REENGINEERING: A FRAMEWORK FOR EVALUATION AND CASE STUDY OF AN IMAGING SYSTEM

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ABSTRACT

Reengineering or business process redesign has become very popular. This paper presents a framework for comparing and evaluating reengineering efforts. The framework is applied to a case study of the reengineering of the securities processing function at Merrill Lynch. The paper compares the old and new process at Merrill. The new process features image capture, character recognition and extensive redesign. The reengineering effort has had a substantial payback for the firm.

INTRODUCTION

One of the latest trends in the information systems field is reengineering. Hammer and Champy (1993) offer a definition of reengineering:

> "Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed."

This definition emphasizes four key words:

Fundamental: Why does the firm do things a certain way?

Radical: Get to the root of a process; look for reinvention as opposed to making superficial changes or minor enhancements to what is already in place.

Dramatic: Reengineering is not about marginal or incremental improvements; rather it focuses on achieving quantum leaps in performance. Results like a 10% improvement are not reengineering.

Processes: Traditional design often is centered on tasks, jobs, people and structures. Reengineering looks at a business process which is a collection of activities that takes one or more inputs and produces some output of value.

In an earlier work on reengineering, Hammer (1990) described the spirit of reengineering as "obliterating" rather than automating. He argues that systems developers have too often automated existing processes without thinking about the need for radical change. Davenport (1993) also emphasizes the radical nature of reengineering in contrast to incremental improvements in an existing process.

None of these authors provides much detail on how one determines what constitutes reengineering or evaluates a reengineering effort. What does "obliterating a process" mean? Does one have to achieve an order of magnitude gain to claim a reengineering success? What are the likely impacts of a successful reengineering effort on the organization?

The purpose of this paper is to propose criteria for describing and evaluating the impact of reengineering efforts. The paper presents qualitative and quantitative criteria for characterizing the impact of a reengineering project. It includes an analysis of a reengineering case study which is evaluated against these criteria. The case describes the significant gains that an organization can obtain from a reengineering effort; it also illustrates the use of a new technology, image processing, in a reengineering effort.

REENGINEERING AS A CONTINUUM

The discussion above centers on reengineering versus incremental improvements to business processes. Table 1

Incremental Improvements	vs	Reengineering
Accept current process		Ask if process is necessary
Look for ways to tune processes		Look for radically different models
Try to modify components of system		Try to make changes that are multiplicative e.g. cut labor 50%
Avoid radical change and disruption		Seek radical change in hopes of making significant improvements

Incremental Improvements Compared
With Reengineering
Table 1

suggests that these two characterization of business process redesign are really endpoints on a continuum. Reengineering and radical change are on the right-hand side of the continuum; small enhancements to a process fall to the left. (Possibly obliteration is off the scale on the right; it leads to order of magnitude changes!)

It is very likely that the middle of the continuum represents an area of maximum work for minimum payoff. This middle ground is a place designers should avoid. One contribution of reengineering is to call management's attention to the fact that designers should either concentrate on incremental improvements or the radical redesign of processes; working in the middle ground often results in high expenditures to automate an existing, inefficient process. (One of the reviewers remarked that most reengineering cases he/she had observed fell into this middle ground, suggesting that they were not reeingineering successes.)

If reengineering creates such dramatic, multiplicative gains why would the organization ever be satisfied with incremental improvements? Working on the reengineering side of the continuum is risky. Changes of great magnitude may even appear to some as doing violence to the organization. When management selects reengineering over incremental improvement, it is taking greater risks in the hope of obtaining greater benefits.

COMPARING SYSTEMS

The next section of the paper presents a case study of a reengineering project. In order to assess the impact of a reengineering effort, it is necessary to compare a new system with the old, existing process in some detail. In conducting the study, the research team found that it was very difficult to rigorously compare two information systems. A literature search found examples of individual systems, but few comparisons of two or more systems.

This section proposes a framework for comparing and contrasting two systems. The framework has two parts, qualitative information and quantitative data. The evaluator of a process must consider all of the evidence and develop an opinion about where on the continuum in Table 1 a particular reengineering effort falls. The proposed framework does not produce a single number to characterize a reengineering effort. For each quantitative measure and for the evaluator's overall evaluation, the evaluation framework allows ordinal comparisons. For example, the evaluator should be able to say that a reengineering effort that scores .75 on the extent of automation is more automated than a project that scores .50. However, it would be incorrect to say that the first project is 50% more automated than the second. More precise comparisons would be possible if a number of reengineering projects could be used to calibrate the analysis proposed below.

The comparison framework includes:

Qualitative Information

- Changes in organization structure
- Major changes in work flows and functions performed
- Interface changes
- Major changes in technology
- Impact on the organization

Quantitative Data

- Comparison of Dataflow Diagrams
- Comparisons of resources required
- Investment
- Return on investment

Most of the items in the framework are obvious and have been used to describe systems in the past (for example see Pugh, et al. p. 1963 on organization structure). These components of the framework will be illustrated in the case which is presented later in the paper. The quantitative comparison of Dataflow Diagrams (DFDs) is new and is described below.

Comparing DFDs

One way to describe business processes is with Dataflow Diagrams or DFDs. Analysts speak loosely of DFDs as characterizing a "system;" in fact most DFDs describe a business process that consists of various manual and automated steps; the automated steps may be complete systems in themselves.

This paper presents the first use of a technique for comparing Dataflow Diagrams proposed by Berndt (1993). Problems comparing DFDs arise because the identification of a DFD element or function is a subjective process. Two analysts are likely to develop two different DFD representations of the same process. In order to compare two processes at the level of DFDs, it is necessary to avoid the bias that is created by the uncoordinated development of DFDs for the processes involved.

In Berndt's approach, the DFDs for two or more processes need to be developed in tandem. Of course, this strategy is most feasible for comparing two similar business processes, such as an old process and one that has replaced it.

The first step is to develop a "core" DFD representing overlap between the two processes. The analyst extends the core DFD, reusing the appropriate functions, to specify alternative system DFDs. The analyst also attempts to develop lower level DFDs at the same level of detail. It should be possible to overlay or encode many alternative systems within a single DFD database by using computer-aided design tools.

Berndt (1993) proposes four metrics derived from the DFDs for comparison; two of these are appropriate for the case which follows: control points and level of automation.

Business processes contain a number of control points which are critical to their success. For example, the preparation of payables has a control point that compares a purchase order and a receiving document. Without this kind of control, the user would have no way of validating payments.

The comparison technique looks at control sources and control points. A control source is an object that produces information utilized at some later points for verification. A control point is a function or process that consumes information and performs a verification function.

The analyst constructs a matrix of control points consisting of two rows for each process being compared. For each process, the analyst lists control sources and points. He or she may also want to categorize the control points into manual, computer-aided or automated controls.

The level of automation achieved is an important measure of the effective use of technology in reengineering. Level of automation can be further broken down into three components: core, obsolete and new functions.

	Manual functions	Computer-aided functions	Automated functions	Totals
Core Old system	c_1	c_2	c_3	c_t
New system	c'_1	c'_2	c'_3	
Obsolete functions	o_1	o_2	o_3	o_t
New functions	n_1	n_2	n_3	n_t

CON Matrix
Table 2

(CON). Berndt's technique involves constructing a CON matrix as shown in Table 2. The purpose of this table is not to replace the observer's intuition; it is designed to help the analyst focus on the most important areas of change. The calculations of the proposed metrics are intended to be accomplished within the framework of a computer-aided design tool and should serve as a guide, not a replacement for commonsense.

Core functions exist in both the old and new processes; they may shift among automation categories (the columns in Table 2). Obsolete functions are functions that exist in the old process, but have been eliminated in the new process. New functions represent change between the old and new process; this category contains functions that exist in the new process but not in the old.

By computing various ratios, the analyst derives a numerical characterization of the extent of automation, the number of obsolete objects, and a measure of process change. Note that these ratios should be treated as ordinal rather than interval data. The stability factor is intended to capture the extent to which two alternative processes overlap and can be thought of as a measure of "radicalness." (The less stable, the more radical the change.)

$$\text{Stability} = c_t/(c_t + o_t + n_t)$$

Obsolescence is the percentage of obsolete functions:

$$\text{Obsolescence} = o_t/\ (c_t + o_t + n_t)$$

Newness is the percentage of changed functions

$$\text{Newness} = n_t/\ (c_t + o_t + n_t)$$

Comparing the changes in automation categories within the stable functions captures a measure of the extent of automation with the expectation there will be more automation in the new process:

$$\text{Automation} = (c_2 + c_3)/c_t < (c'_2 + c'_3)/c_t$$

Finally, it is possible to compute a measure of system-wide change. This ratio should capture the addition of new functions, the nature of the shift of stable functions to more automated categories and the extent to which functions have become obsolete. A measure of change is:

$$\text{System-wide change} = (n_t + \text{Sum}(|c_i - c'_i|/2))\ /\ (c_t + o_t + n_t)$$

The summation in the numerator captures shifts in automation with respect to core functions in both the old and new processes in each automation category, computer-aided and automated (halved to correct for double counting).

The case study in the next section will illustrate the comparison of DFDs using both control points and levels of automation. The authors did this comparison manually, though the technique is designed to be incorporated into a computer-aided design tool.

SECURITIES PROCESSING AT MERRILL LYNCH

Merrill Lynch is the largest brokerage and financial services firm in the United States with over 400 branch offices. The objective of the securities processing operation is to receive certificates from customers, perform the proper processing of the certificates, and post data to customer accounts.

A very high-level process flow consists of the following steps:

1. The customer brings documents to a branch office
2. The branch does preliminary processing
3. Certificates are sent to a processing center
4. The center verifies and checks the certificates
5. The center processes certificates
6. The center posts data to the customer's account

On a typical day, Merrill Lynch offices around the US receive some 3500 securities which need processing of some kind. What are some of the reasons for customers bringing securities to a branch office?

- The customer has sold the stock and must surrender it so that shares can be issued to the buyer.
- A person has inherited stock and must have the shares registered in his or her name.
- A company has reorganized and has called its old stock to issue new shares.
- A bond has been called by the issuer.
- A customer wants Merrill to hold his or her securities.

The customer brings the security plus other supporting documents to the branch office cashier. The cashier provides a receipt and batches all of the securities together to be sent for processing. Before the development of a new process, the branch would send these documents to one of two securities processing centers, either Philadelphia or Chicago.

The objective of securities processing at the centers was to credit the customer's account as soon as possible, certainly within the 24 hours suggested by the Securities and Exchange Commission. Because of exceptions and the possible need to contact the customer again, sometimes it was not possible to achieve this goal.

A good example of problems is in the area of legal transfers when someone inherits stock. There are requirements for supporting documents like a death certificate. If the customer does not bring the documents and the branch does not catch the fact that a necessary piece of paper is missing, the securities processing center must contact the branch and ask them to contact the customer.

Because many of the securities are negotiable, the SPCs must be extremely careful in processing. Merrill Lynch is required to keep an accurate audit trail whenever it moves a security. This requirement led to frequent, repeated microfilming of securities as they moved around a center.

To the Merrill Lynch Financial Consultant (FC) or broker, the securities processing task seemed to require an inordinate amount of time and lead to numerous problems. (There are some 10,000 FCs and 4000 administrative assistants at Merrill.) The branch operations staff had to continually monitor accounts to see if securities had been credited properly. FCs were forced to contact clients to obtain additional documents. There was a great deal of friction between the sales side of the business and securities processing department.

All of these reasons, plus the labor intensive nature of processing, led to a desire to improve securities processing. The most radical approach would be to "obliterate" the process entirely. Unfortunately, this option is not feasible for Merrill Lynch. While there has been much publicity about electronic or "book entry" shares of stocks, there still are a large number of physical shares of stocks and bonds in circulation. Obliterating the process would require industry-level and government cooperation to eliminate all physical certificates, replacing them with an electronic record. This solution would also require consumer acceptance and a massive effort to record electronically and eliminate all existing paper certificates. Thus, obliteration is a worthwhile goal, but not an immediate prospect.

After suggestions by the operations staff and extensive research, the systems group at Merrill proposed a new process using image technology to capture an image of the security certificate and related documents that accompany a transaction. The focus of the project was on workflow redesign, not just the use of image processing. Workflow redesign involved the closing of the two processing centers described above and the development of a securities processing department at a single site in New York (now New Jersey).

The Old Process

Figure 1 is a high-level DFD of the original Merrill Lynch process. In this old process, customers brought securities and supporting documents to a branch office or sent them to Merrill through the mail. This *set* of documents will be referred to as a "certificate," the terminology used at Merrill. After receiving the certificates, the branch conducted a manual review for negotiability; see Figure 2. If this preliminary review verified that the security was negotiable, a clerk typed a receipt for the customer. If the certificates appeared not to be negotiable, the clerk told the customer what additional information was necessary to complete the transaction.

During the day, several branch clerks accepted certificates and accumulated them. At the end of the day a courier took all certificates to one of two securities processing centers (SPC) in Philadelphia or Chicago. The clerks attached a manually-prepared manifest to the package summarizing its contents.

Normally the package arrived at the SPC the next day. Upon arrival, an SPC clerk inspected the package and checked that its contents balanced to the manifest as shown in Figure 3. The clerk contacted the branch office to resolve any discrepancies. (Typically a discrepancy involved the inclusion of a certificate that was not recorded on the manifest.) All certificates that matched the manifest continued to the next stage in processing.

The first step after bursting packages was to microfilm all certificates.[1] Next, clerks conducted a second negotiability review which is contingent on the type of transaction: legal or non-legal. Legal negotiability review is more complex than non-legal, though some of the steps are the same.

[1] A complete set of DFDs for the old and new processes is available from the authors; more detailed expansions of Figure 3 have not been included due to space limitations.

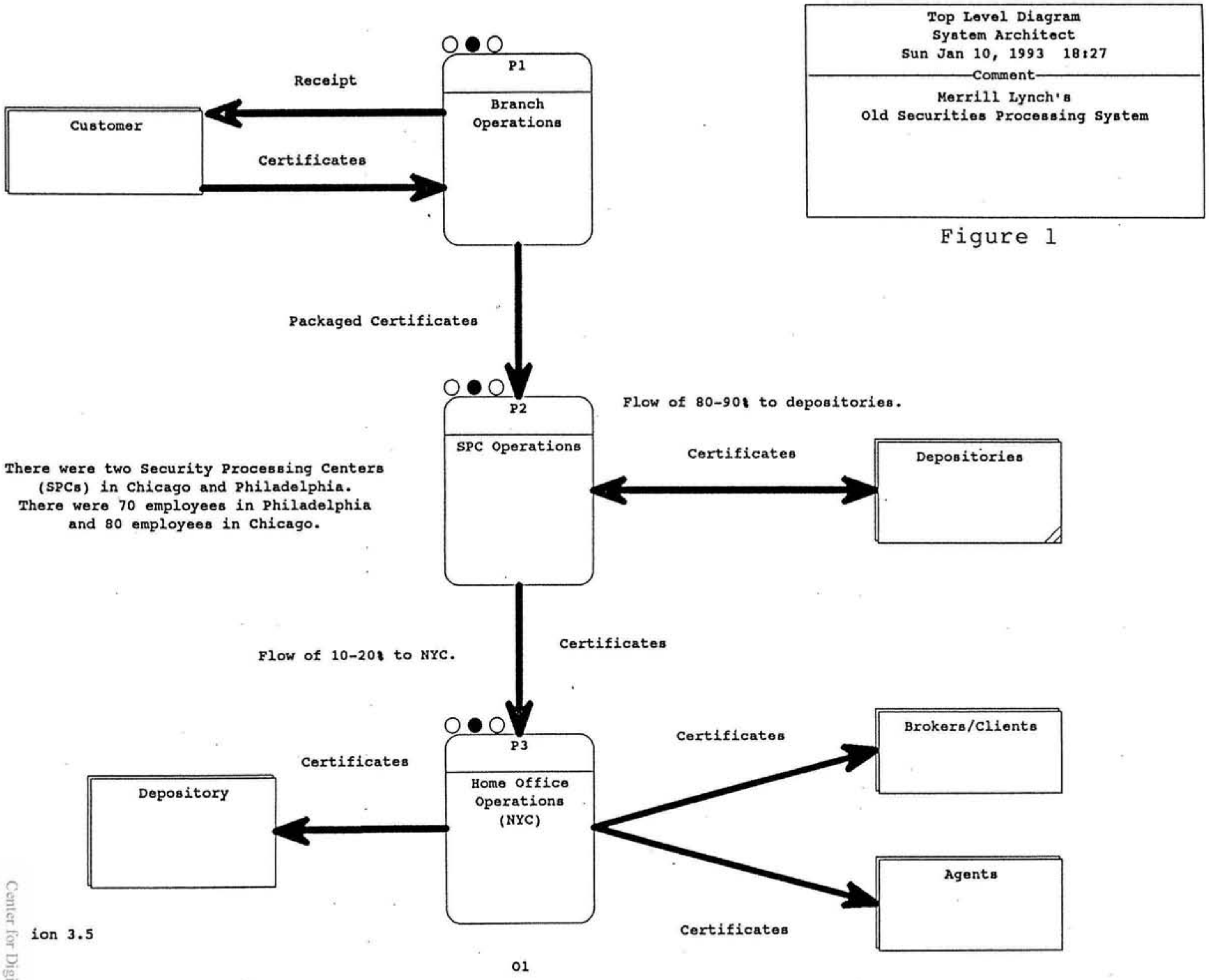
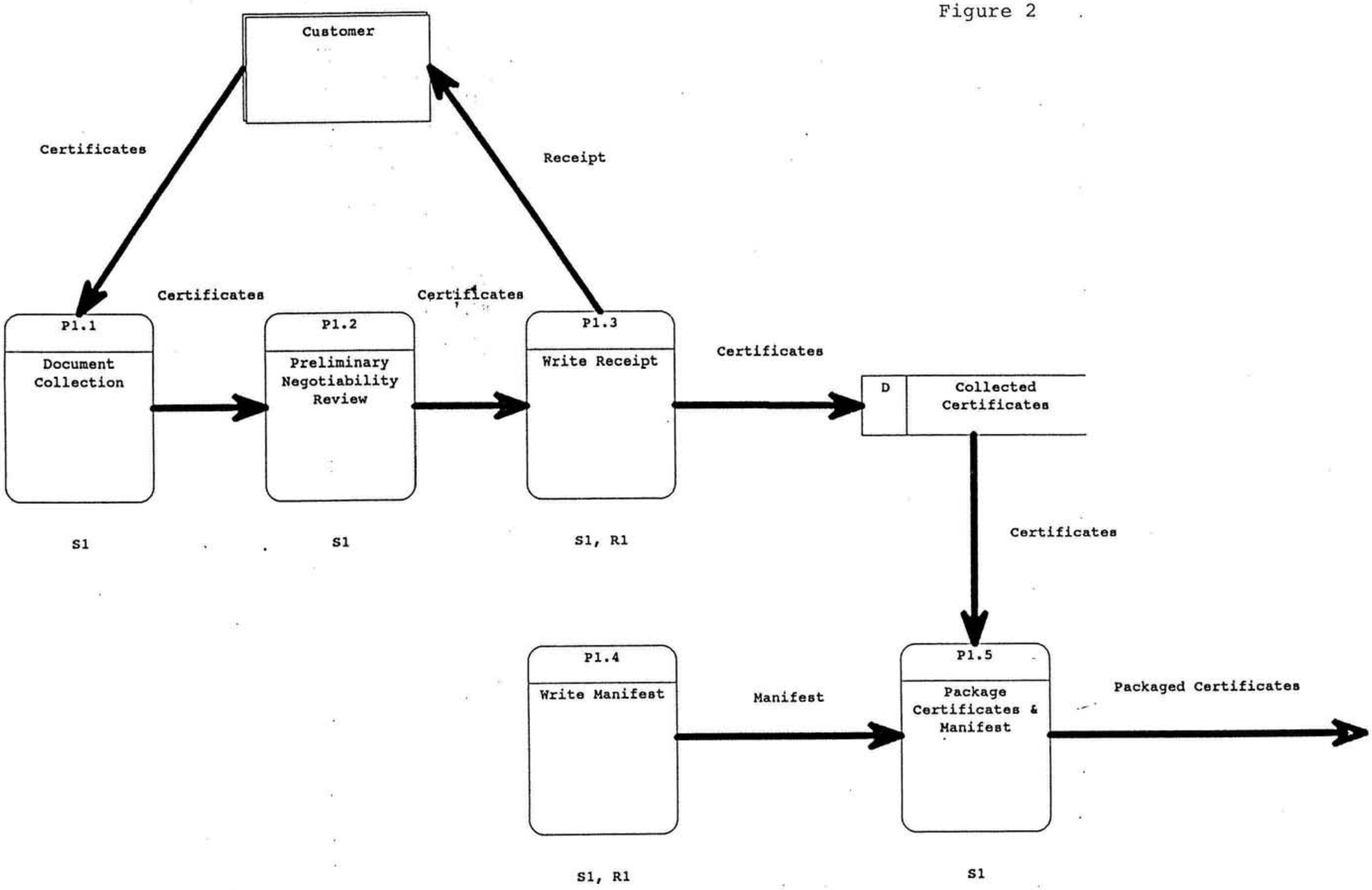
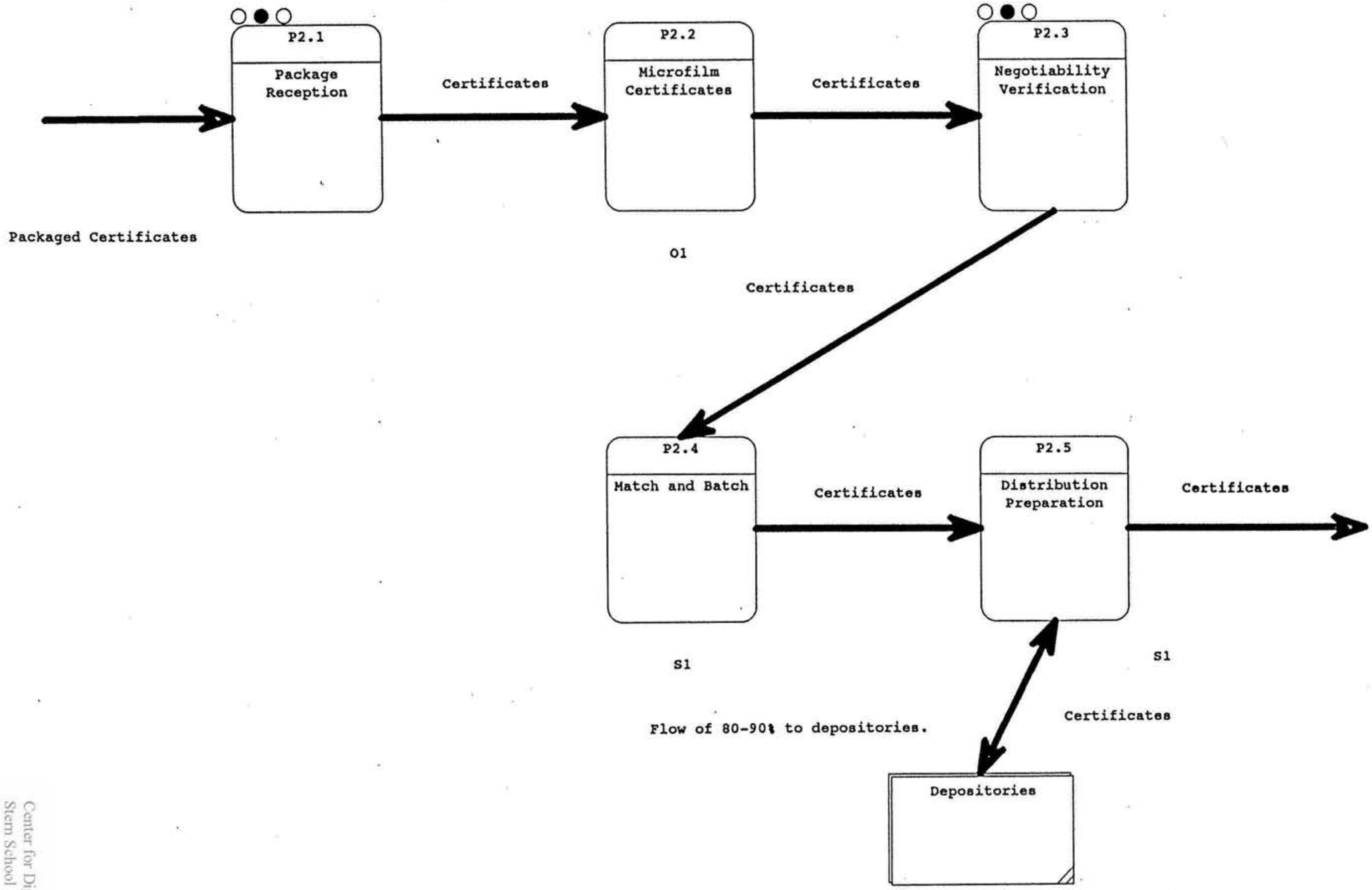

Top Level Diagram
System Architect
Sun Jan 10, 1993 18:27
Comment
Merrill Lynch's
Old Securities Processing System
P1
Branch Operations
Customer
Receipt
Certificates
Packaged Certificates
P2
SPC Operations
Flow of 80-90% to depositories.
Certificates
Depositories
There were two Security Processing Centers (SPCs) in Chicago and Philadelphia.
There were 70 employees in Philadelphia and 80 employees in Chicago.
Flow of 10-20% to NYC.
Certificates
P3
Home Office Operations (NYC)
Certificates
Depository
Certificates
Brokers/Clients
Agents
Certificates
ion 3.5
01

Figure 1

Branch Operations
Figure 2



SPC Operations
Figure 3



An important step in negotiability was verifying the CUSIP number (an industry-wide, unique identifier for each security). If the CUSIP number did not exist in Merrill's internal CUSIP database, then the staff held the transaction until the CUSIP number was located and added to the internal database.

If further review showed the certificate was not negotiable, it was segregated. A clerk logged this status into a Merrill Lynch securities control system known as MICS. This nonnegotiable status triggered MICS to generate instructions to resolve negotiability through a Document Request Form (DRF) which went to the branch office that accepted the certificate in the first place. The branch tried to resolve negotiability, usually by contacting the customer to obtain missing documents. Once classified as negotiable, the certificate moved to a final holding area for distribution.

The SPCs sent 80 to 90% of the certificates directly to depositories. The remaining certificates were distributed to specialty departments in New York for further processing, for example, a department handles exchanges of stock necessitated by a stock split. Upon arrival at a depository or at a Merrill specialty department, the certificates were again microfilmed and staff members updated their status in MICS. Certificates were microfilmed yet again before consignment to their final holding area.

Why did this process entail so much microfilming? Merrill must carefully control securities and credit them to a customer's account as soon as possible. Given the volumes of paper involved, microfilming became an integral part of the control process. Merrill must also pass audits by the SEC which checks the controls on securities processing.

The New Process

Figure 4 is a high-level DFD for the new Merrill Lynch process. As in the old process, customers bring securities to a branch office or mail them to Merrill. The branch cashier conducts a preliminary negotiability review supported by an expert system called CERTS; see Figure 5. This system helps the cashier determine negotiability status; it also prints a customer receipt and generates a document control ticket (DCT). CERTS posts a record of the certificate to the Anticipated Receive File (ARF), including a unique identifier known as the ARF number which is represented by a reference bar code on the DCT.

At the end of the day, clerks package all certificates and their DCTs to be taken by courier to the single Securities Processing Center in New Jersey. The system generates a manifest sheet for the package and updates a

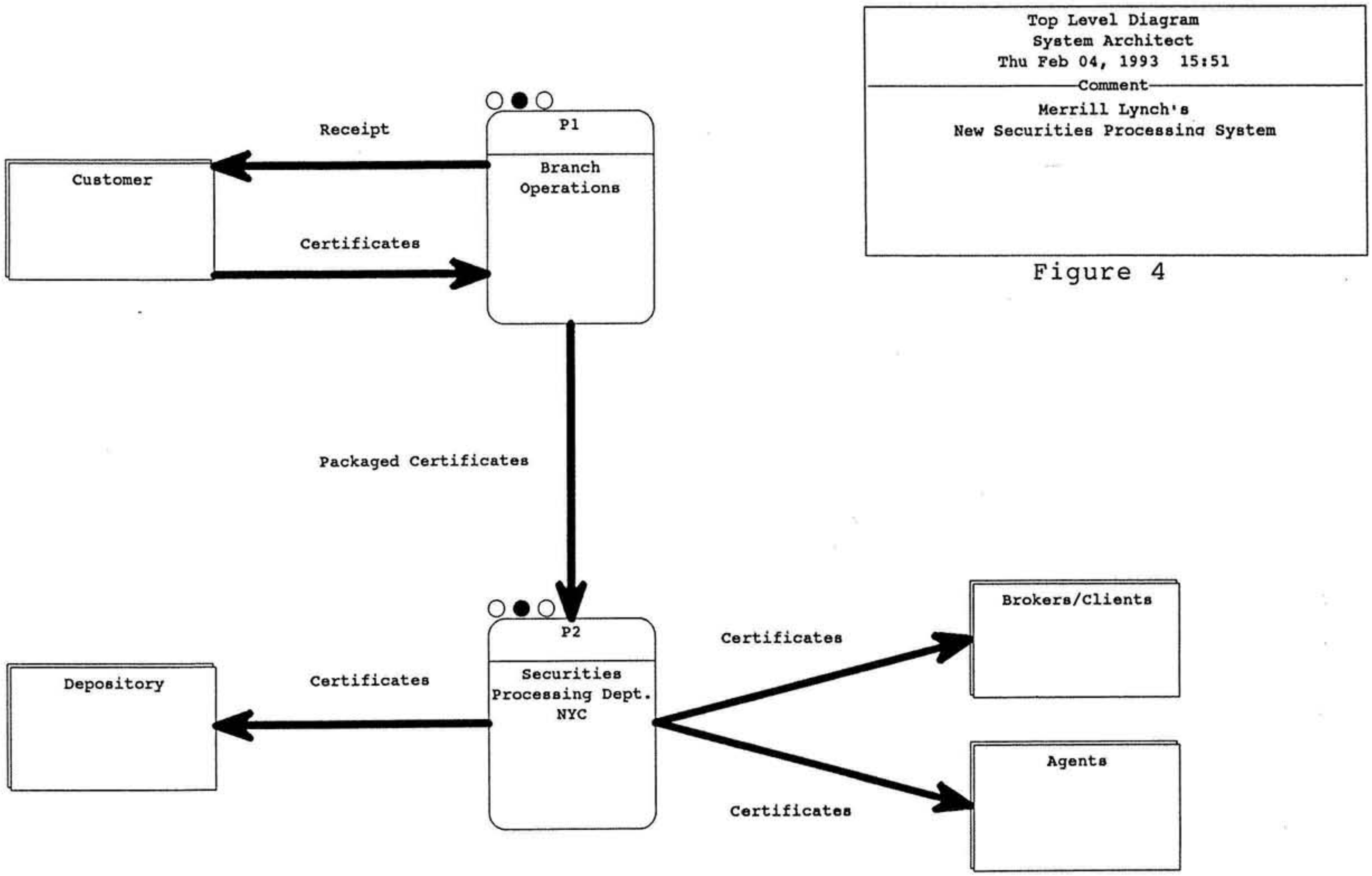
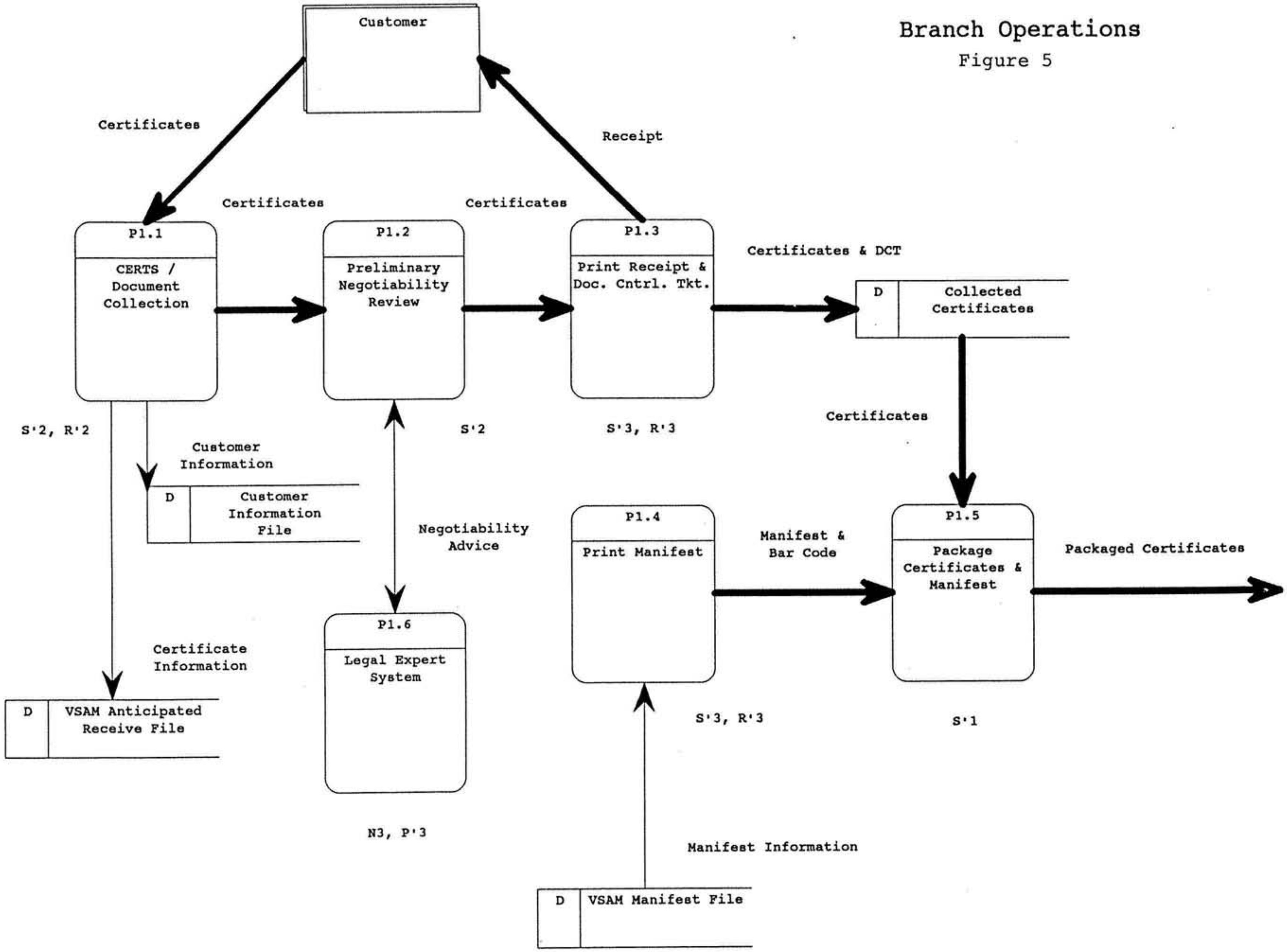


Figure 4

Version 3.5

Branch Operations

Figure 5



manifest file so that it contains information on the shipment.

Figure 6 shows processing at the SPC. The staff first scans the bar code on the package with a wand to verify receipt. Clerks check the package against the manifest; if there is a discrepancy they update the ARF and manifest files and notify the branch. Branch personnel have access to these files so they can check the status of processing of any security at any time. The staff bursts completed and balanced packages for individual certificate processing.

Negotiability must be verified in the new process, both for legal and non-legal documents. However, the presence of the expert system in the branches reduced the number of certificates arriving without the documents needed for negotiability by 50% for legals and 75% for non-legals. As before, clerks must validate the CUSIP number. If the CUSIP number is missing from the DCT, a procedure identifies a new number and enters it into the CUSIP database. The ARF reflects the status of a certificate held pending assignment of the CUSIP number.

Figure 7 shows the image capture subsystem. The staff separates the certificates for scanning into "scanable" and "oversized" groups. If the certificate transaction is non-negotiable, the system records a "9L" status in the ARF (and are held after image capture). Such a status in the ARF triggers branch notification through a system called ASAP. The branch is responsible for clearing up the nonnegotiable status by obtaining the required legal documents from the customer. Documents associated with the 9L transaction proceed en route with other negotiable certificates.

Oversized certificates will not fit through the current scanners and must be microfilmed. Scanable certificates proceed to the imaging operation. The scanning system recognizes the ARF reference number via the bar code on the DCT. The system uses the ARF reference number to access the ARF record which shows the scanner operator the certificates included in the transaction. Following the DCT, the operator scans the certificates and any legal documents. At this point the images and physical certificates diverge.

The scanned certificate image undergoes a character recognition procedure using a proprietary algorithm contained in firmware in the imaging computer. See Figure 8. This recognition process converts three important fields from image to ASCII format: the CUSIP number, denomination of the security and security number. These three numbers are already recorded in the ARF; recognition of the imaged fields is used to establish rigorous control and provide assurance that the right documents have been scanned.

The recognition task is complicated by the fact that there are no standard formats for securities; the three fields may exist any place on the security. The recognition algorithm needs to know where to look for the fields it is trying to convert. This information comes from a template database which contains x, y coordinates for the three fields on the security. Merrill has developed a template for each CUSIP and date of issue combination. The scanning computer routes any certificate whose template is not in the database yet to a workstation operator. The operator uses a mouse to draw a box around each field and the system records this information in a new template for the security.

The system performs the image-to-character conversion by referencing the image, overlaying the template, and executing the algorithm. If the converted ASCII fields match the same fields in the ARF, the system updates the ARF to show that scanning has been completed and stores the images for this transaction permanently to optical disk. If there is a mismatch between the converted characters and the ARF or other non-recognition, the system refers the transaction to "key edit." There, operators examine the image and input data to unrecognized fields.

The staff takes the physical certificates for distribution to their final location. The system generates routing orders that specify a destination box for each certificate; it specifies a destination box for the certificate. On a periodic basis couriers collect certificates from the boxes and take them to their final destinations.

When Merrill Lynch departments need access to certificates they can retrieve the image of the security on a graphics workstation. There is no need to access the physical security, or to hunt through microfilm records, a task that could take as long as three days with the old process.

COMPARISON OF THE OLD AND NEW PROCESSES

Qualitative Information

Qualitative information provides an overall comparison of the changes created in developing the new process. Table 3 lists the major changes from the Merrill Lynch SPC process.

The reengineering effort resulted in the elimination of two process centers and the creation of a securities processing department at a central site. The process supports major changes in tasks and workflow, beginning with the receipt of securities at a branch office. The interface

Securities Processing Department

Figure 6

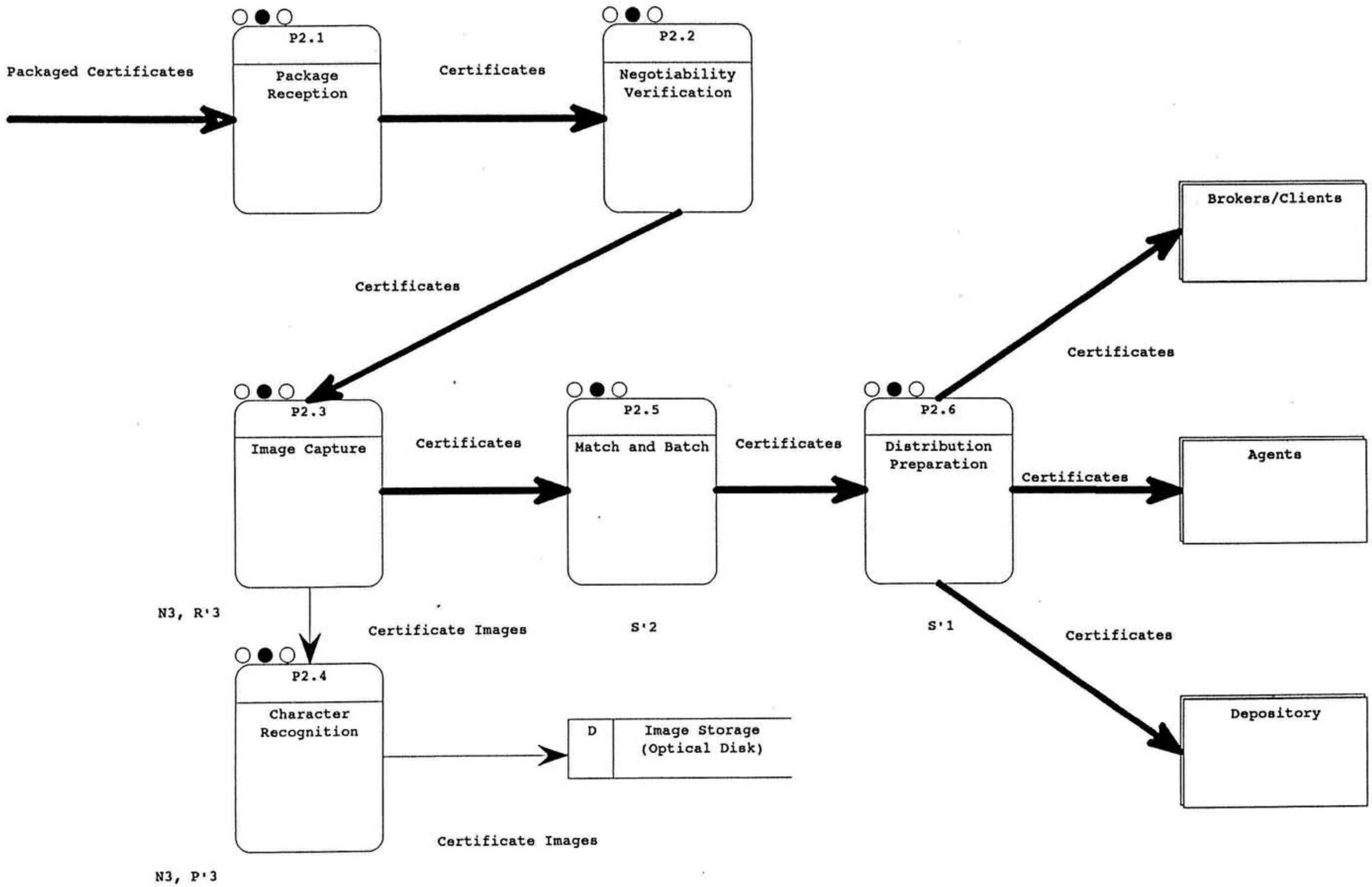
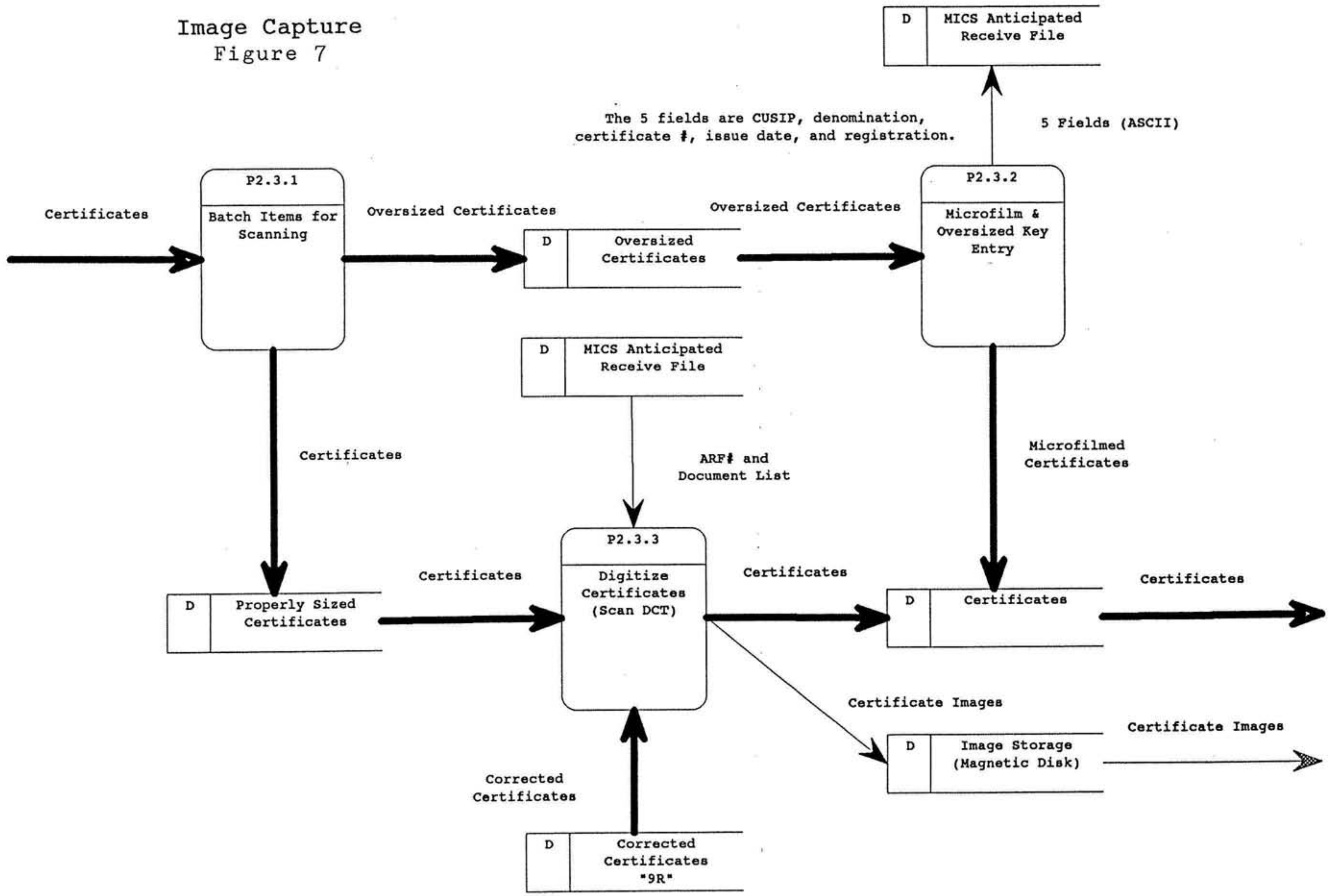
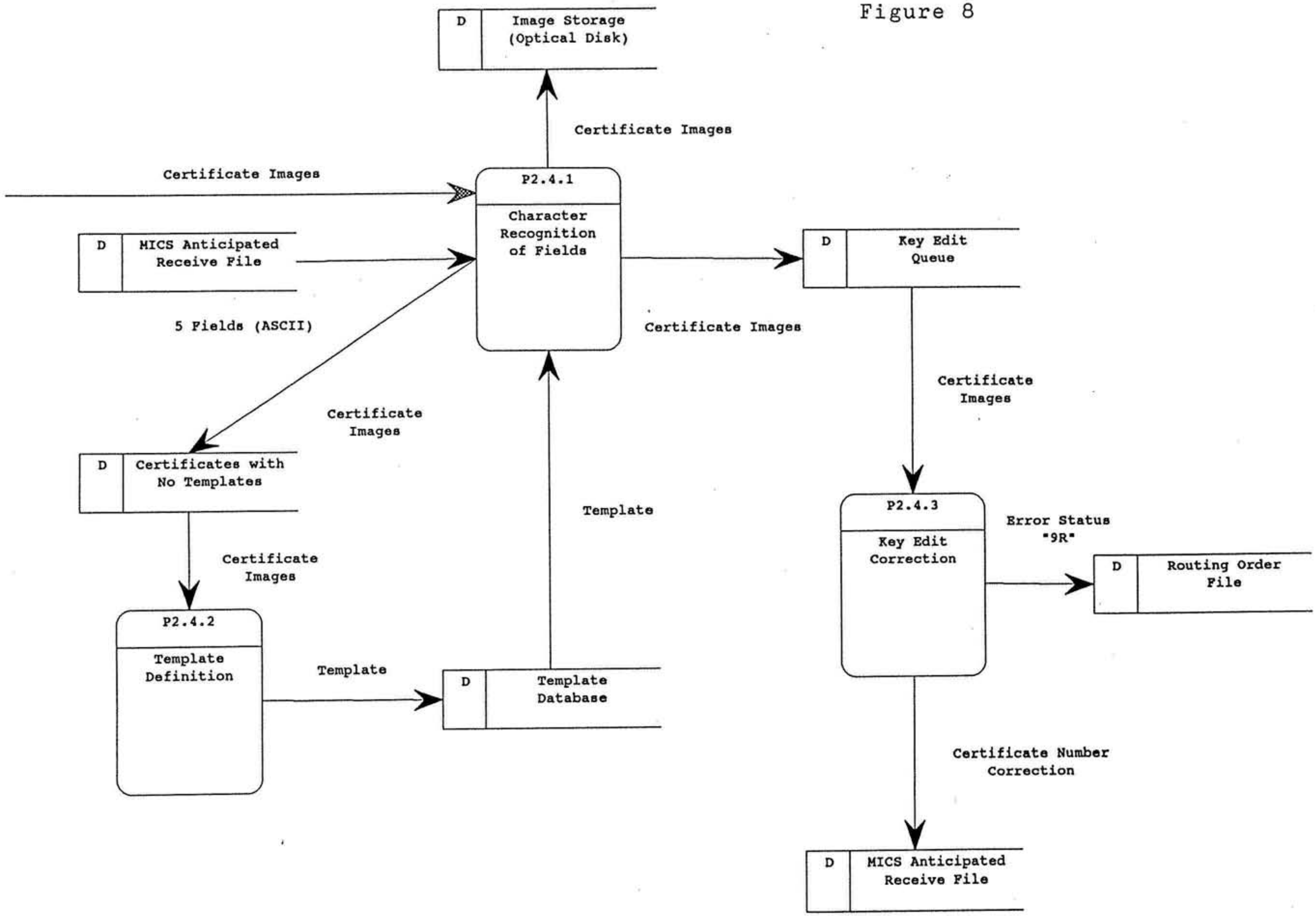


Image Capture
Figure 7



Character Recognition
Figure 8



to the process for all groups having contact with it has also been changed.

Technology changes include the expert system for the branch office input, scanners, a template library, character recognition from images and optical disk storage. There have been significant increases in the level of customer service and the quality of support securities processing provides to the branches. There is much less handling of physical securities and retrieval time for a certificate image is nearly instantaneous. The time to research lost or otherise important securities has been dramatically reduced; from up to three days in the old process to virtually instantaneously in the new.

Quantitative Comparison

Comparison of DFDs. Table 4 presents the results of an analysis of control points following Berndt's method which was described earlier. One of the major enhancements in the new process is additional control sources and points. For example, the on-line document collection system in the branch offices is a major new control as is the branch office expert system. The optical store of securities images is another control as is the character recognition of fields on the digitized image.

In Table 4 the new process exceeds the old process on counts of control sources by 4 to 2 and control points by 5 to 3. More importantly, there are more computer-aided and automated controls. In these categories there are 4 control sources in the new process versus 0 in the old and 4 control points versus 1 in the old process.

Table 5 contains a CON matrix for the DFDs for the old and new processes. Table 6 is an analysis of the data in Table 5 using the ratios defined earlier. The results are difficult to interpret as absolute numbers in the absence of a database of other projects for comparison purposes. Since the maximum for each of the ratios is 1, the results can be carefully viewed as gross measures of percentage change. One would expect that low scores on automation and system-wide change would put a project in the incremental improvement part of Figure 1 while high scores would indicate a reengineering effort.[2]

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[2]Berndt's original proposal includes weighting the changes, for example, based on costs, labor or even completely subjective criteria. In this case study, it was not possible to develop meaningful weights based on the information available from Merrill Lynch.

Changes in organization structure

The major organizational change was the elimination of two securities processing centers and the consolidation of all securities processing in a central site.

Changes in workflows and functions performed

There are many such changes in the DFDs:

- Branch office input changes
- Branch office customer receipt
- Anticipated receipt information
- Package receipt and bar coding
- Elimination of most microfilming
- Legal negotiability workflow changes
- Imaging operation; scanning and key edit
- Retrieval of image rather than physical security

Interface changes

- Branch office interface
- Customer interface
- Worker interface with scanning equipment
- User interface retrieving images

Major changes in technology

- Expert system to assist branch cashier receiving certificates
- Incorporation of scanning to replace most microfilm and provide better control, including:
  - Scanners
  - Template definition
  - Key Edit
  - Computer facility with optical disk jukebox
  - Retrieval of scanned documents
  - Modifications to existing control system

Impact

- Improvements in customer service
  - Better customer receipt
  - More information captured at point of contact
  - Broker can query system for status of processing
  - Better control
- Certificate level control
- High quality images compared to spotty microfilm
- Reduction in up to 3 day searches for microfilm to instantaneous retrieval
- Significant cost reduction as detailed in the next section.
- Reduction in research time

Qualitative Evaluation of the SPC Process
Table 3

Control category	Manual controls	Computer-aided controls	Automated controls	Totals
Old Control Sources Points	2 2	0 0	0 1	2 3
New Control Sources Points	0 1	1 1	3 3	4 5

Merrill Lynch Securities Process
Control Points
Table 4

Function category	Manual functions	Computer-aided functions	Automated functions	Totals
Core Old process New process	10 3	2 7	3 5	15 15
Obsolete functions	3	0	0	3
New functions	0	0	4	4

Merrill Lynch Securities Process
CON Matrix
Table 5

Stability	15/22 = .68
Obsolescence	3/22 = 0.14
Change	4/22 = 0.18
Extent of automation	5/15 = 0.33 < 12/15 = 0.8
System-wide change	14/22 = 0.64

Merrill Lynch Securities Process
Summary CON Metrics
Table 6

The new Merrill Lynch process has a number of functions that are common with its predecessor yielding a stability index of .68. The process did not eliminate securities processing. However, looking at the extent of automation and the system-wide change score of .64, it is clear that the new process is much more highly automated than before. Combined with the analysis of control points, this quantitative comparison suggests that the reengineering project resulted in much greater system control along with extensive automation.

Comparison of Resources Required. The new securities processing system has had a dramatic impact on resources:

Reduction of occupancy from two locations to one
Reduction in depository fees
Interest savings on receivables
Reduction of microfilm costs
Savings in security services
Reduction in staff of 168 positions leaving a current total of 165 including temporary staff

Investment. The new process required an investment of approximately $3 million.

ROI. The return on the investment was calculated as a payback period of less than two years which translates to a savings of around $1.5 million a year.

CONCLUSIONS

The evidence presented above suggests that the securities processing project at Merrill Lynch represents a successful example of process reengineering. The new process represents a major change in handling securities; the changes have had a positive impact on customers and on Merrill operations staff members who need access to the certificates. Image processing is an important technological component of the reengineering, but there is far more to the process than scanning. The entire workflow had to be redesigned taking into account the capabilities of the technology.

It is possible to map the evaluation above into the Hammer and Champy framework for reengineering:

Fundamental: Merrill could not bring about a completely fundamental change by obliterating the process, but it changed fundamentally the way it processed securities from the branches to the SPC.

Radical: In the authors' opinion, the qualitative and quantitative changes described above represent radical as opposed to superficial changes.

Dramatic: The project reduced the number of centers by 50% and the number of people employed in processing securities by 50%. The payback for the project was less than two years. Compared to other design efforts with which the authors are familiar, these results are dramatic.

Process: As the comparison of the DFDs shows, the focus at Merrill was on the process of handling securities, not on individual jobs or structures.

DISCUSSION

The tone of this report has generally been positive. Based on extensive interviews in Merrill, the new process is certainly viewed as a success in the company. Of course, there are few projects in which everything goes well. What were the critical steps and problems with the securities processing project?

Because the firm was not convinced that image processing would work, the design team insisted on a very thorough demonstration on a large sample of documents before it signed a contract with the image subsystem vendor. This pilot test helped reduce uncertainty.

The project, as is often the case, ran late. Part of the problem was the image vendor who was providing an integrated system. Merrill employees ended up closely monitoring the vendor after it became apparent that it would not meet the schedule.

There were problems assigning sufficient programmers to the team so that some functions were not ready when the system was implemented. In addition, various departments had included anticipated savings in their budgets the year the new process was scheduled to begin. Delays that year in the cutover meant that these managers would be over budget. This problem generated intense pressure to install the new process resulting in a conversion that was premature.

Currently, recognition rates are below what was anticipated. However, the number of individuals in key edit who correct mis-scanned fields is fewer than planned in the original design. Part of the problem lies in the measurement; if a single character of a field is not correctly scanned, the operations staff considers scanning to be a failure at the document level. The fact that 95% of the characters in the three fields being recognized are correct does not matter. Currently the method of measuring errors is being changed to reflect the scanning and recognizing task more realistically.

IMPLICATIONS

The purpose of this paper is to provide a framework for evaluating reengineering efforts and to illustrate it with a case study. The paper also suggests an approach for comparing two processes. While the comparison here is of two versions of the same process after the implementation of a new design, the technique should be equally applicable to two or more competing proposals for a new process.

The major contribution of this research is the evaluation framework which can be used to compare and contrast different business processes. It is unwise to generalize about reengineering from a single case; however, the reader can use the Merrill process as a benchmark and point of comparison for other process redesign efforts. It should be possible, using the evaluation framework presented here, to place other reengineering projects on the continuum of Table 1, either to the left or right of the Merrill process. This kind of estimate can help in deciding whether to undertake a project or in evaluating the results of a reengineering effort.

A challenge for reengineering is whether it is possible to use technology to make significant changes in the organization, to transform tasks, functions and organizational structures. When designers can say that their systems enable this kind of change, information technology will have achieved its potential. The framework and case presented in this paper are intended to help evaluate the impact of these reengineering efforts.

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