The Indiana University Electronic Records Project Revisited

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Abstract

Further work on the Indiana University Electronic Records Project has demonstrated the value of systems analysis in identifying the functions, subfunctions, and individual inputs and outputs that need to be documented. In addition to this new methodology, the project has also found its new strategy of aligning the Archives with Internal Audit to be an effective way to participate in information systems review and to provide a forum to present archival considerations and concerns regarding electronic recordkeeping.

Strategies and methodologies are meant to be revised and refined as theory is translated into practice. So it is with the electronic records strategy at Indiana University. Since writing "Developing a Strategy for Managing Electronic Records—The Findings of the Indiana University Electronic Records Project," which appeared in the fall 1998 issue of the *American Archivist*,[1] several significant changes have been made in the methodology and in the implementation strategy. This article outlines and explains these revisions.

Within the IU methodology and the Pittsburgh recordkeeping requirements from which the IU model evolved, a basic underlying principle guiding all other activities is that records are products of business activities and can only be truly understood and appraised in the context of business processes. The IU electronic records management team recognized early that information on how to gain this knowledge of the business could be found in writings on systems analysis. Why did team members regard systems analysis methodology to be pertinent to archivists' needs? To answer this question, one must first understand the objectives of this form of analysis. Systems analysis has been defined

[1] Philip C. Bantin, "Developing a Strategy for Managing Electronic Records—The Findings of the Indiana University Electronic Records Project," *American Archivist* 61 (Fall 1998): 328–64.

as "the study of the problems and needs of a business to determine how the business systems and information technology can best solve the problem and accomplish improvements for the business. The products of this activity may be improved business processes, improved information systems, or new or improved computer applications."[2] Clearly emphasized in this definition is a focus on understanding and analyzing business processes as a means to improving the system, whether that system is defined as the business system or the information system. In fact, the emphasis on business requirements analysis has become so pronounced that some organizations have now divided the role of systems analyst into two distinct positions: the business analyst who "specializes in business problem analysis and technology-independent requirements analysis," and the application analyst who "specializes in application design and technology-dependent aspects of development."[3] Without question, archivists and business analysts have something in common: both regard an understanding of business requirements as critical to the design of the system.

Revised Methodologies

The recognition that archivists and systems analysts share a common concern in the identification of business requirements led the IU electronic records team to review the methodology and techniques analysts employ in reviewing system processes. More specifically, the team examined and adopted a popular and widely practiced technique known as "modern structured analysis."[4] This form of analysis has been defined as "a process-centered technique that is used to model business requirements for a system. The models are structured pictures that illustrate the processes, inputs, outputs, and files required to respond to business events."[5] The functional decomposition process described in stage one of the original IU methodology is based on the structural analysis technique of breaking down the business system into smaller and smaller processes and subprocesses. In the last several months, the Archives staff have methodically reexamined their interpretation of this model of analysis, and

[2] Jeffrey L. Whitten and Lonnie D. Bentley, *Systems Analysis and Design Methods,* 4th ed. (Boston: McGraw-Hill, 1998), 8; all subsequent citations are to this edition unless otherwise noted. The other major type of systems-related analysis is known is systems design, which is "the specification or construction of a technical, computer-based solution for the business requirements identified in a system analysis." Whitten and Bentley, *Systems Analysis and Design Methods,* 7. Clearly, the work of archivists has much more in common with systems analysts than systems designers.

[3] Whitten and Bentley, *Systems Analysis and Design Methods,* 9.

[4] For descriptions of this technique see Tom DeMarco, *Structured Analysis and System Specification* (Englewood Cliffs, N.J.: Prentice-Hall, 1978); Stephan McMenamin and John Palmer, *Essential Systems Analysis* (Englewood Cliffs, N.J.: Prentice-Hall, 1984); James and Suzanne Robertson, *Complete Systems Analysis* (New York: Dorset House Publishing, 1994); Whitten and Bentley, *Systems Analysis and Design Methods;* Edward Yourdan, *Modern Structured Analysis* (Englewood Cliffs, N.J.: Yourdon Press, 1989); and Jeffrey Hoffer, Joey George, and Joseph Valacich, *Modern Systems Analysis and Design* (Reading, Mass.: Addison Wesley, 1999).

[5] Whitten and Bentley, *Systems Analysis and Design Methods,* 122.

have concluded that while the original IU methodology captured the essence of structured analysis, it failed to apply fully all the vital and relevant steps, particularly when it came to identifying inputs and outputs and the formation of records. In short, one of the major shortcomings of the original methodology is its inability to depict precisely how and when records are generated. Moreover, it was discovered that some of the terminology and definitions used in the IU methodology do not always conform to standard usage. Consequently, the Archives staff have revised the set of activities undertaken in the methodology, modified the vocabulary used, and redefined the products created.

In accordance with "modern structured analysis" techniques, the IU methodology decomposes logical processes (business activities that must be undertaken no matter how one implements the system) into three components: 1) Functions, 2) Event Processes or Transactions, and 3) Elementary Processes. In other words, business processes are comprised of functions, which are ultimately decomposed into business events, which normally represent a single process responding to external and temporal inputs and result in one or more outputs known as elementary processes.

The highest-level business processes are known as business functions. "Functions group the logically related activities and tasks." A function is a "set of related and ongoing activities of the business. A function has no start or end; it just continuously performs its work as needed."[6] Functions are decomposed into subfunctions and eventually into discrete business processes that perform specific tasks. Functions are named with nouns that describe the entire set of activities. An example of a function and subfunctions from the business area of the Office of the Registrar include: *Function:* Student Recordkeeping; *Subfunctions:* Official Student Record Maintenance, Student Degree Recording, Semester Data Maintenance, and Student Grades and Credit Maintenance.

Functions consist of business processes that respond to business events. A business event is "something that 'happens,' and that causes business data to change."[7] An event "is a logical unit of work that must be completed as a whole. An event is triggered by a discrete input and is completed when the process has responded with appropriate outputs. Events are sometimes called transactions."[8] There are three basic types of inputs that will trigger a business event or transaction: an *external event* that is initiated by agents outside the system being reviewed, a *temporal event* that is triggered by the arrival of a predetermined point in time, and a *state event* that is triggered by a system's change from one state or condition to another.[9] Most events or transactions are represented by

[6] Whitten and Bentley, *Systems Analysis and Design Methods,* 218.

[7] Whitten and Bentley, *Systems Analysis and Design Methods,* 3rd edition (Burr Ridge, Ill.: Irwin, 1994), 524.

[8] Whitten and Bentley, *Systems Analysis and Design Methods,* 218.

[9] Whitten and Bentley, *Systems Analysis and Design Methods,* 242–43, and Robertson and Robertson, *Complete Systems Analysis,* Vol. 1, 214–40.

a single process, although occasionally, the event may include two or three processes. An event process or transaction is described in a single sentence that identifies the individual or agency initiating the action (subject-phrase); the official action (verb-phrase); and the individuals or objects acted upon or interacted with (object-phrases). Examples of event processes or transactions taken from the Office of the Registrar work area for "Subfunction: Student Grades and Credit Maintenance," include: 1) Registrar's office posts grades for students upon completion of course work (Input: grade roster from faculty member; Output: create a grade and credit record); 2) Registrar's office assigns credit for student work done at other academic institutions (Input: record of work completed at another institution; Outputs: create a credit articulation or evaluation report, and modify student record to reflect the decision).

An event process is further decomposed into elementary processes, which are defined as "discrete, detailed activities or tasks required to complete the response to an event."[10] In other words, elementary processes are the outputs generated by the business event. Types of elementary processes include: creating a new occurrence of an entity (add), updating an occurrence of an entity (change or modify), and removing an occurrence of an entity (delete). The methodology omits any processes that do nothing more than move or route data, thus leaving the record unchanged. Elementary processes are named with a strong action verb followed by an object clause that describes the work being performed. Examples of elementary processes from the Financial Aid work area include: 1) create report listing federal aid recipients with unsatisfactory academic progress, 2) record appeal information in student's financial aid record, 3) complete work-study verification form received from employer, and 4) provide certification information to the lender.

Of course, the purpose of the decomposition exercise is to identify where records are created. After careful review and testing of its methodology, Archives personnel determined that the original methodology provided a less than satisfactory description of when record creation occurred. The methodology described in this article is much more precise and less ambiguous in defining when documentation enters the system and when records are generated. Record creation occurs at the event or transaction level, and the actual records to be analyzed are those documents received as inputs to the system and those records created as a result of the outputs or elementary processes generated in response to the external, temporal, or state event. For example: The business event "processing an appeal" is initiated or triggered by a student or his/her parents, and the input document is the appeal letter received from the student or the parents. The outputs or elementary processes of this event are 1) making and recording a decision on the appeal, 2) modifying the student's financial aid data based on the appeal decision, and 3) notifying the student

[10] Whitten and Bentley, *Systems Analysis and Design Methods,* 219.

about the decision. The appeal letter, the decision document, the modified student record, and the notification are the records of the process.

Eventually all this business process information is described or depicted in models or representations that illustrate, usually through the use of pictures or symbols, the various components and relationships of the processes. Models designed to "depict the system independent of any technical implementation" are known as logical models or essential models.[11] Of these logical models, it is the opinion of the Archives staff that the most valuable models for archivists are those that focus on system processes; specifically, business function decomposition diagrams, business event diagrams, and business process data flow models. In the IU methodology, staff create functional decomposition and business event diagrams.[12]

What types of information are contained in these models, and what do the models look like? To answer these questions, let us review the products Archives personnel created for the business function "Student Recordkeeping." As a first step, business processes for this function are defined in a short narrative statement.[13] Eventually this information is used to generate a functional decomposition diagram for the function.[14] A partial diagram for the function "Student Recordkeeping" contains the following information and is represented in Figure 1.

Once the functional decomposition diagram is created, staff generate descriptions of the business event processes, including information on the inputs and the various elementary processes or outputs. Initially this data is captured in a simple form that includes the following categories of information for each event process: name of process, input activities, input record, output activities, and output record(s). Once this data is gathered, staff create business event diagrams for each of the subfunctions. For the event processes "department modifies course inventory," and "processing an appeal received from a student," the models contain the following information and are represented in Figure 2.

Before leaving the topic of logical models, two other prominent types of analysis should be noted. Perhaps the most well known of logical modeling techniques is data modeling, which is "a technique for organizing and documenting a system's data. . . . The actual model is frequently called an entity relationship diagram (ERD) because it depicts data in terms of the entities and

[11] Whitten and Bentley, *Systems Analysis and Design Methods,* 210.

[12] Of course, in some cases descriptions or models of business processes may have already been created by analysts involved in the original design of the system. Our experience has been that partial lists of processes, usually of functions and subfunctions, are often available. One might also expect to find data models, which can be useful in identifying business processes.

[13] For examples of narrative statements, see the IU Electronic Records homepage at <http://www.indiana.edu/~libarche/index.html>.

[14] IU Archives staff use a flowcharting software called allCLEAR.

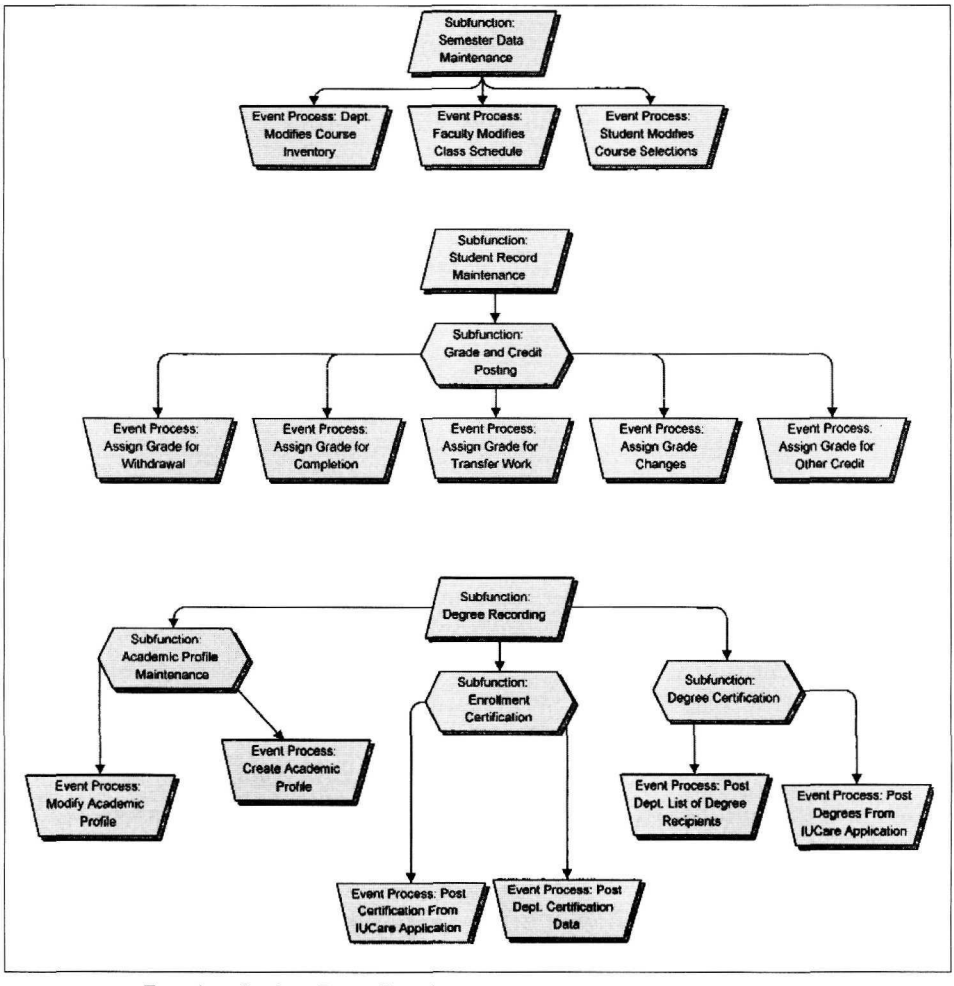

FIGURE 1. Function: Student Recordkeeping

relationships described by the data."[15] The key word here is data, since the ultimate objective of the technique is to identify and describe the data elements required to fully document the process under review. In the IU methodology, no attempt is made to model data. This is not to say that modeling this data is not critical to the development of a trustworthy system. It is, but Archives personnel decided that if the IU methodology were to be cost effective, the Archives could not be involved at the data element level. This responsibility, it was determined, would have to be assigned to other individuals on the systems analysis team.

[15] Whitten and Bentley, *Systems Analysis and Design Methods*, 173, 175.

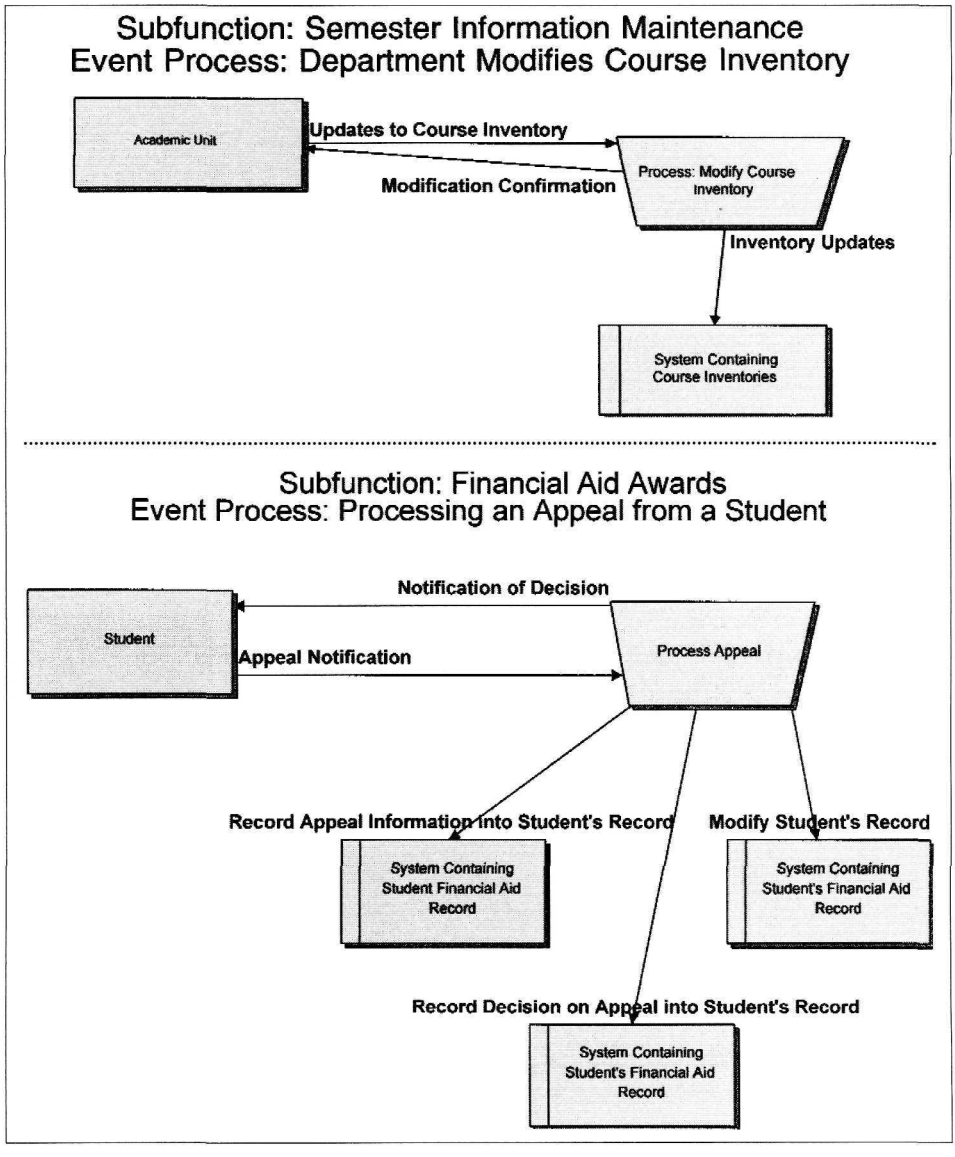

FIGURE 2. Business Event Diagrams

This concept of sharing responsibilities is an important point and one that needs constant reemphasis. Systems analysis is a complex process, involving many tasks and demanding many skills. For this process to work, each team participating in the analysis must identify its own particular strengths, its own unique professional mission, and its own special contributions. The IU Archives team has defined its mission and its contribution to the analysis as the identification and appraisal of records generated in the context of business processes, and the creation of systems that capture, manage, and preserve these records.

Another prominent type of analysis is known as business process redesign or business process reengineering. This process "is the application of systems analysis (and design) methods to the goal of dramatically changing and improving the fundamental business processes of an organization."[16] The primary goals of business process redesign are to reduce costs, streamline business processes, and in general "maximize the value returned to the business."[17] In comparing this process and its objectives to the IU electronic records methodology, there are similarities in method but differences in objectives. Both forms of analysis are committed to describing and modeling business processes. But whereas business process redesign employs this information to identify and reengineer inefficient and outdated processes, the electronic records initiative uses the data to identify business records and improve the performance of information systems.[18]

New Strategies

The other major development to report is the emergence of a new strategy for implementing the electronic records methodology. One of the great challenges facing the IU Archives is gaining entrée to the systems and access to the data and information managers and to system documentation. The kind of authority the Archives has for reviewing paper records simply does not yet extend to electronic systems. Consequently, the Archives is always looking for allies or partners, preferably units with a mandate and well-established lines of authority to review information systems and to effect changes. The administrative unit that emerged as the best and most natural ally for the Archives is Internal Audit. The goals of the two units are similar—both are interested in accountable, compliant, and trustworthy systems; and the methodologies intersect in certain key areas—for example, both acknowledge the critical importance of risk assessment and the value of understanding business requirements.[19]

The Archives has just begun its alliance with Internal Audit, so the details of the collaboration will undoubtedly evolve over the next year or so. However, the basic steps of the audit process will not likely change. The audit process typically consists of four stages: Preliminary Review, Field Work, Audit Report, and Follow-up Review. For the first test case, the School of Optometry,

[16] Whitten and Bentley, *Systems Analysis and Design Methods,* 695.

[17] Whitten and Bentley, *Systems Analysis and Design Methods,* 214.

[18] Presently, the Archives team is working on a systems analysis project involving members of Internal Audit, Human Resources, and the business process redesign team. Each team has its own objectives, but there is regular communication between the groups.

[19] IU Internal Audit's list of objectives includes the following: "Determine the level of compliance with University policies and procedures, and state and federal laws and regulations; and evaluate the accuracy, effectiveness and efficiency of the University's electronic information and processing systems." For more information on the IU audit process, see the IU Internal Audit homepage at <http://www.indiana.edu/~iuaudit/main.html>.

the IU audit review team envision the joint analysis occurring in the following manner:

The preliminary review stage of the audit process is designed to define the objectives of the audit, and to gather the information on business processes. The first step in this stage is a meeting with the dean of the school to discuss the overall strategy, identify any particular concerns or needs the dean would like addressed, and articulate the types of resources the audit review team will need to conduct its analyses. Soon after this meeting, work begins on identifying business processes. Team members decided that the Archives staff would take the lead in generating this documentation. Ultimately, this analysis results in the creation of logical models describing or depicting the business processes. When completed, these models are passed on to Internal Audit team members who use them to determine where to focus their analysis and which processes to test. Internal Audit personnel identified access to the business models the Archives staff generates as one of the primary benefits to them of a partnership with the Archives.

After the business requirements are identified, the audit review team moves on to the field work stage. At one point, the team discussed integrating the Archives and Internal Audit methodologies, but it was quickly determined that this was not the best strategy. Internal Audit field work methodology consists of procedures designed to test the major internal controls and the accuracy and effectiveness of the transactions. To obtain this information, auditors actually go into the system to test and analyze all aspects of a particular business process. Obviously, these detailed tests cannot be implemented for every transaction, so the auditors normally select only the highest risk transactions for review and testing. The Archives methodology functions in quite a different fashion with the objective to achieve a broad analysis of all business functions rather than a detailed sampling of only certain transactions. In the end these differences in purpose and scope defied any attempts to create an integrated methodology. Consequently, it was decided that Archives and Internal Audit would go forward in parallel with their own unique, though complementary, reviews. However, it was determined that during the process team members would meet frequently to compare notes and discuss possible adjustments to the overall strategy.

The next step in the audit process is the creation of the audit report in which team members present findings and outline recommendations for improvements. Rather than present separate reports, the audit review team decided to create a single joint report incorporating the findings and recommendations of both Internal Audit and Archives. This report is sent to the dean of the school and to managers of the school's information systems, to selected high-level administrators, and to the IU Board of Trustees. Shortly after the report is distributed, a meeting between audit review team members and the dean and other managers of the school is scheduled to discuss the

recommendations and strategies for addressing them. Within one month of this meeting, the dean is required to submit a written response describing the activities the school will undertake to resolve the problems identified in the audit report.

Finally, approximately one year after the distribution of the final report, a follow-up review is initiated to determine whether the problems identified earlier were addressed. All unresolved problems are described in a follow-up report, which is distributed to all the recipients of the original report.

Everyone involved in this joint venture agrees that the partnership between Archives and Internal Audit has great potential, in large part because all the participants have something to gain from the collaboration. For the Archives the major benefits are participation in the authorized and routine review of information systems and the opportunity to exchange ideas on the overall management of systems with experienced analysts and auditors. The expectation is that with two and possibly three staff members working on analyzing information systems, the Archives will complete fifteen to twenty reviews of major systems or subsystems each year. For Internal Audit the primary benefits are access to detailed business process models and to previously unavailable analyses of systems from a recordkeeping perspective. Finally, the University benefits by having its information systems much more thoroughly reviewed and analyzed, resulting in more accountable, compliant, and trustworthy systems.[20]

Conclusion

The Indiana University Archives staff are convinced that the changes and modifications outlined in this article represent significant improvements in the overall strategy for managing electronic records. However, it is important to bear in mind that these modifications do not signify an abandonment of the underlying principles or of the primary goals and objectives of the IU electronic records management strategy. The IU electronic records initiative still includes as one of its primary objectives the evaluation of the proposition that "the most effective electronic records management programs the archival profession creates will include as their ultimate objectives the identification, description, and appraisal of the functions and transactions that produce the record and the analysis of the information systems which create, manage, and preserve these records."[21] The strategy still retains the goal of testing the assertion that traditional records management strategies established for paper records will have to

[20] The author welcomes inquires from those who would like to discuss in more detail the IU Archives' partnership with Internal Audit.

[21] Bantin, "Developing a Strategy for Managing Electronic Records," 337–38.

be altered in significant ways to accommodate electronic records. The Archives staff recognize that many of the principles and practices articulated in its methodology exist primarily as theoretical constructs only, and that before they can be endorsed as viable strategies, many real-life applications are required.[22] Consequently, for the next year or two, the major priorities of the IU electronic records management initiative will be to test these principles and practices on actual information systems so as to provide the profession with enough "hard data" to assess the usefulness and value of the IU strategy for managing electronic records.[23]

[22] I generally agree with Linda Henry's judgment expressed in a recent article that "supporters of a new paradigm for electronic records need to demonstrate conclusively that this approach [employing traditional archival practices] won't work and why, and their arguments need to draw on evidence based on archival history, traditional archival theory, and the experiences of practicing electronic records archivists." (Linda Henry, "Schellenberg in Cyberspace," *American Archivist* 61 [Fall 1998]: 327). But I would also argue that those archivists who like Henry believe that "archivists should continue using established archival principles and practices in dealing with electronic records" (p. 327) should be judged by the same standards. They too should be required to fully demonstrate the validity and applicability of traditional concepts and practices for electronic records management. One of the frustrating aspects of working in the field of electronic records is the absence of information on the usefulness and costs of strategies and practices for managing electronic records based on actual field tests. The profession desperately needs real-life applications of all types of strategies and methodologies for managing electronic records.

[23] The Archives has received $10,000 from IU's Information Technology Services to implement and test its methodology. The Archives staff is also planning to submit a proposal to NHPRC for funding to continue testing the strategy. With the Information Technology funding, I have reassigned one of my full-time staff members to work part-time on electronic records management. If the NHPRC proposal is funded, this staff member will be temporarily assigned on a full-time basis to the electronic records project. In addition, other temporary staff will be hired to assist with the project.