

Integration of information technology in agribusiness management

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Objective

Farming has changed dramatically worldwide in a relatively short time. Margins are being squeezed ever smaller. To survive the farmer had to adapt from being a farmer to being a businessman. The rapidness of this change brought about some difficulties, one of which is the farmer's ability to gather and process sufficient information in order to make informed decisions that impact the profitability of the agribusiness.

Statement of findings

Agribusinesses are plagued by information deficiencies. As an example, most farmers cannot determine with certainty if it would be more profitable to replant a specific orchard. They simply don't have adequate information. To acquire this information means many, many man-hours of error-prone manual office work to most farmers. Some information parameters are impossible to even measure accurately by hand.

The rapid innovation of the past few decades in technology resulted in the development of information systems that have enormous potential for agribusinesses. Computers and the Internet has evolved to such an extent that it is now a major part of almost everyone's daily lives. Electronic hardware have become smaller, cheaper and easier to build. Software is constantly being designed and improved. We have evolved from the pocket diary to the smartphone.

Key conclusion

The advantage of an integrated information technology system in the agribusiness cannot be overlooked. Vast amounts of information can be automatically or semi-automatically captured, stored, processed and interpreted. This enables the agribusiness manager to make the right decision at the right time up to the micro levels of business with little or no time and effort.

Keywords: information technology, agribusiness, computer, software, hardware, profitability

Integración de la tecnología de la información en la administración agrocomercial

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Objetivo

La agricultura cambió drásticamente a nivel mundial en un tiempo relativamente corto. Los márgenes se achican mucho más. El granjero tuvo que adaptarse para poder sobrevivir y pasó de ser un granjero a comerciante. La rapidez de este cambio trajo algunas dificultades, una de ellas es la capacidad del granjero para reunir y procesar suficiente información para tomar decisiones informadas que afecten la rentabilidad del negocio agrícola.

Declaración de resultados

Los negocios agrícolas están repletos de fallas de información. Como ejemplo, la mayoría de los granjeros no puede determinar con certeza si sería más rentable volver a plantar un huerto específico. Simplemente no tienen la información adecuada. Adquirir esta información significa muchas, muchas horas-hombre de trabajo de oficina manual tendiente a errores, para la mayoría de los granjeros. Algunos parámetros de información son imposibles de medir con precisión incluso a mano.

La rápida innovación de las pasadas décadas en tecnología dio como resultado el desarrollo de sistemas de información que tienen un enorme potencial para los negocios agrícolas. Las computadoras e Internet han evolucionado de tal manera que ahora es una parte importante de las vidas diarias de casi todo el

mundo. El hardware electrónico se volvió más pequeño, barato y fácil de construir. El software se diseña y mejora en forma constante. Hemos evolucionado del diario de bolsillo al smartphone.

Conclusión principal

No puede pasarse por alto la ventaja de un sistema de tecnología de la información integrada en el negocio agrícola. Se pueden captar, almacenar, procesar e interpretar cantidades enormes de información en forma automática o semi-automática. Esto le permite al gerente del negocio agrícola tomar la decisión adecuada en el momento justo hasta los micro-niveles de negocio en poco tiempo y sin esfuerzo.

Palabras clave: la tecnología de la información, agrocomercial, las computadoras, software, hardware, rentabilidad

Introduction

Successfully managing an agribusiness requires information and acquiring this information poses certain challenges to the agribusiness manager. The human brain can only cope with processing a relatively limited amount of information. We are also limited by our ability to acquire information as well as the knowledge to interpret this information. Information technology (IT) systems enable managers to overcome these obstacles to a large extent. With the help of these systems more information can be gathered with less effort and it can be interpreted with the combined knowledge of specialists in different fields. The interpretation of the information can be done in seconds. This puts a very powerful tool in the hands of the agribusiness manager to use in decision making.

Challenges that face the Agribusiness

Farmers are quite used to the, so-called, fundamental economic problem of satisfying unlimited wants with limited resources. The implication of this basic problem is that choices have to be made in how the factors of production will be allocated to produce which product. These choices will directly influence the profitability of the agribusiness. If no other choices will result in increased profitability, then the optimal choices have been made. Due to the multitude of uncertainties involved, it is easy to see that information plays a very important role in determining the optimal choices and ultimately the profitability of the agribusiness.

Gathering the information presents the real challenge in optimal decision making. It takes time, money and effort to accurately gather and process information and therefore it represents a cost which must be accounted for. In agriculture it is difficult, and in some cases even impossible, to measure certain parameters. Other parameters are time consuming to measure or create a large burden on the people involved. In other words, the cost of gathering and processing the required information may outweigh the benefits of having it.

Another challenge in the gathering of information is that an information overload may result. Trying to interpret too much information often results in poorer decision making.

Despite the lack of information, agribusinesses are also subject to a relatively large administrative burden. This burden is created by the various accreditations that agribusinesses must comply with as well as certain statutory requirements. Also, the larger an agribusiness becomes, the heavier this administrative burden will be. Therefore the ability for an agribusiness to cope with its administrative burden will impact not only its profitability, but also its growth prospects.

History of IT in Agriculture

The development of the personal computer in the late 1970's brought about a new era in information technology. Farmers were visited by salesman who promised a paperless office and simplified accounting. Dreams were dreamt of databases full of rich information. Specialised agricultural software was sold to

farmers. The main focus in the beginning was to computerise existing processes, notably farm accounting. Conversion to the computer did not come without some effort on the part of the farmer though. Some quickly made these new systems part of their management and some were rather frustrated by it and did not consider it worth the money and effort.

Later on electronic systems were created to automate control processes, automated irrigation systems being one such example. Now the farmer could set certain parameters and the rest happened automatically and could just be monitored by the farmer.

Adoption was slow.

With the advent of the Internet our world became progressively smaller and more interconnected. Information became more freely and easily accessible. E-mail provided a cheap, convenient, easy-to-use and very attractive alternative to telephone or mail communication, especially over large distances and across time-zones. This boosted the adoption of the personal computer in the farm office.

IT Adoption in Agriculture

Researchers studied the slow adoption of computer use by farmers (Iddings & Apps, 1990). They found that the factors that influence computer use at that time seemed to be:

- Complexity of Farm
The more complex the farm the more necessary it would seem for computerised systems. However, on the other side it would also require more complex software and require more time and effort to capture the data. These demands are often seen as outweighing the benefits.
- Degree of External Support
Support is already offered by various institutions to the farmer (eg. accountants that keep financial and tax records etc). This brought the question of how much the farmer really needed to do it himself by utilising a computer.
- Age
The old saying of “You can’t teach an old dog new tricks” are believed to be true by some farmers.
- Views on Management
Some farmers don’t like managing the business. They see being outside in the orchard as more important to run a profitable farming business. They may also simply dislike office tasks. Computer related activities detract too much time from being outside.
- Time
Learning and configuring software takes a lot of time. This time has to be subtracted from available time for farming-related activities.
- Experience
Previous experiences with computers dictate the attitude towards further use. If a negative perception is created it will negatively affect future use.
- Network
Because of the specialised, and sometimes complex, nature of farming software generic training is seen to be of little help to a farmer learning to use a computer. Farmers may feel that they have to rather figure it out on their own. Computer use is affected favourably if the farmer knows other farmers that use the computer in a similar way as himself.
- Availability of Information
Information about available software is not freely available. Subsequently farmers are unsure about which product would be worth the buy.
- Personality and Approach to Learning
A farmer’s personality and approach to learning will dictate his attitude towards computers. Those that are keen to learn and discover the world of computers will generally be more positive and enthusiastic about it.

In summary, the adoption of computers and related technology by a farmer will be determined by the farmer's assessment of cost vs. benefit. The cost is not only monetary, but also includes time and effort required.

However, the pressure for farmers to become computer literate has been increasing with time. As a result of the, so-called, "Internet revolution" farmers who don't make use of computers are now increasingly finding themselves more isolated.

Role of IT in Agriculture

The role of IT systems in agriculture should mostly be seen as taking a decision support role and for this reason are also referred to as decision support systems. The systems are used as an aid to the decision-making of the agribusiness manager. This stands in contrast to decision replacement systems where decisions are automatically made based on information gathered. Because of the fact that the decision-making process of humans are not fully understood yet and because IT systems cannot yet apply common sense, these systems largely assume a decision support role.

IT systems have a wide scope of application for agribusiness management. Virtually any facet of the agribusiness' information needs can be addressed by IT systems. Notable examples of these systems are:

- Software
Computer software is the core of the IT system. It is the primary mechanism whereby the manager interacts with the various underlying IT systems and therefore also the primary means of reporting the processed information to the manager to base decisions on. The software might perform one or more of several functions, including but not limited to:
 - Asset management
eg. asset availability, asset location, asset use, asset maintenance etc.
 - Fleet management
eg. vehicle use, vehicle maintenance, vehicle location, vehicle operating costs etc.
 - Production management
eg. crop modelling, pest management, production, irrigation, fertilization etc.
 - Financial management
eg. financial statements, cash flow management, budgeting etc.
 - Personnel management
eg. labour records, labour use, labour cost etc.
 - Administration
eg. documentation regarding accreditations, regulatory matters etc.
 - Communication
eg. e-mail, letters, notices etc.
- Mapping (GIS/GPS)
Mapping plays an important role as a tool in decision making. Various factors affecting production can be geographically mapped in order to provide a visual representation to the manager. Examples would be the mapping of soil type, tree production, temperature, pest incidence, labour efficiency etc.
- Control systems
IT systems can have the ability to control other systems electronically or mechanically. An example of this would be the control of remote pumps and valves for irrigation.
- Measuring systems
In order to decrease uncertainty several factors that influence decision making have to be measured. Examples of these measurement systems are:
 - Weather stations
Weather plays a major part in crop production. Automated weather stations provide a way to measure the different parameters of weather.
 - Soil probes

- The soil as a medium greatly affects crop production. Soil probes can measure soil factors such as pH, moisture content, E.C. etc.
- Labour activity loggers
 - Work activities have to be measured in order to make decisions regarding the efficiency of work that has been performed. To ease the collection of this information details regarding work activities can be logged by using portable logging terminals.
- Training (E-learning)
 - Computer-based training can be used as an effective means to teach new techniques to personnel in an interactive way where practical on-the-job training isn't an ideal option.
- E-commerce and trading
 - IT systems can be used to facilitate the trade in agricultural goods and services. It can make it easier for buyers seeking goods or services to locate the sellers and conversely also make it easier for sellers to reach buyers. It can also serve to make the trading process easier and safer by facilitating the payment as well as the transfer of goods and services. In the case of the trade of futures and options it can also serve to facilitate hedging.
- Precision farming
 - Two trees standing next to each other may have different factors affecting its production yield. By utilising precision farming systems, trees can be managed individually.

Due to the interconnected nature of the various processes in an agribusiness it is also necessary for the various IT systems to be integrated with each other. A specific system needs to have access to any information it requires, in addition to its own information, which may have been gathered by another system in order to take all factors into account when analysing and/or interpreting its information. This poses a challenge in practice due to the fact that different engineers may develop the different systems and result in a situation where one system may not be able to access the information from another system. In fact, at the moment this seems to be more the rule than the exception. It is important that engineers keep this in mind when designing their systems.

Conclusions

Agribusiness managers have become accustomed to, and almost at ease with, uncertainty. They have accepted it as a fact of farming and have developed a "gut-feel" through experience. As a result of the increasing squeeze on margins it will become more necessary to know the facts in order to maintain profitability of the agribusiness. Managers already know this and subsequently there is a definite need in agribusiness management for more information to decrease uncertainty. Fortunately the technology exists that can enable the manager to gather and interpret the information without increasing the burden on the agribusiness. In fact, a well designed, well implemented and integrated IT system will certainly significantly decrease the burden already placed on the manager. Integration of these IT systems is important in order to enable the manager to see the big picture. The automated gathering of information also has the added advantage of eliminating human error that may creep into the manual gathering of information.

The future for IT systems in agriculture holds much promise. Technology is constantly improving to solve human problems more easily. Innovation in technology to solve agriculturally specific problems is driven by market demand. Adoption of IT in agriculture seems to be on the rise as agribusiness managers increasingly discover the need and consequently see the value of these technologies. This will serve to drive the demand for these technologies and therefore stimulate new innovation and decrease costs. As these technologies progress and our understanding of human decision-making increase we should see a gradual shift from decision support systems to decision replacement systems.

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