SYSTEMS DESIGN PROCEDURES FOR FARM ACCOUNTING

Gary D. Schnitkey and Steven T. Sonka

Abstract

This paper presents a conceptual framework, known as systems development, for designing, selecting, and evaluating information systems. Techniques are developed that aid farm managers in choosing an accounting system. Six farmers took part in case studies testing the selection techniques. The participating farmers exhibited great diversity in the preferred design of their accounting systems and the manner in which they desired reports to be presented. This diversity suggests that system selection is an important aspect of implementing an accounting system.

Key words: accounting systems, microcomputer, systems development, systems selection.

Currently, great strides are being made in information technologies. These technologies can provide farmers with marketing, production, accounting, and other information. Farmers, as well as other decisionmakers, seem to be interested in information technology (Fuller; Infanger et al.). Evidence of this interest includes farmer attendance at trade shows and seminars and the number of firms attempting to supply farmers with information technology. Reasons for farmer interest include the financial stress farmers currently face, increasing managerial options provided by new technologies and increasing farm scale (Sonka, 1983), and potential cost reductions associated with use of information technology (Davis and Olsen).

Computerized accounting systems are one of the new information technologies of interest to many producers. One study indicated that 79 percent of all farmers who own computers use them to produce some form of financial records and statements (Arthur Andersen & Co. and University of Illinois). This is an understandable choice because farmers must provide accounting information to tax authorities, lenders, and investors. Also, an accounting system is an effective tool for providing managerial information.

Selecting a computerized accounting system presents the farmer with several decisions, such as what type of hardware to purchase, which of the numerous software alternatives to select, and the appropriateness of design that is incorporated within the accounting software. Currently, there are many different accounting systems available to farmers. Generally, these systems are of good quality; however, there are substantial differences in the types of reports produced, processes used to produce reports, and data requirements. Also, most accounting systems have flexibility in their design structure (i.e., accounts, responsibility centers, ownership splits, and subsidiary ledgers). The design a farmer specifies when implementing a particular system greatly affects the information received.

King and Sonka list information system design as one of five broad problem areas demanding increased attention by farm managers. They stress that the availability of more powerful information management tools also presents challenges for agricultural economists. One challenge is the development of procedures which assist producers in selecting management information systems. A more difficult and probably more important task is the evaluation of alternative management information systems and the valuation of the resulting information generated (Chavas and Pope; Sonka, 1985).

For both of these types of professional efforts, systematic procedures are required. Information specialists have developed a framework, generally called systems devel-

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opment, to aid firms in designing, selecting, and implementing information systems. The goal of this research is to adapt the systems design approach to an agricultural application, that of computerized farm accounting. The procedure developed can be employed in assisting farmers select accounting systems. As important, this process outlines the appropriate methodology that researchers should utilize if they are to rigorously evaluate alternative information systems.

The next section of the paper describes the general components of the system development process. This is followed by a brief description of the accounting system selection techniques developed for farmers and results of actual case farmer studies using these techniques.

THE CONCEPTUAL FRAMEWORK OF SYSTEMS DEVELOPMENT

Although systems development can be used for any information system application, this discussion centers on the accounting system. The goal of systems development is to design an accounting system that facilitates operations, with the ideal system mirroring the firm's business practices. Generally, the process is divided into various stages. A six stage process, as shown in Figure 1, is utilized in this study (Wilkenson).

Planning: Planning involves first defining the business and its operations. Items considered include the number of operators, business organization, business size and diversity, productive activities, financing sources, and marketing techniques. Second, three sets of objectives are defined. These objectives and their purposes are: (1) the firm's objectives allow reports to be designed that monitor a firm's progress towards firm goals, (2) accounting system objectives serve as benchmarks for comparing alternative accounting systems, and (3) system development objectives document weaknesses of the current system and identify what must be accomplished during the development process. Third, the system constraints, such as manpower, costs, resources, and user acceptance are identified. Without defining constraints, a system's design can easily become unrealistic.

PHASE	TASKS
Planning	(1) Define the business. (2) Compile objectives of the: a) firm, b) accounting system, and c) development process. (3) Identify system constraints.
Analysis	(1) Describe current system. (2) Detail information deficiencies. (3) Compile statement of information needs.
Design	(1) Relate information needs to accounting reports. (2) Specify sources of input data. (3) Describe proposed system procedures.
Selection	(1) Compare alternative systems. (2) Identify preferred candidate.
Implementation	(1) Select implementation approach.
Evaluation	(1) Compare operation system with planned objective. (2) Modify system, if needed.

Figure 1. Phases and Tasks Associated with Information System Development.

Analysis: The analysis stage defines the information requirements of the firm. The first task is to analyze the current accounting system. This analysis identifies information of value and weaknesses of the current system, such as information gaps and redundant processes.

Although an analysis of the present system partially indicates future information requirements, it does not identify additional information needs. These needs originate from report users (tax authorities, outside users, and farm managers). Tax authorities and outside users demand relatively standard reports. Therefore, their needs are more easily identified than those relating to internal management needs. Reports necessary for internal decisionmaking depend upon the organizational environment of the firm and the manager's personal attributes. The organizational environment is described during the planning stage. Personal attributes depend on the manager's background and management style.

The result of the analysis stage is a statement of information needs. These include reports that must be produced and each report's performance measure (budget or last year's comparisons), timing, and content. These needs should meet the objectives of the accounting system.

Design: The design stage uses the compiled statement of information needs to develop an accounting design that produces necessary reports. The necessary ownership splits, responsibility centers, accounts, and subsidiary ledgers are designed. Attention is given to the manner in which data are processed, information is updated, and data are retained (Sempevivo). Concerns involve the flow of data from collection methods to the final reports.

The result of this stage is a compilation of system requirements and procedures. System requirements detail the design requirements including necessary accounts, ownership splits, responsibility centers, subsidiary ledgers, and reports. These aid in evaluating alternative accounting systems. Systems procedures serve as a reference for operation of the accounting system and specify necessary input data, collection methods, summarization methods, storage processes, report generation procedures, and control measures.

Selection: The system requirements are used to select an accounting system. Selection involves reviewing and comparing available accounting systems. The review typically includes interviewing vendors and system users, analyzing documentation, and experimenting with the system. For each system, the various specifications and qualitative factors, such as speed and ease of operation, are compiled. The system that most adequately meets the predefined specifications should be selected.

Implementation: The selected accounting system then must be implemented. Because the system is new and unfamiliar, implementation is a substantial task and problems are to be expected. There are two philosophies for installing systems. In the first, the old system is dismantled and the new one started. This method provides a quick break with the old system and forces the installation of the new system. However, if the new system fails, no information is available because an accounting system is not operating. The alternative approach phases in the system. An advantage to this approach is that acclimation to the system occurs gradually and problems can be overcome as they appear. This method is more time consuming, however, because two systems are operating simultaneously.

Evaluation: The newly installed system should be evaluated over several periods of operation. This ensures that the system is meeting the objectives of the firm. If it is not meeting these objectives, modifications are in order. Evaluations should be done periodically, ensuring that the system is kept current with the needs of the changing farm firm.

Definition of these six phases underscores the difficulty associated with evaluation of producers' use of information management technologies. Reports of disappointment and dissatisfaction with a specific system do not necessarily imply a faulty system. Instead, errors in the conduct of the earlier phases of system design or unrealistic expectations associated with failure to perform those earlier phases may be the causes of the user's discontent. Therefore, efforts to evaluate information systems must consider more than the actual performance of those systems.

ACCOUNTING SYSTEM SELECTION TECHNIQUES

The effort described here developed a set of worksheets and procedures to aid farmers in the first four steps of the systems development process. These worksheets were developed through a three step process. First, preliminary worksheets were proposed. These worksheets were reviewed by individuals having knowledge of accounting systems, including university faculty, Illinois Farm Business Farm Management Association (FBFM) personnel, and farmers. Based on their comments, the worksheets were revised. Lastly, the revised worksheets were tested in six case farmer studies and further revisions made. Selected implications arising from the case farmer analyses are reported in the final subsection.

Accounting System Selection Worksheets

Ten worksheets and eleven schedules have been developed for use in the farm accounting system selection process. These are divided into three classes according to the tasks they perform: (1) information needs identification, (2) design, and (3) summarization of system requirements. Figure 2 illustrates the interrelationships of these forms. In this flowchart, rectangles represent worksheets, circles represent schedules, single lines show ordering of procedures, and dashed lines indicate flows of design information to the summary table. The number and letter of each worksheet and schedule, respectively, are indicated in the appropriate box (e.g., Worksheet 1 is denoted W-1 and Schedule A, S-A).

The first three worksheets assist the producer in identifying information needs. Completion of these worksheets accomplishes the planning and analysis stages of systems development. The first worksheet is used to define the objectives of the accounting system. The second worksheet is used to identify reports the current accounting system pro-

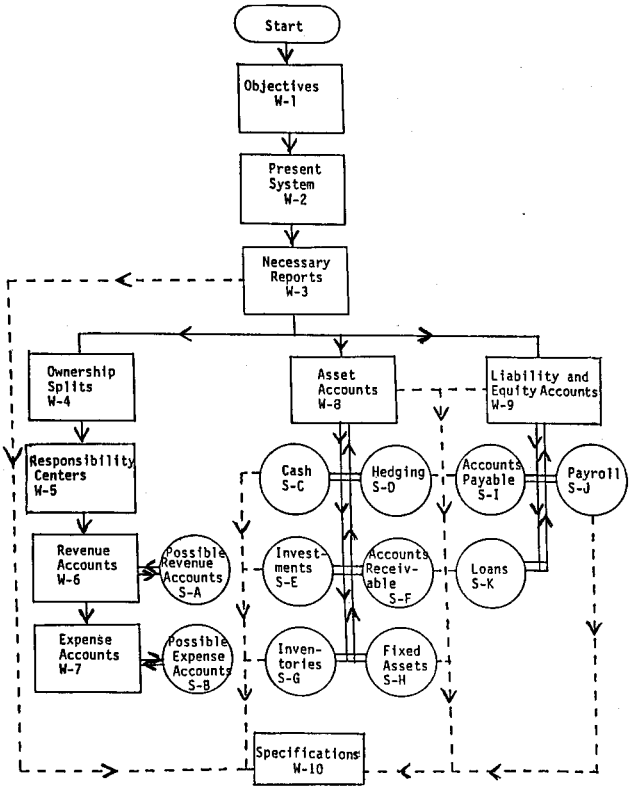

Figure 2. Flow Chart of Worksheets and Schedules Used to Design an Accounting System.

vides and to rank the importance of the prepared reports. These two worksheets aid in the completion of the third worksheet which is the culmination of the needs identification stage.

Table 1 presents Worksheet 3 and contains the case farmer responses (to be discussed later). Farmers rank the importance of receiving each report listed in the left column. The reports in the left column are divided into four categories:

1. total farm—gives aggregate business information,
2. ownership splits—details individual owners or entities shares of revenues and expenses,
3. responsibility centers—details revenues and expenses of segments of the business, and
4. resource management—details individual asset or liability categories.

Farmers use the next three columns (headed as important, desirable, and not important) to rank the importance of each report. The final column refers to the necessary design forms that must be completed if that report is desired.

The next six worksheets and all the schedules comprise the design stage of systems development. Farmers complete the design forms that relate to the desired information noted in Worksheet 3. Worksheets are used to specify relevant accounts, with each worksheet dealing with one type of account, as noted in Figure 1. For example, Worksheet 6 is used to list the number of revenue accounts, divide these accounts between subsidiary ledgers, and total the number of revenue accounts. Schedules provide reference material for the worksheet and are used to define subsidiary ledgers.

Summarization of system requirements is accomplished by completing Worksheet 10. This worksheet facilitates the selection stage of systems development. Contained within the worksheet is a list of potential system

requirements. Farmers gather the majority of these characteristics from the preceding forms and enter them in a requirements column located next to the characteristics. Then, actual capabilities of alternative accounting systems can be entered in adjoining columns. This allows for comparisons of alternative systems and for better judgments concerning system selection.

Results and Implications of the Case Farmer Studies

As noted previously, six producers completed the selection worksheets in the third phase of the effort. The six case farmers operated typical central Illinois commercial farms. All the farmers had crop enterprises ranging in size from 500 to 1,000 acres. Two of the farmers also managed sizable hog enterprises.

As shown in Table 1, these producers indicated some concensus as to the reports they regard as important. All considered the income statement, actual cash flow, tax reports, fixed asset reports, and loan reports as important. However, considerable diversity was shown relative to the design of the accounting system and manner in which reports are presented. One area in which this can be seen is in the number and type of desired responsibility centers. All but one farmer (case farmer F) thought some type of enterprise analysis was important. The form of this analysis varied among the farmers. For example, case farmers A and B divided crop enterprises by the different crops raised, while farmers C, D, and E desired analysis on different acreages farmed.

An area that affects report presentation is the number of accounts used. Generally, a greater number of accounts requires more detail, affecting the financial statements, cash flow reports, and responsibility center reports. Panel A of Table 2 lists the number of accounts each farmer designed. Each of the farmers had different account structures.

TABLE 1. FUTURE INFORMATION NEEDS OF SIX CENTRAL ILLINOIS CASE FARMERS, 1984

Report	Importance[a]			Supporting forms[b]
	Important	Desirable	Not important	
Total farm:				
Balance sheet	A,B,C,F,	D,E		Worksheets 8 & 9
Income statement	•			Worksheets 6 & 7
Statement of changes in financial position	D,E,F	A,B,C		Worksheets 8 & 9
Retained earnings		B,F	A,B,C,D,E	Worksheets 8 & 9
Actual cash flow	•			Worksheets 5-7
Personal expenditures	E,F	C,D	A,B	Worksheet 7
Tax reports (e.g. Schedule F)	•			
Ownership splits	A		B,C,D,E,F	Worksheet 4
Responsibility centers:				
Non-farm activities	C,D	E,F	A,B	Worksheet 5
Crop production	A,B,C,D,E	F		Worksheet 5
Livestock production	A,C	B	D,E,F	Worksheet 5
Resource management:				
Cash				
By bank account	A,C,D,E,F	B		Schedule C
By vendor	D,E	A,B	C,F	
Hedging activities	C,E,F	B	A,D	Schedule D
Investments	B,C,E,F	A	E	Schedule E
Accounts receivable	C	A	B,D,E,F	Schedule F
Inventory				
Costs	A,B,C,D,E		F	Schedule G
Quantities	A,B,C,D,E		F	Schedule G
Market values	A,B,C,D	E	F	Schedule G
Fixed assets				
Depre. schedules	•			Schedule H
Costs	•			Schedule H
Market values	B,C	A	D,E,F	Schedule H
Payroll				
Amount paid	A	E,F	B,C,D	Schedule J
Withholdings		A,E,F	B,C,D	Schedule J
W-2		E,F	A,B,C,D	Schedule J
Accounts payable	A,C,D,E	B	F	Schedule I
Loans	•			Schedule K

[a]Letter denotes individual case farmer ranking of each report.
[b]These supporting forms specify accounts and designs that will produce the corresponding information (not included in this article).
•Indicates that all farmers chose this ranking.

TABLE 2. ACCOUNTS DESIGN BY SIX CENTRAL ILLINOIS CASE FARMERS AND CHANGES IN THEIR ACCOUNTING SYSTEM, 1984-85

Type of account	Case farmer					
	A	B	C	D	E	F
Number of accounts designed:						
Revenue accounts	19	14	12	26	35	13
Expense accounts	143	32	42	66	44	38
Asset accounts	34	16	15	26	22	7
Liability accounts	22	55	5	3	5	3
Equity accounts	4	7	6	1	1	2
Total accounts	222	74	80	122	107	63
Changes in the accounting system	NC[a]	SC[b]	NC[a]	NC[a]	FBFM[c]	MC[d]

[a]NC denotes no change.
[b]This farmer now uses a service bureau.
[c]This farmer enrolled in the Farm Business Farm Management Association.
[d]This farmer purchased a microcomputer and now uses an accounting program.

Generally, case farmers A, D, and E wanted greater detail than did farmers B, C, and F.

A number of implications result from the case farmer studies. Although these farmers managed relatively similar operations, there is diversity in the reports and designs specified by each farmer. (This diversity is not restricted to the previously discussed issues.) The fact that this diversity exists supports the contention that system selection is an important aspect of implementing an information system. One accounting system would not satisfy the needs of each of the case farmers. If each farmer had to utilize the same accounting system and design, each would receive information that they do not find useful or would lack necessary information.

When evaluating the system selection techniques, all the case farmers found the methods useful. Most of these farmers had been analyzing micro-computer-based systems and were confused by the options they faced. They believed that the selection methods eliminated some of that confusion. Approximately 1 year after taking part in this study, all the case farmers were reinterviewed as to changes they had made to their accounting system. Panel B of Table 2 lists these changes. Three of the case farmers had changed their accounting system: one is using a service bureau provided by a bank, one joined the Illinois Farm Business Farm Management (FBFM) program, and one acquired a microcomputer-based program. The three farmers making changes indicated that the design currently used a similar to that developed during the systems development process.

Those farmers who did change their accounting system tended to have a less sophisticated design, as indicated by the number of accounts desired (Panel A of Table 2), than did those not changing their accounting system. This could indicate that these farmers had more clearly defined goals of what they needed and were more realistic as to the costs associated with producing information. The three farmers who changed accounting systems placed emphasis on reducing the costs associated with the accounting function. When contacted a year after completing the worksheets, they indicated that this cost reducing goal had been achieved. An alternative explanation for no change among the three producers who desired more extensive managerial information is that they have not yet been able to find systems which are both suitable and cost effective.

Another interesting aspect of the case farmer studies is the type of information desired by the farmers. The major emphasis of the six case farmers seemed to be on managerial information, not on providing reports for lenders and/or tax authorities. Admittedly, the farmers involved in this research are not a cross section of all farmers. However, the emphasis of these farmers seems to be different than the commonly held opinion that farm accounting is only undertaken to satisfy lender or tax reporting requirements (Hardaker and Anderson). This has implications for farmers' accounting needs, services, and education.

SUMMARY

This research analyzes one aspect of adopting information technology. A method known as systems development is presented that aids firms in selecting an information system. This method is adapted to agriculture to aid farmers in selecting microcomputer accounting systems. Six case farmers participated in a study that analyzed the accounting system selection method.

The selection method seemed to assist farmers in identifying information needs, designing an accounting system, and selecting among accounting alternatives. This supports the belief that system selection is an important aspect of implementing an information technology and that specifying design requirements aids in the selection process.

Three conclusions are suggested by this research. First, the selection and design of an information system should be based on a firm's information needs. By identifying these needs, the chances of implementing a successful information system are increased. Second, the selection of an information system depends on the decisions it will aid. This results because a firm's internal information needs to a large extent are determined by the decisions faced by a farmer. Third, information desired varies considerably among farmers, even among farmers who manage similar operations.

These conclusions have a number of implications for agricultural economists. Educational programs should be designed that aid farmers in selecting information systems based on needs. In developing these programs, the major emphasis should be placed on the decisions the resulting information will aid. This applies not only to accounting systems, but also to systems that provide producing and marketing information. Furthermore, research addressing the value and costs of information to farmers is needed. These efforts should focus on identifying the types of decisions farmers make, identifying information that will aid these decisions, and valuing the effects that differing levels of information have on decisions.

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