INFORMATION QUALITY ISSUES IN THE MORTGAGE BANKING INDUSTRY[1]

(Completed Academic Paper)

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Abstract

The current mortgage crisis and credit crunch presents the U.S. mortgage industry not only with unprecedented challenges, but also with great opportunities for improvement. In this research, information quality (IQ) issues within the mortgage banking industry are reviewed and discussed. Through extensive literature reviews from a multitude of mortgage industry resources, IQ issues within the industry are analyzed utilizing six of the most applicable Wang and Strong dimensions. These widely regarded IQ dimensions provide a framework by which IQ issues in the mortgage banking industry can be assessed. Specific IQ problems are indentified and possible means of improvement are discussed. We focus especially on how the Mortgage Industry Standards Maintenance Organization (MISMO) standards and data specifications help improve IQ in this industry. This research concludes that industry wide standards such as MISMO's eMortgage standards can help provide extensive benefits to the mortgage banking industry providing firms are willing to accept and adopt these standards. And, more importantly, we hope that these conclusions and recommendations may make a small, but important contribution to the current malaise in the mortgage industry.

Key Words: Mortgage Banking Industry, Information Quality, eMortgage, Standards and Policies

INTRODUCTION

The health of the home mortgage industry is vital to the U.S. economy in terms of its contribution to the Gross Domestic Product and number of workers the industry employs [1, 2]. Since mortgage lending is an information-intensive industry utilizing extensively both structured and unstructured data, information quality (IQ) in the mortgage lending process is critical to the success or failure of the mortgage industry. The recent unprecedented mortgage crisis has taken its toll on not only the U.S., but the entire global economy as well. In these financially trying times, mortgage banking (MB) companies are continually

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assessing their financial state in an attempt to reduce costs and risks. These cost cutting measures can be anything from lowering the firm's everyday expenses, to reducing the risk of acquiring toxic assets. With many mortgages either in default or at risk of default (*under water*), the importance of cutting costs and reducing risks for all MB companies has become a priority. With these potential benefits, MB industry leaders are taking greater notice of the efforts of mortgage standards organizations and how they can benefit from the adoption of industry standards.

The Mortgage Industry Standards Maintenance Organization (MISMO), a not-for-profit subsidiary of the Mortgage Bankers Association (MBA) and managed by Mortgage Electronic Registration Systems (MERS), is the leading technology standards development body for both the residential and commercial industry segments. MISMO promotes data consistency throughout the broader industry, reducing processing costs, increasing transparency, and boosting investor confidence in mortgages as an asset class, while passing cost savings on to the consumer (www.mismo.org). MISMO has developed standards for all mortgage process phases along the entire value chain.

Although MISMO has been working with MB companies for years to develop and implement standards, IQ is a relatively new aspect in the MB industry. It should be noted though that IQ was always an important consideration in all phases of the mortgage process. As with all new fields, developing terms, definitions and standards is an iterative, time consuming, and drawn out process. Within the IQ field itself, no universally accepted definition of IQ currently exists [3]. This is partly due to IQ professionals having varied opinions on what quality truly means. With many IQ definitions and dimensions in general, one of the most widely accepted and simplest IQ definitions comes from the popular work of IQ pioneers Wang and Strong [4]. According to these authors, IQ can be defined as information that is fit for use. In the mortgage industry then, information needs to be fit for use in order to gain the most effectiveness from it. Along with this pioneering work, the Wang and Strong research also produced a generally accepted framework for IQ research which provides fifteen widely used and accepted dimensions of IQ.

For this research on information quality issues in the mortgage banking industry, utilizing all fifteen dimensions would be neither necessary nor appropriate as some dimensions would not directly apply or be relevant. With this in mind, additional research on the Wang and Strong framework has shown that four dimensions: Accuracy, Consistency, Completeness, and Timeliness are the most appropriate within the Wang and Strong framework [4] and can play a strong role with information product consumers. Although they can be readily applied to this research, two additional dimensions are used here due to the mortgage industry's high amount of still largely manually entered loan data [5]. These additional dimensions are necessary and appropriate for a more accurate IQ assessment. The additional dimensions of 'Quantity of Data' and 'Accessibility' are needed for this research to help portray a more complete picture of current IQ issues in the MB industry. A full description of each dimension and its applicability to this research is discussed below.

BACKGROUND
In this research, an assessment of IQ issues within the MB industry sheds light upon a growing movement to standardize the mortgage lending system. The MB industry is a vast and complex system of interconnected banks and mortgage brokers working together to provide various loan products to both consumers and businesses. We will provide three succinct examples that demonstrate the need for better IQ and greater adoption of standards in the MB industry.

The process by which a loan is originated and finalized can be tedious and potentially full of IQ errors. One of the most prevalent IQ error problems comes from mortgage loan applications being entered by hand on average seven times between the initial loan application and the final loan approval, i.e. at various stages along the entire value chain [5]. This, unfortunately, is still necessary due to the various

software incompatibilities and lacking of standards. Consequently, IQ errors develop and reside throughout the system and may be difficult to locate and correct. With the addition of automated underwriting and eMortgage, the mortgage lending industry has attempted to reduce the number of human errors by automating the lending process. But practically, the automation process itself has not yet been perfected, in spite of enormous diffusion and adoption efforts by MISMO, due to the complexities of granting credit to credit-worthy consumers and businesses and the lack of wide-spread adoption of industry wide standards and policies within the industry.

Moreover, the MB industry suffers from the proliferation of over 30,000 proprietary forms still being used by local/regional mortgage banks, brokers, realtors, assessors, underwriters, servicers, vendors, insurers, recording companies, etc. [5]. One can readily imagine how this many forms can create compatibility, data capture and transfer as well as error problems [5].

A third industry-level example will suffice to make our case that there is a need to address IQ issues and implement standards in the MB industry: Many mortgage banks, including the top five mortgage banks, have so-called *Lost Mortgage Departments*. One of the top five mortgage banks has 295 employees in its department with this name [5]. These employees look for lost mortgages, although they are probably not really lost, but they are misfiled, not yet returned, i.e. they are located on someone's desk or shelf, etc. We would like to note, however, the relative importance of these documents, i.e. that the original mortgage document is a negotiable document and thus the real value—at least for transaction and selling purposes—is with this very document. In contrast one should note that MISMO has developed standards for its eVault, an electronic secure and tamper-proof vault in which mortgages could be organized, deposited and viewed. As a consequence of the eVault standards adoption, mortgages would never be "lost".

To help understand how a vast amount of mortgage data is accumulated through the lending process, a representative selection of methods used by the MB industry to gather and utilize data is helpful. According to the MBA [6], data in the mortgage industry comes in a variety of structured and unstructured data formats such as:

- Paper documents
- Scans and faxes
- Electronic files in multiple formats such as extensible markup language (XML)
- Desktop Underwriter (DU)
- Comma-separated Values (CSV)
- Microsoft Excel Spreadsheets

These data formats cover the universe of the traditional loan files plus additional innovative new data sources in the process such as Automated Valuation Model (AVM) data [6]. The data coming from so many sources in so many formats exacerbates its tracking, management and overall IQ problems. These disparate sources of data make management for loan transactions complicated and error-prone since the data come from and are managed by different sources and are, therefore, difficult to validate [6]. The emerging trend in the mortgage industry is the true mainstream adoption of eMortgage [6], which combine standardized (MISMO) XML data, a view or image of the document and tamper-evident seals all in one file. eMortgages can be algorithmically checked for their integrity to ensure IQ [6].

In nearly all industries, the idea of creating industry wide standards has been around for a good number of years. The most prominent voice for industry wide standards in the MB industry is MISMO. MISMO was created to promote and support the common business interests of the commercial and residential mortgage markets [7]. Its mission is to benefit industry participants and consumers of mortgage and investment

products and services by fostering an open process to develop, promote, and maintain voluntary electronic commerce procedures and standards for the mortgage industry [7]. This is also accomplished by enabling mortgage lenders, investors, servicers, vendors, borrowers, and other parties to exchange real estate finance-related information and eMortgages more securely, efficiently and economically. More than 150 subscriber organizations, including mortgage bankers, lenders, servicers, vendors and service providers, support MISMO's efforts. MISMO has working agreements with other major data standards development organizations and has developed a repository of industry data elements stored in a common data dictionary used to create all MISMO transactions. MISMO supports free and open access to its standards, which enables companies to begin integrating MISMO standards into everyday business practices immediately [7].

Through industry cooperation and participation MISMO develops, promotes and maintains voluntary electronic commerce specifications. Because of the strong degree of industry input and support, MISMO creates necessary solutions that are being used successfully and implemented throughout the industry. These solutions include open and effective standardized e-commerce transactions, an eMortgage technology framework, information security guidelines and methodologies and related specifications along the entire industry value chain [7].

MISMO data standards make e-commerce transactions more efficient for the industry and open the door to groundbreaking innovations, such as the use of the electronic mortgage (eMortgage) feature [7]. MISMO's standards cover four broad areas [7]:

- *Residential Standards* cover the entire mortgage life cycle, from origination, automated underwriting and service fulfillment through loan administration and investor reporting.
- *Commercial Standards* represent the most advanced and flexible way to transmit complex information on commercial and multifamily mortgages.
- *eMortgage Specifications* provide a path for the industry's evolution from paper-intensive to legally acceptable and truly paperless, including an eVault for mortgages..
- *Information Security Guidelines* support the information security concerns of other MISMO workgroups providing industry security-related recommendations, and general security educational material.

For this research, the discussion of the mortgage industry requires an understanding of how IQ problems can be created during the lending process. Therefore, a brief explanation of the lending process within the mortgage industry is useful. To begin, selling and buying a house can be divided into four discrete stages:

- Listing
- Search
- Negotiation
- Closing

The first stage in the process is ***listing,*** where a prospective seller puts the house on the market. Sellers can market the house themselves or they can contract with an agent to represent them. Central to this in the U.S. residential real estate process is the Multiple Listing Service (MLS): a shared database of properties for sale in a specific city or larger metropolitan area. When a listing agent signs a contract with the seller of a property, the agent enters a description of the property in the MLS database. Originally, the MLS was shared exclusively, i.e. not available to actual buyers and sellers, among agents and brokers as a monthly printed book combining listings from all its local members. Currently, all of the more than 200 companies providing MLS rely on computerized (and, increasingly, online, web-accessible and now public) databases. De facto the agents and brokers have been, at least partially, disintermediated.

The MLS for a particular metropolitan area is usually owned by the local realtors organization (the "Board") but typically operated by a specialized, yet separate MLS company. Real estate agents pay an annual fee to participate in the MLS. Typically, membership in the realtor association is required to join the MLS. This membership also covers dues for the National Association of Realtors (NAR) (see www.realtor.org). Real estate agents who are members of the NAR are called 'realtors', a trademarked term.

Most MLS databases are based on proprietary technology and were developed to handle specific regional issues. Currently this degree of customization makes it difficult for one MLS database system to easily interoperate with others. As we note below, regional MLS are aggregating. What gets reported on the Internet-accessible realtor site (see www.realtor.com) reflects a subset of data available in an MLS database.

A prospective house buyer can *search* for properties advertised online, in newspapers, by posted signs, and working with an agent. Agents who are members of the MLS can search the MLS database for properties that fit their clients' needs. Usually the buyer physically inspects several potential properties before deciding which to buy, with the buyer's agent making the arrangements for these visits and accompanying the buyer. The agents can more easily show MLS-listed properties because the access to MLS-listed properties is made available to other members of the MLS (through a "lock box" to which members have access, attached to the front door handle of the property). Newer electronic lock boxes can record all accesses to the key, providing the selling agent a record of who has viewed the property. In areas where traditional lock boxes are used, custom dictates leaving a business card to show who visited. Thus, the MLS is more than just an information repository since it includes services and agreements that shape the relationship among agents and becomes an important element within the value chain.

Once a property is selected, the buyer's agent provides advice (to the buyer) on making an offer to purchase the property and helps in the *negotiations* and details of the transaction. The listing agent provides advice to the seller. When an offer is made and accepted there are typically a set of contingencies on the contract that need to be addressed. These contingencies typically include the buyer's financing, inspection and appraisal of the property, etc. Both the listing and selling agent typically help by providing access to resources to address these issues. For example, a buyer's agent might refer a buyer to a lender, house inspector or other necessary professionals. A listing agent might suggest several repair personnel to help the seller redress work demanded by the buyer.

The final stage of the transaction is the *closing*, at which the title to the property and the payment changes hands. At the center of this transaction is the HUD1 form. This form is mandated by the U.S. Housing and Urban Development (HUD) Agency via the Real Estate Settlement Protection Act (RESPA) of 1974. The RESPA is decided on by HUD. The HUD serves as the overseer of the commercial transaction of real estate in the same way the Securities and Exchange Commission provides oversight to financial transactions. The HUD1 form provides detailed information (in a line-by-line format split into two columns – one for the buyer and one for the seller, respectively) of the expenses incurred for selling and buying a property. The details reflected in the line items have been negotiated by a number of stakeholders and, in essence, serve to structure the closing. Real estate agents are typically paid at the closing, so their incentive is to engage parties in negotiation and to reach closing.

In finalizing a residential real estate transaction, the HUD1 form and the purchase and sales (P&S) contract are central documents and together help to structure the process of buying or selling a property. The contracts made between real estate agents and both buyers and sellers help to structure the listing and seeking aspects of the process. The contract between a real estate agent and a broker or owner structures the agency. Broker/owners and agents participate in the MLS and this provides them a means to share

their information on houses for sale (listings) with others who also belong to the MLS (or access the MLS via online and offline sources). Along the way, both buyers and sellers enact contracts with a range of value-adding service providers including mortgage-providing financial services firms (such as local banks), home inspectors, and lawyers. In this way the entire set of players involved in a real estate transaction is driven by contractual relationships. It is the structure and form of these contractual arrangements that define the core of the residential real estate industry.

The RESPA and its HUD1 form are also shaped through the ongoing interaction among a number of professional associations and large players. Most of these associations and players have a significant presence in Washington, DC and, in these interactions, engage in policy discussions and policy shaping that gets instantiated in HUD1 and RESPA. These associations and players include (as a representative, not exhaustive, list): the HUD, Fannie Mae and Freddie Mac (the government sponsored enterprises (GSE) guaranteeing most mortgages in the U.S., the NAR, the Mortgage Bankers Association, the Appraisal Institute, American Land Title Institute, The Real Estate Service Providers Council, Cendant and others.

In the following, we define the information quality dimensions that are the most applicable to this research on the mortgage banking industry. The IQ dimensions are fully discussed in the results section. Each dimension's definition comes from the Wang and Strong framework [8]. The IQ dimensions used in this research are:

- Accuracy - defined as the extent to which data is correct and reliable
- Completeness - defined as the extent to which data is not missing and is of sufficient breadth and depth for the task at hand
- Consistency - defined as the extent to which data is presented in the same format
- Quantity of Data - refers to the amount of data
- Accessibility - the extent to which data are available or easily and quickly retrievable
- Timeliness - defined as the extent to which the data is sufficiently up-to-date for the task at hand

All of these dimensions are fundamentally related and can enhance or restrict each other depending on the methodology and context in which they are applied. Although these dimensions are generalized within the IQ field, functional meaning or purpose can only be derived when these dimensions are applied in a contextual area or field of study. With this research, the IQ dimensions are used to illustrate the IQ issues within the MB industry. Since these IQ dimensions represent a widely accepted framework for IQ research, they are appropriately used to gauge the IQ issues in the MB industry.

RATIONALE AND PURPOSE

The current financial crisis, credit crunch and the mortgage industry meltdown provide the mortgage industry with unprecedented challenges and opportunities for the development and deployment of standards and policies within their organizations. As MB companies continue to spend a large portion of their information technology (IT) budgets on business intelligence applications such as data warehousing, customer-relationship management, data mining, marketing automation, and sales force automation, their organizations have become increasingly data-driven [9]. The importance of the quality of the underlying source data that feeds these applications has become increasingly higher [9]. Almost all employees come into daily usage of information that originates from a company's various databases [9]. Critical business decisions and allocations of resources are made based on information extracted from the data. Prices are changed, marketing campaigns created, customers are communicated with, and daily operations evolve around whatever data points are churned out by an organization's various information systems. In other words, companies are literally living and dying as a result of the information contained within their database systems [9].

In the mortgage industry, in order to deliver high-quality data, the mortgage lenders, mortgage underwriters, and mortgage brokers need to understand the sources of poor IQ and what can be done to correct this problem. They need to understand what can go wrong and how they can prevent, detect, and mitigate IQ issues. IQ issues arise from both the original suppliers of data and from the many transactions of data throughout the lending process. Adoption of the MISMO eMortgage standards and data specifications by mortgage lenders help standardize data formats, reduce data redundancy, increase transaction efficiency and storage security [10].

To help illustrate the IQ issues discussed in this research, a survey was conducted in 2002 by Ernst & Young of leading commercial mortgage lenders. This study was chosen as it illustrates well the underlying mortgage process. Moreover, this study is the only representative industry wide study of its kind (other than the 2008 MBA study discussed below). By presenting and discussing the results of this study, a revealing look into the mortgage industry was provided that portrayed the overall lending process as inefficient and the technology used as inadequate [11]. In fact, these same lenders have lamented the inefficiencies of the commercial lending process due to the inadequacies of existing systems to track the progress of transactions and data transfers [11]. In the overall conclusion, this Ernst & Young study also revealed that major mortgage lenders lack adequate information on the cost of their operations [11]. As a recommendation, the researchers suggested a renewed focus on technology-enabled process improvements to better a lender's competitiveness, ease the strain on both the organization and operations, and enhance profitability [11]. This study provides ammunition for the standards movement pioneers, such as MISMO, to cajole major mortgage industry leaders into, at the very least, the possibility of embracing industry wide standards for the MB industry.

From this study, additional information was gathered as to the trends in the mortgage lending process. In the current credit crunch, the efficiency of the lending process has become urgent because of two key trends in the market: narrowing of profit margins due to increased competition and advances in technology that are specifically designed for commercial mortgage lenders [11].

In a similar study by the MBA in 2008, the results provided insight into how credit worthiness is determined for both individuals and companies seeking credit. The results found that due to the lack of standards throughout the mortgage banking industry, credit was consistently issued to both individuals and companies that should not have received credit at such levels. This was due to the credit rating system being based on an outdated model for determining credit worthiness [12]. The credit rating model was based on more traditional loans and borrower behavior that are now outdated [12]. In fact, the MBA released its findings showing that mortgages in one out of every four family homes were in a state of delinquency in the fourth quarter of 2007 [12]. Although the problems illustrated by the MBA's report cannot place blame solely on IQ problems within the MB industry, a sizeable percentage can be traced back to lack of standards within the industry as well as the committing of sheer fraud. With credit agencies using outdated models to base credit worthiness, system wide IQ problems with the MB industry's credit granting process are likely to continue.

At a 2008 MBA conference of IT professionals in the MB industry, an almost uniform answer was given by IT professionals in regard to one of the major reasons for the mortgage meltdown: IT was not used properly in the mortgage lending process [13]. In fact, one of the keynote speakers received the greatest applause when saying, "Don't blame us for the problems; we just provided the tools to implement the guidelines set by others. When used properly, technology can help connect worthy customers with credible lenders and assure solid investments [13]." All of the recommendations from this IT conference are based on the underlying theme that the MB industry, as a whole, must pursue and adopt industry wide standards to ensure the guidelines used in future MB lending IT solutions are both accurate and consistent [13].

A few examples of major MB companies embracing MISMO standards illustrate how such efforts are helpful. GMAC ResCap's Chief Technology Officer Rob Lux admits that: "GMAC ResCap has reaped the benefits of MISMO for many years in a wide variety of areas and has utilized MISMO to act as the critical foundation for our service oriented architecture (SOA) platform, which enables business transactions with trading partners, define the common data elements for our Enterprise Data Warehouse, and build and provide an eVault service to our customers. By using MISMO our company has reduced costs, enhanced speed to market and improved data quality. MISMO is truly a core technology strategy for GMAC ResCap [10]."

In another example, Ron Duff, Fiserv Lending Solutions' senior vice president (SVP) of IT believes that: "The use of the MXCompliance process is helping accelerate the adoption of MISMO standards among mortgage industry trading partners. And MISMO is always delighted to see more technology vendors working to get their products certified—it makes the mortgage process faster and more affordable for both lenders and borrowers [10]."

The following section describes our findings.

RESULTS
This research was conducted through literature reviews of representative Mortgage Banking Association's industry journals such as *Mortgage Banking*, conference proceedings, white papers, and resources available on the websites of mortgage companies and standards organizations. We included all of the generally relevant and authoritative mortgage industry publications. These publications included salient mortgage issues addressing problems and concerns that highlight and bring MB problems to the surface to be addressed. However, we focused primarily on the *Mortgage Banking* journal since it has the most prominent voice in the MB industry. Additional resources, such as conference proceedings, white papers, and industry websites, such as the Mortgage Banking Association's website, provided invaluable information regarding the MB industry and the overall lending process. Furthermore, this research focused on resources within the last three years of publication to ensure the most recent information was used in our study.

Through this literature review process, it became evident that a plethora of articles, journals, and industry experts are supportive of eMortgage standards and have demonstrated how they have helped improve data quality in the mortgage lending process for the MB companies that have embraced them [7]. This is due largely to MISMO standards helping to save time, reduce costs and improve data accuracy and transparency while passing cost savings to consumers. Through the support of its 150 subscribers, MISMO provides free and open access to its standards [10]. This accessibility to MISMO standards enables subscriber companies to begin integrating the standards into everyday business practices. Organizations adopting MISMO standards are able to operate more efficiently and improve their bottom lines. Companies using MISMO standards can reduce costs in data management, improve their data quality and save time in interface development. One service provider reported using MISMO standard XML data transactions reduced interface development time from six months to a few weeks [10]. MBA research indicates that significant cost savings, income gains and process efficiencies are achievable through the use of standards [10]. Mortgage bankers, lenders, servicers, vendors and service providers are adopting MISMO standards to promote consistent data usage and understanding throughout the industry. Use of one common set of data can dramatically improve data quality and purity and thereby boost investor confidence in mortgages as an asset class [10].

In making an assessment, the previously mentioned IQ dimensions have been utilized to provide a set of predefined IQ principles by which this research can gauge the current state of IQ in the MB industry. In doing so, the IQ dimensions are discussed in detail with each IQ dimension's applicability to this research. Each is defined and applied to this research, starting first with Accuracy.

Accuracy: Accuracy has been defined as the extent to which data is correct and reliable [8]. Of all the IQ dimensions, Accuracy in MB data is of the highest importance. From our literature reviews, inaccurate loan data nearly always has a detrimental effect in the lending process and can cause system wide errors. Our findings provided numerous articles proposing the idea of improving the accuracy of MB data by using, e.g., automated underwriting systems (AU) that rely heavily on uniform standards. These same articles, however, conceded AU is a long way from accomplishing this goal due to the lack of said standards' implementation. Without these standards, data cannot be trusted to have a high degree of accuracy. This is just one example of how improving accuracy in the MB industry will be a difficult task due to the highly complex nature of the lending process and also due to the large amount of heterogeneous data used in calculating mortgage information. Inaccurate data is a plague for systems in nearly all industries, and the MB industry is no exception. Improving accuracy through standardization has been around since the dawn of the industrial revolution. Identifying potential areas of improvement in a production process came from the pioneering work of Shewhart and his use of control charts to locate the assignable causes of variation [14]. Shewhart went on to demonstrate that accuracy can be improved by identifying employees that require additional training. Accordingly, MB industry employees can be indentified for additional training to help reduce the number of human errors made in the mortgage process.

Completeness: The completeness dimension is defined as the extent to which data is not missing and is of sufficient breadth and depth for the task at hand [8]. Ballou and Pazer [15] argue that the completeness dimension includes two components: structural completeness and content completeness. Applying the completeness dimension to our research on the MB industry provides a simple, yet highly accurate statement: the lending process cannot function properly without complete loan data. The MB industry needs both structural completeness and content completeness of loan data to make an accurate loan decision. Without complete loan data, applications for mortgages cannot be approved, and will be delayed until the required data is received. As with Accuracy, our findings suggest the MB industry is implementing AU to ensure completeness of loan application data. Although AU is a still a problem for Accuracy, AU is helping with Completeness. In each step of the loan process, complete information must be entered into the system before the borrower can proceed to the next step. It should be noted, however, the information entered is not necessarily accurate. This dimension is closely related to the timeliness dimension (see below). In some cases, loans can still be approved while lacking loan data. This is directly related to the accuracy dimension. Loan information may not be accurate due to missing data and vice versa. This can be due to fraud or inefficiencies in the mortgage lending process. Only by ensuring the loan data is both accurate and complete can a correct loan decision be made.

Consistency: The consistency dimension is defined as the extent to which data is presented in the same format [16]. It also refers to the use of common data formats from system to system and application to application [6]. This is perhaps one of the most critical IQ problems within the MB industry. In one example from our findings, credit would be issued by MB companies using differing credit models to establish credit worthiness. Some MB companies would issue a high line of credit to an individual or company that other MB companies would not issue any credit at all. These credit rating systems used by some MB companies utilized outdated credit scoring models that did not include important data when making a credit worthiness decision. This

inconsistency in the MB industry greatly increased the risk of an MB company to acquire a toxic asset. Without industry wide standards and policies, data is recorded inconsistently since every MB company has its own recording system. In this research, this problem has been a principal complaint from a multitude of MB information workers. With each mortgage bank using its own system, IQ problems are created across database systems when submissions of data between mortgage brokers and mortgage lenders occur. With industry wide standards, the IQ problems can be lessened. The effort to achieve data consistency also poses one of the greatest challenges to the industry to implement standards. Each MB company has its own trade secrets and will not want to share how it values a potential customer for a loan. Implementing an industry wide standard for consistency in all MB companies could be problematic unless MB industry leaders are willing to step up and lead the way by embracing standards and challenging their peers to do the same.

Quantity of Data: This term refers to the quantity of the data [6]. In the MB industry information overload occurs when there is too much data for an individual to process. In the literature reviews, the results showed that when data is processed by hand, and possibly reentered up to seven times during the course of the mortgage transaction [5], this can lead to errors of omission and delay. When faced with a plethora of written data, the probability of omitting words becomes higher as each MB information worker attempts to manually process the data or correct an error in the system. Thus, quantity of information can be a serious IQ problem [6]. The automated underwriting and eMortgage solutions are being incorporated into many MB companies to help combat this problem, but the lack of standards are keeping them from being truly effective at minimizing IQ errors due to overwhelming amounts of data. By utilizing MISMO's eMortgage specifications, MB companies can reduce the overall amount of loan data handled in paper format. The storage of loan data in a data warehouse can significantly improve data security and accessibility as well. The standardized automation process could also help improve the accuracy and completeness of mortgage data by reducing the number of human errors.

Accessibility: The accessibility dimension is the extent to which data are available or easily and quickly retrievable [6]. In this research, accessibility of mortgage data by both consumers and MB lenders is a serious IQ problem within the MB industry. Easy accessibility of online application forms for customers, and swift accessibility of accurate customer information to mortgage lenders can help improve effectiveness, quality of the loan applications, and the approval process by reducing the traditional paper based forms and associated errors due to completing information multiple times by hand.

By improving the accessibility of mortgage information, consumers are given options they did not have in the past. Using the most current credit rating, consumers can obtain the best possible interest rate based upon their credit tier. To be competitive, MB companies can also reference a potential home buyer's credit rating and offer a more competitive interest rate. In doing so, the number of offers a consumer can choose from when shopping for a mortgage increases. Consumer choice in mortgage interest rates drives competition and can help promote innovation within the MB industry.

Timeliness: This dimension is defined as the extent to which the data is sufficiently up-to-date for the task at hand [8]. Regardless of the industry, when consumers become impatient due to waiting for an event to occur, they will typically take their business elsewhere. For individual MB companies, this problem translates into lost sales. As mentioned above, incomplete loan data, whether the fault belongs to the consumer or the MB company, can make a difference in the timeliness of the mortgage processes' total time to complete the transaction. If the deal takes too long, potential home buyers can lose their patience, and change to another mortgage bank, or give up the mortgage process entirely. In either case, this result translates into lost sales. One example

of timeliness is the speed with which a mortgage applicant's credit worthiness can be established. It was not too many years ago when prior to the advent of the Internet that processing a mortgage application (completed by hand on paper forms by the applicant) took a full six weeks to process until a decision was communicated to the applicant. Those six weeks of processing time have shrunk today to three to five minutes.

Since all of the IQ dimensions mentioned in this research are intertwined in the MB industry, it is a combination of factors that contribute to the timeliness problem. No single IQ principle can be used to improve a timely mortgage transaction, but instead a combination of the other IQ dimensions help to bring about a timely process. An MB industry commitment to improve IQ through standardization could improve the timeliness of the mortgage lending process and thereby help reduce the number of lost sales.

After discussing our findings along the six IQ dimensions chosen for the present study (Accuracy, Completeness, Consistency, Quantity of Data, Accessibility, Timeliness), we present our discussion, limitations and conclusion sections below.

DISCUSSION

This research does not intend to assign blame for the mortgage crisis. Instead, we attempt to illustrate how introducing and embracing industry wide standards can improve the IQ within the MB industry. With our findings supporting the possibility of reducing costs and risks, one would think the entire mortgage industry would readily jump at the opportunity to fully embrace MISMO's mortgage industry standards. The MB industry, however, has been slow to adopt these standards. This is not a phenomenon restricted to the mortgage industry alone. Throughout modern history, companies have been reluctant to embrace new standards [2]. Many factors contribute to the lack of or seeming slowness in adoption of industry standards, i.e. vertical standards, but none more so than companies being unwilling to be the first to invest time and resources in implementing such standards. This mindset, dubbed the *penguin effect* [17] is viewed as analogous to a number of penguins floating in the ocean on a floe: a given penguin within a group of peers is afraid to enter the water first for fear of being eaten, analogously due to the notion that the first company to implement a particular vertical standard will undertake a substantial financial risk and thus potentially lose when compared to its competitors. If the company wagers its financial future by adopting a particular vertical standard, and the industry adopts another, that company could possibly be facing considerable risks. This fear of financial risk is ever prominent in the minds of innovators and early adopters of any new standards. In the mortgage banking industry, embracing of new industry standards is a difficult pill to swallow. This line of reasoning can also be supported by casual observations: When we talked with mortgage bankers in 2007 why they do not adopt MISMO standards, we were told that times are too good and that they were making too much money, but to worry about implementing time-consuming standards and thus lose out in the then-strong money making process. When talking with the same companies today the argument is advanced that today introducing standards is too costly and that the firm cannot afford this at the present time.

The application of the IQ dimensions within this research provides a means by which the current state of IQ in the MB industry can be ascertained. Moreover, the IQ dimensions chosen were shown to be applicable to the MB industry in all facets of the lending process. In using these dimensions, we illustrate how the conceptualized IQ framework from Wang and Strong [8] can be applied to this real world situation.

LIMITATIONS

A full assessment of the current state of IQ principles and policies in the MB industry would be ideally measured by using an IQ methodology such as AIM Quality (AIMQ) [18]. AIMQ provides a comprehensive measure for an organization's IQ and provides a benchmark to compare its efforts against its competitors [18]. AIMQ uses IQ models, questionnaires, and analysis techniques to interpret and assess an organization's IQ. With this comprehensive analysis, future research could provide support to the validity, reliability and representativeness of this study. Unfortunately, AIMQ cannot be utilized in this study due to its requirement for a series of surveys to be distributed to the information consumers. With the current mortgage crisis, obtaining sufficient survey results from a large portion of the industry would be difficult with many MB employees being laid off. For future research, the AIMQ methodology could establish an IQ benchmark within the MB industry for standards and policies. This benchmark could also provide a keen insight into how organizations adopt policies and standards and its effects on the industry.

CONCLUSION

Based on countless news articles as well as our mortgage banking literature reviews, we discovered a small, but growing movement among the prominent players in the MB industry to adopt industry wide standards. This movement clearly shows that in order to survive in the current economic crisis and to prosper in the future, MB companies should move towards adopting industry-wide standards as developed and proposed by MISMO's eMortgage data specifications. In addition, these reviews also show the applicability of the aforementioned IQ dimensions. More specifically, the IQ dimensions can be used as a guide to assist with the assessment of IQ issues within the MB industry. This can be done by ensuring problems, such as providing the most up-to-date credit scores for potential buyers, are identified and corrected in the beginning of the mortgage lending process. In essence, finding and correcting small problems before they grow into large problems which in turn threaten buyer success in attaining a mortgage.

With industry-wide implementation of these IQ principles, MB expert systems could automate much of the lending process and thereby help reduce errors. In addition to the automated expert systems, highly trained MB employees can perform random sampling of the applications to ensure the highest levels of accuracy are being employed. By utilizing Shewhart's control charts, MB employees can continuously monitor and improve information quality in the mortgage lending process by indentifying and removing any underlying assignable causes that affect data quality.

Only through the adoption of standards and policies will mortgage companies be able to improve more efficiently and effectively the information quality of their mortgage data throughout the lending process value chain. Subsequently, with standards in place, mortgage banking companies can make serious in-roads into regaining profitability. Once a brave few mortgage companies dive into the water, the *penguin effect* in standards adoption will lessen and other mortgage companies will be more apt to join in the standards fray. With this in mind, it should be noted that a good number of mortgage companies have already embraced MISMO's eMortgage standards applications. In time, with perseverance and the diffusion of additional success stories more companies could and should follow suit.

REFERENCES

[1] M. L. Markus, C. W. Steinfield and R. T. Wigand, "E-commerce Business Models in the US Home Mortgage Industry," *ebusiness.tc.msu.edu*, paragraph. 1, [Online]. Available: http://ebusiness.tc.msu.edu/netindustry/page2/files/NSFmortgageWP1.pdf. [Accessed: June 12, 2009].

[2] M. L. Markus, C. W. Steinfield, R. T. Wigand and G. Minton, "Industry-wide Information Systems Standardization as Collective Action: the Case of the U. S. Residential Mortgage Industry," *MIS Quarterly*, vol. 30, pp. 439-465, 2006.

[3] C. Fisher, E. Lauria, S. C. Smith and R.Y. Wang, *Introduction to Information Quality*, First Edition, Cambridge: MIT IQ Program, 2008.

[4] Y. Wand and R.Y. Wang, "Anchoring Data Quality Dimensions in Ontological Foundations," *Communications of the ACM*, vol. 39, no. 11, pp. 86-95, 1996.

[5] R. T. Wigand, C. W. Steinfield and M. L. Markus, "Information Technology Standards Choices and Industry Structure Outcomes: The Case of the U.S. Home Mortgage Industry," *Journal of Management Information Systems*, vol. 22, no. 2, pp. 165–191, 2005.

[6] G. Minton and A. Young, "Data Quality Matters," *Mortgage Banking*, pp. 56 – 61, April 2009.

[7] "Specifications and Guidance," June 10, 2009. [Online]. Available: http://www.mismo.org/SpecificationsAndGuidance. [Accessed: June 10, 2009].

[8] R. Y. Wang and D. M. Strong, "Beyond Accuracy: What Data Quality Means to Data Consumers," *Journal of Management Information Systems*, vol. 12, no. 4, pp. 5-34, 1996.

[9] B. Brauer, "Data Quality: Spinning Straw into Gold," June 10, 2009. [Online]. Available: http://www2.sas.com/proceedings/sugi26/p117-26.pdf. [Accessed: June 10, 2009].

[10] "Why MISMO," Jun. 10, 2009. [Online]. Available: http://www.mismo.org/AboutMISMO/WhyMISMO.htm [Accessed: June 10, 2009].

[11] J. Rubin, "The Impact of Operational Efficiency on Profitability: A White Paper for the Commercial Mortgage Lending Industry," *CMBS World*, vol. 3, no. 4, pp. 62-76, 88-89, 2002.

[12] J. Milligan, "The Model Meltdown," *Mortgage Banking*, vol. 68, no. 7, pp. 42-47, April 2008.

[13] E. Jones, "What's Next for Technology?," *Mortgage Banking,* vol. 68, no. 6, pp. 56, March 2008.

[14] D. Wheeler and D. Chambers, *Understanding Statistical Process Control*, pp. 143-147. Knoxville: SPC Press, 1992.

[15] D. P. Ballou and H. L. Pazer, "Modeling Data and Process Quality in Multi-input, Multi-output Information Systems," *Management Science,* vol. 31, no. 2, pp. 150-162, 1985.

[16] L.L. Pipino, Y.W. Lee and R.Y. Wang, "Data Quality Assessment," *Communications of the ACM*, vol. 45, no. 4, pp. 211-218, 2002.

[17] R. T. Wigand, C. R. Steinfield and M. L. Markus. "Impacts of Vertical IS Standards: The Case of the US Home Mortgage Industry," *Proceedings of the 38th Hawaii International Conference on System Sciences*, pp. 1-9, 2005.

[18] Y. W. Lee, D. M. Strong, B. K. Khan and R. Y. Wang, "AIMQ: A Methodology for Information Quality Assessment, *Information and Management*, vol. 40, pp. 133-146, 2002.