowes is called “Location Intelligence”. Imagine putting a RFID chip on every asset or name tag, and putting a RFID reader port on every door or in every truck... Suddenly one can know at any moment where every piece of equipment or supply, and every person is. What could that do in a hospital emergency room, or in a rush season to get products to customers. What is your level of location intelligence?

Now, a peak into the Future, first looking at I.T. hardware. Moore’s Law is alive and kicking, at least for 2-3 more iterations. Computers will get more powerful, and often cheaper as

well. Wireless networks and telemetry are coming along strong. From “ubiquitous computing” we will go to to “ubiquitous GPS” with place and time stamps on many things that move around and have to be tracked.

SAAS (Software as a Service) starts penetrating business in general. The days that software comes in a box are vanishing. Technically SAAS is available in agriculture. Some companies offer it today. SAAS will grow, if the ‘cultural’ challenges of our target audience, the farmers, are managed well.

We have already spoken about the new Value Chain concept. What will be its impact on dealers and farmers? The re-definition of roles and functions in the value chain will re-define I. T. and information services. Different farmers will play different roles, and will need different services. The question to be asked is: Can a single entity give technology support in all aspects and all functions related to variable inputs, farm operations, downstream marketing, and information management?

That leads us to the concept of the Integrated Service Model. Today, in agriculture the ISM includes capital goods (warehouses & elevators), distribution of variable inputs, contracting of field operations and applications, seasonal credit, some information services and often even downstream elements.

We need to realize that in general business these Integrated Service Model have disaggregated, or fallen apart in ‘plain speak’. In financial businesses, attempts of integration (i.e CitiGroup) have had mixed results. In technology NONE of the “convergence” concepts that were put forward have materialized. In media markets, the jury is still out.

What does that mean for agriculture? Information Services on their own will NOT be enough to keep the Integrated Service Model alive, should the model disaggregate. However, should the Integrated Service Model remain strong, Information Services WILL help strengthening it. Future will tell. One recommendation: make every single operation you have a profit center. Track it as such! And that includes information services.

Thanks.