

Technology and Mortgage Banking in the United States

by Jeff Lebowitz

Mortgage banking technology in the U.S. has undergone profound generational change over the past two decades. A complex and volatile environment has left many technology products seemingly too inflexible to solve mortgage bankers' intractable operational problems. A new generation of technological solutions is being introduced. A sound business and technology plan provides the only assurance that good technology decisions will be made.

THE FOUR ERAS OF TECHNOLOGY

As the mortgage industry has changed radically over the years, so has its use of technology. The industry has experienced four generations of technological application. From the primordial technology of paper, we have had access sequentially to batch data processing, on-line computation, and, in the future, the interconnection of business function through integrated data, word and voice technologies, all placed in a distributed technology configuration. The structure and dominant business model of the mortgage

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industry has dictated the alacrity of movement across the technology plain.

TECHNOLOGY AND COMPETITION

How technology is used in the mortgage industry reflects the health of the industry. Introduction of batch data processing in the mid 1970's brought a new level of operational efficiency to the mortgage industry. Particularly in servicing, more work and better control could be obtained for a fraction of the unit cost of purely paper processing. The industry became more aware of the importance of cost reduction through automation.

Servicing, the primary source of wealth in the industry, was the natural recipient of technology investments¹. The data processing service bureau became the primary source of servicing support. In this environment, costs of developing improved servicing technology could be spread over a large number of technology users.

In the service bureau model, larger customers pay more of the service bureau's operating costs, but they are rewarded with lower prices per unit processed. By their nature, however, service bureaus provide a standard service to all their customers. With 99% of mortgage firms having access to automated servicing support, the mortgage industry has remained fragmented with few firms gaining more competitive advantage than in a paper-based processing environment.

In the past five years, on-line systems have become more prevalent. Response times for

processing a loan, posting a payment, answering an investor's or borrower's question, and issuing a report to management have become nearly instantaneous. Local Area Networks (LANs) have become the dominant technology configuration in loan origination and processing.

In the era of on-line processing, larger competitors have asserted their independence from standard service offerings. The new systems are designed with the flexibility to customize functionality to serve individualized marketing and operating plans. With flexible technology architectures, mortgage companies are capable of determining their own bases for competing with new products, establishing a unique level of customer service and charging differentiated service pricing.

Larger volumes of business now translate into greater cost economy. Full control is exercised over the nature and timing of operational change. The firms capable of investing and managing the newer technologies have the opportunity to increase the cohesion and effectiveness of their entire enterprise. They can turn their capabilities of providing a higher level of service to borrowers, bankers and investors to a competitive advantage.

THE MORTGAGE INDUSTRY

The residential mortgage industry in the U.S. is large and complex. Exhibit 1 gives an overview of the fundamental mortgage creation and funding process. As many as twenty three different types of institutions may touch a mortgage somewhere in its life cycle.

By almost any measure, the U.S. mortgage market is extraordinarily large and complex. By year end 1994, an estimated \$3.08 trillion of mortgage debt was outstanding. This translates into approximately 44 million individual mortgages held by financial institutions. A market of this size calls for extensive automation to account for and control such a massive asset base.

In 1994, an estimated \$725 billion in residential mortgages were originated. The 1994 volume translates into about 6.6 million loans closed and 8.5 million loan applications (and a like number of credit reports and property appraisals) processed through the mortgage finance system. The extraordinary transaction volume has taxed the existing technology base, prompting mortgage firms to rethink their systems architectures.

Loan trading is an important part of capital management and profitability management for mortgage firms. Institutions originating loans destined for sale must carefully manage both the value of loans warehoused prior to sale and the matching commitments with purchasing institutions. Many depositories will sell loans currently in their origination pipeline and loans from portfolio. Risk-based capital guideline increases since 1988 forced depositories to reduce asset-to-capital ratios. This resulted in an acceleration of sales over loan purchases.²

Since 1980 the mortgage market has become highly liquid. In 1993, \$2.2 trillion in mortgages were both bought and sold. Development of sophisticated analytical technology has facilitated valuation of mortgage cash flows, and permitted trading of whole mortgage loans

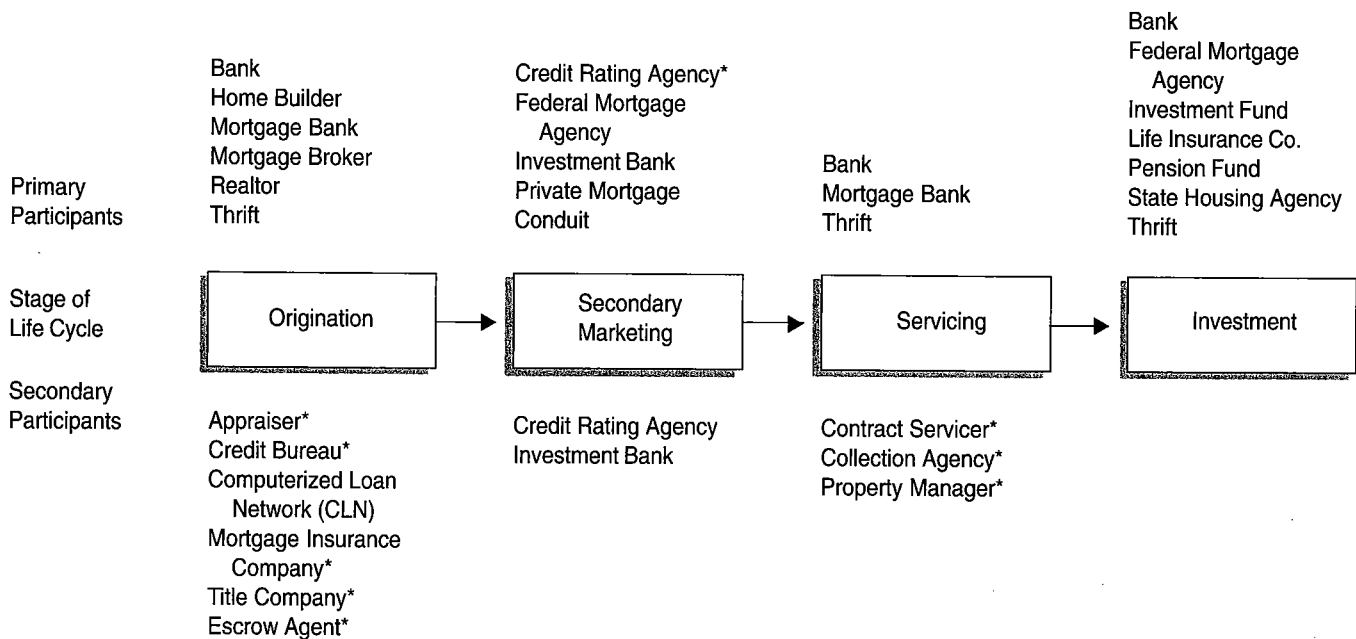
and securities backed by the cash flow of underlying mortgages.

The mortgage market is served by a large array of depository institutions, mortgage banks and brokers, investment bankers and investors. There are approximately 5,000 firms that originate and close loans as mortgagees. In recent years, nearly 50% of mortgage originations have been through mortgage banks, which normally sell all of their origination to investors. The complexity and fragmentation of industry functions and the overall transaction volume determines the level and form of technology infrastructure employed.

THE BUSINESS SYSTEM

Increasingly, mortgage lenders of all types have adopted the mortgage banking model of

Exhibit 1. Mortgage Process



* Denotes support service providers requiring elements of mortgage information function in the market.

operation (Table 1). This operational model determines the content of technology used in the industry.

The elements of the business model that affect the definition of appropriate technology are: origination mode (own or indirect origination through an unrelated company that must be linked to own system) and reach; complexity of product set that must be supported; trading environment, with external investors imposing data standards, asset evaluation, and numerous exchanges of inquiries and data; and, finally, corporate income and wealth that is dependent on efficient and controlled accounting and customer management in the loan servicing operation.

A critical element that determines a mortgage bank's technology configuration is its primary source of loan origination. Mortgage bankers have varied sources of originating loans. The two primary approaches, retail (closing loans for individuals) and wholesale (indirect origination through other originators) dictate differing attitudes toward and design of technology support. Size and scale of operation are the final determinants of technology use. Larger firms have the resources and inclination to use technology as a basis of competing for business.

ATTITUDES TOWARD TECHNOLOGY

Integrating technology requires a different set of management skills than has been needed in the ancient world of paper. In the U.S., only one in five firms integrate technological change in their strategic or tactical planning. Fewer than one in ten experiment with new technologies.

Despite its increasing importance, technology is generally not an integral part of business strategies among mortgage institutions. As noted, few firms integrate technology into their business strategy or tactical moves. Most see only an operational role for automation. The preponderance of firms invest in technology

Table 1. Mortgage Banking Business System

BUSINESS COMPONENT	APPROACH
Primary Origination Channel	Realtor/Mortgage Broker/Own Network
Product Mix	Broad
Geographic Reach	Regional/Nationwide
Funding Source	Secondary Market
Investor Market	Agency Private Investors
Principal Income Source	Servicing
Source of Capital	Parent

only as needed (rather than in anticipation of changing competitive positions).

Mortgage bankers rarely experiment with technology. By and large, technology is employed for incremental operational improvements. The major purpose of technology investment is to simplify basic operations.

The only positive correlation between aggressive use of automation and other firm characteristics is with institutional size. Larger firms introduce technology as part of a business strategy. Larger mortgage companies are most likely to have a systematic approach to technology investments. Large firms are:

- more likely to regard technology as strategic
- more likely to experiment with new technology
- more capable of managing technical projects
- more likely to implement in-house
- more likely to want to update base technologies

Although automation planning generally is not integral to strategic or tactical planning, the industry has begun to realize a major benefit from automation in providing improved service levels. In the era of batch processing (service bureau), cost control always outranked service

improvement as the major benefit of technology. This change in perception, coupled with the availability of flexible online systems, has turned the *focus of competition toward serving the customer and dominating the channels of mortgage distribution.*

DISTRIBUTION CHANNELS AS THE NEW COMPETITIVE PARADIGM

The key strategic theme of the '90s will be domination of channels of mortgage distribution. Technology is being used to enable experimental business strategies focused on increasing market share to be implemented. The critical value of technology is the integration of information flows from the point of sale through delivery and reporting to investors.

Consumer value is being enhanced through rapid turnaround loan commitments made through on-line underwriting supported by artificial-intelligence-based quality control systems. Further, a common processing, quality control and risk management system is being brought to independent brokers who retain independent name presence in the market.

Whether the corporate strategy is to be vertically integrated or to integrate information flows across all the (external) information suppliers to the mortgage production process,

automated interfaces and on-line control systems will reduce marginal unit costs and ensure that a standard level of service (and policy) is enforced throughout.

FOCUSING ON LOAN ORIGATION

Today's business strategies are targeting the consumer directly. In the past, marketing has emphasized product features and pricing. Now, technology design and operational re-engineering have turned to building account relationships. The battleground of competition is shifting to the mortgage point of sale. To cope, mortgage originators are changing the technology mix in their operations and have initiated a reengineering campaign of their own.

A great deal has been said (and done) about the industry's commitment to process reengineering. As improved customer service has replaced cost reduction as the objective of operational change, mortgage companies are reengineering to improve service as well as to reduce costs.

Reengineering (fundamental redesign of operational flow) has entered the consciousness of the entire industry. Seven out of ten mortgage originators are in the process of, or have just completed reengineering their operations. The major objective is to support loan production, and the focus differs by basic origination strategy. If a company expects its future source of origination to be primarily retail, the emphasis of reengineering is on improving service levels. For the retailer, cost containment is an important, but secondary, investment objective.

Wholesale-oriented companies, on the other hand, are primarily driven by cost management. Service improvements are not ignored by wholesalers, but they seem to be more focused on competitive conditions rather than on their customers. Wholesalers' behavior is consistent with the price competitive nature of their businesses.

Regardless of strategy, originators state that most processing improvements will come by giving loan officers laptop personal computer origination systems. With intelligent field systems, lenders feel they have taken an important step toward enhancing service and improving business prospects.

The laptop will be outfitted with a self-contained sales management system, an artificial intelligence agent, an application processing module and a telecommunications facility. Through the sales management system, loan officers will have the ability to build a demographic and financial profile of their prospects. An in-file credit report will be used as a primary source of client-specific characteristics. The credit report and data provided by the prospect will be enhanced with client information from commercial consumer data bases. A merged portrait of the prospect then will be built by integrating data from these diverse sources. An artificial intelligence agent, located on the laptop, will be used to calculate a best fit mortgage product for the prospect. The final step is document set-up and ordering necessary verifications to process a loan.

For the laptop investment to pay off, the rate of acceptance has to be high. Completing as much of the loan file as possible before a case is shipped to processing and underwriting is necessary to compress operating complexity (and expenses). Finally, adequate technical field support to help remote users is a necessary precondition to wide laptop acceptance and use.

INTEGRATING DISTRIBUTION SYSTEMS ELECTRONICALLY

A corollary to remote origination is lenders taking technology deeply into their distribution channels. In the U.S., a third of retail originators want to set up electronic ties to realtors. At the same time, more than one-half of wholesalers are looking to install their technology into brokers' offices. The industry is moving toward the consummate inte-

grated and interconnected phase of technology use.

In the dominant origination approach, retail implementation of distribution systems through technology may take several forms. The first possibility is that realtors and brokers will opt for an exclusive relationship with a lender, a controlled business arrangement. The second could be wide acceptance of computerized loan origination systems (shared loan quotation and origination). Finally, technology suppliers may give an enterprise license to a lender, who in turn installs a fee-based origination capability in realtors' and brokers' offices; the lender and the software supplier would share in transaction or usage fees.

To effect the technology integrated distribution system, either a common or multiple interconnected industry transaction and information network with standard interfaces will emerge. Mortgage lenders will want the mortgage networks to be largely transparent and interchangeable. Rational design dictates that any user can reach any destination through all of the networks.

In view of the basic movement toward an interconnected technology base, two emerging technologies are seen as fundamental to industry change: Electronic Data Interchange (EDI) and Expert Systems (A/I).

ELECTRONIC DATA INTERCHANGE (EDI)

EDI is the electronic (computer to computer) interchange of data required to complete a business transaction between two companies. Parties on both sides of an EDI transaction ("trading partners") mutually agree on the data necessary to evidence completion of a transaction. EDI then translates this agreement into a form of paper-less business dealing.

The motivation to implement EDI lies in the precision and speed with which business may

be conducted in an electronic medium. Orders, status inquiries, remittances and confirmations nicely lend themselves to EDI applications. The two EDI transaction sets that will initiate the standard for electronic commerce in mortgage banking are the residential loan application and the request for credit reports.

EDI software edits and checks for errors in the content of any transaction entering the system. The error free data enters into the operational systems of each trading partner for order processing, accounting, management reporting or decision making. Redundant data entry and error correction is eliminated, freeing up labor resources, reducing the non-productive costs associated with exception processing and making transaction data available to management within nano-seconds. Adoption of EDI standards eliminates excess costs, lost time and errors experienced in the every day transfer of mortgage and servicing assets. Due diligence and quality control are improved.

The U.S. mortgage industry has made a major commitment to EDI. The industry will adopt EDI as a fundamental element in conducting business. EDI is a movement driven by advances in technology that affect all the partners with whom a mortgage banker trades. EDI should be part of an overall information investment strategy. The rate at which EDI will be adopted will vary with the behavioral traits of each mortgage organization. One way to visualize EDI acceptance is by classifying company objectives. The "initiators" will introduce EDI early in order to improve earnings. A small group, the "facilitators," will streamline transactions in order to increase market share. Finally, the majority of firms, the "reactors," will convert with the prospect of saving money.

The underlying question about EDI is how to improve the infrastructure of the industry. Improvement in the common industry operating environment requires an extensive analysis of paper-based and manual procedures that today retard communicating

between mortgage companies. The major business objective is to reduce turnaround times and to progressively improve the quality of information available to every firm in the industry. EDI is an important component in managing the total quality of how business is conducted.

Experts in EDI agree that individual firms need to understand and prepare for EDI. More to the point, EDI is an industry issue generated through the universal evolution of technology. Thus, implementation of EDI is most effective on an industrywide level. The development of standard mortgage transactions will facilitate development of an efficient nationwide mortgage banking infrastructure.

EXPERT SYSTEMS

Hiring, cultivating, and replicating expertise is the critical management issue in mortgage banking, as it is in any business. The scarcest resource in the business is the talent and experience of key staff members. Technology, in the form of expert systems, may provide the touchstone for harnessing and leveraging the intelligence of the masters of mortgage banking. Tom Peters characterizes expert systems as integral to "the first genuine revolution since the . . . industrial revolution of the late eighteenth century."

Why make this kind of investment? The rationale is somewhat abstract, socio-economic in its nature. The bases are summed up in a quote from Lester C. Thurow, Dean, Sloan School of Management, MIT: "Standards of living rise not because people work harder but because they work smarter. Economic progress is the replacement of physical assertion with brain power." The principal approach underlying future success, then, is to institutionalize intelligence.

Expert systems are employed in very specific areas of knowledge. In the mortgage business, the most common use is in support of mortgage underwriting. Thus, underwriting is

the logical point for inserting an intelligent system.

Underwriting relies on experience to recognize patterns of data that discriminate between potentially good or potentially delinquent loans. Underwriting judgments often deal in the gray area between good or bad. Good underwriters are necessarily pragmatic, able to calibrate judgment to accommodate a wide range of cases. Data processing systems, on the other hand, have been most effective in dealing with problems that are highly structured, operate under a set of standard procedures, and do not require the generation or evaluation of alternative approaches to solving a problem.

Expert systems are built with the ability to handle factual data (e.g., calculate borrower qualifying ratios). They also process heuristic information, soft knowledge gained from being exposed to experiences representative of situations encountered in solving problems (e.g., cases demonstrating good versus bad loans). When the system "learns" from experience, it begins to emulate the reasoning of human experts.

In practice, expert systems are trained by in-house authorities (e.g., senior underwriter), who define for the system the most important factors (from 35 to 200 data elements) in making an underwriting judgment. The system's "mentor" then enters a series of underwriting examples demonstrating acceptance and rejection. The system stores each discrete experience. Over time (and many case examples) it is able to interpret new situations in light of comparable cases it has previously been given. The system begins to make judgments in the way its mentor (the real expert) would make them.

Expert systems have additional capabilities that make them potentially valuable tools. First, they can display the reason for making the judgments they issue. Secondly, they are able to go beyond simple binary "yes" or "no" decisions. Expert systems indicate the degree

of confidence they have in each judgment rendered. These explanatory faculties take such systems out of the realm of being the mysterious "black box." They become part of the support system created for the underwriting team.

To justify investment in an expert system, the payoff has to be large to compensate for the financial and development risk required. Where-in lie the potential returns?

The economic bases for considering expert underwriting systems lie in the realm of working "smarter" and faster:

- reducing the number of bad loans accepted
- reducing the number of good loans rejected
- increasing the number of decisions made in a given time frame
- increasing market share through improved service

Risk-oriented segments of the financial services industry are primarily concerned with the quality of risk assessment decisions. In the mortgage insurance business, the cost of accepting a bad loan averages about \$16,000; the cost of rejecting a good loan is typically about \$2,000. The system need only catch 63 bad loans that might slip by a human underwriter to pay for a million dollar investment. Beyond accuracy, the judgments of the system are said to be more consistent than those of underwriters. Research indicates that underwriters are expected to render the same decision about the same case only 80% of the time. System-assisted decisions are subject to less variance and greater consistency.³

In order to gain the benefits of faster decision turnaround and increased market share, the expert underwriter needs to be integrated into everyday work flows. Integration into the mortgage operation is accomplished through distributed processing, running on LAN (Local

Area Network) or client-server configurations. This establishes a cooperative processing environment that links the judgment processor with a central processing unit, making the system an inconspicuous extension to normal mainframe processing.

Such an arrangement brings the underwriting department into the mainstream of the business and achieving the benefits of decreased origination turnaround time. The expert system can play a strategic role in increasing the flow of business while applying consistent control over product decisions. If these intelligent systems live up to their billing, those mortgage companies that are not equipped will face diminished position in the marketplace. The fundamental conceptual advantages include leveraging the experience of the most effective employees, employing the consensus judgment of departmental management, standardizing decision making across specific business areas (i.e., underwriting), increasing the volume of "good business," and improving customer service through faster and more accurate decision making.

The benefits are real: faster and more consistent underwriting decisions; better resolution in discriminating between a good and a bad loan; greater volumes of high quality product being closed; and reduced origination costs.

Still, adoption of expert systems has come slowly. There is confusion between how statistical models, rigid in their application, and how expert systems, adaptable to changing underwriting conditions, perform. It takes a year or more to build A/I into operations. The hard part in introducing new techniques is in figuring out how the users (e.g., underwriters) and technology will work together.

The expert system does not replace the human operator but provides a consistent screening tool for improving decisions that authorizers have always made. The use of

expert systems has to elbow its way into the operations flow. Commitment and funding from top management enables the work to be done. Senior management must be determined to support experimentation with "risky" technology in research and development. Enculturating innovative technology has to be initiated at the highest levels of an organization.

Acceptance (of judgment software) depends on the existence of visionary leadership in the industry. A/I will be a vital component of lenders' re-conceptualizing their marketing relationships with borrowers and investors. A number of point-of-sale experiments utilizing judgment software are underway. Aggressive firms are redefining service levels to their clients.

A fully automated processing and underwriting operation will enable the innovating lenders to make reliable commitments almost at the time a loan application is received. The only contingency placed on a loan commitment will be receipt of an acceptable property appraisal.

The conventional approach to underwriting has actually been an inhibitor to growth. Data acquisition and underwriting combine to become the longest duration tasks in originating a loan. Judgment software, integrated into a network that gathers information and decisions from credit agencies, mortgage insurance companies and appraisers will convert the longest duration tasks to nearly simultaneous transactions. Customer service will be greatly enhanced. Further, with electronic underwriting, the decision-making capability of the best underwriters will be behind every originated loan.

SYSTEMS CHARACTERISTICS

Clearly, the dominant theme for the balance of the decade will be the use of technology to better serve consumers. As lenders have elected to revitalize loan production, new

origination systems are in greatest demand. Implementing strategy changes has been constrained by "inflexibility" in current systems.

Lenders are becoming more exacting of systems technology and economic performance. They require more direct control over systems changes: they want the ability to modify everything from computer screens to hardware architecture; and they do not want to be wholly dependent on vendors for systems changes.

U.S. mortgage companies rank general systems characteristics in the following order:

1. systems must be functionally complete
2. non-technical staff must be able to easily modify system performance
3. underlying technology must be up-to-date
4. the technology investment must pay for itself within three years
5. the software must be able to run on different hardware platforms
6. staff is able to install and implement a system within ninety days time

There are a wide range of technological solutions available to improve the operating profile of a mortgage company. The selection factors above must be weighted according to individual company plans and resources.

Even for companies with a clear vision of their technology needs, there are serious inhibitors to progress. Research shows that realization of technology objectives are most often retarded by: an inadequate technology budget; lack of staff skills to implement a technology plan; and installed technology solutions that cannot be sufficiently modified to meet changing business conditions.

TECHNOLOGY PLANNING

Adequate planning lays the groundwork for effective technology decisions and management. Adopting a technology portfolio planning approach ensures that information

planning and business planning are integrated. To accomplish this, a technology strategy must precede the search for a solution. In the plan, the following elements for the company must be incorporated:

- business strategy
- technology strengths and weaknesses
- technological gaps
- new technology investment requirements
- new technology integration path
- organizational implications
- education and technology adaptation needs
- acquisition, implementation and maintenance budget
- technology roll-out strategy

In order to strengthen the framework of technology planning, a lender must develop scenarios of alternative technology futures. The scenarios should describe current uses of technology in the industry, technological events that may occur to fundamentally alter the operational bases of competition and alternative possibilities for the evolution of technology innovation in the mortgage industry. The technology plan should assess the probabilities of particular scenarios evolving and compare the current strategies against the most likely alternative futures.

Scenario development is useful in providing a context in which to judge technology investment decisions. Knowing what important

technological advances may be adopted, what conditions need to exist prior to adoption and when these innovations are likely to occur, all contribute to selecting and timing investment in core technology.

Once the general framework is constructed, a plan for investment in systems that support critical business capabilities needs to be addressed (Table 2). The appropriate technology for supporting particular business objectives from production effectiveness to operational flexibility can then be identified.

A portfolio of core systems solutions then may be arrayed that correspond to critical business competencies required for effective competition. The assessment of how well each prospective systems investment contributes to executing the business strategy, reinforcing operational strengths and fortifying organizational skills delineates the flow of capital to the technology sector of the firm.

The critical management function is to coordinate and integrate environmental trends, business need and appropriate technology. The description of technology trends in the U.S. mortgage market and the focus on distribution based strategies suggests implementation of distributed technology (laptop computing, EDI) containing embedded intelligence (expert systems). The practical process to achieve integration of environmental change and technology implementation is operational reengineering, now so prevalent among U.S. mortgage lenders.

Table 2. Technology Portfolio Elements

BUSINESS OBJECTIVE	TECHNOLOGY ELEMENT
Production Effectiveness Pipeline Management Quality Control	Point-of-Sale Origination, and EDI Asset Valuation System Expert Underwriter
Cost Management Through Reengineering Operational Flexibility	Image-work-flow Technology Client-server Configuration

The size, market structure and business practices in the U.S. mortgage industry have resulted in a highly varied technological structure. Investment in new techniques has been inhibited by the fragmented functional organization of the U.S. industry and uncertain returns expected in a volatile environment. The increasing consolidation of the mortgage industry has created an operating imperative that is now reshaping the fundamental technological infrastructure.

NOTES

¹ In U.S. mortgage banking, it is common practice to originate a mortgage, sell it to an investor and maintain the right to administer repetitive bookkeeping tasks on behalf of the investor for a monthly fee (which averages 33 basis points of the unpaid principal balance).

² In order to reduce their capital requirements, portfolio institutions also have an incentive to

"swap" mortgages for mortgage-backed securities. Mortgage whole loans carry a risk-based weight of 4 percent; whereas, agency (Fannie Mae and Freddie Mac) securities have weights of only 1.6 percent and 0 percent for Ginnie Mae securities.

³ In order to counter the appearance of lending discrimination, mortgage originators (particularly depository institutions) are under pressure to justify and make their underwriting guidelines more flexible.