Establishing a Model to Identify Information Systems in Nontraditional Organizations

Jean S. Adams
jeanadams@surfmk.com
5635 Library Road
Bethel Park, PA 15102, USA

Abstract

Information is critical in both traditional and nontraditional organizations. But few tools exist to identify information systems in nontraditional organizations. Much of the past research has focused on reviewing organizations that have large automated information systems. This has left gaps in the knowledge of smaller organizations which rely on more manual processes to gather and process information. These organizations have unique needs and this makes studying them in mass difficult. This paper explores merging to previously examined models into a process that would allow us to study organizations of every size and automation level. The focus of this paper is to describe the process used during a 2007 study of small farms in Pennsylvania to develop a model to identify the information systems in place. The end result was a development of a model which takes into account the uniqueness of nontraditional organizations such as small farms.

Keywords: information systems, nontraditional organizations, farm information systems, and small business systems.

1. INTRODUCTION

Information and the handling of information are critical to success in all organizational settings. As the demand for information reaches all time highs organizations need to find tools to manager the ever increasing information flow. Many authors define information systems as a tool necessary to manage information demands. Identifying and studying information systems have been popular topics for past research primarily focusing on traditional organizations (in both the academic and nonacademic arenas). Traditional organizations are defined as having established computer-based information systems.

Past research has provided many models for researchers to use to identify and analyze information systems in these traditional settings. Few models exist to address the systems of nontraditional organizations. Nontraditional organizations tend to be smaller in size and less computer automated. These organizations focus on operational needs and have very unique information requirements. They also have little expertise to systems development and lack the manpower necessary to build a large automated system.

The aim of this paper is to describe one method that was used to build a model to identify and analyze the information systems in a nontraditional setting. The model discussed in this paper was used to explore information systems on small farms in Pennsylvania, a very nontraditional setting. The process for developing the model is applicable to other settings such as a classroom, campus, educational groups, small businesses, and other nontraditional settings.

2. BACKGROUND

Across the United States, today's farm operators face continuing challenges from global competition, urban sprawl, and scarce resources. New technology, government

regulations, agri-terrorism, and biological threats are changing the way farm operators face these challenges. With the introduction of the Internet and new technology this non-traditional organizations has been faced with new information processing demands. As a result, farm operators are forced to institute processes and procedures to gather and process information to protect their farm, products, and way of life.

Today's farm operators, like many others, must develop tools to become information managers to survive and thrive. Case and Rogers (1987) report that "today's agriculture exists in the context of an information society, and so the gathering, processing, and outputting of information is one of the most important roles of the modern farmer" (Case & Rogers, 1987).

One path to understanding how small farms (those with average yearly agricultural income of less than $100,000) are addressing these information demands is to identify the types of information systems in use on small farms. Unfortunately there are few tools available to identify the types of systems being used on these nontraditional settings. To research farm information systems (FISs) on small farms a process must be developed that takes into account the uniqueness of this nontraditional setting while at the same time upholding traditionally accepted definitions of information systems.

3. LITERATURE REVIEW

Identifying FISs is not a new topic in agricultural or academic research. However, identifying FIS on small farms has not been heavily researched in either the academic or public forums. Much of the previous literature has focused on large farms, (those with gross receipts, i.e., sales and government payments greater than $100,000 per year). Batte's 1995 study of large farms was one of the first studies to identify information systems on large farm operators. In his study Batte chose to use identification of a computer based information system as the model to identify the types of systems in place. Batte was able to use this approach due to the similarities of large farms to traditional organizations with formal computer based information systems.

Previous literature has gone so far as to indicate that computer adoption on large farms assumes or can be equated to usage of information systems. Doye et al. (2000) agree that computer adoption is a key indicator of information system adoption on large farms. They found that the characteristics of farm operations that use a computer and those that have adopted a FIS were very similar. This provided the support needed to identify FISs on large farms using the models established by previous research on traditional organizations.

El Louadi confirms in his study of small organizations [small businesses] that research needs to focus on the individuality of organizations and not on applying standards developed in a different setting. This would aid the researcher to better understand how small organizations operate (El Louadi, 1998). Hunter confirmed in his 2004 study of small businesses that "small businesses [organizations] tend to emphasize the use of information systems for more immediate daily operations" (Hunter, 2004). Hunter also documents that small businesses [organizations] are "limited to what activities can be initiated with the scarce resources and talents" available to them (Hunter, 2004). Therefore, by restricting research objectives to only those standards adopted by larger traditional computer based organizations, the researcher may not achieve the intended results when studying a smaller less automated setting.

4. MODEL DEVELOPMENT

We begin developing the process by defining the most basic component of an information system, information. For this research effort information, in general, can be defined in the following manner: "data that has been shaped into a form that is meaningful and useful to human beings", (Laudon & Laudon, 2002), "messages evaluated to be of value in dealing with a problem", (McDonough, 1963) or "codified and non-codified information used and created as humans perform their work." (Alter, 2006).

Every organization or group must work with information to produce the required output. The tool that makes information usable to the end user is referred to as an information system. In their book *Essentials of MIS*, Laudon and Laudon (2002) define an infor-

mation system as "a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making, coordination, and control in an organization. In addition to supporting decision making, coordination, and control, information systems may also help managers and workers analyze problems, visualize complex subjects, and create new products" (Laudon & Laudon, 2002). For Laudon and Laudon, the primary focus of an information system is the ability to bring together useful information that will support the organization or manager.

Extending these definitions to our example, the small farm, farm information can then be defined as any type of information used to perform farm activities or that information used to deal with a farm problem. The definition of a farm information system (FIS) can then be extended as a tool to assist farms in forward planning, risk management, and the control function of farm management" through the use of information (Doye et al., 2000). In other words, an FIS is a tool that helps to coordinate information to support the farm management activities. By starting with a basic definition of information and information systems we can build a specialized definition of information and information systems associated with the environment in question just as we did above for small farms.

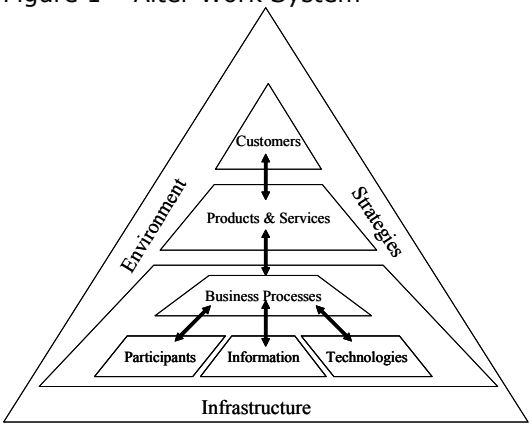
5. MODEL REQUIREMENTS

Using the Laudon & Laudon definition of information systems the core requirements of an information system exists to collect, process, store and distribute information that supports the decision making and control of an organization. This provided the first requirement of our model. Our model must be able to identify the mechanics necessary to gather, process, store, and distribute information. Second the model must also identify if the information gathered is processed to support management of the organizations. Using these criteria as a means for identifying information systems requires that our model be two pronged. That is the information being processed must support management functions and our model must be able to identify both the processes and the intended usage before existence of an information system can verified.

6. WORK SYSTEMS

This two pronged approach was achieved by combining two models previously developed in information system research. The first was Alter's framework of "work systems". According to Alter, a "work system is a system in which human participants and/or machines perform business processes using information, technologies, and other resources to produce products and/or services for internal or external customers" (Alter, 2002). Alter defines an "information system as a special case of a work system in which the business processes preformed and products and services produced are devoted to information" (Alter, 2002). In other words, the "work system framework is an approach for understanding and analyzing systems [processes] in organizations [any organization]" (Alter, 2002). Alter's framework is not limited to computer based organizations and is also not constrained by an organizations size. The foundation of Alter's model is built on analyzing the activities that an organization undertakes to produce a desired outcome such as producing a product.

Figure 1 – Alter Work System



Note. from Alter., (2002) The Work System Method for Understanding Information Systems and Information System Research, Communications of the Association for Information Systems.

Alter's work system framework is developed from nine core elements as displayed in Figure 1. The first four elements: information, participants, processes, and technologies, "constitute the systems doing the work" (Alter, 2002). These first four elements define what Alter refers to as a basic system within

his framework. This is where "work" is actually performed. The "work systems output are the products and services received by its customers" (Alter, 2002). These customers can be either internal or external users of the system, or both. The remaining three elements: environment, strategies, and infrastructure influence the overall process to determine "if a work system can operate as intended and can accomplish its goals" (Alter, 2002). For the special case of information systems, "business processes are limited to six activities: capturing information, transmitting information, storing information, retrieving information, manipulating information, or displaying information" (Alter, 2002).

Alter's framework provides a two-level approach to explore the activities established in an organization. The first level, the work system, identifies the components of the systems doing the work. This level provides the tool necessary to identify the mechanics used to gather information in an organization. The second level identifies the interaction of the work system with the environment, strategies, and infrastructure. This second level provides data on how systems are used which brings us to the second prong of our model development.

7. ORGANIZATION MANAGEMENT

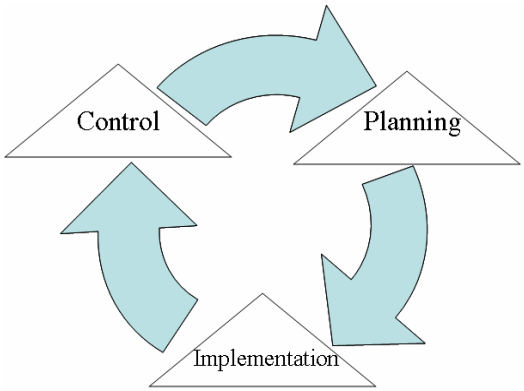
The Alter framework provides the structure for identifying the physical mechanics used to generate information for any type of organization and identifies how the work system interacts with the environment, strategies and infrastructure of an organization. The second requirement of our model requires that the information generated from an information system be used to support the management of the organization in question. Due to the uniqueness found in nontraditional organizations Alter's model alone does not meet the requirements set out in this study.

We again return to previous established models to search out a management model specific to the industry and environment to be studied. To determine if the information specific to our setting supports farm management we must first understand what is information is used in farm management.

Kay's (Kay & Edwards, 1999) functions of farm management offers a structured approach for organizing information that enables farm operators to reach their agricultural goals. Kay (Kay, 1986) defines farm management to be "the decision making process whereby limited resources are allocated to a number of production alternatives to organize and operate the [farm] business in such a way as to attain some objectives" (Kay & Edwards, 1999). This requires decision making during all three basic management functions: planning, implementation, and control. Without adequate planning, implementation, and control, valuable time and resources may be wasted or even destroyed.

Kay's functions of farm management can be expressed as a cycle where information is used to navigate and move through each of the functions: planning, implementation, and control. This cycle is illustrated in Figure 2.

Figure 2 – Kay's Functions of Farm Management



The first function in Kay's model is planning. Planning is also referred to as the strategic decision stage. In this stage identification of the problem or strategic direction occurs. The farm operator must identify the problem or opportunity and choose to act or not. Examples of planning decisions are: herd expansion, capital acquisitions (land or machinery), crop selection, farming techniques, and breeding plans.

The second function in Kay's (1999) model is implementation. Implementation is selecting and acting on a plan. Once a plan is identified, resources (land, labor and capital) are allocated, and an action plan is put into place to implement the selected strategy. Progress is monitored on a routine basis to

determine if the actions put into place are moving the farm operator towards the intended goals.

Control or monitoring the progress of an action plan is the last function identified in Kay's (1999) model. If the progress is not acceptable, then a new action plan can be put into place or adjusted to meet the intended goals. Examples of implementation and control functions are: crop maintenance including fertilizers, pest control, milk production, feed rations, and machinery choices.

Kay's functions of farm management provide a filtering process to disseminate the many different information inputs that are used for farm management. Kay's functions of farm management not only classify what information is critical to farm managers but also serve as a guide for gathering data related to farm management activities.

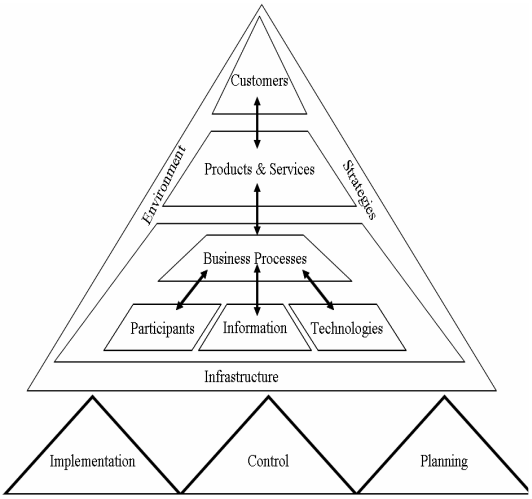
8. ESTABLISHING A MODEL

Combining the strengths of Alter's work system framework to identify the mechanics of an information system along with the industry specific management model to evaluate if information supports management activities creates an approach that can be used to identify information systems in nontraditional environments.

Although Alter's framework (2002) was developed based on non agricultural business processes, the core concept is built around "human participants performing work and using information to produce products" (Alter, 2002). Alter's approach does not limit the type of work being performed but only requires that human participants are performing work to meet an objective such as product production.

Kay's definition of farm management is established as the guideline for defining farm management or the "work" of the system. According to Kay farm management is "the decision making process whereby limited resources are allocated to a number of production alternatives to organize and operate the [farm] business in such a way as to attain some objectives" (Kay & Edwards, 1999). In Kay's definition we see human participants allocating resource, land, capital, and labor, to produce products.

Figure 3 - Farm Management Functions Applied to the Work System Method



Alter's core concepts are therefore present in Kay's definition of farm management and provide the thread needed to easily weave these two models into one. Merging Kay's farm management functions with the work system framework provides a process to identify FISs on small farms without the use of established and accepted small farm FIS vocabulary.

Figure 3 illustrates the result of merging Kay's farm management functions with Alter's framework. Farm management activities are based on different business process, daily routines, driven by the type of farm, management structure and goals of the individual farm. A systematic approach for identifying information and systems and defining their use is achieved when the functions of farm management are analyzed using the Alter framework.

9. STUDY OVERVIEW

This approach was introduced in a 2007 quantitative study conducted with small farm operators located in Pennsylvania. One primary research objective of this study was to identify if information systems existed on small farms and if so to categorize the types of systems in place.

Methodology: The sample was drawn from the population of agricultural operators in Pennsylvania. According to the

National Agriculture Statistics Service (NASS, 2002) the target population consists of over 48,000 farm operators who reside in Pennsylvania and whose average yearly agricultural income is less than $100,000 per year. Members of two organizations were contracted to participate in this study. The Pennsylvania Associations for Sustainable Agriculture (PASA) and also the Pennsylvania Women's Agricultural Network (WAGN) both worked with the researcher to contact potential participants. A second source of participants came from visits to agricultural fairs held throughout Western Pennsylvania. Through these methods 100 usable data sets were received. The researcher noted the convenience of this sample but also recognized that due to the exploratory nature of this study the convenience and size of the sample did not impact the utilization of the model shown in Figure 3.

The first step of the model application was to identify the work systems of the small farm operator. Questions were designed based on the model presented in Figure 3. Questions were aimed at the identification of the components of a work system: processes/routines participants, information, technologies, environment, strategy, and infrastructure. Close-ended multiple-choice questions were used to gather component data. To ensure adherence to the approach survey questions were mapped to each model component. This ensured that that all components were considered in the final outcome of this study.

Small farms like other small organizations perform daily activities to service their customers and support their goals (farming). Asking participants basic questions about their daily routines identifies which activities require information and the information processing related to these routines. These routines according to our model are the beginnings of the "works systems."

Participants were asked to indicate the type of information for which they maintain records such as livestock breeding schedules, pesticide applications, and cash-flow information as examples. Once collection of records was identified participants reported on the processes used to gather information. For example did participants gather pesticide applications through the use of a notebook, markings on a barn wall or computer based tracking system. Was this information processed and stored in the same format it was gathered or was it transcribed before storage. And finally participants were asked to identify if information from prior years was ever referred to in current decision making.

The second step of model application was to determine if the work systems identified in step one supported farm management. Questions were developed to determine the environment, infrastructure, and strategies present on each farm. Environment was defined by the types of products produced on each farm. Farms were categorized as livestock, crop, or combinations of both. Strategies were defined through the profit motivation of each farm and by any formal documented farm goals. Infrastructure was the defined by the management structure in place on each farm ie: sole proprietorship, partnership, corporation, or other. By studying the interaction of the three elements environment, strategies, and infrastructure we can determine "if a work system can operate as intended and can accomplish its goals" (Alter, 2002). In this study the goal was planning, implementation, and control which provide the steps for farm management.

10. MODEL IMPLEMENTATION

Through the use of the model illustrated in Figure 3 it was determined that each farm implemented the mechanics of their system in a unique fashion to achieve their individual farm goals. Therefore FIS could be identified in use on these small farms.

One hundred usable data sets were received from participants responding to the questionnaire. Participants identified financial records, crop records, and livestock records as the three areas in which information is gathered. Each farm gathered different levels of information in these areas but the most basis issue was the presence of information records in these areas. Participants also reported through what mechanisms were records gathered. Financial records were tracked manually or on a computer or through preformatted worksheets. Crop records were tracked in the same manner with some reporting using just a notebook system. Livestock records were also gathered using similar formats several participants listed tracking markings on a barn wall. The

predominant use of these systems to support farm management was as follows: Financial systems were used to identify unprofitable business sectors and monitor cash flow. Crop systems were used to track and review fertilizer soil analysis analysis. Livestock systems were used for birthing/breeding planning and feed application.

The model proved successful in determining FIS existence in the areas of financial management, crop management, and livestock management.

11. CONCLUSIONS

Combining two established and accepted models used in traditional organizations provides an exploratory tool for identifying information systems in nontraditional environments. By linking the application of information to the mechanics of information handling provides a foundation to begin research in these nontraditional areas without having to redefine a nontraditional information system or in this specific case a small farm information system. Although this study was based on small farms the same approach could be used for other nontraditional organizations as previously mentioned.

I acknowledge that the participants were a convenient sample and the numbers of responses was also limited. Future research will include a larger sample and could also include large farms. The combined model is not constrained by size or farm type and should prove useful even in traditional large farm settings. Future research should also study in depth all of the components of a FIS the aim of the study was only to identify the components as it relates to farm management

The key to information system research is to be able to identify the use of information and the mechanics of information processing without getting bogged down by the "system". By achieving this researchers can focus and isolate information gaps. The combined model provides a systematic approach that maintains the focus of the research on information and its related processes.

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