

DATA QUALITY ISSUES IN THE US MORTGAGE ORIGINATION PROCESS

(Completed Paper)

Apolonia Lintag

University of Arkansas in Little Rock

adlintag@ualr.edu

Abstract: The US mortgage origination process is comprised of a complex set of activities and events. In this paper, the data quality issues that arise in the US mortgage origination process were examined through a literature review and analysis. The event-driven process chain technique was used to map out data quality issues within the origination process. This publication reviews the problems and complaints of people related to the mortgage origination process.

Key Words: Origination Process, Event-driven Process Chain, Data Quality Dimensions

INTRODUCTION

The US mortgage origination process has come under renewed scrutiny due to recent events in the housing market. One way to scrutinize the mortgage origination process is from the perspective of data quality. In this paper, data quality (DQ) issues were mapped out through an Event-driven Process Chain (EPC) so as to identify potential locations in the mortgage origination process where these issues might occur. The main focus of the study is to review the mortgage origination process, to define the DQ issues associated with the process, to evaluate which phases are the most problematic areas in origination process in terms of DQ issues, and to propose recommendations for improvement.

The Bank of America's five-step mortgage process blueprint was chosen as a guide to model the origination process because its mortgage processes are well-documented. It is also one of the banks in the US that has the largest volume for online mortgage applications, according to www.compete.com. Since there are many different origination forms used in the US, it was determined that only a few should be chosen—provided by Bank of America online. Data quality issues were tabulated against Bank A's mortgage origination process to published articles in the literature that pertain to people's complaints with the mortgage origination. In this way, the data quality issues that were gathered can be referred back to the process chain in order to better understand why certain data quality issues occur. The sources for this study came from online articles, journals, and other publications collected between January 2008 and May 2008.

BACKGROUND

Overview of the US Mortgage Origination Process

The five-step blueprint of the Bank of America's mortgage origination process (Appendix) was chosen as the model for this workflow analysis. The five-step blueprint consists of the following; prequalify, complete application, provide information, sign final document, and manage the loan. Since mortgage origination is a vast process to analyze, processes were mapped out from the time the borrower contacts Bank A concerning a mortgage to the time the loan is issued. In this study, four out of the five-step

blueprint of the Bank of America’s mortgage origination process are analyzed. They are from prequalification to signing of the final document process. Bank A is the name given in this paper to model any generic bank for this process.

Event-driven Process Chain

To analyze its workflow, the five-step blueprint of the Bank of America’s mortgage origination process is modeled as an event-driven process chain diagram which represents its tasks or activities as a chain driven by its events. These tasks are further investigated to assess which phases in the US mortgage origination process are the most problematic areas in terms of data quality.

As shown in Table 1, an EPC diagram is comprised of the following constructs that depict events, functions, logical operators, organization units, and information objects. [2]






EPC SYMBOL	MEANING
 <p>Event</p>	<p>An event can be a trigger for a certain function (input) or a state reached after an activity (output)</p>
 <p>Function</p>	<p>A function can be a detailed task or activity that needs to be executed by a certain person. It requires one or more inputs and possibly produces one or more outputs. Examples are “get prequalified” and “determine mortgage rate.”</p>
 <p>XOR OR AND</p>	<p>There are three types of connectors that are used to connect functions and events: \wedge (AND) is used for parallel execution of function, XOR (exclusive or) is used for decisions when only of several choices is possible and \vee (OR) is used for decisions when one or more choices is possible.</p>
 <p>Organization Unit</p>	<p>The organization unit represents persons or roles in charge for a specific function. Examples are “Underwriting Department” and “Product & Services Department.” It is represented as an ellipse with a vertical line.</p>
 <p>Information or resource object</p>	<p>An information objects represent input or output to functions. Examples are, signed document, title insurance, customer and co-applicant.</p>

Table 1: Elements of Event-driven Process Chain Diagram

Details of the US Mortgage Origination Process

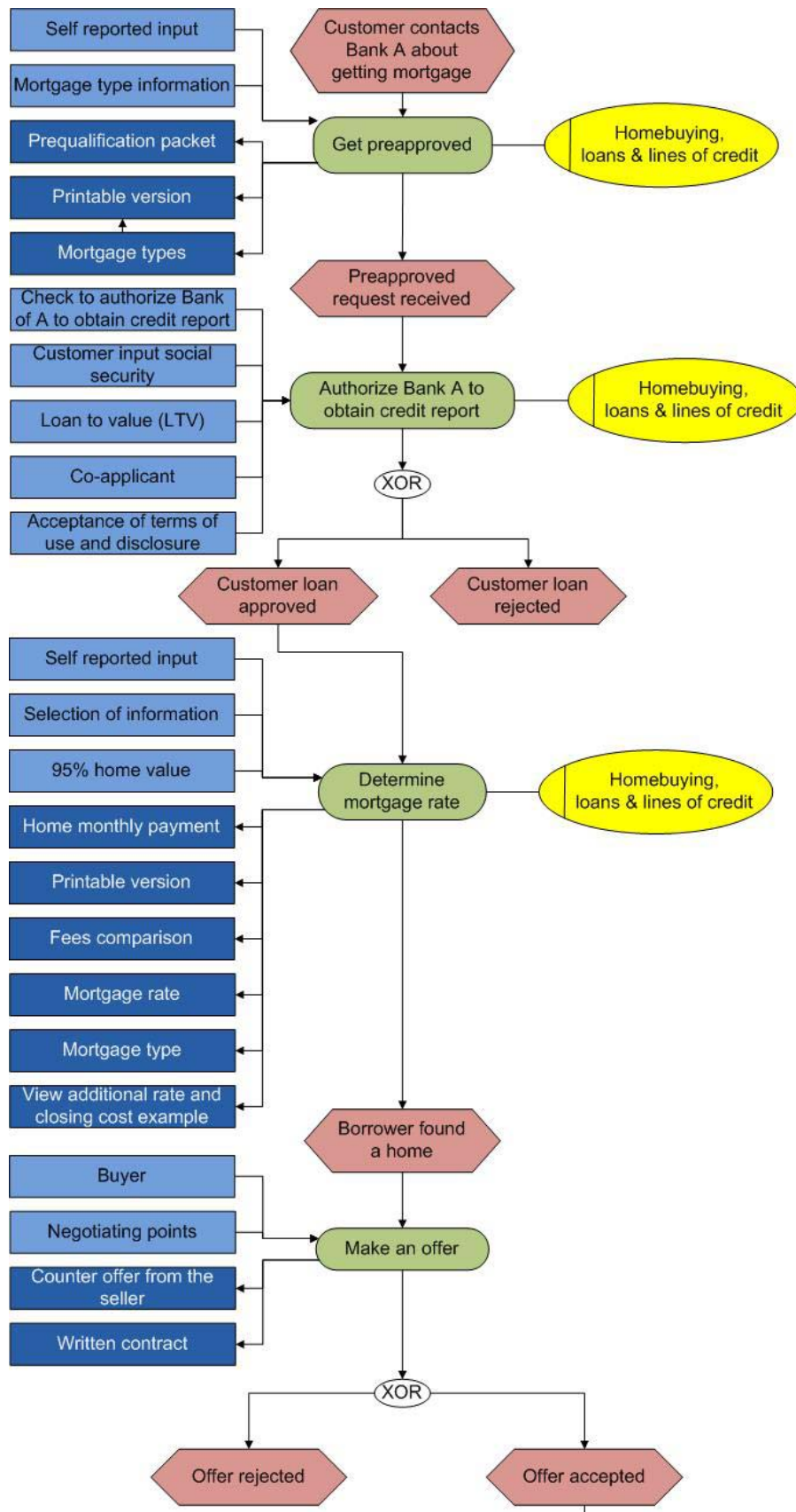
The first event modeled in Figure 2 begins with the customer who “***contacts Bank A about getting a mortgage.***” This event triggers the first function, the customer “***gets preapproved***” for the loan. This function is executed by the customer with self-reported information and is managed by Home Buying, Loans and Lines of Credit Department. It produces several outputs: prequalification packet, printable version and mortgage type. As a result of this function, the event, “***preapproved request is received***” occurs. Then, this event triggers the function “***authorize Bank A to obtain credit report.***” This function is managed by Bank A’s Home Buying, Loans and Lines of Credit Department. The inputs needed to execute this process online are; checking a box to authorize Bank A, customer input of social security number, loan to value (LTV), co-applicant, and acceptance of terms of use and disclosure. The XOR connector models the fact that after the execution of the function “***authorize Bank A to obtain credit report,***” one of the two events, “***customer loan preapproved***” or “***customer loan is rejected***” happens. If “***customer loan is rejected,***” the mortgage origination process stops.

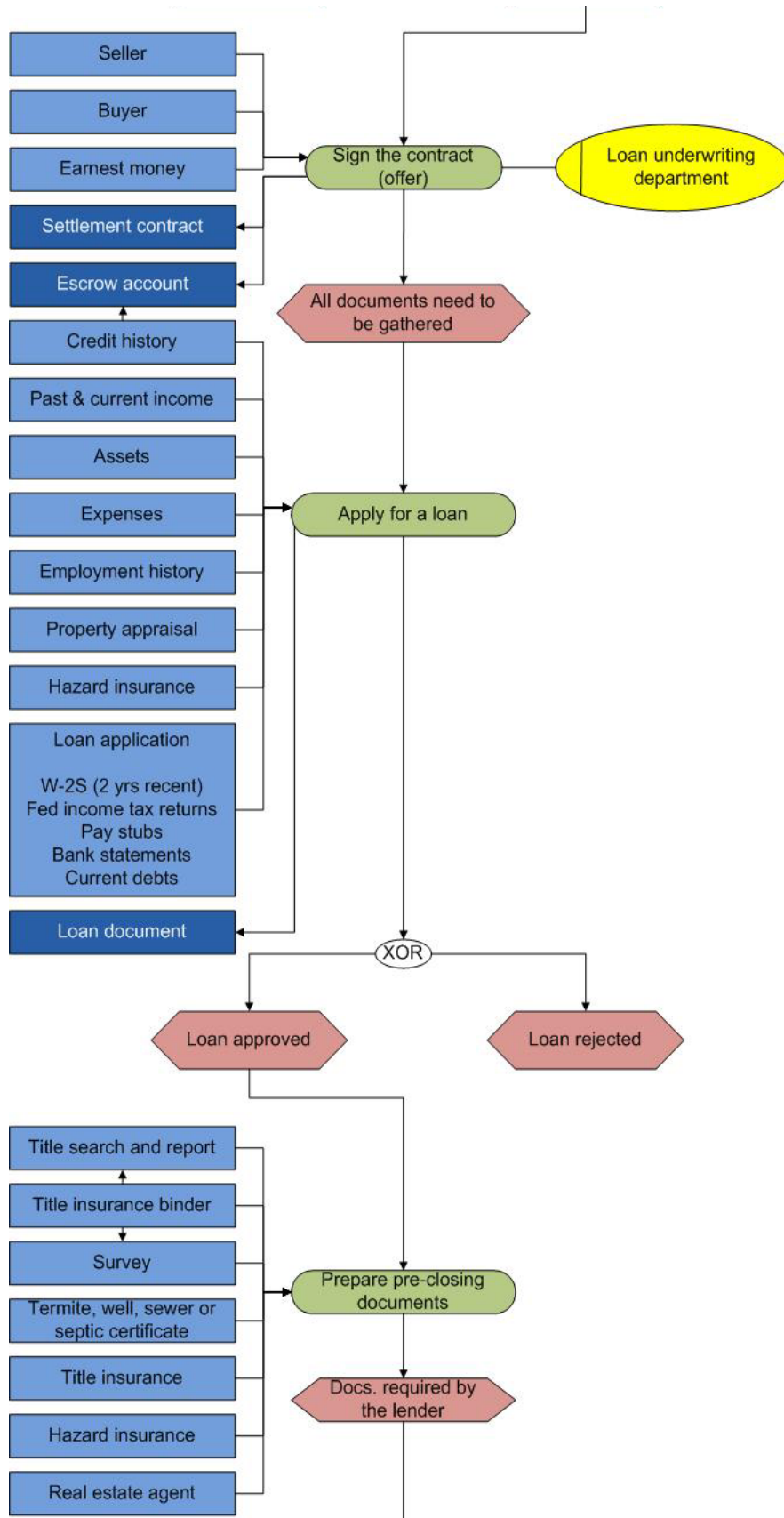
The next function is “***determine mortgage rate.***” There are a number of outputs produced by this function. They are hardcopies of information like fees comparison, mortgage rate, mortgage type, home monthly payment and the opportunity to view additional rate and closing cost online. Inputs are selection of information, self reported, and 95% home value (95% - maximum loanable amount). This function is also maintained by the Home Buying, Loans and Lines of Credit Department.

In this diagram, it is assumed that, the “***borrower found a home,***” which drive this borrower to the next function, called “***make an offer.***” According to Bank of America’s website, this offer is executed after some negotiating points have been made. These points determine what the bank offers for a home and what the seller might accept. The offer has to be written as a binding contract that should be reviewed carefully. Outputs are counter offer from the seller and a written contract of the offer. If the function, “***make an offer***” is accepted, then, the seller and the buyer have to “***sign a contract***” with the earnest money. The earnest money works like a deposit to show that the buyer or customer is interested. This serves as inputs to this function. Outputs are settlement contract and escrow account.

The diagram above suggests that since all “***documents need to be gathered,***” a function “***apply for a loan***” becomes the next step. The execution for this function requires several inputs such as past and current income, assets, expenses, employment history, hazard insurance, property appraisal, credit history and loan application which consists of W2s, Fed income tax returns, pay stubs, bank statements and current debts. A loan document is the only output. This “***apply for a loan***” function triggers two events. They are, “***loan approved***” and “***loan rejected.***” Assuming the loan is approved, the real estate agent of the customer is going to prepare the “***pre-closing document.***” The real estate agent has to collect the documents such as title search and report, title insurance binder, survey, termite, well, sewer or septic certificate, title insurance and hazard insurance. Aside from the pre-closing documents that will be prepared by the buyer’s real estate agent, there are other “***documents needed to be prepared by the lender***” in this event.

The next function allows the buyer to “***prepare other documents before closing.***” These other documents are loan documents, the deed, and the HUD1 Settlement Statement. The logical connector “and” is used because in preparing other documents before closing, the settlement document is reviewed by both the lawyer and the buyer. Lastly, both the buyer and the seller have to “***sign the documents for closing.***” These documents are the settlement statement (HUD1), the mortgage or the deed, and the note. Outputs for this function are signed documents and home keys. Conclusively, “***New home ownership***” is the final event for this process chain.





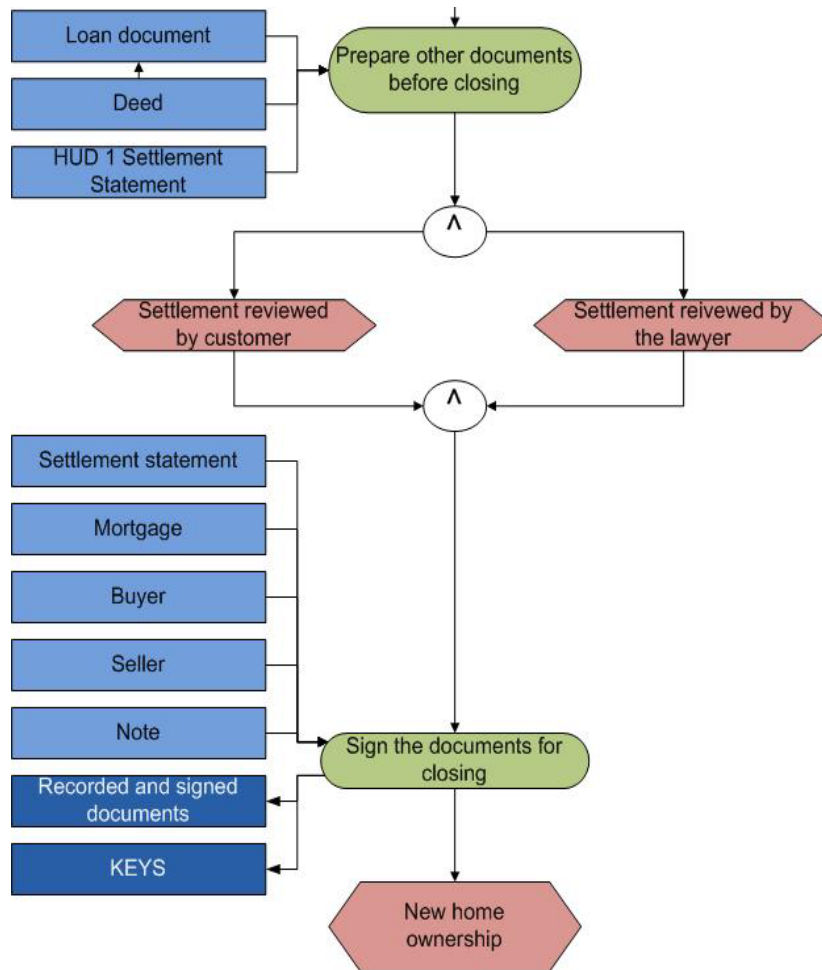


Figure 2: Event-driven Process Chain Diagram: Mortgage Origination process

ANALYSIS OF DATA QUALITY ISSUES ASSOCIATED WITH MORTGAGE ORIGINATION PROCESS

The literature concerning the mortgage industry origination process provides much insight into data quality issues. In analyzing which information quality dimensions are most frequently mentioned in the literature concerning the origination process, said dimensions must first be clearly defined.

The dimensions (Table 2) noted are believability, objectivity, value-added, reputation, consistency, accuracy, security, completeness, representational consistency, access, and ease of understanding. Fisher et. al. defines believability as the data item's credibility. A piece of data may be accurate, but it loses its usefulness if the user does not believe its accuracy. Objectivity is the data item's property to be unbiased and impartial. The data's believability is directly influenced by how objective the data is. If the data was collected and/or created in a judgmental process, the object's believability is decreased since people may not have much confidence in it. [4] Value-added refers to the "extent to which data is beneficial and provide advantages from their use" [4]. Basically, value added is defined as either an increase or decrease of value in direct proportion to the believability and/or reputation of the data. There is little value added to data consumer if, over time, the data's credibility deteriorates. [10]. Reputation is the data's background of believability. If inaccuracy is present in the collection and/or creation of data, it can accumulate

overtime leading to poor reputation. “A reputation for poor-quality data becomes common knowledge,” directly affecting the data’s believability and hence its usefulness. [10].

The consistency dimension concentrates on the representation of data values being the same in all cases. If for example, the representation of the gender attribute corresponds to 1 being male and 0 being female, this same system of differentiation should be applied to all databases. Consistency also means that there is no redundancy, and that the integrity of the data is kept. [4]. Accuracy determines the ability of the data to be representative of the real world. “Accuracy generally means that the recorded value conforms to the real-world value and refers to lack of errors.” [4].

Security and accessibility are inversely proportional, in a sense. If the data’s dimension of access is good, then security is hard to keep. If security is enforced beyond a point, then data will be hard to access [4]. Completeness is self-explanatory. It focuses on the data’s characteristic of being complete or incomplete. If data is missing, then completeness would be an issue. [4].

Representational consistency refers to the data’s consistency when represented to the user. For example, if measurable quantitative data is mostly represented in the metric system, then it should be represented consistently in this system alone. The data may be accurate but if its units or measure and etc. are not the same all throughout then the data risks inaccuracy over time. [4]. Ease of understanding merely means that the data must be “clear, unambiguous, and easily comprehended” [4].

Data Quality Dimensions

Data Quality Issue	Definition	Source
Believability	Data item's credibility	[4]
Objectivity	Impartiality of data	[4]
Value-added	Extent of data's beneficiality; increase or decrease of data's worth	[4]
Reputation	Data's background of believability	[10]
Consistency	Refers to the constancy of the representation of data; no redundancy	[4]
Accuracy	Ability of the data to be representative of the real world	[4]
Security	Data's characteristic of being safeguarded from too much access	[4]
Completeness	Refers to data as being all-inclusive or not	[4]
Representational Consistency	Refers to how constant the physical appearance of data is to the user	[4]
Access	Openness of data to allowed users	[4]
Ease of understanding	Clarity and comprehensibility of data	[4]

Table 2 – Data Quality Dimensions

Having defined all the dimensions that are focused on in this paper, the literature concerning the mortgage origination process was analyzed in order to determine the prevalence of data quality issues that the system is currently facing.

DISCUSSION

Problematic Areas and Why

The following are some discussions, current information quality issues and complaints of the mortgage origination, identified from the literature, as seen in Table 3. From the literature that was gathered, the US mortgage origination has a process that is geared towards not telling people the truth about information. Thus, the quality of information is basically overlooked in the mortgage origination process chain.

In terms of data quality issues cited by the literature, the most problematic areas of mortgage origination process identified in the EPC diagram and based from data quality literature summary table shown below, is **determining the mortgage rate**. It is observed that a lack of objectivity, believability, reputation, value-added, completeness, representational consistency and accuracy, are the most critical data quality issues in the mortgage origination process.

In *ARMs Aren't Always Behind Foreclosures' report*, the objectivity of the data influences the believability, reputation, and less added-value of the information from the point of view of the borrower. "It's not the loans alone that are causing the problems. Places with heavy concentrations of nontraditional loans and plunging home prices also typically have overextended buyers, homeowners with poor credit who couldn't qualify for conventional loans and speculators who planned to flip properties for a quick profit" [8]. Only those who have knowledge of mortgage products, like the brokers, are aware of these things possibly happening in the future. The borrowers not only started with higher rates, but were approved for loans they couldn't afford. If for example they started out at \$1,500 and moved up to \$2,500 per month, they might as well leave the house and rent an apartment. Here it shows that for the sake of quick profit on the part of the lender/broker, there appeared an objectivity problem in presenting the data to the borrower: the real outcome, or information, on the health of the economy. In spite of the lender's awareness that the borrowers can't afford the house, they fitted the borrowers with a certain mortgage for the sake of making a profit. The borrower would be put into a situation in which the borrowers would only know to refinance. However, the lenders/brokers do not inform the borrowers that they might be rejected since their credit history is being stretched out already from the start. The accuracy of the data and its completeness are obvious problems in this scenario.

In addition to the **determining the mortgage rate** process from EPC diagram, Steve Cocheo observes that completeness, objectivity, believability, reputation, value-added, and accuracy are all part of the process. The believability issue rises from "how borrowers who had good credit and good assets were talked into subprime loans that they should have had to settle for...the borrower obtained both a refinancing loan and a home equity loan on the basis of high appraisal" [3]. In the following report, Lawrence Walsh, mentions in his article, *What a Subprime Mess We've Made*, states that "As it turns out, the subprime crisis is the perfect storm of good, old-fashioned greed, data and intelligence blindness, and blissful ignorance" where objectivity, accuracy, reputation, and completeness of information are all thrown in the air [16]. The reputation of information deteriorates which leads to less added-value of mortgage products as the business disintegrates due to the crisis.

Garritano notes that there are issues in consistency, completeness, ease of understanding, and objectivity. He says that, "[the data] warrants strong risk management standards, capital levels commensurate with the risk, and an allowance for loan and lease losses that reflects the collectibility of the portfolio, and ensure that consumers have sufficient information to clearly understand loan terms and associated risks prior to making a product or payment choice" [6].

In Wikipedia, *Subprime Mortgage Crisis* shows how the crisis came out of similar issues. "Misrepresentation of loan application data is another contributing factor" [15]. This quote shows how representational consistency is an issue as well as objectivity and completeness. "Easy credit, combined

with the assumption that housing prices would continue to appreciate, also encouraged many subprime borrowers to obtain ARMs they could not afford after the initial incentive period” [15]. The believability of the data presented to the borrowers might have been positive and might have added value to the data, but it misled many to invest in something that would soon depreciate.

Also in the article, *It's The Process, Stupid*, by Anthony Garritano, the issues of completeness, objectivity, believability, reputation, value-added, and accuracy are of importance in determining the mortgage rate. Garritano believes that “the industry continues to focus too much on the product and too little on the process” [7]. Garritano suggests the use of technology to improve and automate the actual lending process—which should improve upon the issues of completeness, believability, objectivity, and accuracy. This increases the value-added of the data and reputation of the data involved.

Applying for a loan process is the second most problematic areas in origination process, in terms of data consistency, accuracy, completeness, believability and security. *Mortgage Fraud Worse Than Believed* article, it is apparent that the mortgage industry is bombarded with many problems. The article itself indirectly suggests that mortgage fraud can be traced back to “misrepresentations of the borrower’s incomes” [13]. This points toward the issue of accuracy. It is also noted that whenever a certain borrower has questionable loan applications, it is most probably tracked by how his or her income would change from one application to another—leading to the consistency and completeness issues of the data collected. The means by which this is determined is implementation of a security program, “which warns clients that a borrower has submitted multiple loan applications” [13]. Believability hence becomes an issue as Ann Fulmer states that “[she] has no idea how many of the loans were funded, but [she] hopes none of them” [13]. Likewise, Craig Focardi mentions that, “This results in slow, expensive loan processing; weak underwriting decisions; inaccurate loan pricing; excessive quality-control costs; incorrect portfolio management; loan buybacks; and other costs to lenders and mortgage investors” [5].

Anthony Garritano mentions that consistency is an issue in loan application. He says that the Federal Reserve Board said in a statement that the lender must “ensure that loan terms and underwriting standards are consistent with prudent lending practices, including consideration of a borrower's repayment capacity, and recognize that many nontraditional mortgage loans, particularly when they have risk layering features, are untested in a stressed environment” [6]. There should be consistency in all lending practices in terms of collecting data for this industry, in other words. According to the *MBA 2007 MARI REPORT EXPOSES/EXPLORES MORTGAGE FRAUD*, in **applying for a loan**, accuracy, believability, consistency, and security are all issues in the mortgage industry. “The most common types of fraud found in 2007 originations continue to be in the areas of employment history and claimed income; and -- The continuing unsettled state of the mortgage market as a whole does not bode well for any improvement in avoiding fraud in the coming year” [1].

The first process of **getting preapproved**, as shown in the EPC diagram, is the third most problematic areas in terms of quality of information issues. When the customer attempts to get preapproved by the bank, the data quality problems found from the literature is as follows: Believability, Objectivity, Value-added, Reputation, Consistency, Accuracy, Security, Completeness, Representational Consistency, Access, and Ease of understanding.

In the report *An Alternative to Credit Scores*, completeness and accuracy are some of the data quality issues in evaluating the loan approval based solely on customer’s credit report. “Fast-forward to today. A quick review of how underwriters qualify a loan applicant will show that the process has evolved into a credit-based pricing model. This model completely ignores the balanced approach of the four C's in favor of overemphasis on only one of the C's—credit...This heavy upfront emphasis on credit for mortgage-qualification purposes led to some critical failures in borrowers' capacity” [9].

Representational consistency, along with objectivity, reputation, value-added, and completeness, are data quality issues faced by wholesale lenders, according to Lisa Schreiber. In deciding on whether a loan should be approved or not, Schreiber advises that “the only way to ensure satisfied borrowers is to make certain that there is value throughout the lending process, from the first contact with the broker to the closing table and beyond” [14]. Borrower satisfaction becomes an important measure of the success of the lender, which indirectly puts an emphasis on the representational consistency and reputation of the data. All of which gives added value to the borrower.

Authorizing Bank A to obtain customer’s credit report process from EPC consists of two cited data quality issues. Access and security are the two data quality issues found from Mortgage Banking Magazine that has the following report; *Whose Data Are They Anyway?* The issue of the data’s accessibility leads to a vague interpretation of the data’s ownership. “As Web sites are used more regularly and are applied more throughout the loan application life cycle—thus making data much more available to many more parties—who owns the data, and the where are the boundaries of data, ownership as you moves through the loan origination process?” [11] Enough security must be implemented. “It would not hurt to research data rights or speak with your organization’s general counsel about its legal rights to data, with the understanding that data access rights are evolving legally as well” [11].

Review of Comments

Mortgage Origination Process	Information Quality Issues	Source
get preapproved	accuracy consistency completeness objectivity reputation value-added representational consistency	[9] [9] [9] [14] [14] [14] [14] [14]
authorize Bank A to obtain credit report	security access	[11] [11]
determine mortgage rate	accuracy consistency completeness ease of understanding objectivity believability reputation value-added representational consistency	[3] [7] [8] [16] [6] [3] [7] [6] [8] [15] [16] [6] [3] [7] [6] [8] [15] [16] [3] [7] [8] [15] [16] [3] [7] [8] [16] [3] [7] [8] [15] [16] [15]
make an offer	no major IQ issues cited	
sign the contract	no major IQ issues cited	
apply for a loan	accuracy consistency completeness believability security	[5] [13] [1] [6] [13] [1] [5] [6] [13] [1] [13] [1] [13]
prepare pre-closing documents	no major IQ issues cited	
prepare other documents before closing	no major IQ issues cited	
sign documents for closing	no major IQ issues cited	

Table 3 – Mortgage Origination Processes from the EPC diagram and Information Quality Issues Identified from the Mortgage Origination’s Literature

CONCLUSION

Completeness, objectivity, believability, value-added, reputation, representational consistency and accuracy are the most critical data quality issues in the mortgage origination process. Gopal Prashant mentioned that it’s not the loans alone that are causing the problems. He adds that lenders place heavy concentrations on nontraditional loans (with higher interest rate for lower credit report history) and higher home prices have overextended borrowers with poor credit who couldn’t qualify for conventional loans, as well as to speculators who plan to flip properties for a quick profit [8]. This data quality issue is also noted by the book, *Journey to Data Quality*. The authors point out that, “These appear as concerns about data objectivity. Overtime, information about subjective nature of data production accumulates, resulting in data of questionable believability and reputation and thus of little added value to data consumers.” They also add, “The overall result is reduced use of the suspect data” [10]. Another issue mentions that “Misrepresentation of loan application data is another contributing factor. [15]. Cocheo adds that, “Brokers and lenders who put people into “pick your payment” option ARMs and other attractive traps are an obvious place to point fingers [3]. From the literature cited, it is observed that nobody took the initiative to address the data quality issues within the mortgage origination process chain.

Craig Focardi stressed out on his article entitled, *Data Quality: The Cost of Dirty Data in the Secondary Market*, which says, “Dirty data persist despite the proliferation of automated computer systems for core lending processes and sub-processes.” He also adds that it is “similar to a ‘water-bucket brigade,’” where water is lost as water-buckets pass from hand to hand, duplicative legacy systems, the lack of one database of record and less-than-seamless integration between lending subsystems result in lost, inaccurate, and manually re-entered data” [5]. In spite of the development of computer system technology in the mortgage industry, inaccurate and incomplete data will become more evident throughout the US mortgage origination processes. He also points out that, “The problems of inconsistent data names, definitions, structure, cleanliness, usability, transfer and governance are well known in the mortgage industry. We subsist on a steady diet of missing, incomplete and inaccurate data elements for loan origination, loan servicing, portfolio management and securitization processes” [5]. In addition to these, it is also observed that the quality of information in the US mortgage industry is not yet developed as far as MISMO (Mortgage Industry Standards Maintenance Organization) is concerned. Gabe Minton’s MISMO Memo, explains that, “...there are three data necessities in the industry, of which MISMO has addressed two moderately successfully: data field names and definitions--addressed by MISMO’s LDD; taking the data fields and putting them into structure by business need--addressed by MISMO’s DTD and schema; and data quality not addressed yet” [12].

Finally, since the escalation of the US mortgage industry market, data quality issues on accuracy, consistency and completeness have increased when the duplicity of the profit makers have created a process that is generally driven by greed. The quality of information was basically overlooked in the process chain. Hence, the resulting outcome of DQ issues in the mortgage origination process affects the data’s believability, reputation, and value added.

In conclusion, the most problematic areas of the US mortgage origination process, in terms of the quality of information cited by the literature is *determining the mortgage rate*, secondly, **applying for a loan** process and lastly, *getting preapproved*, as shown in the EPC diagram above. There are no major IQ issues cited by the examined literature for the following functions; *make an offer, sign the contract, prepare pre-closing documents, prepare other documents before closing, and sign documents for closing*.

Recommendations for Improvement

Knowing the consequences of bad information will certainly prevent foreclosures that may have an impact for borrowers, lenders and the economy as a whole.

- Lenders should be objective enough not to approve a borrower's loan that has no capacity to pay. It should be clear-cut on whether or not the borrower can pay back the loans. Cocheo points out that, "the basic problem with poor people is they don't have enough money" [3]. As Anthony Garritano was saying, lenders should make an initiative to "ensure that loan terms and underwriting standards are consistent with prudent lending practices, including consideration of a borrower's repayment capacity." [6].
- Mortgage bankers and lenders should explicitly explain the possible outcome of decisions in mortgage. They shouldn't only explain a 30 year fix, or ARMs, or a 15-year fix, but they should inform the borrower the consequences, along with the benefits, of each plan.
- Advantages and disadvantages of a certain mortgage plan with concrete examples are helpful to both borrowers and lenders. Comparisons of mortgage plan with illustrations that are easy to understand would also be very beneficial to borrowers.
- Lenders and brokers must take the initiative to not only improve their information products but the origination process as well. Lee et. al. points out, that in order "to properly treat information as a product, a company must follow....manage information as the product of a well-defined production process." [10]. Self reported input during the prequalification process is sometimes considered of lower quality than data that is read or scanned by a machine. Gabe Minton mentioned in his report that, "... but it is really the business people operating, inputting and reacting to the data who play a more important role in data quality at an organization" [12].
- Transfer of data from one organization to another must not make the owner of the data ambiguous, so ownership's access and security of the data is clear. Minton clearly asked the question, "...where are the boundaries of data, ownership as you move through the loan origination process?" [11].

Craig Focardi of Mortgage Banking, points out that, "Lenders should improve quality-control procedures not only to ensure accurate loan documents and salable loans, but also to correct inaccurate data in core lending systems." [5]. Minton adds, "Other item of note, data quality should be looked at as an evolutionary process of continual improvement—it is not something you can fix in your organization and it stays fixed." [12]

Data governance, management systems and processes should be improved continuously not only to have 100 percent data accuracy and credibility but to achieve added-value in information products in all of the US mortgage origination processes, from the time the borrower contacts a lender about getting a mortgage until the time the borrower assumes ownership of a home. [5][12]

ACKNOWLEDGEMENTS

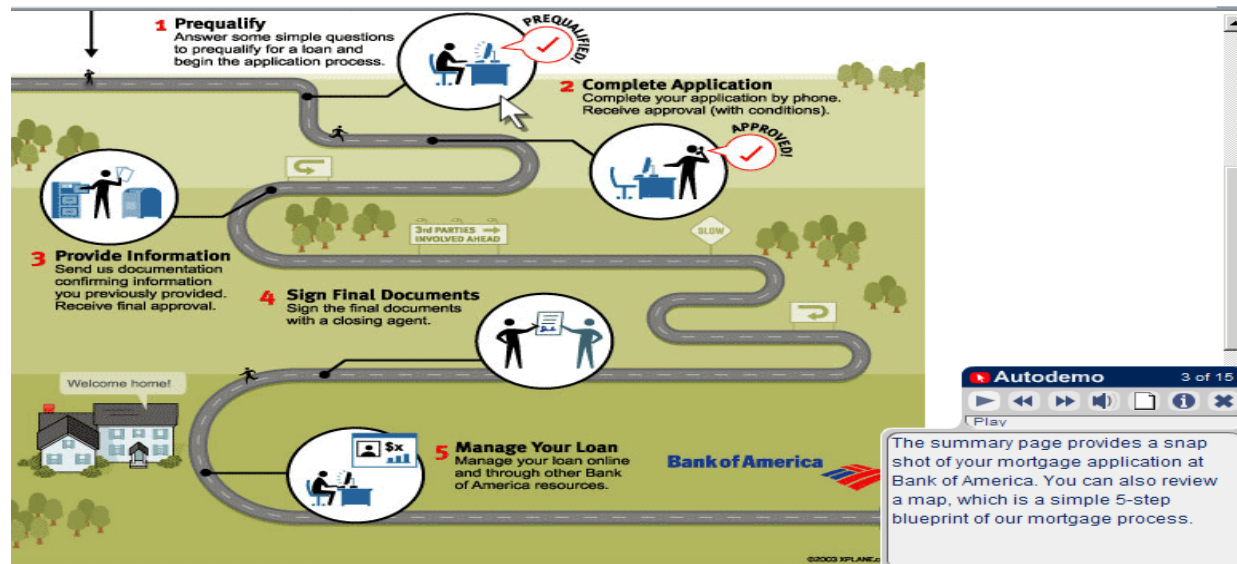
I would like to thank Dr. Elizabeth Pierce, for her invaluable guidance and encouragement in this research. I am grateful to her for giving me this opportunity to train myself. She also took the time to proofread this paper. I am also thankful to Dr. Rolf Wigand for his contribution during this research.

REFERENCES

- [1] "MBA 2007 MARI REPORT EXPOSES/EXPLORES MORTGAGE FRAUD." (2008, April). Retrieved from Worldwide Databases.
- [2] Boquin, Tatiana Process Oriented Modeling. Retrieved March 2008, from <http://www.wagse.informatik.uni-kl.de/teaching/> Web site: http://www.wagse.informatik.uni-kl.de/teaching/re/ss2007/downloads/Student%20Talks/EPCs_Talk.pdf

- [3] Cocheo, S. (2007, December). Can Subprime's Casualties Be Saved? *ABA Banking Journal*. Retrieved March, 2008 from www.ababj.com
- [4] Fisher, C., Lauria, E., Chengalur-Smith, S., & Wang, R. (2006). Introduction to Information Quality. M.I.T. Information Quality Program.
- [5] Focardi, C. (2008, February). Data Quality: The Cost of Dirty Data in the Secondary Market. *Mortgage Banking*. Retrieved March, 2008, from <http://www.mortgagebankingmagazine.com>
- [6] Garritano, A. (2007, March 26). Vendors Addressing Current Origination Issues. *National Mortgage News*. Retrieved from <http://www.nationalmortgagenews.com>
- [7] Garritano, A. (2008, March 1). It's The Process, Stupid. *Mortgage Technology*. Retrieved from <http://www.mortgage-technology.com>
- [8] Gopal, P. (2008, January 1). ARMs Aren't Always Behind Foreclosures. *Business Week Online*. Retrieved March 5, 2008, from EBSCOhost database.
- [9] Lesin, E. (May 2008). An Alternative to Credit Scores. *Mortgage Banking*. Retrieved June 10, 2008, from <http://www.mortgagebankingmagazine.com>
- [10] Lee, Y., Pipino, L., Funk, J., & Wang, R. (2006). Journey to Data Quality. Cambridge, Massachusetts: The MIT Press.
- [11] Minton, G. (2007, August). Whose Data Are They Anyway? *Mortgage Banking*. Retrieved March, 2008, from <http://www.mortgagebankingmagazine.com>
- [12] Minton, G. (2007, May) Data Quality: Crucial for Every Organization. *Mortgage Banking*. Retrieved March, 2008, from <http://www.mortgagebankingmagazine.com>
- [13] Mortgage Fraud Worse Than Believed. (2008, March 13). *Mortgage Technology*. Retrieved from <http://www.mortgage-technology.com>
- [14] Schreiber, L. (2008, April 30). For Successful Wholesale Lenders Offering Streamlined, Cost-effective Processes while Meeting Customer Needs Is Crucial Today. *Mortgage Technology*. Retrieved March, 2008 from <http://www.mortgage-technology.com>
- [15] Subprime Mortgage Crisis. (2008). Retrieved March, 2008 from Wikipedia.
- [16] Walsh, L. (2008, January). What A Subprime Mess We've Made. *Baseline*. Retrieved March, 2008, from EBSCOhost.

APPENDIX



Five-Step Blueprint of Bank of America's Mortgage Origination Process

