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Process Change From User Requirements Elicitation: A Case Study of Documents in a Social Services Agency

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Abstract
The Maryland Department of Juvenile Justice (DJJ) is seeking a new information system to replace its legacy system for youth case management. The major goal of the new information system is to improve the process of juvenile case management, and thus deliver more effective services to youths, by better facilitating the tracking of case information and the production and handling of case-related documents. The primary challenge in designing the new system is to integrate optimally the appropriate components of existing processes, information, and documents. Our approach has shown that fostering user discussion and review of existing documents is extremely valuable in defining existing processes and information requirements, and effectively highlights areas where valuable process changes can be made and what system features are needed to support them. Subsequently linking user requirements for documents with innovative graphic user interface techniques can integrate diverse information for users and can affect additional positive changes to organizational processes.

1.0 Introduction

A role for information technology in business process re-engineering (BPR) is well recognized, though not without more than a bit of controversy, disagreement, and lack of predictive empirical research (Barothy, Peterhans & Bauknecht 1995; Davenport 1993; Hammer and Champy 1993; Kaltoff 1994). Ongoing efforts on many fronts are working toward developing methodologies for designing appropriate information technology to improve organizational processes. Developing more precise notions of process concepts and process change is part of these efforts. Some argue for a revolutionary approach to changes in organizational processes that is typically referred to as *process re-engineering* or as the more encompassing *process innovation*, while others support a more evolutionary form of change that might best be referred to as *process improvement*. For the purposes of this paper, we will consider aspects of information technology design in support of *process integration*, defined as the general "reorganization of structural relationships among process entities for enhanced performance" (IPIC 1996). This definition captures the central emphasis on structural changes to process rather than the replacement of specific process entities leaving the existing process structure intact.

Process integration is highly interrelated with *information integration*, defined as "the creation of new, value-added information out of existing information, often from multiple, unrelated sources" (IPIC 1996). Information integration can be seen as a way to support new business interpretations and decisions from the existing collection of possibly unrelated information available within an enterprise. Information integration is thus "a means of bridging information and processes by generating an actionable interpretation of information in the context of a specific process" (IPIC 1996).

Documents are increasingly recognized as a class of information-conveying vehicles that are highly critical, indispensable business process components. At the same time, document content is least amenable to information integration given the structural complexity and demanding life cycle management requirements of documents (Bearman 1994; Cox 1995; IPIC 1996; Penn 1983). This case study discusses the value of, and some practical methods for, a detailed analysis of enterprise documents, including direct elicitation from users of their document-centered information requirements. This work has been done in the context of the design and specification of a new information technology application. From the design perspective, the benefits of coupling the results of the document analysis effort with innovative user interface techniques is discussed. The result is better support for user role management, particularly of documents, which will increase the system's potential for achieving enterprise-wide process integration.

The organization in this study is the Maryland Department of Juvenile Justice (DJJ), which is seeking a new information system to replace its legacy system for youth case management. DJJ is responsible for juveniles who have violated the law or who are a danger to themselves or others. The major goal of the new information system is to improve the process of juvenile case management, and thus deliver more effective services to youths, by better facilitating the tracking of case information and the production and handling of case-related documents. Most documents at DJJ are produced manually, often involving the manual compilation of aggregate information, repeated copying of previously collected information, or the referencing of disjoint records distributed across many offices. In addition, DJJ feels that its legacy system is not able to provide the database reports needed to conduct useful analyses of DJJ operations. Data entry into the old system is considered a black hole from which little of use is extractable. Many reports are only possible through special requests submitted to central system administration and require several days' turnaround time. Addressing these functional shortfalls in database reporting and document production and handling should bring significant benefit in terms of time and cost savings, and should be attainable with a cost-effective level of effort (Saunderson 1995).

Many DJJ documents are not only critical and actionable interpretations of information, but are also legally required and admissible instruments. Given the significance to DJJ of document-based information, the design of the new system must not only accurately capture on-screen data and functionality for end users, it must have a fully integrated document production component. In embracing the permanence of the document, in all its forms, as a key business process artifact, DJJ's new information system will represent a migration to a truly comprehensive workflow management system that includes support for the production and routing of documents. The analysis of documents has emerged as a focal point for defining system functional requirements, as documents emphasize information content, information flow, and recordkeeping requirements. Documents are a reflection of the character of an organization.

A number of organizational constraints have led to the current state of document use within DJJ, and will continue to complicate efforts to improve the handling of documents. To begin with, DJJ in not monolithic. At a high level, DJJ is an independent agency of the executive branch of state government that answers directly to the Governor. Both the Governor's office and the Legislature determine DJJ's operating context, and place specific information demands on DJJ in formulating relevant legislation, budgets, and regulations.

At a lower level, DJJ must interact closely with many external, independent entities which control information input to DJJ and as well as control information output by DJJ. For example, the State's Attorney's Office (SAO) must review cases recommended by DJJ for formal Court action. The SAO may approve, reject, or modify the recommendations of DJJ, which must then pursue the case as directed by SAO. Each jurisdiction in the state has its own police department with its own standards for police reports and for the formulation of specific criminal allegations related to the relevant incidents and perpetrators. In addition, the judicial system varies among jurisdictions with respect to many procedures, and even varies at the level of the individual judge. These differences have direct impact on the case management processes of DJJ and on the documents it must produce in the course of carrying them out. These regional and jurisdictional variances must be accommodated within the system and place limits on the degree of standardization and information integration attainable. The key to this work is to identify and exploit opportunities for information and process integration where possible, while maintaining the ability to deal with varied external constraints. The design of the new system, and the document analysis in particular, has highlighted these issues within DJJ and is driving new policy initiatives which, while just beginning, may eventually begin to support integration with external processes at a higher level, perhaps through interfaces to external systems, affording some greater potential for document standardization as well.

In addition, process integration in a public social services agency like DJJ is not straightforward. It is difficult to measure success, given that at DJJ success means to improve the lives of troubled youth and their families and to protect public safety. The promise of the new system is to allow case managers to spend more time with youths and less time seeking information and composing or referencing documents. In addition, the new system should afford better data analysis on aggregate youth information, as well as more sophisticated reporting and documentation of that analysis, to better measure performance.

The primary challenge in designing the new system is to integrate optimally the appropriate components of existing processes, information, and documents. The Human-Computer Interaction Laboratory (HCIL) at the University of Maryland, in conjunction with Cognetics Corporation, is working with DJJ to design the new system. The design effort has included a great deal of close interaction with DJJ personnel at all levels.

2.0 Background

We have used iterative, interlocking methods for determining how best to accommodate documents in the design of the new system. They included data gathering from stakeholders at DJJ, analysis of the data gathered and of the documents themselves, and evolving system prototypes. Our approach to gathering and analyzing information about documents is grounded in the literature of information and records management, and archival theory, where the unwavering significance of the document as an information source has always been recognized (Johnson 1983a, 1983b). An information and records management program is an organizational attempt to more effectively and systematically manage information resources, which is a major goal of the new DJJ system. To ensure a successful program, a comprehensive and detailed survey of existing records is considered the crucial first step (Kane 1978; Kubicki 1985; Saffady 1992). Records may be in any form or media, including paper, electronic, and others. Within DJJ, virtually all records are in the form of paper documents, with a small portion produced on paper from electronic sources. Thus for DJJ, the records survey was essentially a survey of paper documents. We began the survey by compiling an inventory of existing DJJ documents.

To complete the records survey, the document inventory was annotated with information about each document's content and the context of its use. This information is required for effective information management in general (Wolchak 1986), and is also recognized as critical to the design of information technology to address the management of documents (Barry 1994; Hendley 1995a; Kay 1994). In deciding how to properly characterize a document, we were guided by a particularly thorough set of functional requirements designed for electronic records management, including the management of documents, that is being developed at the University of Pittsburgh by Richard J. Cox and his associates (Cox 1995). To mention them briefly, these requirements hold that electronic records must be

- Compliant with regulations
- Responsibly managed
- Implemented and employed at all times
- Consistently used to insure credibility
- Comprehensive, to cover all organizational transactions

- Identifiable as to their discrete purpose
- Complete, reflecting the content, structure and context of the events they document, and thus:
    - Accurate
    - Understandable
    - Meaningful
- Authorized by appropriate records creators
- Preserved, maintaining content over time, and thus:
    - Inviolate
    - Coherent
    - Auditable
- Removable, with authorization, leaving an audit trail
- Exportable to other systems
- Accessible, meaning:
    - Available
    - Renderable
    - Evidential
- Redactable, in that contents can be masked for security reasons.

These functional requirements speak to the need for the adequacy of records, or as in this case study, of documents. Adequate records are those that allow reconstruction of the activities or decisions that created them. An organization such as DJJ deals with sensitive family and personal issues, and must comply with the appropriate legal standards in doing so. The issue of adequate records, or adequate documentary information, is thus intimately tied to many of DJJ's organizational processes. In the design of new information technology for DJJ, we have attempted to begin to meet the requirements of adequacy by gathering the right information and conducting or facilitating appropriate analyses of existing DJJ documents. We have identified the persons involved in the creation and use of each document in order to meet requirements such as compliance, responsibility, authority, and accessibility. We have analyzed and redesigned documents in order to meet requirements such as consistency, identifiability, and completeness. And we have prioritized documents in order to gauge the relative importance of each of these requirements for individual documents.

3.0 Data Gathering

Working from the compiled inventory of documents, we began with a cursory survey of the documents, creating a record for each in a relational database to be used to manage data in the analysis. Documents were identified as either forms, short reports, aggregate statistical reports, or correspondence. They were then clustered according to their relevance to functions within DJJ, such as intake procedures, medical care, education, and interaction with the courts. Multiple variations of the same document, in use at different offices, were identified and grouped. Excluded from entry into the database and thus from further consideration were all documents not related to youth case management, such as personnel documents. The new system is not intended to support any functionality in those areas. The resulting inventory contained roughly 300 functionally distinct documents, about 57 of which had two or more variants, with some having as many as eight or nine variants.

We used a set of user segment names to begin to identify individuals involved with each document. The user segments were previously defined from information gathered during site visits and interviews with DJJ personnel, and from analysis of a set of process maps produced internally by DJJ. The user segment definitions had been circulated to and approved of by stakeholders at DJJ, and have been serving as the standard end users in the design of the new system. In attempting to identify the user segments relevant to each document, however, we discovered that the process maps, formal descriptions of all internal DJJ processes, did not systematically encode information about documents. It became clear that eliciting information about documents directly from DJJ personnel would be necessary. Thus we held a series of document workshops with approximately 20 representatives from DJJ with the knowledge and authority to describe and revise documents and to set policy. For context, we started the first workshop by giving participants a general introduction to the issue of adequacy and of the role of documents in organizational function in order to stimulate broad, critical thinking. This was followed with a discussion of the specific questions about documents that we asked them to consider.

Practical time limitations forced us to focus on a few key points during the workshops. These points were divided between two main tasks. The first task was to annotate each document with meta-information about its users and its priority. The second task was identify, analyze, and if needed revise and standardize the information content and structure of each document. Participants were asked to systematically examine each document in the inventory and supply the requested information. The points to consider were organized as follows:

1. Document Meta-information:
    - Identify source users and divisions
    - Identify destination users and divisions
    - Identify users with access
    - Identify users with authorization
    - Prioritize according to:
        - Frequency
        - Effort
        - Criticality

2. Document Content:
    - Identify field contents
    - Review field structure

3.1 Document Meta-Information

Source Users and Divisions attempt to capture the context of the document's creation. The source user segments are the original producers of the document. Source divisions are defined as either the organizational divisions internal to DJJ or the external agency in which the document is typically produced.

Destination Users and Divisions attempt to characterize the use of documents. Destination users are the varied consumers of information in documents, including both DJJ-internal user segments as well as individuals at external agencies. Participants were encouraged to augment the list of internal user segments to adequately capture the flow of documents. Users at external agencies, such as judges, prosecutors, and federal auditors, as well as individuals such as parents of trouble youths or victims of juvenile crimes, were of course not part of the internal user segment list, and were encouraged to be identified on an as-needed basis. In addition, a case file or other form of permanent storage was suggested as an important kind of pseudo destination user. Destination divisions include the DJJ division of internal users, and external entities, such as the educational, medical, law enforcement, or judicial agencies with which DJJ regularly exchanges documents in the course of youth case management.

Access and **authorization** are important concerns for DJJ, where confidentiality and clear lines of responsibility must be maintained. Using the augmented user segments, participants were asked to identify the users with clearance to access the information in a document, as well as those that must give signed authorization to the document.

Prioritization of documents is very important given limited resources for system development and the likelihood of its incremental rollout. In addition, eliciting information about the priority of documents helps to identify those for which certain functional requirements, such as compliance with regulations, are most important. Three separate scales were used to characterize priority. The scales were the frequency of a document's production, the amount of effort required to produce a document, and a document's criticality with respect to decision making and organizational activity. Priority will be given to those documents most frequent, critical, and difficult to produce.

3.2 Document Content

The **content** and **structure** of each document was evaluated for its completeness, identifiability, and consistency. Participants were asked to standardize variants of the same document, to analyze each document's structure and content, and to produce example revised versions of each document. Emphasis was placed on analyzing a document's information fields. Participants were asked to consider the appropriateness and adequacy of both the discrete and narrative information fields found in documents, and to identify the typical content of each field. Field contents may be a limited set of possible field values, or perhaps a discrete case or petition number. Other fields may be structured narratives, in which something like a psychological evaluation is documented in narrative fashion with prompts for specific areas of content. By analyzing and perhaps revising each document's structure and content, and identifying its typical use within the organization, the documents are not only improved but made more understandable to those outside the organization, with system designers and implementors being the primary beneficiaries.

4.0 Results of Data Gathering

The workshops proved to be extremely productive for gathering useful information about documents, despite an aggressive agenda with a somewhat daunting amount of work to be done. Some resistance was voiced initially, but overall the response from workshop participants was extremely positive. They seemed to recognize the benefits for the design of the new information system. Responses to the requested information were agreed upon, and revised and standardized versions of documents were successfully negotiated. From initial work on standardization and revision of document contents, documents were being entirely eliminated at a rate of two out of every three. About a third of the contents of some two dozen documents were found to be roughly similar in content. The standardization efforts worked to make them identical, thus streamlining information and simplifying the specification of system requirements. These results should facilitate process integration by allowing the collection of information about youths at any point in their interaction with DJJ to be usable at other points of contact within the department. With agreement on document content, information can be collected once and used repreatedly by workers throughout the department with responsibilities in vastly different areas, such as counseling, medical care, or education.

The examination of some specific documents provided a unique forum for the discussion of long entrenched and recalcitrant problems within the organization. Lively debate was sparked, new information was shared among representatives from different jurisdictions, and a number of significant policy initiatives were undertaken. The document analysis tasks of the workshops thus proved to be extremely valuable starting points for discussing important issues of process and policy. In analyzing document contents, occasionally different answers came from different participants, and points of contention were often settled by reference to internal policy documents, when available, or by turning to the Annotated Code of Maryland as the final authority. The design of revised documents benefited from these policy revisitations by ensuring their compliance to regulation, identifiability as to their purpose, and the consistency of their use and thus the credibility of their contents.

Discussions of policy have in some cases led to the identification of specific opportunities for process integration at DJJ. One example comes from a policy initiative motivated by the examination of a document involved in the tracking of youth income information. This document is used to determine eligibility for federal reimbursement of nutrition expenses for youths in DJJ residential facilities. Currently, this document is prepared at admission solely to indicate an income class code for a youth. Federal auditors visit the facilities and manually review this document in each physical case file to determine overall reimbursement figures for a given time period. Workshop participants suggested this income class code could be included on the standard admission form, eliminating this extra document and simplifying the admission process. DJJ initiated correspondence with the appropriate authorities to determine if this change, specifically if implemented in an electronic environment, was acceptable under the terms of the reimbursement program. Initial approval has been granted, provided the eligibility code determinations are easily linked to individual admissions. This concern is met given that the admission sheet is generated at every admission. Moreover, with eligibility codes entered electronically at every admission, determining overall reimbursement information can be done with a simple database report generated at a personal computer. Not only is the admission process simplified, but the administration of this entire program will require less time and fewer personnel for both DJJ and the external auditors. This initiative has led to information and process integration while at the same time has specified additional functional requirements for the system. It was a direct outcome of the analysis of documents, as the potential for the new system to support the program in this way had not been previously articulated.

Not all policy revisitations have yet led to process integration. The Service Plan document, which is intended to detail the provisions of the treatment plan devised for an individual youth, proved to be quite controversial. Some workshop participants not only found its structure inadequate, but voiced the opinion that it should be eliminated entirely. Its value in contributing to effective case management was seriously questioned, as was its secondary role as a method of evaluating case managers. Others felt the document was a useful tool. A heated debate ensued, and avenues for revising the policy requiring this document were identified. The Service Plan's status, and thus system requirements for it, remain unclear. The Service Plan document's free format does not make it an ideal candidate for automation, but regardless of the eventual level of system support, this document is extremely detailed and difficult to produce, and changes in policy regarding it will have significant implications for the process of youth case management.

These examples just begin to illustrate the effects that the elicitation of user requirements through document analysis has had on issues of process and policy at DJJ. While this work was motivated by the needs of information system design, many benefits can be realized even if the system were never to be built.

5.0 Benefits for the System Design

For the critical areas of youth case management and individual workflow support, the emerging user interface design for the new system tightly couples documents to novel graphical presentations and tailored user functionalities. The information elicited from users at the document workshops helps define the important events in youth case management, what documents and information are relevant to these events, and which users must be given access to the information and documents. The framework of the interface design and the content provided by the document analysis combine to take the system beyond workflow or document management systems by integrating the management of both within comprehensive, graphic representations and customized but flexible user views.

As detailed in Rose, et. al. (1996), user interface designs for the new system are being based on the concept of creating a customized "view" of the central system database for different user segments. The functionality defined for each view features links to the documents that must be produced or handled as part of the procedures supported within that view, in direct support of user workflow. Links to documents will either display electronic documents or provide a pointer to non-electronic documents. A number of documents in the inventory, however, are entirely subsumed by the design of the user views. These consist primarily of spreadsheet or list documents showing, for example, all youths assigned to a case manager that have court hearings scheduled on a particular day. The user views include list display areas and simple query mechanisms for creating and printing lists of records, providing both pre-defined and ad-hoc query and reporting functionality. This approach makes a far greater variety of such documents available to users.

Various DJJ forms and reports are related to individual youths, such as psychological assessments or court orders. These documents are bundled in the youth record by events. The youth record is a display that provides an overview of an individual's history with DJJ. It also provides access to all the relevant documentation. The LifeLines display of the youth record (Plaisant, et. al. 1996) is a graphic timeline interface that shows the youth's status using color to indicate the depth of penetration into the system. Users can pull down menus from each status indicator to see a list of documents related to the activities associated with the status of the youth at that point in time. In addition, significant discrete events such as medical evaluations, special behavioral incidents, and educational assessments are represented on the LifeLines with tick marks, which provide navigation to the supporting documents that detail the event. The LifeLines thus give users a graphic overview of a youth's entire history, with quick access to details, on demand, in available documents. This design achieves information integration by gathering documentary information on a youth, from distributed sources, in a graphical, single-screen life history representation. The design indicates the existence of, and provides access to documents without requiring a search of any kind.

6.0 Conclusion

This work has demonstrated the utility of document analysis in the context of information system design to achieve process and information integration. The DJJ document workshops spawned a new kind of self-examination for the organization, which explored entrenched and problematic activities long ignored. The results will positively affect process changes and will lead to a better information system design. Fostering user discussion of existing documents helps define existing processes and information requirements, and highlights areas where process changes can effectively be made and what system features are needed to support them. In addition, information integration can be achieved with innovative graphic representations that collect information, particularly documents, from diverse sources and of multiple types, into single screen overviews.

These results suggest a valuable synthesis of research from the fields of human-computer interaction, information and records management, archival theory, process theory, and process technology. Some future research opportunities now seem apparent. Workflow management systems, document management systems, and process technologies have evolved separately and targeted distinct markets. Only recently have such systems begun to move toward closer integration (Hendley 1995b; Jablonski 1995; Karagiannis 1995; Medina-Mora, et. al 1993; Teufel and Teufel 1995; Watson Jr., et. al 1995). Methods for integrating process definition and modelling, requirements analysis, and document and workflow management should continue to be pursued because these research fronts can all contribute to the goal of enterprise process integration.

Developments in user interface design are benefiting these technologies for both the organization and the individual user. For organizations, new system administrative tools with graphical user interfaces are being developed to aid in the collection and analysis of business process information and the design and specification of process models and information technology. For the individual user, the recent work of Shneiderman and Plaisant (1994) on Personal Role Managers (PRM) (also Plaisant and Shneiderman 1995) helps users structure their work in harmony with their roles in an organization, effectively becoming personal process support tools. Graphical interfaces to both personal role management and organizational modelling must accommodate process artifacts, such as documents. The elicitation of specific information about documents, as demonstrated in this case study, can have great benefit for the documents themselves as well as their optimal accommodation by system design.

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