Notes on Operations

Reengineering Technical Services Processes

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Reengineering is the evaluation and restructuring of the work processes of an organization. Using the experiences of an academic research library project to reengineer its technical services operations, I begin with a description of the framework in which the library conducted reengineering. The work of one reengineering team in evaluating the process for ordering notification slip books is then singled out for examination. Examination of a single process illustrates the mechanisms used to map, analyze, and redesign the process and addresses concerns of implementation. It also allows introduction of reengineering concepts and tools used during evaluation and restructuring.

Reengineering involves evaluating work processes and restructuring work flows to improve efficiency and better meet organizational goals. The roots of the reengineering movement are found in the business world. Changes in the current business environment are the driving force behind reengineering efforts. Growth of service-based enterprise, restructuring of competition, globalization of business, and the increasing importance of information have created a need for business to become more alert and responsive to trends (Morris and Brandon 1993).

Libraries are experiencing similar changes. In a study of user services reengineering at Rice University, Shapiro and Long (1994) identified concerns that the private sector and academic libraries share. They mention customer orientation, increasing competition in a changing environment, and concern for the future. In deciding to outsource cataloging at Wright State University, Hirshon (1994) cited ongoing decreases in library budgets as the motivating factor to cut expenses and redirect the savings to increase access to materials.

Change factors that motivated the reengineering project at the University of Illinois at Chicago (UIC) also reflect these concerns. Issues at the campus level included: budget allocation; the need to provide quality customer service; greater cost accountability; and the emergence of distance learning in higher education. The UIC library administration sought greater adaptability in controlling and planning for constant change in technology, to increase its ability to respond to

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the growth and use of networks for educational purposes, and to facilitate interaction with external services and suppliers. The administration also wished to prepare for the increasing importance of electronic resources in scholarly communication.

In July 1994, library administration at Stanford University (1995) began a reengineering project of its technical services processes. Three months later UIC began a similar project. Linden (1994) suggests considering two primary factors when choosing which process to reengineer. The first is the importance of the function to the customer. Although technical services activities typically occur without direct interaction with the public, its activities decide in part whether and when library materials will be available to users. The second factor is the capacity to affect performance of the organization. The potential to save time and money by accomplishing tasks electronically rather than manually, and by using new services and products also based on new technology, requires evaluation when a library is striving to optimize its performance. The positive effects on customer service and the potential to improve library performance create an environment that makes technical services a candidate for reengineering.

In this paper I begin with a general description of the framework in which UIC conducted reengineering. Following this general overview, focus shifts to the work of the Before Team, which was a team that evaluated the beginning steps of technical services work flows. This team's activities in evaluating, measuring, and redesigning the work processes that occur before the library receives an item are examined, and the results discussed.

Reengineering Methods

Recognition of the need for change, the importance of correct structuring of the reengineering effort, evaluation of existing work processes, and redesigning processes characterize all approaches to reengineering. Controversy in methods centers around evaluation of existing work processes during a reengineering project. Advice ranges from the conscious exclusion of current processes from consideration, to choosing specifically to evaluate existing work processes. On one end of the continuum are Hammer and Champy (1993), perhaps the best-known reengineering advocates. They endorse methods that strive to redesign a business without the influence of its current procedures. They avoid evaluation of existing processes because of inherent and possibly mistaken assumptions they carry. On the other end of the spectrum are those such as Manganelli and Klein (1994), who claim that consideration of existing processes is necessary to acknowledge the environment in which a process exists, to provide information about customer needs, and to provide a point of focus for team effort. In deciding which reengineering approach to apply, Harrison and Pratt (1993) claim that times exist when processes cannot be considered, usually in situations where a process is technologically obsolete or constrained by outdated thinking.

UIC staff began its reengineering effort by evaluating existing technical services operations. Analysis of existing operations provided details about customer relationships—who interacts with technical services and how interaction occurs. Library patrons are the ultimate customers of technical services production but library departments can also be considered customers of each other. Technical services is a customer of collections development, receiving its input from that department. The library circulation department and book vendors also have dealings with technical services. Each of these groups has different capabilities, and separate information and time needs that influence process redesign. Evaluation of the current process also gave the reengineering participants a starting point, a sense of direction and structure. Discussion and mapping of existing processes provided a familiar point of reference as participants began the reengineering process.

Mapping Work Processes

Network maps are specific tools of the reengineering method used to create diagrams that illustrate the process under study. The first step taken by UIC reengineering teams was to map existing work processes. Maps illustrated all technical services work flows, aided staff understanding of technical services processes and suggested changes to them. Adair and Murray (1994, 16) define a process as a "series of tasks or steps that receive inputs (materials, information, people, machines, methods) and produce an output (physical product, information, a service) designed to be used for specific purposes by the recipient for whom the output is produced."

The process analyzed in this paper's examples began when an order for a book entered the Catalog Department from the Collections Development Department. The process ended with the mailing of orders to book vendors from the Acquisitions Department or the Catalog Department. To trace work flow and gather information about a process, Adair and Murray suggest (1994, 120, 122) "[following] one unit of work as it passes through the process. The unit may be one item, one batch, a particular service, or some other increment, but it is always the smallest unit possible to follow separately." The unit of work tracked in this paper was a single order for a notification slip book.

Network map assembly used information similar to details outlined by Galloway (1994). Questions concerning process boundaries rose early in the mapping phase. Setting the boundaries of the process under study limited departments under examination and defined team responsibilities. Acquisitions and Catalog Department work flows were evaluated while collections development activities were considered external to the process. Teams also itemized requirements of the process, the essential pieces of information used to complete work activities, and outputs of the process—mailed or duplicate orders. These details decided the general content of the network map and helped define the path that the reengineering effort would follow.

The next step in network map preparation involved making choices about which pieces of information to include in the map. A network map must be concise, yet full enough to give a clear picture of the process being analyzed. Teams defined network map detail by the use the map would receive. They constructed the very detailed network maps of this paper for analysis and redesign of the process. They identified each task of a work activity separately. This amount of information was reasonable for a working map, one used in evaluating a process. A more general map was appropriate for reporting team progress. A progress report map would consolidate several work tasks into general work activities, making a process easier to understand for presentation purposes. Once the detail for a map was chosen, it remained consistent within one map or between maps that teams compared. Network map construction also involved identifying points of change. Clear delineation of libraries, departments, and sections helped in tracking work as it passed between library departments and from one person to another.

Construction tools for network maps range from manual methods to specialized computer software. ClarisDraw, a general purpose graphics software product, was a good compromise between manual drawing and more advanced and expensive automated products. Learning the software involved a reasonable expenditure of time, and online revision capabilities proved a distinct advantage over redrawing by hand. Software features allowed clear identification of departments and activities of the book order process. Each section of a library department contributing to the process received a unique background. Figure 1 shows all activities in the pre-processing unit of the Main Library Catalog Department with a dark background. White backgrounds identify Acquisitions Department order unit activities. Each separate box or circle of figure 1 identifies one distinct work task of ordering a book. Box shapes denote tasks done for each book order that

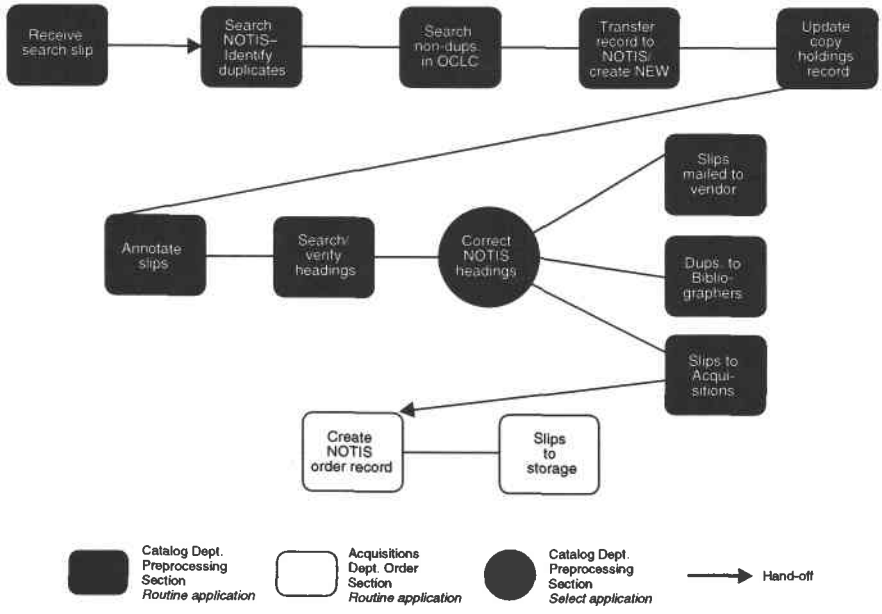

Figure 1. Network Map of Existing Process for Notification Slip Materials—Main Library.

moves through the process. Circle shapes identify tasks done selectively for certain categories of materials. Lines connect boxes to show the sequence of tasks and carry information about work hand-offs, a critical detail of reengineering analysis. A hand-off is the point when a unit of work passes from one person or department to another. Lines between task boxes with an arrow at one end identify a hand-off. Lines without arrows link different tasks done by the same individual.

Besides illustrating work flows, network maps served a critical function in gaining a common understanding of the entire process of ordering a book. The technical services departments under study are broken into acquisitions and cataloging functions. Morris and Brandon (1993) propose that such an emphasis on functions and departments results in a loss of knowledge about the complete process. Reengineering team members had fragmented and diverse job responsibilities. No team member had knowledge of all the details of the book order process. Discussing book ordering provided a great deal of information and revealed many different ideas and perceptions of what occurred and what should occur during the process. Transferring information and ideas to one or two page network maps helped resolve conflicting semantics, misunderstandings, and differences of opinion. It focused team members on common ground about what was important about the process.

Technical Services at UIC

The library system used to illustrate this study currently maintains two separate technical services operations. The Main Library houses one operation; the Library of the Health Sciences (LHS) houses the other. The two libraries are one mile apart. Main Library technical services processes materials for its own collection and for three subject oriented branch libraries. Main Library collections are those of a traditional academic research library. Acquisitions include English and

foreign language materials across the spectrum of disciplines. LHS technical services processes items for itself and three regional medical library sites. LHS collections emphasize current English language medical materials.

The organizational structures are similar at Main Library and LHS but the departments have evolved independently, resulting in different work flows. Similarities include separate acquisitions and catalog departments. Acquisitions, serials, and binding tasks occur in the acquisitions departments. Preorder searching, cataloging, and file maintenance are responsibilities of the catalog departments. Main Library Acquisitions consists of an ordering unit, a serials unit, and shelf preparation. Staff totals 17, led by a department head, and assisted by a second professional librarian. An operations assistant oversees technical services functions at LHS. Nine staff members make up serials and acquisitions with serials supervised by a professional. An additional 5 support staff and a half-time professional work in cataloging. Main Library Catalog Department is broken into an original cataloging unit of 5.5 professionals, a copy cataloging unit and a preprocessing and maintenance unit, for a total of 20.5 cataloging staff. Staffing levels at LHS are lower in reflection of a smaller volume of materials processed. Staffing levels fluctuated slightly during the reengineering project, with normal movement of staff within and outside the library. UIC uses OCLC Online Computer Library Center, Inc., NOTIS, and vendor specific databases to accomplish technical services tasks.

The Before Team Project

The UIC library administration chose to evaluate and restructure the steps taken by its technical services departments in acquiring and processing monograph and serial materials. Major changes in work processes were limited to acquisitions and cataloging departments but adjoining library functions also received scrutiny as teams analyzed work flow practices. The overriding goal in evaluation was to streamline processes, and improve the time and efficiency of procedures without unduly sacrificing quality. Part of the streamlining included evaluating automated solutions to current processing methods. Staff downsizing was not a goal of the reengineering project. Library administration anticipated that emerging electronic initiatives would create new roles for staff.

The Before Team, one of the two reengineering teams that undertook detailed evaluation and restructuring of technical services work processes, had the charge of examining technical services processes before the library receives an item. This involved gathering and analyzing information and developing new, more efficient processing. The team created maps of work flows to define and illustrate the processes they were studying. They also measured the time involved in carrying out a process and predicted the impact of changes to processes. Analysis involved detailed evaluation of individual work tasks. Redesign brought together preceding changes and consolidated the flow of work into a new process.

Reengineering Group Structures at UIC

Evaluation and restructuring of work processes involved more than just the work of reengineering teams. Reengineering activities required the participation of 24 employees (approximately 10% of total library staff). The central structure of the initial 18-month analysis and redesign phase of the UIC reengineering project consisted of four types of working groups: a Steering Committee, consultants, task forces, and reengineering teams.

Guha, Kettinger, and Teng (1993) maintain that reengineering group membership as a whole should include staff from all functional departments of an organization, including those who are seemingly less obvious candidates for inclusion because they are not directly involved in a process being reengineered. Acquisitions and cataloging departments were the most heavily represented with 14 people participating. The other 10

members of the reengineering group membership were from outside technical services. Membership included two members each from both collections development and circulation departments, four administrators, and one librarian each from a branch and a remote site library. This representation from throughout the library brought diverse perspectives to the effort. Some members could supply insight into customer needs and others could realistically assess the feasibility of suggested changes because of their involvement with daily processing.

The UIC reengineering effort included representation from multiple levels throughout the library. Total reengineering membership included 15 professional staff from various departments and 9 technical services support staff. The broad representation provided the knowledge base that fueled the reengineering effort. Professional staff provided broad perspectives in library knowledge, administration, management, and professional concerns. Technical services support staff provided detailed information about the types of work moving through their departments. They knew what information was needed to accomplish tasks, and the reasons for when or why they carried out activities. The knowledge and abilities of the members of each group enabled the four groups to fulfill unique roles in the project.

The Steering Committee consisted of the university librarian, library department heads, a coordinator for the reengineering project, and two team champions. Team champions served as liaisons between the committee and the two reengineering teams evaluating work processes. The champions facilitated administration of the project and communication between groups. They exchanged information on project progress, reported on problems needing resolution, and proposed work flow changes for approval. The Steering Committee focused on determining environmental factors and reengineering issues affecting the entire library. In fulfilling its charge, the Steering Committee arranged visits to peer libraries and book providers, interviewed various university focus groups to learn about library users and their needs, and conducted an availability study of library materials. Beyond its administrative role of providing direction and support for the projects described in this paper, the committee improved work processes that fell beyond the scope of the reengineering teams and developed electronic collections.

Consultants assisted in the reengineering process. An outside reengineering consulting firm provided two consultants. At least one consultant attended weekly reengineering meetings in the mapping, analysis, and redesign phases of the project. Consultants provided knowledge of reengineering principles and leadership in navigating various steps of the reengineering process. They also introduced the working groups to the tools needed to gather information and helped in analysis of that information and in the redesign process.

The Steering Committee also appointed separate task forces to examine specific concerns in detail. A common characteristic of task force members was knowledge of a specific process or area of research that enabled them to judge the topic being studied. For example, an ongoing task force studies transaction logs of the library catalog and makes recommendations for user interface displays. Task forces also studied outsourcing options, which resulted in a project that tested the OCLC PromptCat service. A task force visited another university library to gather information about its newly redesigned technical services work flows. Task forces also studied expanding existing approval plans and implementing electronic data interchange.

Two reengineering teams were designated to explore technical services processes in depth: the Before Team and the After Team. The Before Team charge called for evaluating processes occurring before the library receives an item; the After Team with processes after an item enters the building. Teams studied work flows for firm order, approval plan, standing order, serial, and notification slip books. Membership consisted of nine people on each team, including the team

champion and the reengineering project coordinator from the Steering Committee. Support staff and professional staff served on the teams in almost equal numbers with most support staff participants involved in performing or supervising actual technical services processes. As process evaluation and restructuring progressed, teams resolved most questions immediately by relying on the knowledge of members present.

Having described the overall framework in which reengineering took place at UIC, focus will now return to the work of the Before Team.

The Before Team Activities

The Before Team focused most of its work on firm order and notification slip book work flows. They simplified firm order and rush order work flows by eliminating points of review. A redesigned, but not yet implemented, process for firm order books suggests changing in-print searching tasks. It is also proposed that information gathering and vendor assignment tasks be shifted from acquisitions and cataloging departments to the Collections Development Department. The redesigned process for notification slip books standardized and streamlined work tasks, and allowed consolidation of the process so that one person could carry it out. The Before Team also initiated exploration of sending orders to vendors using electronic data interchange and considered sending notification slips directly to vendors without technical services processing. Electronic claiming of serial issues also resulted from team effort.

Initial activities of the team centered on mapping the work flow of orders at both LHS and Main Library. Teams traced orders as they moved into the pre-processing unit of the Catalog Department from collections development and then moved on to the acquisitions department. Team members shared knowledge among themselves and interviewed other technical services staff on existing procedures and policy. They brought back information to group meetings where team members collectively identified work tasks and the order in which they occurred as book orders to be placed moved through the departments. From this they created a visual network map of the process, beginning with preorder searching, moving through the creation of local catalog records, and ending with the printing and mailing of book orders.

In tandem with mapping a process, the team developed procedures to measure the cycle time for completing a process. Cycle time measures the time it takes to carry out a process from beginning to end. Measurement involved identifying beginning and ending points and major activities of the process. At these points, the team defined what data existed to allow an assessment of cycle time. The resulting measure required collecting and analyzing a series of dates stamped on paper order slips as they moved through the work flow. Procedures were set in place for systematic sampling and analysis of the results. Measurement eventually allowed a comparison between the process as it existed before redesign and the new process after implementation.

Once mapping and cycle time measurement were underway, process analysis was used to evaluate the contributions of each work task. In team meetings members discussed and judged the value of individual tasks based on the cost of performance, and the frequency and impact of errors. Team members reached a consensus on task value or ran a pilot test to measure the results of a proposed change. Pilot tests were used to assist in developing and implementing new procedures, and in measuring rates of error, processing times, and the effect of changes. Test results allowed team members to weigh savings in processing times against errors and their impact to decide whether the benefits of a change outweighed its drawbacks.

Later changes involved redesign of the entire work process. Team members redesigned the process by eliminating or curtailing work tasks previously judged as having limited value. They also consolidated the process by eliminating work hand-offs whenever possible. During im-

plementation of the new process, the team created automated alternatives to simplify or replace existing manual tasks and processes.

Therefore, the accounting of improvements made during the reengineering process focuses on reducing process cycle times by decreasing the number of work tasks and the number of hand-offs in a process. Elimination of two or three tasks and one or two hand-offs from a process would not seem to have measurable impact on processing times. However, cycle times measured before and after implementation of the redesigned book order process show the benefit of making these changes.

As defined earlier, network maps illustrate the process under study. Measurement of process cycle time produces data from the existing process that serve as a basis for comparison with future changes. With these underlying mechanisms in place the Before Team moved to evaluate individual ordering processes. In this paper I examine reengineering the process of ordering notification slip books. Examination of the single process illustrates the mechanisms used to analyze and redesign the old process and addresses concerns of implementation of the new process.

Process Analysis and Redesign

With completed network maps, team members could begin the step of judging component tasks of the notification slip book ordering process. The goal of analysis and redesign was to streamline the process by eliminating unnecessary work tasks and hand-offs without compromising quality. Some tasks became candidates for total elimination or limited application. The team evaluated tasks in the order process using the reengineering concepts of value- and nonvalue-added activities.

Adair and Murray (1994, 116) identify tasks that add value as those "that physically change the work and affect the work output in a way that makes it more valuable to the customer." The Before Team evaluated all work tasks in notification slip book order processes at both libraries. Value was easily recognized in necessary tasks like record creation and slip annotation that documented and conveyed information needed in later cataloging procedures. Value was also found in duplicate detection that prevented the library from spending funds for books already owned and saved staff time in receiving and then returning duplicate titles. Searching tasks were necessary for completing the process but redundant searching of the same database, as staff carried out different tasks on an order in multiple departments, was considered nonvalue-added. Nonvalue-added steps do not substantially change the status or content of a piece of work but seem primarily to slow work down.

Assigning nonvalue-added status to a task was straightforward in the case of redundant activities such as searching the in-house database multiple times to enter different pieces of information. Assigning value to other tasks, especially those where the focus was on improving the accuracy or completeness of data, was more problematic. Historically, the technical services departments at UIC have had the goal of achieving error-free processing. Striving for this level of quality incorporated tasks into the work process that reviewed and verified work for accuracy. Any increase in accuracy, such as additional correct orders received, or improved online catalog content, justified performance of a task. Reengineering introduced new criteria for evaluating tasks that challenged these quality standards. In addition, technical services team members were working with team members from other areas of the library who had different experience and perspectives on acceptable levels of error in processing.

Three criteria contributed to determining the value of these tasks: time or staff costs of performing the task, the frequency of errors found while doing the task, and the impact that errors would have on the quality of the output or end result of the task. The team moved from the technical services assumption that all tasks improving quality had some value, to balancing the productivity of each

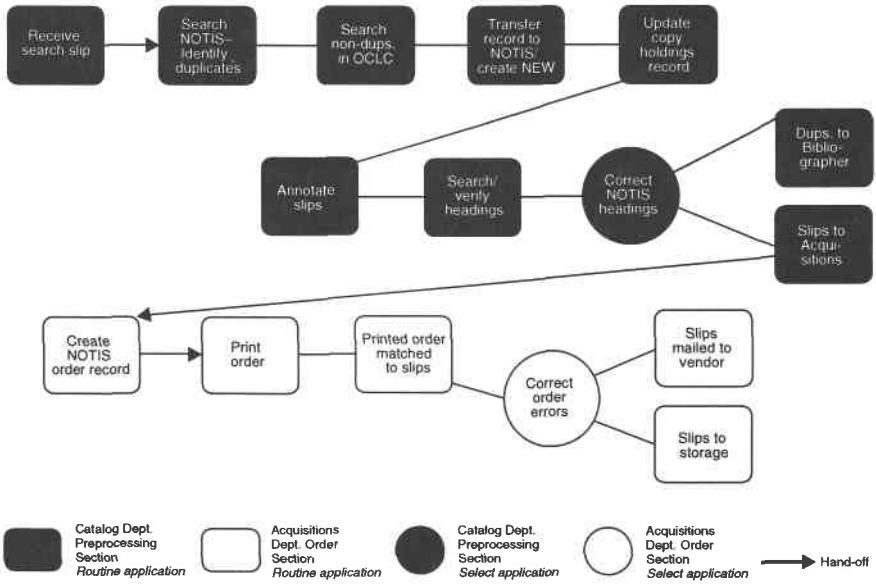

Figure 2. Network Map of Existing Process for Notification Slip Materials—Library of the Health Sciences.

work task with its cost. If a task had high costs, such as adding a half day or a day of processing time, or required attention of supervisory personnel, high levels of error frequency, or critical impact on the quality of the end result would have to exist in order to warrant continuation of that task.

At times the team was satisfied with informal assessments of costs and benefits gathered at team meetings. For example, a set of review tasks in the process at LHS involved supervisory staff printing orders that had already been processed on the local system, checking the printed order against its paper notification slip and correcting any errors that would result in incorrect receipts (see figure 2). Discussions between the LHS acquisitions supervisor, the technical services operations supervisor, and a bibliographer led to the conclusion that the errors found during this review did not identify enough incorrect receipts to merit its continuation. These three individuals concluded that the low frequency of errors, which in this specific situation was based on the shared observation not a measurement, did not affect total order quality enough to warrant the cost of supervisory personnel completing the task.

When discussion within the team was not on its own sufficient to result in consensus on the value of the task, the team set acceptable rates of error, measured error occurrence, and assessed the effect on the output of the task. Determining the value of the task that verified headings in records newly added to the local catalog was especially sensitive because of the longstanding belief of its impact on catalog quality. The team decided that 3% was an acceptable rate of error in the catalog. In a pilot test, 449 OCLC records containing 813 headings were searched in the local catalog and 22 (approximately 2.7%) conflicted with established local catalog forms. Besides frequency of the occurrence of error, members were also concerned with how long the errors would

exist in the database. By measuring movement through technical services, the team found that for Library of Congress and National Library of Medicine titles, conflicts would exist for the one to eight weeks that it takes to receive and catalog the books. Fast processing further lessened the impact on catalog quality. Acceptable error frequency, combined with the short time that errors would exist in the catalog, resulted in a nonvalue-added status for this category of orders.

Besides evaluating process tasks, team members worked to eliminate hand-offs, the point where a unit of work passes from one person or department to another. Hand-offs can have a nonvalue-added status in the same way that work tasks can. However, hand-offs are different in that they are not a work activity but a transition point in the work flow of a process. Prabha (1989) found that the time to catalog material lengthens when greater numbers of people handle an item. This corresponds with the nonvalue-added status of hand-offs because of the idle time that occurs between one person completing their work on an order and the next person beginning it. In the LHS process, after creation of the local system order, the work moved from one person to another for review (designated on the network map in figure 2 by an arrow connecting task boxes). The time orders spent waiting for that review added processing time without adding anything of value to the order. The Before Team had already judged the review to be a nonvalue-added task. Now it eliminated the task and the hand-off, resulting in less work for the supervisor, no perceptible decrease in the quality of orders received, and faster processing times.

The team detected a second, less evident but potentially significant source of hand-off delay as work moved between collections development and cataloging departments at the Main Library. In initial measurements of processing time, the preprocessing unit in cataloging was pinpointed as a source of processing lag time. Further investigation revealed that transfer of book orders to the unit did not always occur immediately after a bibliographer decided to order an item. Practice varied by bibliographer and type of order, but questioning bibliographers on their methods identified two submission patterns. Some orders were submitted daily in small numbers, but sometimes batching occurred for notification slip orders, resulting in packages of 50 to 100 slips together. Other orders were submitted less frequently, but also in large numbers. This created potential for the convergence of many orders in the Catalog Department at once. Batching and holding orders was practical for collection development order receipt patterns and fund management. Yet the point of the hand-off, when the Catalog Department contended with orders in unpredictable volume, led to processing delays.

Phase One Results

The next step of analysis and redesign became the first phase of results as team members looked for parts of the process that they could change quickly. Making changes quickly to realize some improvements was desirable, especially when a consensus existed about clear positive benefits to the process. An opportunity to decrease processing time was found in revising the application of the heading verification task because the team had judged it to be partially nonvalue-added. Because both catalog departments carried out this task, both processes would benefit from the change. The team eliminated searching personal, corporate, conference, and series names for orders with Library of Congress and National Library of Medicine bibliographic records. Eliminating the task affected 60% to 80% of records searched during the pre-order process. It also reduced cycle time about two minutes per record and saved up to 55 work days per year.

The final step of the reengineering project involved redesigning the entire notification slip book ordering process. Figure 3 shows a redesign of the book order processes depicted in figures 1 and 2. This redesign results in identical work flows for notification slip books for LHS

TABLE 1
WORK STEPS* FOR NOTIFICATION SLIP ORDER PROCESS

	Work Steps Prior to Reengineering	Work Steps Following Reengineering	Net Reduction in Number of Steps
LHS Process	19	13**	6
Main Library Process	15	13**	2

*Tasks and hand-offs involved in the entire process.
**Two tasks applied on a selective basis.

and Main Library. The team eliminated hand-offs whenever possible, including one from the Main Library process and two from LHS. The hand-off between cataloging and acquisitions departments and its time delays are gone, as are tasks duplicated in each department, such as online searching. Only one hand-off remains in the new process, when orders come into technical services from the Collections Development Department. Also eliminated were tasks previously given nonvalue-added status. Tasks decreased to 12 (from 13 at Main Library and 16 at LHS), with two applied selectively. The redesign eliminated nonvalue-added review tasks of completed orders from the LHS process. Heading verification for Library of Congress and National Library of Medicine records was discontinued at both libraries. Table 1 summarizes the reduction of hand-offs and tasks in the reengineered process.

The most evident change in the redesign is the consolidation of the book ordering process. Rather than a process carried out in two departments by two or three people, the redesign resulted in a process combined and simplified through automation so that one person working in one department could perform it. Preorder searching, which includes bibliographic and holdings record creation, and occurred in the Catalog Department, was consolidated with order record creation, which took place in the Acquisitions Department. The team anticipated that this redesigned work flow would result in a reduced cycle time that would be measured after implementation.

IMPLEMENTATION OF NEW WORK FLOWS

Reengineering groups redefined and reformed to execute initiatives approved during process redesign. The implementation stage for the reengineered notification slip order process took an additional nine months of work for a reconfigured team of eight people. The implementation team was responsible for evaluating the proposed redesign and setting up a pilot test of the initiative, which included developing procedures for the process and training staff. Team members were chosen for their direct involvement in supervising and carrying out the book order process. The implementation team included staff that would be conducting the pilot test, so training began immediately with exposure to the new design and continued as implementation developed.

Consolidation of the process for ordering notification slip books meets reengineering streamlining goals and has potential for job enrichment goals. According to Hirshon (1994, 14, 16), "A key re-engineering notion is the discarding of the division of labor in favor of combining jobs, empowering the worker, and making jobs more multi-dimensional." However, a key concern during implementation was whether the consolidated process would be too complex and result in work overload for one employee. Required of one person are searching skills and manipulation of OCLC and NOTIS systems, knowledge of MARC bibliographic fields and NOTIS fields in bibliographic, holdings, and order records, and finally mailing tasks. Maintenance of acceptable levels of accuracy

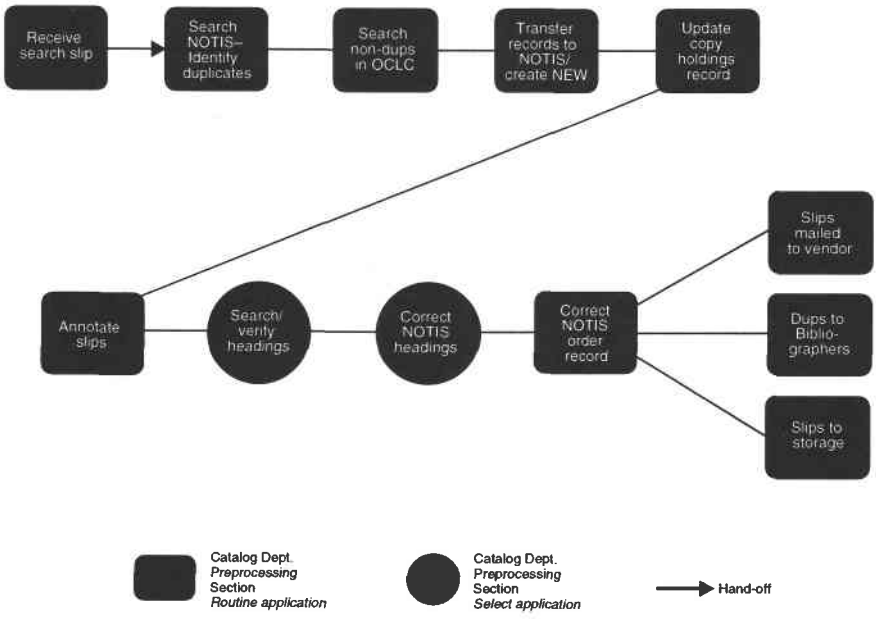

Figure 3. Network Map of Redesigned Process for Notification Slip Materials.

remained critical in spite of the additional tasks assigned. Hackman and Oldham (1980) propose that such job redesign might not be suitable for all workers. A combination of knowledge, skills, personal growth needs, and job environment contribute to the abilities of each worker to accept and succeed in such a challenge.

To answer the problem of overload, implementation team members from the acquisitions and cataloging departments developed computer macros to record commands that would automatically perform creation of the order record. They recorded keystrokes to fill the order record fields in a macro so that pressing one function key accomplished order record creation. Automation of this part of the process also determined who would take responsibility for the redesigned process in technical services. Staff in the preprocessing unit of the cataloging department had the knowledge of OCLC, MARC, and NOTIS required for the rest of the ordering process. Rather than require acquisitions staff to learn this skill set, creating orders became the responsibility of the pre-processing unit in cataloging for the immediate future.

Phase Two Results

The implementation team successfully tested the redesigned process that consolidated notification slip ordering. Task overload did not turn out to be a problem for one person carrying out the process. Verification of the benefits of the redesigned process can be found in a comparison of cycle times before and after process redesign. At the onset of the reengineering project the Before Team began measuring the cycle time of the process. Cycle time measurement continued in the implementation phase of the project. This allowed comparison of the process as it existed before reengineering with the redesigned process. A comparison of cycle times shows anticipated reductions in the average time to process an order.

Measurement of cycle time involved

TABLE 2
CYCLE TIMES FOR NOTIFICATION SLIP ORDERS (IN DAYS)

	Cycle Time Prior to Reengineering	Cycle Time Following Reengineering	Net Reduction
LHS Notification Slip Orders	10	2	8
Main Library Notification Slip Orders	42	18.5	23.5

gathering a series of dates as the order moved through the process. The first date showed when a bibliographer decided to order an item (denoted by the date entered on the notification slip by the bibliographer). The measurement procedure used a second date when staff created bibliographic and holdings records in NOTIS in the preprocessing section of the Catalog Department. The last date recorded occurred when staff created the order record in NOTIS (in the Acquisitions Department for the old process and the Catalog Department for the redesigned process). Team members combined dates to find the cycle time it took an order to move through cataloging and acquisitions processing with the understanding that delays in order submission possibly extended cycle time and that some cycle time was not accounted for because mailing tasks, considered part of the ordering process, were not represented in the statistics. Table 2 shows a summary of notification slip cycle times prior to and following reengineering the process. Baseline samples taken four months after beginning the reengineering project show an average 42-day cycle time for ordering Main Library notification slip materials and an average cycle time of 10 days for ordering LHS notification slip materials. Latest figures, taken 43 months after the beginning of the reengineering project and 15 months after implementation of the redesign, show an average cycle time of 18.5 days for Main Library and 2 days for LHS notification slip materials. This decreases the cycle time for book ordering at Main Library by 23.5 days (56%) and at LHS by 8 days (80%).

EVALUATION OF REENGINEERING PROCESS AND RESULTS AT UIC

Though reengineering has its origins in business applications, its framework and tools proved valuable in the assessment and redesign of technical services work processes. Evaluating existing processes provided focus. Teams successfully questioned assumptions and redesigned processes, policy, and procedures. The Steering Committee provided direction and handled broad concerns while teams researched processes in-depth and task forces dealt with special topics that would otherwise have diverted team effort. Diverse group membership promoted a balance of perspectives that encouraged questioning of processes and generated creative suggestions for improvement.

Network map construction demanded that the Before Team determine the boundaries and components of ordering a book and in doing so broke down barriers of functional departments that prevented viewing book ordering as a single process. Map construction also facilitated greater agreement about and understanding of the process. Network maps encouraged analysis and redesign by allowing systematic evaluation of work flows. Cycle time provided tangible information regarding the time involved in book order processing and showed improvements brought to the process through redesign.

Reengineering concepts of task value and hand-off were applicable to evaluating library processes. Assigning value to work tasks identified problem areas

within technical processing work flows. The team easily identified value in the creation of NOTIS records and duplicate detection tasks. Though nonvalue-added tasks were sometimes not so easy to judge, the team nonetheless identified and eliminated these tasks. Assigning value to tasks resulted in a reevaluation of traditional technical services quality standards. A degree of tolerable error replaced the goal of error-free processing in some instances, once the team evaluated the frequency of errors, the cost of performing a task, and the impact of errors together. In sensitive situations, quantifying acceptable error rates, task costs, and effects of the change, coupled with final review and approval by library administration via the Steering Committee, signaled a change in expectations and eased acceptance of new standards by staff.

The evaluation of hand-offs was especially enlightening in understanding the fits and starts of how work progresses through a process. Reengineering conflicts with older organizational theory in which a division of labor develops specialized functions to increase processing speed through a set of small, well-defined work tasks. In functionally designed technical services work flows, acquisitions staff concentrated on the details of order records while cataloging specialized in bibliographic and holdings records. Each department operated with well-developed knowledge and skills within its area of expertise that supposedly maximized production. Segmentation of work, however, does not account for the idle time built into the hand-off between people and departments. The time that orders spend in an out basket waiting for transportation to the next stage of the process, or on a desk waiting for work tasks actually to begin, was a revelation when teams analyzed work processes.

The potential pitfalls of undertaking a project to reengineer work processes are many. Following on the heels of the initial promotion of reengineering as an organizational design tool there seemed to come the recounting of its failures more than its successes. Even proponents such as Hammer and Champy (1993) give pause by listing a large set of factors on which success hinges. The project under discussion fell prey to a few reengineering traps on that list. Some slowed progress of the project but others were less problematic.

Hammer and Champy claim (1993, 212) that 12 months is the optimum time for progression from "articulation of a case for action to the first field release of a reengineered process." The reengineering project under discussion began three years ago. During this time the initial mapping, analysis, and redesign phase of the notification slip order process took 18 months. Implementation took an additional nine months. Part of the reason for this was the time that library staff could contribute to the effort. Reengineering progressed along with the usual work load of an academic library. Consultants suggested longer or more frequent meetings. Participants felt that the demands of the library limited their ability to divert more attention to reengineering. The choice to maintain rather than increase time committed no doubt lengthened the reengineering project.

A second reason for the length of the project was the complexity of technical services processes. While the library had only one reengineering project, so as not to "dissipate energy across a great many reengineering projects" (Hammer and Champy 1993, 210), it was difficult to anticipate the time it took to study work processes. The number of processes within the acquisitions and cataloging departments is large. The seemingly simple process of ordering a book quickly acquires complexity when one considers the different order streams and their accompanying work flows. Initial efforts of the Before Team concentrated on notification slips and firm order work flows. Mapping, measurement, and analysis of these processes occurred practically concurrently. During redesign, the evaluation of tasks for quick changes and redesign of the entire process also progressed together. Attention shifted from one issue and sometimes from one process to another during and between meetings, leading to confusion and slow progress.

This situation escalated as the project progressed and the team considered alternative options and services. The Before Team made its greatest progress once it focused on the simplest process available to it—notification slip book orders. Now, after initial success with notification slips, movement to consolidate firm orders into a one-person process can be more focused, should it occur.

A warning against "trying to fix a process instead of changing it" (Hammer and Champy 1993, 201) did not prove problematic at UIC. Fixing a process refers to modifying an existing process in contrast to starting over to develop a completely new process. There might be advantages to starting over but the team had success in making incremental modifications to the notification slip order process. It eliminated single tasks or applied them selectively. While these modifications were individually minor in nature, the collective result was a substantial reduction in cycle times and overall decreases in time for the order process of 56% and 80%.

During the project, the library has realized significant benefits beyond changing technical services work processes. The library administration has made a survey of its environment. In exploring automated alternatives to current work flows, it has brought itself up-to-date about current options, and positioned itself to use newly emerging capabilities offered by technology. The project has offered opportunity for staff development. Professional and support staff have worked together developing skills to generate new ideas and evaluate what works best among a broad range of options. Team responsibilities required support staff to work in new roles and develop written and oral communication skills. Library staff, especially those from different locations, have gotten to know each other better, which eases future contact and interaction to accomplish library activities. Finally, and perhaps most important, the library administration and its staff have become more accustomed to change, making the task of managing change, if not comfortable, at least more routine.

Conclusion

Technical services do affect the level of customer service a library can provide and the reengineering project was intended to increase the level of service through faster ordering and thus more timely receipt of new materials. This reengineering project involved mapping work flows, analysis, redesign, and implementation of a notification slip book ordering process. Mapping produced clear, concise illustrations of work flows used throughout the reengineering project. Process analysis eliminated work tasks that did not show adequate contributions to the work process, such as review tasks that verified headings occurring on Library of Congress bibliographic records. Standards defining higher allowable levels of inaccuracies have not resulted in discernable harm to the ordering process or the quality of the catalog. The redesigned process for ordering notification slip books eliminated the hand-off between acquisitions and cataloging, and consolidated ordering into a single set of steps performed by one person in one department. Together, task and hand-off elimination resulted in decreased cycle times for book orders.

Reengineering of technical services processes is an ambitious undertaking motivated by changing times. Through reengineering, UIC staff sought flexibility in controlling and planning for changing technology. Participation in the reengineering project has resulted in a survey of the surrounding environment. Teams have evaluated and implemented new practices, products, and services available to technical services. Reengineering also has allowed the library to know itself better. Reengineering participants have come through a daunting change process successfully. They have developed new knowledge and new skills and are better equipped to respond to additional change, which realizes for the library part of the adaptability it seeks for the future.

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