



# Business and Information Technologies

## **The Impact of New Information Technologies on the US Mortgage Industry\***

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**The Business and Information Technologies (BIT) Research Project  
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## **1 EXECUTIVE SUMMARY**

The scope of this paper is to identify the technologies that will have significant impact on the United States consumer loan origination process in the next five years and what their impact will be on the major industry trends. While the mortgage industry encompasses residential properties as well as commercial real estate, this paper focuses on residential mortgages although some of the conclusions may have application to the commercial loan origination process as well.

For most residential homeowners, the dream of the perfect house also includes the reality of obtaining a mortgage. Common borrower complaints involve submitting a volume of financial paperwork to the lender, deciphering the information about the multitude of loan products available and trying to determine which loan product is appropriate, and signing a plethora of documents at closing with little time for review. Overhanging the entire process is the shadow of doubt that one is somehow paying too much in points, fees, and closing costs.

Over the years, many industry professionals have attempted to improve the process, both in terms of back office processing as well as the customer experience. Technology has had an important role in these changes. For example, the development and spread of the Internet has led to the “online mortgage” through which customers can complete their initial loan application and obtain a contingent approval for a loan. Although the Internet and other technologies are improving the mortgage process, much of the loan origination process and customer interaction with the lender remain cumbersome and involves the management of voluminous amounts of paper.

This paper analyzes the loan origination process and identifies major industry trends. It then identifies the five key technologies that are expected to significantly improve the process and address the industry trends in the next five years. The paper begins with an overview of the mortgage industry including the size of the market and key players. Next, the major industry trends of “the paperless mortgage,” one stop shop, automation and outsourcing, and the continuing role of brokers and agents are discussed. The description of the end-to-end information chain emphasizing the loan origination process follows. The five key technologies are then identified. They are: enterprise software and extensible markup language, intelligent systems, electronic signatures, security, and document imaging. The paper concludes that the technologies will affect the loan origination process, but the level of change with respect to the industry trends may not be significant. The paperless mortgage will not be commonplace and the role of brokers and agents will not be eliminated in the next five years. On the other hand, the adoption of the five technologies will increase the level of automation and use of outsourcing and the creation of one stop shops for both home buying needs as well as diversified financial needs in the next five years.

## **2 INDUSTRY BACKGROUND**

In 2003, the United States mortgage industry consisted of approximately \$9 trillion in loans outstanding of which just under \$7 trillion consisted of residential mortgages.<sup>1</sup> It is a highly competitive market which has developed through the growth and development of the

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<sup>1</sup> Mortgage Bankers Association: Mortgage and Market Data as of October 27, 2003.  
[www.mortgagebankers.org/marketdata/data/mortgage\\_loans\\_outstanding.html](http://www.mortgagebankers.org/marketdata/data/mortgage_loans_outstanding.html). Accessed 3/12/04.

housing industry. Approximately 80% of the new mortgage loans originated in 2003 are conforming loans<sup>2</sup> which are a commodity product. The government sponsored enterprises, Fannie Mae and Freddie Mac<sup>3</sup>, are the principal market makers for mortgage backed securities (MBS) based on conforming loans. Their dominance in the secondary market has made conforming loans the primary loan product for residential mortgages and has also made the product a commodity.

The number of new loans each year consists of new purchases and refinancings. With the decline of interest rates from 2002-2003, the mortgage industry experienced a boom in the number of new loans. The combined total volume of new purchases and refinancings reached an estimated total of \$3.8 trillion in 2003 from just over \$1 trillion in 2000<sup>4</sup>. The number of new loans is very cyclical and can be volatile due to its dependence on interest rates. It is unlikely that the recent high growth in the number of new purchases and refinancing will continue in the near future and management of expected interest rate increases will shape the reactions of the industry moving forward.

Among the most significant developments to transform the mortgage industry has been the increased specialization of various parts of the mortgage information chain. In the 1970's, integrated companies, such as savings and loans, used to generate, hold, and service loans. The savings and loan scandals in the early 1990's had a serious negative impact on the savings and loans and mortgage industry. In addition, increased industry competition and the development of secondary markets for mortgage backed securities have led to the gradual separation of the steps in the mortgage process. A specialized set of mortgage bankers may originate and fund loans but immediately bundle the loans into portfolios to sell as MBS in the secondary markets. Even the servicing rights may be sold separately to other institutions.

However, as the information chain may be separating into specialized segments and each segment undertaken by a different entity, the companies in the mortgage industry seem to be consolidating. The top ten mortgage lenders in the industry are all large companies and have strong businesses in conforming loans. The industry has been traditionally fragmented but consolidation in the industry is increasing. In 1993, the top ten mortgage banks accounted for 23% of the market compared to 67% in 2003<sup>5</sup>. Small mortgage lenders in the industry tend to focus on nonconforming loans for which the secondary market is not as well developed. This allows for more pricing flexibility and the opportunity for small lenders to find a profitable niche.

## **2.1 THE REGULATORY ENVIRONMENT**

The mortgage industry is heavily regulated and most lenders are subject to three main types of regulation: real estate industry regulations, banking regulations, and privacy regulations. Many of the mortgage lenders also own retail banks as a source of capital for their mortgages and to stabilize their year-to-year revenues. Through the retail banks, mortgage

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<sup>2</sup> Fannie Mae estimate from [www.fanniemae.com/global/pdf/ir/resources/fanniemae glance.pdf](http://www.fanniemae.com/global/pdf/ir/resources/fanniemae glance.pdf). Accessed 3/12/04.

<sup>3</sup> Fannie Mae is chartered under the Federal National Mortgage Association Act and Freddie Mac is chartered under the Federal Home Loan Mortgage Corporation Act.

<sup>4</sup> Mortgage Bankers Association of America, "MBA Long Term Economic Forecast" (January 22, 2003) <<http://www.mortgagebankers.org/news/2004/MBALongTermForecast2004.pdf>>.

<sup>5</sup> Miller, Paul, Annett Franke and Steve Stelmach. "Mortgage Industry – Year 2004 Outlook" Friedman Billings Ramsey (January 9, 2004).

lenders become subject to the banking regulations. Mortgage lenders are subject to privacy regulations because of the type of personal data collected in loan origination and servicing. Because the risk of fraud in real estate and banking, these industries are heavily regulated by both state and federal governments. The steps in the mortgage process and information chain are deeply influenced by the need to comply with government regulation and therefore, the use of technology in the mortgage process is also bound by the industry regulations.

## **2.2 CURRENT STATE OF TECHNOLOGY IN THE MORTGAGE INDUSTRY**

The use of technology has shortened the process time and improved the efficiency of the mortgage process. More powerful computing, cheaper data storage, and the ability to transfer bigger data packages over networks have helped mortgage companies to decrease their operations costs and improve profitability. In the past three decades, technology has reduced the costs of storage, transmission, and processing of information by 25 to 35 percent annually, a trend which is expected to continue<sup>6</sup>.

Some of the most influential of these technologies include:

- Electronic payment technologies which improve the speed and efficiency of mortgage payments.
- The Internet and wide area networks and local area networks which have become a powerful means of communication to provide new channels for finding new borrowers and improve information flow among the multiple parties involved in the mortgage process.
- Statistical programs for credit scoring as means to analyze and summarize the credit risk of borrowers.

As effective as technology adoption has been in the mortgage industry so far, the mortgage industry is not known as an early adopter. The choice of which technologies to develop and adopt are influenced by many factors including cost, ability to comply with industry regulations, attitudes of borrowers and industry professionals, and lack of standards among industry participants. However, increasing competition in the mortgage industry from the gradual standardization of loan products into commodities, consolidation of large mortgage banks, and interest rate pressures force mortgage lenders to search for methods to lower costs and maintain a competitive advantage.

## **3 MAJOR TRENDS**

Several trends have emerged from the research. These trends include a mix of long standing goals of the mortgage industry, such as the “paperless mortgage,” and new trends that have developed with the introduction of new technologies.

### **3.1 THE PAPERLESS MORTGAGE**

The paperless mortgage has been a goal of the mortgage industry for over a decade. Borrowers and lenders alike have recognized the problems of organizing, processing, and storing

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<sup>6</sup> Guldemann, Till M., “Technology in Reshaping Finance and Risks,” Business Economics. Jan 2000:44-51.

the paper documentation associated with a mortgage. A borrower file can consist of several hundred pages which can be bulky to transfer or store. If a borrower file can be reduced to an electronic file, it can be sent more easily between the lender and the borrower or between agents of the lender collecting the documentation for the mortgage. Also, the physical storage space for the file which must be archived after the loan is funded can be significantly reduced.

Despite the paperless mortgage being the “holy grail” of the mortgage industry, it has not yet happened. A truly paperless mortgage requires the integration and automation of the entire loan origination process on a single platform including the adoption of standards for the exchange of data and documents. In addition to the technology challenges, issues regarding government regulations, document integrity and fraud, and borrower acceptance must be addressed before the paperless mortgage can become a reality

### **3.2 ONE STOP SHOP**

The concept of a one stop shop is that one company provides a variety of related products and services from different industries. A mortgage lender can be a one stop shop for home buying needs, which may include homeowners insurance, home equity lines of credit (HELOC) as well as mortgages. Lenders can also be a one stop shop for broader financial services and provide commercial banking products, brokerage services, and credit cards in addition to products related to home purchases.

The emergence of a one stop shop for either home purchase or broader financial services depends on several economic factors. First, economies of scale need to be present such that larger companies can capture cost savings from higher volumes. This seems to be true in the commodity market for conforming loans and mortgage servicing. Because there is little or no product differentiation, lenders with large loan portfolio can negotiate better pricing in securitization from Fannie Mae and Freddie Mac. For servicing, the high fixed costs necessary to establish an internal servicing department favor lenders which can spread those fixed costs across a large loan portfolio. Economies of scope should also be present such that cost savings can result from one company operating in different but related industries. One possible area for economies of scope is cross-selling financial products, such as credit cards or insurance, to existing mortgage borrowers.

Trends in the industry indicate that the largest companies in the mortgage industry are increasing their share of the market and dominate the commodity conforming loan market. Most small mortgage lenders tend to focus on niche markets for loans with less than perfect credit ratings which have higher risk and more flexibility in pricing.

### **3.3 AUTOMATION AND OUTSOURCING**

Automation and outsourcing are means to reduce costs in a process. They are possible when a step in the process can be isolated and reduced to relatively simple tasks. Automation is one obvious area where new technologies can influence the information chain in the mortgage industry. Because human labor costs are relatively high and human error is a possibility, automation has the potential to reduce labor costs and significantly reduce errors in the process. Outsourcing is another way to reduce labor costs by shifting away from expensive, specialized labor to less expensive, low-skilled labor. Outsourcing often includes offshoring, sending the work outside of the United States. However, the ability to introduce either automation or

outsourcing into a process often requires analysis of the process to separate and isolate individual steps.

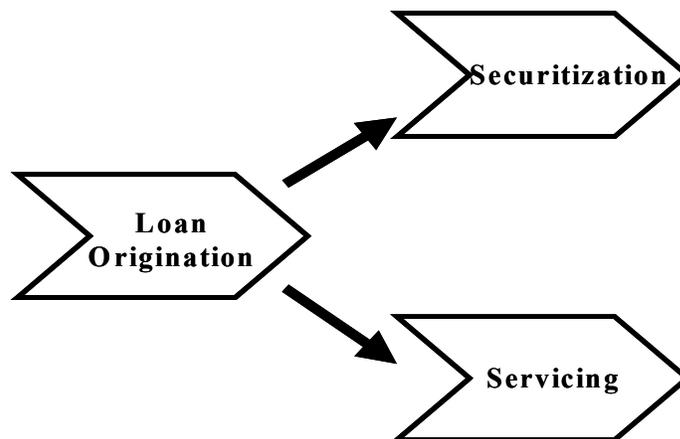
### **3.4 THE CONTINUING ROLE OF BROKERS AND AGENTS**

The reduction of human beings in a process can potentially reduce labor costs for a company. With the aid of technology, many tasks that used to be performed by service personnel have been increasingly replaced by self-service. For example, the number of bank tellers has been significantly reduced with the wide adoption of automated teller machines (ATMs). Mortgage industry professionals speculate whether advances in technology will eventually lead to the extinction of mortgage brokers and loan agents. Despite the potential cost savings and service improvements that may exist with automation and self-service, the need for human contact or the additional complex reasoning skills that a person can bring to a process often preclude the complete removal of people from a process.

## **4 THE MORTGAGE INFORMATION CHAIN**

### **4.1 OVERVIEW OF THE INFORMATION CHAIN FOR THE MORTGAGE INDUSTRY**

The information chain for the mortgage process consists of three main segments: loan origination, securitization of loan portfolios, and servicing. Loan origination is the first step in the process and securitization and servicing follow and may take place in parallel. The following diagram illustrates the three main steps.



#### **4.1.1 Traditional Loan Origination**

Loan origination is the process through which the mortgage is created. It begins with borrower acquisition and ends when the loan is funded and final documents are signed. This paper focuses primarily on the loan origination portion of the information chain which is described in more detail in the next section.

### **4.1.2 Securitization**

Since the first issuance of mortgage-backed securities (MBS) in 1969, the development of a secondary market has increased the liquidity of mortgage instruments and helped to provide more consistency in pricing, loan terms, and underwriting guidelines. It has also helped to transform mortgages into commodity products. MBS were developed to create a market for the future stream of cash flows provided by mortgages. A package of loans can be bundled together and securities issued based on the loan package. The selling lender can realize a present cash flow from the sale of the loan package which can be used to make additional loans.

The price for a package of loans is determined by the performance of the loans relative to what is expected. For example, if a certain loan pool is expected to have a 3% loss, then it must have no more than a 3% loss. Generally, the loss comes from borrower default or prepayment of a loan. If the loan pool does not perform as well or better than expected, the lender may have difficulty in securitizing future pools of loans or obtaining a good price for them.

A lender is not limited to securitizing only loans that it has originated. It can also purchase loans from other banks which is referred to as “correspondent lending.” Lenders can create more robust loan pools by combining loans which they have originated with loans purchased from other lenders. For large commercial banks in the mortgage industry, the correspondent channel is also used to obtain servicing rights.

### **4.1.3 Servicing**

Servicing is the customer service that takes place after a loan has been funded. It consists of forwarding the monthly mortgage payments to the investor who purchased the loan pool to which the loan belongs, confirming borrower information, and answering questions the borrower may have about the loan.

Servicing is not always performed by the lender originating the loan. Because of the labor involved in responding to customer calls, the fixed costs of a servicing system is high. Often smaller mortgage companies will outsource the servicing at a per-loan servicing charge. If a mortgage company decides to service its loans directly, it can keep the servicing fees which are approximately 0.25 - 0.375% of the stated interest rate for the mortgage. For example, for a mortgage at an 8% interest rate, 0.25 - 0.375% goes to the servicer and 7.625-7.5% goes to the investor upon securitization. In addition, a loan originator can sell the servicing rights to another mortgage company with a servicing system at the same time it securitizes the mortgage.

Most internal servicing systems tend to be in large mortgage companies because the fixed costs of the servicing system can be spread across a larger portfolio of loans. In addition, large companies can get ancillary income from cross-selling other financial products, such as credit cards, life insurance, or mutual funds, to its servicing customers. Finally, larger companies are better at refinancing their own portfolio and preventing refinancings with another lender, known as “run-off.” They also have higher guaranteed fees with Fannie Mae and Freddie Mac for their loan pools and can negotiate volume discounts with vendors.

## 4.2 DETAILED INFORMATION CHAIN FOR LOAN ORIGATION

The first step of the mortgage information chain is loan origination which can be described in more detail as a series of six steps. These six steps are illustrated in the diagram below and described in the following paragraphs.



### 4.2.1 Borrower Acquisition

The first step in loan origination is to find the borrowers who are the customers of the mortgage lenders. Two main channels are used to contact borrowers. The first is the retail channel through which the lender has direct communication with the borrower. This communication can be in a branch office, through a call center, or more recently, through the Internet. The second major channel is the wholesale channel through which a mortgage broker facilitates the loan origination process but the lender funds the loan. The lender maintains relationships with many mortgage brokers, but it is the brokers who have the direct relationship with the borrower.

### 4.2.2 Application and Borrower Approval of Loan Product

The loan application traditionally begins when a new homebuyer meets with a mortgage broker or representative of the lender to discuss financing the new home purchase. The mortgage brokers or lender representatives assist the buyer with completing a standard residential loan application called a Form 1003 and determining which loan products may be applicable. For the traditional loan origination process, the borrower must choose a loan product at the time of submission of the loan application. The customer is also inherently giving approval to the lender to proceed with the remaining steps in the loan origination process by providing financial documents to support the loan application and paying a non-refundable application fee.

If the borrower is working with a mortgage broker, the broker then calls the rate lock desk at a lender and forwards the borrower information formatted on the Form 1003. This conversation is usually recorded. After receiving the information, the lender determines the appropriate interest rate either with a rate sheet or electronically, locks the interest rate, and then sends a confirmation of the rates to the broker. Afterwards, the buyer compiles his or her income, employment, and asset information to send to the lender with the completed Form 1003.

### 4.2.3 Data Collection from Borrower and Third Parties

Once the lender receives the Form 1003 loan application and supporting borrower documentation, the lender then begins the verification process. The verification process begins when the lender collects data from the borrower and third parties to assess the borrower's credit

risk as well as the real property to be purchased. These third parties include the borrower's employer, banks or financial institutions where the borrower has accounts, credit reporting agencies, and the county recorder's office. Additional documentation may be requested by the lender during the verification process and when submitted, such documentation must be matched to the borrower's file. Waiting for documents and matching documents from the buyer or third parties to the file can take several weeks.

#### **4.2.4 Comparison and Reconciliation of Data**

In the second part of the verification process, data about the borrower and the property are collected by the lender and reviewed and verified against other sources of the same data. For example, the monthly salary reported by the borrower on the Form 1003 loan application must exactly match the monthly salary reported by the employer. If the borrower reports monthly income of \$4,000 but the employer report \$3,855, the lender must reconcile the information and decide which is more accurate for purposes of analyzing the credit risk. Almost all information provided by the borrower must be independently verified with third parties such as the employer, other banks, county recorder's office, appraisers, and property inspectors.

This process of comparing and reconciling is one of the primary means of protecting the lender from fraud. It also assures that the data used in making the underwriting decision and pricing the loan is as accurate as possible. Problems and inconsistencies which arise when reviewing the data often result in a request for additional documentation from the borrower or third parties. The two steps in the verification process of collecting data and then analyzing them may be repeated many times.

#### **4.2.5 Underwriting Decision**

The end of the verification process results in a borrower file with data about the borrower and the property to be purchased with which the lender can make a decision about funding the loan. The decision to fund the loan and the terms on which it will be funded is known as the underwriting decision. The underwriter making the decision reviews the borrower file and determines the credit risk for the loan based on the verified data in the file. If necessary, adjustments are made to the terms of the loan or the interest rate.

#### **4.2.6 Funding and Final Documents**

Once the decision is made to underwrite the loan, the loan approval is communicated to the borrower with the final terms of the loan including interest rate. The lender prepares documents to reflect the terms of the loan which must be signed by the borrower. These documents include the promissory note evidencing the loan itself as well as documents granting a security interest in the property. Once the borrower signs and delivers the loan documents, the lender funds the loan.

## **5 TECHNOLOGIES IMPACTING LOAN ORIGINATION**

The immediate targets for the use of technology in the mortgage industry are the reduction in the time the process takes as well as the amount of paper and its movement in the process, the paperless mortgage trend referred to earlier. Although these two ideas are separate, there is a strong correlation between them in that a significant amount of time in the process is allocated to the movement of paper and therefore a reduction in paper movement will in turn lead to a reduction in time for the end to end process. The security and validity associated with an electronic environment is also a focal point for technological solutions.

The five technologies that will have the greatest impact on the mortgage industry over the next five years are:

- Enterprise systems and XML
- Intelligent systems
- E-signature
- Security
- Document imaging

These five technologies directly address the business and regulatory issues that inhibit the reduction of paper and time in the process. Without the adoption of all five, the mortgage industry will not be able to move to a complete electronic system. In the subsequent sections, each of the technologies is discussed in more detail covering its definition, its effect on the information chain, and the issues in its adoption.

### **5.1 ENTERPRISE SYSTEMS AND EXTENSIBLE MARKUP LANGUAGE (XML)**

Extensible markup language (XML) is a computer language used to set up standardized rules for defining content, formatting, and classifying documents that can be shared on the Internet. This allows for data exchange across platforms and applications. XML is one of the building blocks required to successfully implement enterprise software. Enterprise software is a class of software that enables different functions and processes to be integrated seamlessly to allow for a complete electronic flow of information without manual intervention. Some examples of enterprise software are enterprise resource planning (ERP), data warehousing, and customer relationship management.

#### **5.1.1 Enterprise Systems and XML in the Mortgage Industry**

The major driver of use of XML currently is the need for application integration. Mortgage companies have begun to adopt this technology to achieve the goal of the paperless mortgage. However, many companies in the mortgage industry still lack a long-term strategic approach to XML adoption and have not assessed the long-term benefits of this technology. This has resulted in a patchwork use of XML by constituent parties and low penetration.

The mortgage industry is at the juncture where widespread use of an XML standard could pave the way for the creation of an enterprise software system for the mortgage industry. The Mortgage Industry Standards Maintenance Organization (MISMO) is a committee of industry professionals created to establish the XML standard for the mortgage industry. Because a

standard has not been adopted across the industry, an effective enterprise software system to manage the end to end process of loan origination has not been developed.

### **5.1.2 Impact of Enterprise Systems on the Information Chain**

An enterprise system impacts each stage of the information chain as it is the method of communication from one step in the process to the next. As a result of the specialization of different steps of the mortgage information chain, separate systems were developed for these different steps. For example, an enterprise system can take data gathered from a borrower using the mortgage broker's Internet interface to directly produce loan documents for the lender. Without the enterprise system, the borrower's data collected using the broker's interface would need to be re-entered into the lender's system because the two systems were developed independently. An enterprise system would coordinate the different systems in each step of the information chain and eliminate redundant steps and inefficiencies.

These enterprise systems are fully open source and web-based systems. Once deployed, they would run entirely on the Internet, support all major hardware and databases, and scale to virtually unlimited number of users and transactions. Their integration capabilities will allow real-time collaboration among market participants and with support systems and services.

### **5.1.3 Adoption of Enterprise Systems**

In order for enterprise systems to be successful, players in the industry need to agree on standards. MISMO is attempting to accomplish this and is trying to encourage the adoption of MismoXML as a standard. The recently formed eMortgage alliance, an organization of software companies developing software for the mortgage industry, is encouraging the use of defined standards in the development of the enterprise software to eventually reach the goal of the paperless mortgage.

## **5.2 INTELLIGENT SYSTEMS**

Intelligent systems are computer systems that "act appropriately in an uncertain environment, where appropriate action is that which increases the probability of success, and success is the achievement of behavioral subgoals that support the system's ultimate goal<sup>7</sup>." In other words, intelligent systems are computer systems that can learn and perform functions such as decision making, image recognition, and planning. Some technologies that perform these functions are expert or rule based systems, fuzzy logic, and neural nets.

### **5.2.1 Intelligent Systems in the Mortgage Industry**

Intelligent systems are currently being used for two purposes in the mortgage industry, automated underwriting and customer relationship management. The use of intelligent systems in automated underwriting is much more mature than its use in customer relationship management. Automated underwriting systems (AUS) are rule-based systems which are software with a set of binary rules that help in electronically reviewing a loan application. The

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<sup>7</sup> Albus, J., "Outline for a Theory of Intelligence," IEEE Transactions on Systems, Man, and Cybernetics. 21.3 (May/June 1991): 473-509.

AUS reads and evaluates the loan application based on the rules and comes up with an output to the broker or customer that includes interest rates for the loan product specifically requested and various prices and other loan products for which the borrower may be qualified. AUS's are used to evaluate the level of risk a particular loan represents and determines whether that loan would be a benefit to the current portfolio. As more and more loans are funded and tracked to see which ones go to term, refinance, or default, the additional information allows the rules to be modified so that better risk assessment decisions can be made. Fannie Mae and Freddie Mac have developed AUS's such that if the system reports that the loan qualifies, Fannie Mae and Freddie Mac commit to buying the loan subject to verification and validation of the information provided.

Intelligent systems are also in their nascent stage for use as customer relationship management tools. Customer relationship management allows companies to track and understand customer behavior on the aggregate as well as learn about the behaviors of individual customers. By evaluating such behavior, mortgage companies can provide better service by having customer call history available to the operator receiving a call as soon as the customer is connected, as well as target product cross selling opportunities appropriately.

### **5.2.2 Intelligent Systems Impact on the Information Chain**

Intelligent systems, specifically AUS's, have changed the order of the steps in the information chain. Prior to AUS's, an underwriting decision could not be made until after customer application data was verified. With an AUS, a contingent but binding, underwriting decision can be made within minutes of a customer submitting an application. For example, IndyMac Bank, a mortgage lender located in Pasadena, California, has developed an AUS called "electronic-mortgage information and transaction system" (e-MITS) that enables it to make an underwriting decision within three minutes of the submission of a loan application. This change in the information chain allows IndyMac to provide better customer service as potential borrowers receive a binding underwriting decision much earlier in the process. The AUS also streamlines IndyMac's processes. Prior to the adoption of e-MITS, IndyMac had underwritten approximately three loans for every one loan funded. After e-MITS, the company underwrote approximately 10 loans for every 8.5 loans funded. Also, a loan application can be submitted 24 hours a day rather than just during business hours and metrics collected by IndyMac indicate that applications are submitted around-the-clock.

AUS's also provide better risk assessment as the system refines its underwriting decisions by storing more information about the existing outstanding loans. Improved risk evaluation allows the mortgage companies to compile better performing loan portfolios which in turn makes it easier to sell their new loans in the MBS market. The improved evaluation of risk and increasing sophistication of the intelligent systems over time will allow mortgage companies to provide increased customization of pricing that can lead to individual pricing of loans. Individual pricing results in better customer service as each potential borrower will obtain the best price for their particular circumstances.

Increasing use of customer relationship management systems will enhance customer acquisition capabilities. First, the systems will allow for more targeted marketing campaigns. Only individuals who qualify or meet certain criteria will be contacted about opportunities. Hopefully, the criteria will not only limit the target audience to those financially qualified, but will also limit the audience to those potentially interested in the offer. These offers could be for

initial loans, but could also reflect cross-selling opportunities. As the mortgage industry needs to manage the fluctuation in revenue streams based on interest rate changes by finding products that even out revenue, cross-selling products to customers becomes increasingly important. Customer relationship management systems will enable mortgage companies to use their marketing dollars efficiently to increase their customer acquisition statistics. In addition, new federal regulations regarding “do not call lists” and privacy require that solicitations be for specific product offers and only go to households with which companies have had a prior relationship. Customer relationship management systems allow companies to identify potential customers with whom they have existing relationships and to leverage the information to best cross-sell products while complying with federal regulations. Also by effectively cross-selling to customers, mortgage companies make progress toward becoming a “one-stop shop” for their customers.

### **5.2.3 Intelligent System Adoption**

Fannie Mae and Freddie Mac have influenced the adoption of intelligent systems within the mortgage industry. By requiring that applications be sent electronically through their proprietary AUS's, Fannie Mae and Freddie Mac have brought the industry to accept AUS's much sooner than would have otherwise occurred. However, this small victory does not mean that intelligent systems are prolific within the industry. Intelligent systems are time and resource consuming endeavors that require a lot of planning and capital to implement. As the mortgage industry is very competitive, these systems need to prove their value. AUS's have been proven cost effective far more than have customer relationship management systems. Therefore, companies for whom Fannie Mae's and Freddie Mac's systems are not sufficient, namely, companies which have significant non-conforming loan businesses, have independently developed AUS's. These intelligent systems are critical to establishing a competitive advantage and enabling these companies focusing on non-conforming loans to succeed.

Customer relationship management systems have not been adopted as quickly. This may be because there are no requirements for companies to use them. Therefore, it is up to each individual company to adopt and implement a system. Before a company will invest the capital and resources into development, proof of value needs to be established. To date, that proof has not surfaced. As other companies and other industries demonstrate the value of customer relationship management tools, mortgage companies will likely assign resources to their development, and intelligent systems will play a greater role in the industry.

## **5.3 ELECTRONIC SIGNATURES**

Electronic signatures, or “e-signatures,” generally refers to any type of signature in electronic form attached to or associated with an electronic document or record. It is the electronic equivalent of a traditional pen-and-ink signature, also called a “wet signature.” Whether involving basic imaging or sophisticated encryption, e-signatures typically represent certain basic assumptions also associated with wet signatures:

- the signatory can be identified by his or her signature
- the signatory agrees to be bound by the contents of the signed document

- the signed document will not be changed after it has been signed
- a signature on one document will not be transferred to another document without the authorization of the original signatory

E-signatures can vary from the attachment of an image of a wet signature to password protection to digital signatures. “Digital signatures” typically refer to authentication methods which rely on public key cryptography (PKC). PKC is a method that uses two mathematically related keys, one private and one public. The private key is kept by the individual and is used to sign the documents. The public key is given to the corresponding party who will need to authenticate the documents. When using PKC to sign a document, a one-way algorithm is used that transforms a string of characters into a shorter value of fixed-length referred to as a “hash,” “hash result,” or “message digest.” The private key is used to encrypt the hash to produce the digital signature which is attached to the electronic document. The electronic document is sent and the recipient uses the public key to retrieve the hash and decrypt it. If the two hashes match, then the document and signature are authenticated. If the document has been modified the hashes will not match. Although many of the e-signature technologies involve document and signatory authentication and fraud prevention that is more secure than the traditional wet signature, general acceptance and adoption of e-signatures is slow.

### **5.3.1 E-signatures in the Mortgage Industry**

In October 2000, the U.S. Electronic Signatures in Global and National Commerce Act (e-SIGN) went into effect. This federal regulation was designed to remove some of the legal uncertainty surrounding the use of e-signatures and to encourage the use of e-signatures in government and commerce. Many state governments have also enacted regulations allowing the use of e-signatures and encouragement of e-signatures has been included in other federal laws such as the Government Paperwork Elimination Act. In general, most e-signature regulations remain technology neutral to allow government entities and businesses flexibility to adopt new technologies that best fit their needs.

### **5.3.2 E-signatures Impact on the Information Chain**

Because of the extensive paperwork involved in the loan origination process, e-signatures can be an important tool to reduce the amount of paper and streamline the process. Beginning from the completion of the standard Form 1003, almost all brokers and lenders currently require a wet signature on this form. Some brokers and lenders may even require that the form itself be completed in the customer’s own handwriting. Because of this requirement, it is more likely that a borrower will need to meet with a broker or loan agent to obtain a copy of the form and complete it. This can make comparison shopping for loan products more difficult for customers because working with non-local or out-of-state brokers or lenders would involve higher transaction costs to physically transfer the signed loan application. With an e-signature, a borrower could potentially apply for a loan in any geographic location by downloading a copy of the standard Form 1003, completing it electronically, signing it electronically, and then submitting it over the Internet to a broker or lender. Currently, many brokers and lenders type in information from the physical Form 1003 into a computer as part of loan processing. E-signature

can remove the extra data transfer step and allow lenders with competitive interest rates and fees to compete more effectively for buyers across the country and eventually even internationally.

E-signatures can also help to transform the verification process and it is likely that this may be the first place for initial adoption of this technology. The various pieces of financial information of the borrower must be verified and checked with third-parties such as employers, financial institutions, and the government. Traditionally, this verification process had been undertaken by specially trained underwriters. More recently, in order to lower costs and increase loan throughput, the process has been increasingly broken down into smaller steps. Each step is then evaluated for automation potential or completion by less-skilled labor, including outsourced labor. As each step of the process is completed, which is not a simultaneous event because information from third parties is received at different times or the borrower must be contacted to provide additional information, some type of indication or sign-off is needed. E-signatures can help with the internal sign-off during verification of each piece of borrower information. Moreover, innovative mortgage lenders can keep borrower files in entirely electronic form and transfer portions of the verification process to different physical locations to better allocate its labor pool. For example, if a mortgage lenders has regional offices in Los Angeles and Cleveland and the Los Angeles offices is suddenly swamped with new loan applications, some of the workload can be electronically transferred to the Cleveland office to process. Also, if the lender has worldwide offices, the differences in time zones can be used such that the processing work is continuous 24 hours a day as the files are electronically transferred from one office to another. E-signatures help coordinate the sign-off for each portion of the verification process which can now be done by multiple individuals in different physical locations. If there are questions on particular portions of the verification process, the e-signature can trace the individual who performed the work regardless of his or her physical location.

Finally, e-signatures can improve the final stage of loan origination, the drawing of documents. Typically borrowers must physically go to an escrow agent or have a thick stack of documents sent to them to sign to finalize the loan. These documents include notarized signatures for actual transfer of title and the promissory notes evidencing the mortgage to acknowledgments of receipt of required disclosure forms. Even if the loan and verification process involved documents in electronic form, currently, all final documents must be printed out and manually signed by the borrowers. E-signatures can keep all of these documents in electronic form and allow them to be easily transferred to the borrower for signing and then to the requisite institutions and agencies for eventual archiving. Electronic storage of real estate documents can save the lender money in terms of physical space necessary to store the loan documents for each loan of every borrower. The “paperless mortgage” has been a long standing goal for the mortgage industry yet still remains elusive. E-signature is an important step in that direction.

### **5.3.3 E-Signatures Adoption**

If e-signature technology of various types already exists, has the potential to improve the efficiency and throughput of the loan origination process, can possibly improve the customer experience, and has been explicitly sanctioned by federal and state governments, it is difficult to understand why it has not been adopted. The primary reason for the delay in adoption cited by many mortgage industry professionals is the lack of a developed body of law specifically enforcing the use of electronic signatures. While governments have put regulations in place,

there has been little litigation to develop the case law regarding specific circumstances of enforceability of e-signatures. Most lenders do not want to risk their billion dollar portfolios on an e-signature without a more developed body of law regarding enforceability, and simultaneously, no lender wants to be the test legal case. Moreover, attitudes and habits can be difficult and slow to change and real estate transactions are notorious for preserving ancient tradition. Widespread trust in e-signatures does not seem to exist yet and paradoxically, trust is difficult to develop without widespread use and widespread use is difficult to develop without trust.

## **5.4 SECURITY**

Security represents a number of different technologies and roles within a system. In this paper, security refers to document integrity, authentication, and authorization. Document integrity refers to methods that ensure that a document has not or cannot be modified. There are several technological implementations to ensure documents have not been tampered with: file creation and modification dates, read-only files, password protection, the checksum method, and public key cryptography. The checksum method refers to the process of adding up the number of bytes in a document and verifying that the number has not changed. If a file changes, it is very hard to change it in such a way that the number of bytes remains the same. PKC, which can be used as a sophisticated e-signature technology, has the added benefit of ensuring document integrity. The creation and encryption of the hash with the private key and the subsequent decryption and comparison of the hash by the document recipient using the public key is a means of authenticating the document.

Authentication and authorization are security concepts that are usually addressed together. Authentication is the process by which a system verifies that the person trying to access the system is who he or she claims to be. Authorization is the process by which the system verifies that the person authenticated has permission to access the information. Another security concern related to authentication and authorization issues is theft of information while it is being transferred through the network, known as “packet sniffing.” User identifications (ID’s) and passwords are used to accomplish both authentication and authorization. However, if someone is packet sniffing while user ID’s and passwords are being transmitted, then the systems are compromised as authorized users can be impersonated. Therefore, encryption is a necessary tool for implementing a solid authentication and authorization system. Encryption of data and user ID’s and passwords renders the data stolen useless as an unauthorized user will not be able to read the information obtained.

### **5.4.1 Security in the Mortgage Industry**

Within the industry, there are security concerns at two major points, the storage of the data within the mortgage banking company databases and the delivery of the information from the borrower as well as third parties. The document integrity, authentication, and authorization for the data stored within many mortgage banking companies is handled through user ID’s and passwords. Because the process is still largely paper based, many of the security functions in the application process are handled by people within the current process. Notaries validate that the borrower is who he or she claims to be. Underwriters validate the documents from third parties. Documents are mailed to specific people handling an application. Security is also handled by

building trust between the parties. Although trust building is not a fool-proof method, the sense of security from this method is an entrenched factor within the industry. As the industry moves to a more electronic industry, the concerns for security grow as the human relationship built on trust no longer exists. More secure systems are required to replace the trust that existed in the old process. In addition, the number of privacy regulations enacted also raises the level of security that the mortgage industry needs to provide.

#### **5.4.2 Impact of Security Technologies on the Information Chain**

Designing security systems is a process of assessing the level of risk to the organization if the system is compromised and making a determination of how much investment in security should be made. The technological solution adopted should match the level of security required. With the privacy requirements imposed by federal regulations and the need to find a replacement for trust created by human interaction, the security systems in the mortgage industry must provide the highest level of security. The cost of a security system is not a use by use cost, so if the system requires building the most secure environment possible for a significant amount of the transactions, it might as well be used for all transactions. Using methods such as file creation and modification dates, read-only files, password protection, and the checksum method for document integrity would be insufficient to the high level of security required for some of the transactions in the origination process. These types of technologies are easily compromised. A skilled hacker can change the read-only file flag to make the document changeable or could similarly change the checksum number. Therefore, the only technology secure enough to accomplish document integrity is PKC. Similarly, encryption is a necessary element to accomplish authentication and authorization. PKC accomplishes the security goals of document integrity, authorization, and authentication. If a document is encrypted with both the originator's private key and the recipient's public key, then the recipient knows that the document came from the originator accomplishing authentication and recipient can only read the document if he or she has the correct public key accomplishing authorization. In addition, the document will only be valid if the hashes or signature have not changed so document integrity is accomplished. The most significant impact on the information chain from security will, therefore, be a result of PKC.

Throughout the paper-intensive process of originating a mortgage, documents are gathered and then verified to ensure that the property has the value stated and the loan recipient has the means to repay the loan. The verification process in the information chain is the most time intensive, least automated, and most vulnerable to fraud. If fraudulent loans are inadvertently accepted, then mortgage companies would lose the value of the loan. Having too many loans that were not repaid would impede the mortgage company's ability to sell its mortgages as the default rate would be too high. Other companies would not want to take on the increased risk for little, if any, additional compensation. PKC would address these issues and affect all the steps in the information chain. It acts as an enabler for a paperless mortgage and removes time from the verification step because underwriters would not need to wait for documents to be sent by mail. As stated above, much of the security in the current system is based on trust in human relationships and human verification. This security is not a very tight system. A borrower could sign a document and later someone could modify the document and file it without the borrower's knowledge. Thus, trust establishes the security of document integrity. PKC would provide increased security as the document would become invalid if it

were modified. Also, brokers play a large role in determining and establishing the trust. Mortgage banks trust the brokers. The brokers do business with borrowers they trust; and thus, the mortgage companies trust the borrowers. With PKC, trust could develop without the human intervention. As PKC becomes more accepted, the need for brokers will decrease.

### **5.4.3 Adoption of Security Technologies**

Security system adoption, specifically public key encryption, has been slow. Until 1999, the algorithm for PKC was under patent protection. The patent owner charged high license fees which made software development and system implementation using PKC cost prohibitive. The patent has expired, so the industry can now implement PKC systems without paying license fees. However, implementation of PKC will take time to implement because companies have scarce resources.

Trust is also a decisive issue. Mortgage companies and other participants in the loan origination process need to develop trust in the security systems. The participants are accustomed to trusting other people, not trusting machines. Social engineering is also contributing to the mistrust. Social engineering refers to the security problem that occurs when people reveal their passwords to unauthorized people or convince systems administrators to give them unauthorized rights to a system. Diligent systems managers are required to keep social engineering at bay, so that trust in the security system can develop.

## **5.5 DOCUMENT IMAGING**

Document imaging refers to the set of technologies for converting paper documents into electronic format. The term also includes archival, indexing, and retrieval functions often referred to as “document management.” The process involves scanning or electronically converting files into high resolution images which are saved on a storage media. These images can then be organized, stored and retrieved electronically. Optical character recognition (OCR) technology can take scanned text and translate it into character codes. OCR technology gives documents an active content which enables advanced applications such as file retrieval by word or phrase searching.

### **5.5.1 Document Imaging in the Mortgage Industry**

The mortgage industry is still primarily a paper-driven process. In addition, regulatory requirements regarding archiving of loan files and disclosure requirements add to the paper files. Loan officers are dependent on outside sources for information such as a credit report, employment verification, or tax statements which are often received in various forms and formats. Searching and organizing documents has a significant labor expense attached to it. Mistakes also occur with manual processing which put lenders at risk of losing potential applicants and valuable customers. When the loan is finally approved, the loan documents must be organized and stored which requires expensive physical space. If archived loan documents need to be referenced, a person needs to physically go to the storage warehouse to pull the file. Sometimes, loan files can be misplaced and finding a missing or misplaced file can be time-consuming and expensive.

Document imaging is currently being used to a limited extent in the loan origination process, primarily during the verification process. Many mortgage lenders scan and convert the paper documentation provided by the borrower into an electronic file. Different portions of the file or electronic copies of the file can then be distributed to employees, sometimes in different physical locations, for verification against information gathered from third parties. However, the paper borrower file is usually considered the source of record and final loan documents are printed on paper, manually signed, and included in the final file for archiving.

### **5.5.2 Impact of Document Imaging on the Information Chain**

Although document imaging is currently in the verification portion of the information chain which requires the most transfer, comparison, and use of paper documents, the technology can affect other portions of the information chain. A fully implemented document imaging system can begin from the time the borrower completes a Form 1003 loan application. Rather than retyping information from a form into a computer, an active, electronic document can be created from the beginning. Similarly in the verification steps, the documents necessary for verification can be purely electronic documents which can be distributed to necessary loan agents quickly and inexpensively which may allow for increased specialization of each item for verification. Also, purely electronic documents may help to automate the process as computers will be able to read the text of the document rather than treating it as a static image. Finally, if combined with electronic signatures, the final loan documentation can be verified and signed electronically without the need for a wet signature by a borrower. The electronic files can be archived which will reduce physical storage space. Also, active electronic files can be searched which can make retrieval of files faster and more efficient.

### **5.5.3 Adoption of Document Imaging**

The adoption of document imaging is increasing in the mortgage industry. It allows lenders not only to reduce storage space and costs by eliminating paper, but also to cut labor costs through the network distribution of records which contributes to increased profitability. Less human intervention also reduces the chance of error.

In order to utilize document imaging, each party in the process needs to be equipped with computer hardware such as scanners and software such as email. As many third parties such as appraisers are small businesses, it is unlikely that all parties will be equipped with the necessary tools in the near future. Lack of tools among all parties involved in the loan origination process inhibits the widespread use of document imaging across the entire information chain.

Another hindrance is the industry's difficulty in accepting electronic files. Borrowers are used to having paper in their hands. The average person does not yet trust electronic mortgage files especially with respect to security and are not completely comfortable with its legitimacy. Until consumers and third parties become more comfortable, the adoption of document imaging will be slow. Finally, regulatory issues are not fully resolved. A developed body of law does not yet exist regarding the enforceability of electronic documents. Although electronic documents are encouraged by the federal government, such as through the e-SIGN legislation, companies are not yet willing to risk full reliance on electronic documents without more definite legal precedents.

## 6 FINAL CONCLUSIONS ABOUT THE INFORMATION CHAIN

The technologies discussed have been shown to affect the loan origination information chain at different points. Below is a diagram that illustrates each step in the information chain for loan origination and where each technology impacts the information chain. The overall effect of each technology on the information chain is more complex than the sum of the impacted steps. By affecting several steps simultaneously, each technology can change the overall loan origination process, it is important to evaluate each of the future trends being affected by the technologies.

	Borrower Acquisition	Application & Product Approval	Data Collection	Compare & reconcile	Underwriting	Fund & Final Docs
<b>XML/ Enterprise System</b>	✓	✓	✓	✓	✓	✓
<b>Intelligent Systems</b>	✓				✓	
<b>E-Signature</b>		✓		✓		✓
<b>Security</b>		✓	✓	✓		✓
<b>Document Imaging</b>		✓	✓	✓		✓

While exciting new technology developments hold the possibility of revolutionizing the information chain for loan origination, our research indicates that several helpful and well-developed technologies still have not been adopted. The major industry trends introduced earlier are revisited and evaluated in light of the five specific technologies discussed.

## **6.1 THE PAPERLESS MORTGAGE**

While electronic signatures and document imaging have the ability to significantly reduce the amount of paper in the loan origination process, these technologies currently have not been used to their full potential. Currently, document imaging and electronic signatures are being used by lenders internally during the verification process. We believe that widespread adoption of these technologies with lenders for internal use will occur during the next five years.

However, the goal of the paperless mortgage is very unlikely to occur within the next five years. System integration with the numerous third party information providers during the verification process involves too many entities and too much coordination and agreement on standards that we believe it is unlikely to occur in the near future. Even if MISMO or another central organization could coordinate, set, and enforce industry standards for systems integration, the lack of a body of law regarding electronic documents will also prevent the paperless mortgage from occurring during the next five years. Small lenders which may consider the paperless mortgage to be a competitive advantage will not have sufficient capital to risk litigation over enforceability of electronic documents in the event of a dispute. Large lenders with sufficient capital to defend potential litigation have loan portfolios too large to risk an uncertain outcome. Finally, personal attitudes about paper and its tangibility will also likely prevent full scale emergence of the paperless mortgage. Because home ownership is such a significant transaction for many borrowers and a mortgage is the largest source of indebtedness for most individuals, many individual borrowers may psychologically feel more secure with tangible evidence of their transaction and be unwilling to switch to an intangible electronic documents.

## **6.2 ONE STOP SHOP**

We believe that increasing consolidation will occur in the mortgage industry as there is an industry trend towards increased market power to remain competitive. There is also pressure for companies to broaden their product and service offerings. First, the economies of scale and scope are present and become stronger as loan products in the mortgage industry become commodities. The use of intelligent systems to price complex and specialized loan products for the specific needs of borrowers will make securitization and pricing more efficient. These pricing pressures on an increasingly broader range of loan products will give companies with economies of scale and scope a pricing advantage in attracting borrowers.

Moreover, the ability to retain customers and maintain a customer relationship will become increasingly more important and lenders will be unable to distinguish themselves by their loan product offerings. Therefore, increasing the number of customer contacts through different products is a means to retain a particular borrower. This includes cross-selling of different mortgage and financial products as well as tailoring financial services to individual customers. Also, more information about an individual customer gathered through multiple financial products such as checking accounts or credit cards, can help lenders better gauge credit risk when considering a mortgage application. Advances in data mining and enterprise software will help mortgage lenders and financial institutions develop customer relationships. As a result, there will be a strong movement toward one stop shops in the next five years – first for home buying and eventually to financial services.

### **6.3 AUTOMATION AND OUTSOURCING**

Currently, lenders are re-evaluating their loan origination process to find ways to reduce labor costs through automation or outsourcing. With the loss of jobs in the recent economic recession, offshoring has become a dirty word which many companies do not mention. However, despite the political backlash against sending US jobs to overseas workers, companies, including mortgage lenders, are still quietly and persistently pursuing it. We believe there will be increased outsourcing with significant offshoring in the next five years as competitive pressures in the mortgage industry force mortgage lenders to review their loan processes. Document imaging facilitates the outsourcing of the verification step as images of the loan file can be sent cheaply and quickly to an outside party rather than incurring the costs of shipping physical paper files. Once an image a document in the loan file is in the system, the information can be validated in any location. This makes offshoring a viable alternative for this step. We also believe that automation will increase as it gives lenders more control over the process and does not have the negative public connotations of offshoring.

### **6.4 ROLE OF BROKER OR REPRESENTATIVE**

Despite the development of intelligent systems and interfaces with borrowers, we believe the mortgage broker or lender representative will continue to have a strong position in the loan origination information chain for at least the next five years. First, the increasing number of loan products which can be tailored to a borrower's particular financial situation can overwhelm a home buyer. Also, since home purchases only occur on a few occasions in an individual's lifetime, most individuals do not develop sophisticated knowledge about mortgages and generally do not keep themselves updated on industry developments. The comfort and feeling of security and responsiveness from talking to another human being is important in the mortgage context which we believe will not be replaced by self-service or automation in the next five years.

Also, mortgage brokers and loan representatives play an important role in fraud detection during the loan origination process. The ability of human beings to process subtle and complex signals when meeting a potential borrower and to detect signs for fraud has not been replicated by machines. Even if certain sophisticated borrowers do not need an agent to explain loan product offerings, we believe lenders will still require borrowers to meet in person with a human agent as a means to detect potential fraud.

### **6.5 OTHER**

Two other important issues affect the overall business environment in the mortgage industry and the adoption of new technologies. These are changes to regulations and attitudes.

#### **6.5.1 Government Regulation**

Changes to regulations in an industry can result in a new prioritization of technology projects especially if there is a deadline for compliance. Technology projects which relate to compliance with the new regulation will have higher priority and increased budgets. Technology projects which relate to other business goals will be delayed. This could impede the adoption of

technologies which improve business processes in the industry. Also, a short term need to comply with new regulations contributes to the piecemeal development of technology solutions at the expense of more efficient long-term strategic planning.

The development of technology is often faster than updates to regulations. Many regulations which have existed for years do not contemplate process changes or paradigm shifts brought about by new technologies. As a result excess resources could be wasted on bringing technologies in compliance with outdated regulations which could otherwise be used for continued process improvement.

### **6.5.2 Attitudes**

Attitudes of mortgage industry professionals and customers will need to change to accept new technologies and the process changes they bring. Because of the disruptive nature of changes in the industry which result from technology, a complete shift in attitude is often required. However, attitudes do not change quickly especially in an industry with a long tradition. The purchase of a home is a major life event and borrowers need to be completely comfortable with the process, the security of their personal and financial information, and the records of the purchase. Because homeowners have so much at stake, it is likely that their attitude change may be slower than for other industries.

As the industry will change very slowly, especially for the commodity market of conforming loans, the industry will look largely the same to the borrower over the next five years. However, during that time, the technological and legal infrastructure will be developing so that the foundation will be ready when the attitudes catch up.

## **7 SUMMARY AND FUTURE RESEARCH**

The focus of this paper is the loan origination processes within the mortgage banking industry. The most pressing industry trends for the loan origination process which technology can address relate to the reduction in time and paper within the origination process. Future research could be done on the impact of existing and developing technologies in the other two steps in the mortgage information chain, namely, servicing and securitization.

The servicer of a mortgage has a wealth of information about mortgage customers for which they bought the servicing rights, whether or not the servicer originated the mortgage. The number of mortgages serviced can far exceed the number of mortgages originated for an individual servicing company. More research can be done to determine how technology can facilitate the management of the volume of servicing transactions and improve the quality of customer service. Regulatory issues such as privacy regulations and restrictions on marketing through the federal “do not call lists” provide challenges to effective use and management of customer data. Additional research can be done on technologies to evaluate their influence on the servicing information chain.

Securitization is another process on which technology can have an impact, but further research needs to be completed to identify the influential technologies and their effects. One technology that could potentially impact securitization is the development of intelligent systems such as neural networks which could allow for more accurate valuation and risk analysis of MBS.

Even in the loan origination process, other areas for future research remain. For example, even if the mortgage industry successfully implements the paperless mortgage, storage systems to hold all the borrower and loan information will be still required. Although the volume for electronic storage media is much smaller than for paper files, physical storage space will still be a concern. However, the more complicated issue for storage is longevity of the storage media. Because real estate records may need to be stored for decades and sometimes even for generations, the determination of the proper storage media and method of replication is still an unresolved issue. The eventual archiving process needs to ensure document integrity as well as be cost-effective.

Many of the changes analyzed in this paper require changes in attitude. For an industry and a process which has evolved from long tradition, the psychological readiness of mortgage lenders and their customers for technological change plays a significant role in the overall ability of technology to impact the information chain. More research can be done to determine how customers and the mortgage companies will react to and adopt new technologies. This future research could also include an analysis of the features or characteristics that will be needed before a majority of industry professionals and customers will adopt the new technologies.

## APPENDICES

### APPENDIX A: BIBLIOGRAPHY

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### **Company Web Sites**

ABN Amro Mortgage: <http://www.mortgage.com>

Broker Universe: <http://www.brokeruniverse.com>

Countrywide Financial Corp: <http://www.countrywide.com/>

DignityMortgage.com: <http://www.dignitymortgage.com/index.htm>

Fannie Mae: <http://www.fanniemae.com>

Freddie Mac: <http://www.freddiemac.com>

GMAC Mortgage Corporation: <http://www.gmacmortgage.com/home.asp>

IndyMac Bank: <http://www.indymacbank.com>

International Union for Housing Finance: <http://www.housingfinance.org>

Mortgage Bankers Association: <http://www.mbaa.org>

Mortech LLC: <http://www.mortech-llc.com>

Mortgagebot: <http://www.mortgagebot.com>

Mortgage Banking Mag: <http://www.mortgagebankingmag.com>

Mortgage Technology: <http://www.mortgage-technology.com>

Office of Federal Housing Enterprise Oversight: <http://www.ofheo.gov>

Search Security: <http://searchsecurity.techtarget.com>

US Department of Housing and Urban Development: <http://www.hud.gov>

## **APPENDIX B: ACRONYMS**

AUS - Automated underwriting systems  
B2C – Business to Consumer  
e-SIGN - Electronic Signatures in Global and National Commerce Act  
HELOC – Home Equity Line of Credit  
HUD - Department of Housing and Urban Development  
MISMO - Mortgage Industry Standards Maintenance Organization  
MBS – Mortgage Backed Security  
OCR - Optical character recognition technology  
PKC – public key cryptography  
RESPA - Real Estate Settlement Procedures Act of 1974  
XML – Extensible Markup Language

## **APPENDIX C: RESEARCH PROCESS**

The research process began with secondary research on the mortgage industry and preliminary identification of the information chain for a residential mortgage. An initial identification of key issues in the industry was also accomplished through secondary research. Primary research followed which involved interviewing technology and process improvement executives at local mortgage lenders which were perceived to be leaders in technology adoption or technology innovators in the industry. Further refinement of the information chain was also accomplished through primary research interviews with executives in mortgage lending divisions of mortgage banks.

Through the combination of secondary research and primary research, hypotheses were developed around the major industry issues. Key technologies with the potential to impact the loan origination process were identified. Finally, the hypotheses were tested through additional primary and secondary research. The additional primary research included interviews with executives in the residential mortgage divisions of more traditional commercial banks and interviews with other industry professionals such a mortgage broker.

## **APPENDIX D: BRIEF HISTORY OF FANNIE MAE AND FREDDIE MAC**

Since the mid-1980's lenders have financed most conforming mortgages by selling them to or swapping them for mortgage-backed securities (MBS's) guaranteed by Fannie Mae and Freddie Mac, created to provide a secondary market for residential mortgages. Fannie Mae was chartered in 1938 by the federal government to make more money available for the mortgage market by purchasing loans insured by the Federal Housing Administration (FHA) and selling these as securities in the financial markets. The result was a more liquid and efficient market for conforming loans, and a consistent, lending process with the same loan terms, interest rates, and underwriting guidelines applicable nationwide. Also, basic costs of lenders which sold mortgage portfolios to Fannie Mae and Freddie Mac began to converge. Fannie Mae's guidelines and restrictions became uniform principles which lenders needed to follow to sell their loans to the secondary market.

After being re-chartered in 1968 by the US Congress as a private, shareholder-owned and publicly traded corporation, Fannie Mae's focus shifted to conventional loan programs. Nonetheless, its purpose to create a more liquid mortgage market by linking the primary and secondary mortgage markets remained essentially the same. By 1970, Fannie Mae was entirely purchased and owned by private shareholders.

In that same year, the US Congress chartered Freddie Mac with the purpose to increase the supply of mortgage loan funds available to commercial banks, savings and loan institutions, credit unions and other mortgage lenders. Freddie Mac essentially complemented Fannie Mae. Although also not a government agency, but privately owned and publicly traded, Freddie Mac is regulated by the federal government.

Recently, Freddie Mac has encountered accounting and management issues and restated its financial statements for 2000, 2001, and 2002. The problems have damaged its reputation and by association has negatively impacted the reputation of Fannie Mae.

[From "A Brief History of Mortgages" Dignity Mortgage Corporation January 22, 2004  
<<http://www.dignitymortgage.com/MortgageIndustry/MortgageIndustryHistory.htm>>]

## **APPENDIX E: REAL ESTATE REGULATIONS AFFECTING THE MORTGAGE INDUSTRY**

Laws and regulations of state and federal agencies govern the mortgage industry with the aim to improve consumer protection. These include real estate regulations, banking regulations, and privacy regulations. Some of the principal real estate regulations are described below:

- The Equal Credit Opportunity Act (ECOA) prohibits discrimination by lenders and creditors on the basis of sex, race, religion, color, national origin, age, marital status, whether the applicant receives government assistance and if the person has previously exercised his or her rights under the ECOA. Complaints and violations are monitored by the Federal Trade Commission.
- The Fair Housing Act, administered by the Department of Housing and Urban Development (HUD) focuses on the housing industry and residential real estate. It prohibits real estate industry agents, specialists, and professionals from discrimination on the basis of sex, race, religion, color, national origin, age or marital status.
- The Fair Credit Reporting Act, regulates the reporting of consumer credit and the use of consumer credit reports by creditors and lenders.
- The Home Mortgage Disclosure Act (HMDA), passed by Congress in 1975, addressed public dissatisfaction with the lack of sufficient loans in urban areas. To ensure that mortgage companies met the credit demands of their neighborhood, information about the loans, property and borrower must be entered in the Loan/Application Register (HMDA-LAR) and reported every year to the government.
- The Real Estate Settlement Procedures Act of 1974 (RESPA) regulates the disclosure requirements for the real estate industry and to protect consumers from undisclosed fees. Two revisions took place in 1990 and 1992. RESPA requires lenders to provide the following disclosure documents: good faith estimate, truth-in-lending disclosure, notice of servicing transfer, escrow disclosure, and HUD-1 Settlement Statement.

## **APPENDIX F: STEPS TO OBTAINING A MORTGAGE**

[from Nation's Mortgagebank <[www.nationasloan.com/learning\\_center/mechanics.rad](http://www.nationasloan.com/learning_center/mechanics.rad)>]

### **Application**

The loan starts when a new homebuyer, also referred to as customer or buyer, approaches a mortgage broker for a home loan. This process could occur in a few different ways such as, the customer filling out an enquiry form on a broker's website or a referral from an existing customer or real-estate agent. The next step in the process is to complete the standard residential loan application form. Most brokers or lenders use a standard application form that is accepted by the major secondary market investors, such as Fannie Mae (Federal National Mortgage Association ) and Freddie Mac (Federal Home Loan Mortgage Corporation). The form is commonly known as Form 1003 and is divided into sections. Generally, this form is initially completed by the customer and finalized by the lender after verifying the information on the application. It is extremely important that the application contain accurate information. Many loan officers will work with borrowers to help in completing the application and in gathering important documentation.

The following lists the sections of the Form 1003: Uniform Residential Loan Application:

- Type of Mortgage and Terms of Loan.
- Property Information and Purpose of Loan
- Borrower Information
- Employment Information
- Monthly Income and Combined Housing Expenses Information
- Assets and Liabilities
- Details of Transaction
- Declarations
- Acknowledgment and Agreement
- Information for Government Monitoring Purposes

Choosing the right loan requires customers to review their financial objectives. The customer then needs to review their product options and pricing and select the product they want to pursue. Customers depend heavily on brokers and other financial advisors in helping them make this decision.

After customers complete the loan application and choose a loan type, the lender provides several documents to the borrower that discloses important aspects of the loan. These documents are provided within three days of receipt of the application and are required by federal regulations. The documents are:

- Estimated Closing Cost Statement: Lenders provide an estimate of the closing costs incidental to obtaining a loan.
- Truth in Lending Statement - Regulation Z: This statement shows annual percentage rate (APR) on the loan. This rate combines the actual interest paid on the note rate over the life of the loan plus the total costs to obtain the loan. The APR is a measure of the cost of credit expressed as a yearly rate of interest. Because all lenders follow the same rules in

calculating the APR, it provides consumers with a good basis for comparing the cost of mortgages.

- **Settlement Cost, A HUD Guide:** This booklet gives an overview of the lending process and is required by HUD. The booklet is provided to consumers after the loan application is completed.

## **Underwriting**

After the information on the loan application has been validated, the value of the property has been confirmed, and the title search has been completed, the loan is ready to be underwritten. Usually, a trained professional reviews all of the information, analyzes the credit worthiness of the borrower, and renders a decision on the loan request. Increasingly, much of the analytical tasks of underwriting are performed by technology through artificial intelligence and use of databases. There are generally secondary market underwriting guidelines, but many variables are considered in the analysis.

### **Monthly Housing Expenses and Total Debt Obligations**

One of the first things an underwriter determines is the borrower's proposed monthly housing expenses and total monthly debt obligations.

*Housing expenses:* These include the monthly principal and interest payments that are stipulated on the mortgage note. In addition, the monthly housing expenses include a monthly amount for the property taxes and hazard insurance (1/12 of the annual taxes and insurance). There may be other expenses, such as condominium fees, homeowners fees, special assessments, etc., that are included.

*Monthly debt obligations:* These include monthly credit obligations, such as installment payments, revolving charge cards, or other borrower obligations that will continue longer than 10 months. Usually, 5% of the current balance of a revolving charge account is used for the monthly payment.

### **Funds to Close**

When the proposed loan is being used to finance the purchase of a home, underwriters will determine the source of funds for the down payment and closing costs. The following are acceptable sources of funds for closing:

- *Cash:* Cash in any depository institution or investment company is acceptable.
- *Stocks, bonds, mutual funds, etc.:* Cash equivalent investments are acceptable forms of funds. They can be validated through statements from investment companies for the last two months.
- *Sale of existing property:* Many times the source of funds for the down payment on a home comes from the equity in a property that will be sold. The sales price of the property being sold is indicated on the loan application and any existing loan is verified on the credit report or through a verification of previous mortgage.

- *Gift from family members:* Gifts from family members for the down payment and/or closing costs are acceptable so long as there is no requirement for repayment. Some loan programs limit the amount of gift funds allowed.

## **Credit Analysis**

Another very important part of the underwriting process is determining the creditworthiness of the borrower. Loan underwriters review the borrower's credit report to find evidence of debt repayment behavior. Some of the important areas that are reviewed are:

- *Past and existing mortgage debt:* The past repayment history on mortgage debt can be a good indication of a borrower's attitude toward mortgage obligations. A good payment history on mortgage debt is very important in the credit analysis. Generally, payments received 30 days past the due date are reflected in the credit report as late. Lenders vary in strictness, and some may not allow any late mortgage payments, while others will allow 1 or 2 in the last two years if there is a good explanation.
- *Installment and revolving credit:* Other items on the credit report can also indicate a borrower's attitude toward credit obligations. Credit reports indicate the outstanding balance, current balance, and terms of payment on the borrower's revolving and installment debt. Underwriters review these credit obligations to determine the borrower's patterns of credit use and repayment behavior. Revolving credit encompasses department store and bank credit cards. Installment credit encompasses longer-term credit with structured payment plans, such as car loans. Generally, underwriters are not concerned over isolated and minor slow payments indicated on the credit report.
- *Collections, repossession, foreclosures and bankruptcies:* Credit reports also indicate public records such as collections, repossessions, foreclosures, and bankruptcies. Though these items may indicate past credit problems, they sometimes have valid explanations. Underwriters may require a letter of explanation on items noted in the public records. Many times consumers have re-established credit and have an excellent payment history on their current obligations.

## **Appraisal**

Generally, underwriters are not professional appraisers and do not re-appraise the property. They will review the appraisal to assure that it meets the requirements of the investor and sometimes request additional information to substantiate the value. They may request that a second appraisal or review appraisal be performed. If they believe that the value cannot be substantiated, a review appraisal can be completed from a site inspection or review of the written appraisal. In both cases, another professional appraiser will perform the review.

## **Compensating Factors**

The underwriters consider many variables in their analysis. No two borrowers have the same credit and income profiles and underwriters use all of the information in the loan file to render a decision. Many times, borrowers fall outside the guidelines, but have strong compensating factors that reflect low credit risk. Some compensating factors are history of

savings, long-term job stability, history of making monthly credit payments that equal or exceed the proposed payments, a substantial down payment, or a large cash reserve after the close of escrow.

## **Loan Approval**

After the underwriter has reviewed the entire loan package, there can be four outcomes:

- *Approval:* If the loan is "picture perfect" and the underwriter has no questions, the loan will be approved with no conditions.
- *Approved with conditions (the most common response):* There are two types of conditional approvals:
  - If the underwriter needs additional documentation before a final credit decision can be made, a "prior to document" conditional approval will be rendered. In essence, the loan documents will not be prepared until the condition has been satisfactorily met. An example of a "prior to document" condition could be a pay stub to validate the borrowers income.
  - If the loan can be approved, but a condition must be met prior to closing, a "prior to funding" conditional approval will be rendered. In this case, the loan documents will be prepared and sent to the closing agent, but the lender will not fund the loan until the condition has been met. An example of a "prior to closing" conditional approval could be proof of sale of existing home where the equity will be used as the down payment.
- *Suspended:* Sometimes the underwriter will be unable to make a decision on a loan file because it is either incomplete or there are many unanswered questions. In these cases, the underwriter will ask for additional information from the borrower before an underwriting decision is made. An example of a suspension may be large gaps in the borrower's previous employment history and no tax returns to indicate the place of employment.
- *Denial:* Underwriters will be unable to approve a loan if the loan file has substantial deficiencies and does not meet the minimum standards of the lender or the lender's secondary market investors. Most lenders require that a second underwriter review the loan package before a final denial is communicated to the borrower. Denial letters with the reason for denial are sent to borrowers within 3 days of the final credit decision. Underwriting criteria can be different among lenders and a borrower may find other acceptable alternatives in the market place.

## **Loan Closing Process**

After the borrower has been approved, the legal documents required for the loan closing are prepared by the lender and forwarded to the closing agent. Before funds are released to the closing agent, the borrower must sign the loan documents and meet any conditions required by the lender. The lender will submit instructions to the closing agent that outline the procedure and conditions for loan closing. Closing agents can be title companies, escrow companies and lawyers. Each lender may have its unique instructions (lenders instructions) for loan closing and each state may differ on some of the legal requirements. There are several major documents that are included for all closings.

## **Required Documents For Loan Closing**

*Mortgage Note:* The mortgage note outlines the amount of the debt, the terms and payments, the interest rate, margins and caps for adjustable rate mortgages (ARM's), the name of the lender (beneficiary), the name of the borrower (mortgagor), and any other material item required by the lender. The borrower(s) must sign the note.

*Security Instrument -- Deed of Trust/Mortgage:* A deed of trust is an instrument given by the borrower to a third party (trustee) vesting title to the property in the trustee as security for the borrower's repayment of the mortgage loan. A mortgage is the conveyance of interest in real estate used as security for repayment of a note. Depending upon the state and customs within that state, one of these instruments is generally used as security for the mortgage note. In the event a borrower defaults on the note, the security instrument outlines the legal procedure enabling the lender to take ownership of the property. Usually the security instrument is recorded as a public document.

*Deed of Trust Riders:* When the mortgage loan is an adjustable rate mortgage, lenders require a rider that is recorded along with the security instrument.

*Truth in Lending Statement -- Regulation Z:* The lender will provide an updated Truth and Lending Statement to reflect the actual costs of the loan and indicate the annual percentage rate.

*Closing Statement -- HUD 1:* After the loan has closed, the closing agent will provide a closing statement document that outlines the final costs of the loan. Borrowers can expect to receive this document within 3-5 days after loan closing.

## APPENDIX G: TOP LOAN ORIGINATORS IN 2003

	<u>(in millions)</u>
1. Wells Fargo Home Mortgage	\$470,119
2. Washington Mutual	435,391
3. Countrywide Financial Corp.	434,864
4. Chase Home Finance	284,257
5. Bank of America	140,937
6. ABN Amro Mortgage	124,048
7. GMAC Residential Holdings	114,455
8. CitiMortgage, Inc.	108,433
9. National City Mortgage	105,561
10. Cendant Mortgage	68,759

[data from: "Top Mortgage Originators" National Mortgage News. 19 March 2004  
<<http://www.nationalmortgagenews.com/mortgagestats/freedata/orig.htm>>]

**APPENDIX H: ALTERNATE MORTGAGE INFORMATION CHAIN FROM THE TOWER GROUP**

(Jacobides, Michael. "Where Do Markets Come From?" Center for the Network Economy CNE WP. Jun 2002)

