

Impacts of Vertical IS Standards: The Case of the US Home Mortgage Industry

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Abstract

Vertical IS standards prescribe data structures and definitions, document formats, and business processes for particular industries, in contrast to horizontal IT standards, which concern IT characteristics applicable to many industries. This paper explores the potential effects of vertical IS standards in the US home mortgage industry by examining technical implementation requirements.

This paper makes two important contributions. First, as one of the first in-depth cases of the benefits of e-business standards in a particular industry, this paper can serve as a foundation for future theoretical development. Second, although other authors have noted that the initiators' benefits from adopting interorganizational standards like EDI dependent on how their partners implement the standards, we describe in depth the technical choices that lead to partners' suboptimal implementations and the business considerations that lead them to make those choices.

1. Introduction¹

The development of Internet-based technologies for structured data description has stimulated renewed interest in the topic of interorganizational transaction standards [10, 15] – an area that heretofore languished due to the relatively low uptake of an earlier generation of electronic data interchange (EDI) standards [13]. Indeed, despite much promotion, only an estimated 2% of the world's businesses [1], including just 300,000 US companies (<http://www.disa.org>), have adopted EDI. Today, there is a growing recognition that interorganizational data and process standards are essential in order to effectively pursue electronic

commerce [3]. Increasingly, these efforts are focused on industry-oriented, vertical information systems standards, designed to promote communication and coordination among the organizations comprising a particular industry sector [10]. These standards address such aspects as product identification, data definitions, business document layout, and/or business process sequences. Efforts to develop such standards have emerged in electronics (RosettaNet), chemicals (CIDX), insurance (ACORD), petroleum (PIDX), automotive (AIAG), aerospace (AIA) and other industries.

Despite the multiplicity of efforts to *establish* vertical XML-based ebusiness standards, there has been little research to date investigating the processes that must take place to ensure *implementation* of the standards once developed, nor the *impacts* that may result from the use of such standards in different industries. In general, there is a presumption that such standards will entail significant efficiency benefits for firms. However, it is not necessarily clear if such efficiency benefits accrue to all adopters, or are subject to network effects requiring widespread adoption. The strong potential for network effects commonly associated with the benefits from adopting standards Katz and Shapiro [8] suggests that there is also a need to understand the factors that affect organizational adoption and implementation of inter-firm e-business standards. Moreover, once e-business standards are in place, many other outcomes besides greater efficiency may emerge, including the possibility for the creation of new services. Finally, there may be system level implications – industry structural change – for example, if the costs associated with particular functions in a value chain are significantly reduced, enabling firms at adjacent stages to “make” rather than “buy” certain services. Lower transaction costs may also reduce entry barriers, causing further industry-level changes.

In this paper, we examine the anticipated benefits, the factors influencing adoption and implementation, and the potential second-order consequences of e-business standards in the context of one industry that has achieved some success in establishing vertical information system standards - the US home mortgage industry [10, 14]. Our research is based on interviews with officials and key players from this industry, including the Mortgage Banking Association of America (MBA), the Mortgage Industry Standards Maintenance Organization [MISMO, (see: <http://www.mismo.org>)],

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as well as archival research. Standards-based IT applications have already had considerable impacts on this industry, as evidenced by the industry's successful handling of the recent refinancing boom. The additional benefits anticipated from adoption of MISMO standards, such as the fully electronic mortgage, still lie ahead.

The format of the paper is as follows. In section 2 we describe our case-based research method. Section 3 describes MISMO, the standards development initiative in the mortgage sector, and outlines the benefits that adopting MISMO standards is expected to achieve. In section 4 we discuss the technical choices that industry players make, and the challenges they face, while implementing the standards to achieve the intended benefits. Finally, in section 5 we briefly discuss the potential for second-order. Throughout, we employ data from interviews and archival sources.

2. Method

Evidence for our analysis comes from three sources: documents, in-depth interviews, and observation. We extensively surveyed published sources, including academic literature, trade publications, and MISMO websites. Our primary data source was interviews with key informants involved with mortgage industry standardization activities. We conducted interviews with three people from MBA (one several times) and six additional people active in the standards organization who represented other players in the mortgage value chain, including a government sponsored enterprise, a mortgage information and document services provider, a mortgage insurer, a mortgage credit reporting company, and two mortgage information technology vendors. We also interviewed representatives from an industry group that supports several standardization efforts including MISMO (and who can therefore compare the mortgage industry experience with that of other industries), as well as three interviewees with executives in leading mortgage industry companies. A third critical source of information was observations and onsite interviews at the two industry meetings we attended: the Mortgage Technology Conference in Orlando, FL (March 2003) and the MISMO Trimester Workgroup Meeting in Dana Point, CA (January 2004).

Interviews were taped and transcribed to facilitate review and analysis. We hand-coded interview transcripts for key themes related to our research questions. Moreover, we wrote numerous theoretical memos documenting our evolving understanding of key issues. We elaborated our growing understanding through weekly conference calls and periodic face-to-face meetings over the eighteen months we have been working on this project. Versions of our research reports have been reviewed for factual accuracy by interviewees and other industry experts.

3. MISMO standards

The MBA, in partnership with Fannie Mae, Freddie Mac and other industry participants, launched MISMO in January 2000. (The acronym MISMO is the Spanish word for "the same"—a fitting name for a standards development organization). MISMO was established to coordinate the development and maintenance of vendor-neutral eXtensible Markup Language (XML)-based transaction specifications to support data sharing among the many participants in mortgage lending processes.

MISMO can be viewed as two standardization efforts in parallel. The first concerns data standards for various mortgage transactions related to loan origination, secondary marketing, servicing, and real estate services. Examples of such transactions include: (for origination) application, closing, underwriting, (for secondary marketing) bulk pool transfer, commitment, funding, (for servicing) cash transactions, credit reporting, default management, and (for real estate services) appraisal, credit, escrow and settlement. One of MISMO's major accomplishments has been the development of a mortgage industry-wide data dictionary covering 3,400 unique industry-specific business terms.

The second track in the MISMO standardization effort concerns process standards to enable fully electronic mortgages, from initial application, through closing and recording, and through sale into the secondary market and transfer of mortgage servicing rights. In January 2001, MISMO launched its eMortgage Workgroup. The passage of the Uniform Electronic Transactions Act (UETA) in 1999 and the Electronic Signatures in Global and National Commerce Act (E-SIGN) in 2000 had made it possible to envision a mortgage lending process that produces legally binding mortgages entirely without paper. These laws provide that electronic signatures can be used wherever existing law requires a "wet" signature. A true e-mortgage is originated, closed, recorded, stored (in an electronic registry) and delivered to a secondary purchaser entirely in electronic form while using electronic/digital signatures.

In 2001 Fannie Mae and Freddie Mac agreed to support MISMO standards. Today more than 250 firms and 1,000 individuals are involved in more than 30 MISMO workgroups. The outcomes of these efforts will emerge over the next five to eight years.

3.1. Anticipated benefits of MISMO standards

According to MISMO documents, the goals of eMortgage standards include "cost savings (reduced re-keying, manually verifying data)" and "increased efficiency and liquidity in mortgage marketplace" (eMortgage Workgroup General Session, Dana Point, CA 1/28/2004). Although the MBA estimates that the cost of originating and servicing mortgage loans has

decreased 50% in the last 10 years owing largely to information technology, the industry still exhibits numerous inefficiencies that could be reduced through the adoption of MISMO standards.

Rekeying. Industry experts estimate that some mortgage lenders may manually key-enter the basic data in a typical mortgage application as many as seven times owing to unintegrated back office systems for various activities (e.g., ordering appraisals and mortgage insurance, etc.). The value chain participants that provide such services (e.g., credit reporting agencies, escrow companies, etc.) may also re-key basic mortgage data.

"If a closing agent needs to get a payoff from a lender they might get in touch with them [by phone] or request it pseudo-electronically but the actual payoff statement will get faxed and then he'll take the data and re-key it into their closing statements." (9/16/2003)

The eMortgage effort would allow the data to be entered once. A major by-product of reduced re-keying would be a substantial reduction in data entry errors and the costs of their correction.

Forms proliferation. Owing to differences in state and local regulations, as many as 30,000 different forms are used in the industry today, making forms management a major challenge. MISMO standards could ease this burden.

Lost documents. Major mortgage banks expend considerable labor in filing and retrieving paper documents. Searching for lost documents is a major source of inefficiency that could be eliminated by the eNote Registry, which is part of MISMO's eMortgage initiative.

Customer frustration. Today, the process of taking out or refinancing a mortgage loan can take months. Customers often don't know what their closing costs will be until the date of closing, and lenders often cope with uncertainties by initially overcharging and then refunding the balance. These problems could be eliminated through process innovations enabled by eMortgage standards.

Post-closing process problems. A considerable cost of mortgage lending is the post-closing correction of errors generated during the origination process (e.g., missing documents and signatures).

"After the closing .. the documents come back to the lender and they realize that what was signed has got this change or this typo or this [note] has been sent to be recorded and it's not correct. A lot of energy and money goes into that post-closing cleanup." (10/2/2003)

A fully automated lending process could reduce or eliminate the post-closing error correction cycle.

Secondary market processes. The paperwork doesn't end with post-closing reconciliation. Mortgages are frequently resold after closing, and mortgage servicing is often managed by parties other than the original lender. These transfer processes offer many opportunities for errors:

"What happens today is that the paper documents are signed, fields are entered or transferred into the secondary

[marketing] system, then they deliver certain data fields to us [and we enter it] into our computers. Then the paper note is forwarded to a document custodian. The document custodian receives the piece of paper, pulls up our transmission then says 'is this what we expect it to be?' They do an eyeball check: 'okay, this is right, that's right -- oh this doesn't match -- there's some confusion here'. And they certify that the paper document matches what was delivered to us electronically. That's [the assurance] we're buying on. ... It's a very paper intensive process." (10/2/2003)

eMortgage standards promise major efficiency improvements in these later stages of mortgage life cycle.

In addition to these anticipated first-order efficiency benefits is the frequently stated goal that the adoption of MISMO's eMortgage standards will make both large and small companies into nimble competitors:

"Data standards help the smaller companies play in the same ball field as the larger companies, and they help the larger companies be as nimble as the smaller ones." [cited in 4]

The potential for gains by both large and small firms is illustrated by the industry's recently demonstrated ability to handle an unprecedented volume of mortgage refinancing because of IT-enabled improvements. Eighteen million loans worth \$3.2 trillion were processed in 2003. It would not have been possible to recruit and train enough new workers to handle this volume 10 years ago given the low level of automation at that time. These automation benefits have extended to small firms as well as large organizations: the CEO of a small mortgage reported that he was able to increase output by 127 percent during the recent refinance boom while increasing staffing only 42 percent, and part of the staff increase was from temporary help [6]. Similarly, the additional benefits anticipated from adopting MISMO eMortgage standards are expected to apply to small firms as well as large ones.

3.2. Achieving the benefits of MISMO standards

Achieving the hoped-for benefits of vertical IS standards depends on widespread adoption. In general, organizations, regardless of industry, can be expected to adopt standards when they expect the benefits of adoption standards to outweigh the costs [12]. Therefore, it is useful to explore the costs of adopting MISMO standards. In the next section we consider technical choices in MISMO standards implementation, the particular problems faced by large industry players with complex legacy systems environments, and the benefits that come from deploying MISMO standards in conjunction with interorganizational process restructuring and collaboration.

4. Technical choices in implementation

The vision of MISMO's data standards is "straight-through processing". In this vision, each participating company in the mortgage value chain would continue to employ the information technology of its choice. Whenever a participant needed to pass information or documents to another party, that participant would be able to generate automatically (without special manual procedures) output that is MISMO-compliant and to transmit that output electronically to other parties. Those other parties in turn would be able to accept that output automatically as input to their own systems without rekeying or electronic transformations. The benefits of this envisioned process flow include: 1) no need for labor-intensive and expensive output and transfer procedures such as printing, courier or fax, 2) no need to rekey the output of another party's work, 3) increased process speed from (nearly) instantaneous transfer of information and documents from one party to another, and 4) opportunities for process streamlining or reengineering and higher forms of interorganizational collaboration (discussed below).

The following description is couched in terms of the particular industry we studied. However, interviews with an organization that supports standardizations efforts in several industries lead us to believe that the following considerations apply across many industries.

4.1. Translation versus conversion

In practice, value chains may fall far short of the ideal of straight-through processing (at least in the short-term) because of technical choices made when implementing MISMO standards. The major implementation choice is whether to produce MISMO-compliant output (and/or to accept MISMO-compliant input) by *replacing/upgrading existing information systems* or by *employing a translation program*. This design choice may also have implications for another relevant feature of technical implementation: whether MISMO-compliant output is transmitted to the other party *in batches* or *one transaction at a time*.

Translation. Employing translation often appears to be the cheapest and lowest cost option for becoming MISMO-compliant. This choice does not require an organization to replace its existing systems or to modify them so that they produce MISMO-compliant output. However, the disadvantages of the translation approach are several: Translations always entail the possibility of errors that require manual correction. In addition, commercial translation programs or specialized third-party services can be expensive, and organizations that have built their own in-house systems or have heavily modified commercial mortgage industry packages may not be able to use commercial translation programs. (By contrast, straight-through processing does not require translation, merely "parsing", i.e., using inexpensive open-source software for compliance checking.) An additional problem is that using translation programs

may involve separate manual processing steps and may operate on batches of documents, reducing transfer speed relative to straight-through processing. Even though the output of such a batch translation would be MISMO-compliant, the receiving party would have to undertake additional manual processing steps to accept this input. In brief, under this scenario, the two parties would be "compatible" but would not be fully "interoperable" (<http://www.gogallagher.com/about/whitepaper02.htm> access date 5/18/04).

Upgrade/conversion. Companies that already employ COTS (commercial off-the-shelf) mortgage industry software that has not been customized to their unique needs often find it quite straightforward and inexpensive to become MISMO-compliant. (Organizations that use IT services from an application service provider or a large business party also face minimal technical implementation challenges.) Many vendors of software for the mortgage industry have already announced the ability of their software (or their intention to modify their systems) to provide MISMO-compliant output. For example, Atone software advertises the MISMO compliance of its technology for connecting lenders and brokers (<http://www.atone.com/> access date 5/18/04). Similarly, in March 2003, Dynatek and a la mode, inc. announced plans to begin joint development of a software plug-in that would produce and transmit MISMO-compliant output from various real-estate appraisal production software to lenders (<http://www.alamode.com/pr/press%20releases/dynatek.html> access date 5/18/04). Not only is the upgrade approach relatively hassle-free, but it is also likely to result in the ability to process transactions one-at-a-time.

Organizations that do not now use an uncustomized commercial software package can convert from their existing systems to a MISMO-compliant program, but doing so will generally entail more challenges than simple upgrading. Organizations trying to modify "nonstandard" software for MISMO compliance will likely experience one or more of several implementation challenges outlined in MISMO's "XML Implementation Guide: General Information, Oct. 16, 2003" (<http://www.mismo.com> access date 5/17/04):

- XML reserved characters. "... [I]gnoring these reserved characters (&, <, >, ', ") is a frequent cause of errors in mortgage data. ... Some XML software systems will automatically do the conversion of the SML reserved characters; otherwise [special programming will be required]" (p. 4-1)
- Location of the Data Type Definition (DTD). "... [W]hen sending XML files to your trading partners, they may have differing requirements for where the DTD is to be found by their processing software. ... [T]rading partners may ask you to specify a directory path or URL for locating the DTD." (p. 4-3)
- Handling attributes with no data. "When processing XML data from your business partners,

you should be aware that two valid ways of showing (or not showing) that an attribute has no data value. The preferred method is ...” (p. 4-5).

In short, even though MISMO standards are intended to enable seamless interconnection among business partners in the mortgage industry, the choices that individual organizations make about implementation (how to become compliant) can result in something less than the vision of straight-through processing. Table 1 depicts the levels of MISMO standards-enabled integration that are possible between pairs of business partners. Similar levels of integration have been observed in EDI compliance. Although the lower costs of XML technology suggest that MISMO standards will be much more widely adopted than EDI has been, past experience suggests that at least some MISMO adopters will not achieve the ideal of straight-through processing for all transactions with all business partners in the near term.

4.2. Internal integration challenges

The previous section might have given the impression that the smallest organizations will face the greatest difficulties in achieving a high level of integration using MISMO standards. Actually, some large organizations are also likely to have a difficult time. Whereas many small organizations can achieve MISMO-compliance through adopting standard software or services, larger organizations may be limited in their ability to implement MISMO standards, because standard software packages may not meet their needs and their existing information system may be aging and unintegrated.

Table 1. Levels of integration with MISMO standards

Non-integration	One party's voice, paper, fax, email, or web output is manually reentered by other party.
One-sided automation	One party automatically produces compliant output, possibly through batch translation, but the other party manually reenters it.
Manually assisted interchange	One party's compliant output is electronically processed by other party after manual file extraction, etc.
Straight-through-processing	Compliant output from one party's systems is automatically processed by other party's systems on a transaction-at-a-time basis with little or no manual effort.
Process restructuring	Straight-through-processing is accompanied by significant process streamlining, shift in division of labor, etc., producing additional benefits.

Large lenders (and other mortgage industry participants with diverse lines of business) may face three sources of complexity in their information systems environments. First, because of growth through acquisition, they may have multiple unstandardized and unintegrated instances of the same type of information system. For example, the CEO of the residential lending unit of a large financial services company told us that his company had thirteen different loan origination systems at the time it started on a major systems project to develop a single processing platform. (This company explored available software packages but concluded that none was appropriate.) Second, large lenders often do business through multiple channels (e.g., retail, wholesale/broker, correspondent, and web); these lenders may have developed separate systems to support each sales channel. Third, large lenders often have different mortgage loan products (e.g., fixed-rate, adjustable, home equity), each of which might be supported by disparate systems.

Lenders with complex systems environments must either implement MISMO standards on a system-by-system basis or seek first to create an integrated service delivery platform. Either way involves challenges. In the first place, legacy mainframe systems environments do not readily lend themselves to XML-based web services. One key player in MISMO standards development described the difficulties faced by larger lenders with inflexible technology platforms:

“[T]here's a lot of legacy technology around the industry. [Some large lenders] missed certain windows to rewrite their platforms. [Their systems are not] XML friendly ... A lot of these platforms run on mainframes, ... they weren't designed to perform with Internet traffic. ... [Those lenders] have to augment that technology with complementary software that pulls functionality out of the loan origination system into a complementary platform, which allows them to become more e-commerce friendly, have greater access to outside parties, but it also opens up different challenges, which is how to you keep a centralized view of your data, your loan file. So you're solving some shorter-term issues and have other longer-term struggles you have got to continue to deal with and new ones you're introducing.” (9/30/03)

She explained further that their very size may keep large lenders tied to their legacy mainframe platforms, because:

“... those systems tend to be able to handle more volume by design. And so, as more and more consolidation happens, lenders tend to keep relying on those legacy platforms to merge new divisions or new branches or the smaller companies that they've acquired. What's happening is the old [technology] is almost getting bigger. ... So I think it's actually having sort of a negative affect of moving technology to a newer place.” (9/30/03)

The challenges of trying to implement MISMO standards without significantly upgrading the legacy system environment may lead some large lenders to delay adopting MISMO standards as long as possible. Because most such lenders have long ago deployed proprietary systems and EDI for integrating with their major business partners, these companies may perceive little benefit from adopting MISMO standards.

Large lenders that decide to replace their legacy systems face a multi-year implementation process. For example, the lender with 13 different origination systems began planning for systems integration in 1996 and is only now in the final stages of that project. The Senior Vice President for IT planning of another major residential lender discussed his company's "major, multi-year" initiative to replace legacy systems "with a single environment that will support all of our products and all of our channels" (7/23/03).

To be sure, replacing legacy systems provides numerous benefits to large lenders over and above the benefits associated with MISMO-enabled electronic integration with business partners. The CEO explained that a single operating platform would improve execution, enable more rapid integration of acquired companies, and drive cost efficiencies:

"There's nothing better to get people focused on the same page, get your arms around them in terms of brand and culture, than to have everyone on the same operating platform. We view this deployment when complete as a very important future strategic advantage for us. We'll be able to do acquisitions and immediately go in and leverage the existing scalable technology which will help us integrate [the acquired companies], and also allow us to achieve the cost efficiencies that we want almost immediately." (7/25/03)

In addition, the new platform was expected to enable a "mass customization" (customer-specific products and pricing) and to support data mining.

Similarly, the SVP noted that a single IT environment for all products and channels would support the company's strategy of profitable growth in market share:

"That will allow us to introduce automated workflow which will provide significant benefit in reworking our processes that exist in the origination business, will provide links to allow us to digitize and support the development of e-mortgages as some critical mass develops around that, will be the platform around which we will build many of our third-party integration capabilities so that we can expand on some of what we're doing today with automated vendor integration and look to really drive that automation across all the components of the transaction with third-party providers and across all of our channels." (7/23/03)

Although internal integration alone can provide many benefits, perhaps the most significant benefits MISMO standards implementation would come from reengineering processes involving different mortgage industry players and from adopting higher forms of collaboration—activities described below.

4.3. Process restructuring

Mortgage industry players can implement MISMO standards and reap substantial benefits from doing so without significantly altering the nature of their interorganizational business processes. However, eliminating manual processing and duplication of effort can allow business partners to create new ways of doing business that give them a significant advantage over competing value chains [5].

For example, a senior executive for a major mortgage services firm explained that his company worked with a leading lender to reengineer their joint business process to enable extremely rapid refinancings. Other lenders had achieved the same goal by cutting corners that increased their risk and reduced their profitability. By contrast, this business partnership retained, but automated, certain tasks and decisions that were traditionally done manually. The two-year project:

"... required quite a bit of IT work on the lender side and our side, so that they could get the correct data that they needed out of their [systems], so that they could feed the data to us, for us to process and run through the decision rules. And we had to set up new business processes, we had to redesign loan packages." (8/27/04)

This same executive also mentioned a number of as-yet-unrealized opportunities to do business differently in the mortgage industry as a result of IT- and standards-enabled interorganizational business integration:

"Processes like the one I just described will become endlessly available to us. We just don't know exactly what they are yet. I can give you one more example. We know that it would be a good thing if it was possible to get payoff information on loans that were paid off instantly and in an automated fashion. That's pretty logical, so why has no one ever done it before?" (8/27/04)

4.4. Higher forms of interorganizational collaboration

Most industry observers see a continuing trend toward interorganizational collaboration. Shared or commonly adopted standards would make the sharing of data and partnering in general considerably easier.

Recognizing that the Internet has been the most important technological advance over the last five to ten years, Sam Ourfalian, Executive VP for Information Technology, Countrywide Financial Corporation, stated:

"In the next five years we won't see many incredible advancements [in information technology]; rather, people will start collaborating more with different technological capabilities. One company may have an underwriting system, one a cool doc engine, and another a smart borrower best-execution engine. What we see and what we think will continue to happen is that companies will tap into other vendors' engines electronically to provide the best service possible. ... We are enablers. We want to enable our business partners to succeed." [2 p. 59].

The adoption of standards is an essential prerequisite of such collaboration—if not industry-wide adoption, at least adoption by the collaborating organizations.

The examples in this section show that organizations can obtain significant benefits from reengineering and collaboration, but that doing so will require more than just the electronic integration that is possible from implementing MISMO standards. In addition to electronic data sharing, organizations require business vision and process restructuring activities to achieve these additional benefits. Not every MISMO adopter is likely to undertake restructuring and collaboration, but those that do have the possibility of reaping far greater benefits.

4.5. Recap

In this section we discussed what is necessary to implement and to reap the benefits of implementing MISMO standards. We observed that not all organizations (or value chains) are likely to implement the standards identically, and, as a result, the benefits are likely to vary across participants as well. In the short term, we expect the following observations to characterize the adoption of, and benefits of implementing, MISMO standards:

- Some small organizations with low IT knowledge and skills and some large organizations with complex legacy IT environments and effective EDI technology will delay implementing MISMO standards.
- Organizations and partnerships that adopt MISMO standards are likely to experience periods (of varying duration) in which mortgage loans are partially, but not fully electronic.
"You're going to find there's going to be what we call "hybrid" mortgages. Some documents are still going to exist in paper and either be scanned in or somehow brought in as an image and then put in this electronic folder, because some of the documents at this point can't be created electronically."
(10/10/2003)
- Business partnerships in which MISMO standards are adopted by more partners will be more effective (in terms of process cost and speed) than partnerships in which MISMO standards are not adopted or are adopted by fewer partners.
- Business partnerships in which one or more partners implement MISMO standards with translation, especially in the batch mode, will not realize benefits as significant as those that implement MISMO standards in a way that achieves straight-through processing.
- Business partnerships that use MISMO-enabled integration as a point of departure for significant interorganizational process reengineering will achieve greater benefits than those that do not.

5. Potential second-order consequences

Even if all industry players implemented MISMO standards similarly and achieved comparable cost savings and efficiency benefits, the possibility of second-order consequences would exist owing to aggregation effects. For example, some cost saving would undoubtedly be passed on to consumers, possibly increasing price competition and lowering profits.

However, the likelihood that the implementation of MISMO standards and benefits realized from implementation will vary across the mortgage industry,

as discussed above, suggests that there will also be system-level effects other than those that are publicly announced as MISMO's rationale. Below we provide an initial, albeit speculative, look at potential second-order consequences [12] based on our discussions with mortgage industry leaders. Our observations are organized into the categories of increased automation, new products and services, industry structure changes, and changes in consumer behavior.

5.1. Increased automation

The existence of MISMO standards is likely to promote greater automation in the mortgage industry and change the shape of the IT sector that supports the industry. The mortgage industry currently has no analog of the enterprise resource planning systems that are widely used by manufacturing companies. Different segments of the mortgage industry are served by different vendors; in some segments, there are only a few vendors, whereas in other segments, many small vendors fragment the market. Mortgage industry observers have speculated that one reason for the historically slow adoption of IT in the mortgage industry was the low level of maturity of the IT sector [9].

The potential benefits to be had from implementing MISMO standards are likely to attract more customers for IT products and services that embody the standards. A larger market means that IT product and services companies will invest in improving their offerings, thereby attracting more customers. The resulting competition among IT vendors could result in consolidation and the emergence of dominant vendors and "standard" IT solutions, which in turn may encourage yet more customers to automate.

Increased automation might result in ever further declines in the amount of labor required to process a certain volume of transactions. The possibility of reduced employment opportunities in various mortgage industry segments is a probable result.

5.2. New products and services

Increased automation in the mortgage industry enables the development of new loan products and services. Industry experts give automation the credit for the development of adjustable rate mortgage [7]. Some mortgage lenders offer today more than 350 mortgage product variants compared with about 30 just ten years earlier [6, p. 49].

Automation based on MISMO standards offers the potential for yet more individualized mortgage products: "Let's say [a customer] tells you, 'I'm going to retire in 17 years nine months two weeks and four days. This is the date I would love to have my mortgage paid off.' Systems today just do 30-year amortization. So what you'd have to do is tell the borrower well go ahead and make your normal payment but pay an extra \$87.23 and that should be about right, which is a pain So we think that customer retention can be increased by giving that customer what

they want. Maybe there's a schoolteacher who doesn't have a paycheck for three months a year. Give them a mortgage that where there's only nine payments." (7/25/2003)

The standards-enabled ability to rapidly develop and deploy new products and services could lead to new business strategies and business models and to the emergence of specialized new competitors.

5.3. Industry structure changes

The mortgage industry has undergone major changes over the last ten years; new entrants have appeared and considerable consolidation has occurred—changes attributed by many experts to IT [7]. Since 1992 17 of the 25 largest residential lending firms in the mortgage industry have disappeared from the market [6]. The second largest firm in the industry today, Wells Fargo Home Mortgage, was not a player in 1990. (Its predecessor firm was Norwest.) Moreover, successful new online players, including Quicken Loans, e-Loan, and Lending Tree, have appeared on the scene.

Widespread adoption of MISMO standards can be expected to open the door to further consolidation and additional new entrants. For example, industry observers believe that mortgage industry standards help small and new companies compete with larger companies by transferring industry knowledge and loosening relationships among traditional trading partners.

"Over the past six or seven years, [my company] has gone from a nobody in the industry to [a leading player]. On the disadvantage side, because of the growth and use of standards that helped [my company] grow, it also helped a lot of smaller [companies] establish themselves by using those standards. Because anytime you set or establish a data standard, what is being put out there is not just data formats, there's a lot of industry knowledge that goes into those data standards.

"At the same time, [when there are] seven or eight companies out there using the standard, if one company starts providing poor service, it makes it easy for [their customers] to switch to a different company who is using the same standard. Whereas when they're on proprietary standards, they're kind of locked into the company that they're doing business with." (9/30/2003)

On the other hand, bigger firms might still retain the advantage of their greater industry experience.

Another potential change in industry structure might be the increasing disintermediation of certain types of firms in the mortgage industry value chain. For example, document preparation firms may have to find new sources of business value should standards contribute to reducing their role in managing loan documents.

5.4. Changes in consumer behavior

The new products and services enabled by MISMO standards might also have the potential to change consumer behavior, to the detriment of established industry players. Many people refinanced their homes during the recent refinancing boom, often with different

lenders. How much more would customer loyalty erode, if standards-based automation allowed certain lenders to provide consumers the capability to pay off their old loans with another lender and refinance with the new lender instantaneously?

"If you're a lender and you're sitting on a portfolio of loans and your competitor down the street runs a good marketing campaign, you don't want to see all those payoffs happen real quickly without you getting a chance to keep those people." (9/16/2003)

6. Conclusions

Information technology, applications, and vertical IS standards are changing the products, structure, and processes of the mortgage industry. As Angelo Mozilo, chairman, president and CEO of Countrywide Financial Corporation, stated, "There are consumers and there are investors, the rest is friction" [cited by 6, p. 49]. The "rest"—the many players in the mortgage industry today—can potentially be much altered by the widespread adoption and implementation of MISMO standards.

How adoption and implementation happens depends to a large extent on the technical choices MISMO adopters make—choices about translation versus conversion and choices about process restructuring and interorganizational cooperation. Other researchers have noted that one organization's benefits from implementing interorganizational standards depend on others' implementation choices [11]. However, this research makes an additional contribution by revealing the specific technical choices that lead to partners' suboptimal implementations and the business considerations that influence those choices.

Information technology and software applications will unquestionably continue to shape the structure and processes of the US home mortgage industry, among many others. At the same, our analysis in this paper shows how dependent future cost savings and productivity gains are on the widespread adoption and implementation of vertical IS standards. How this occurs will be fascinating to observe.

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