

**IT STANDARDS CHOICES AND INDUSTRY STRUCTURE OUTCOMES:  
THE CASE OF THE UNITED STATES HOME MORTGAGE INDUSTRY**

**Rolf T. Wigand**

Maulden-Entergy Chair and Distinguished Professor of  
Information Science and Management  
Department of Information Science  
University of Arkansas at Little Rock  
2801 South University Avenue  
Little Rock, AR 72204-1099  
Phone: 501.371.7647  
Email: [rtwigand@ualr.edu](mailto:rtwigand@ualr.edu)

**Charles W. Steinfield**

Department of Telecommunication, Information Studies, and Media  
Michigan State University  
East Lansing, MI 48824-1212  
Phone: 517.355.8372  
Email: [steinfie@msu.edu](mailto:steinfie@msu.edu)

**M. Lynne Markus**

John W. Poduska, Sr. Professor of Information Management  
Department of Management  
Bentley College  
175 Forest Street  
Waltham, MA 02452-4705  
Phone: + 781.891.2312  
Email: [mlmarkus@bentley.edu](mailto:mlmarkus@bentley.edu)

Last revised: April 23, 2005

# IT STANDARDS CHOICES AND INDUSTRY STRUCTURE OUTCOMES: THE CASE OF THE UNITED STATES HOME MORTGAGE INDUSTRY

---

## ABSTRACT

*Vertical IS standards* prescribe data structures and definitions, document formats, and business processes for particular industries, in contrast to generic IT standards, which concern IT characteristics applicable to many industries. This paper explores the potential industry structure effects of vertical IS standards through a case study of the United States home mortgage industry. We review theoretical arguments about the potential industry structure effects of standards for interorganizational coordination, and we compare the characteristics of XML-based vertical IS standards with those of EDI to gauge the applicability of prior literature. We argue that the lower costs and wider accessibility of XML-based standards that use the Internet can result in significant changes to the structure of the mortgage industry. However, the nature of industry change will depend on the specific ways in which standards are implemented by firms in the industry—there are many patterns of implementation with potentially different effects at the industry level of analysis. We illustrate these theoretical arguments with data from our case.

**Keywords and phrases:** IS standards, vertical standards, industry structure, IT choices, effects of standards, industry-level effects, implementation, adoption, benefits

---

**IT STANDARDS CHOICES AND INDUSTRY STRUCTURE OUTCOMES:  
THE CASE OF THE UNITED STATES HOME MORTGAGE INDUSTRY**

---

**ACKNOWLEDGMENTS**

This research was funded in part by the National Science Foundation's Digital Society and Technology Program (Award Numbers: 0233634, 0231584, and 0323961). We gratefully acknowledge the support received from the Mortgage Bankers Association of America (MBAA), the Mortgage Industry Standards Maintenance Organization (MISMO), the Data Interchange Standards Association (DISA), the unnamed interviewees who provided their insights, as well as the anonymous reviewers.

**IT STANDARDS CHOICES AND INDUSTRY STRUCTURE OUTCOMES:  
THE CASE OF THE UNITED STATES HOME MORTGAGE INDUSTRY**

---

**BRIEF BIOS**

**Rolf T. Wigand** is the Maulden-Entergy Chair and Distinguished Professor of Information Science and Management at the University of Arkansas at Little Rock. He is the past director of the Center for Digital Commerce and the Graduate Program in Information Management at Syracuse University. His research focuses on information management, electronic commerce, the development of IS standards, and the strategic deployment of information and communication technology. His research interests lie at the intersection of information and communication business issues, the role of newer information technologies and their strategic alignment within business and industry. Most recent and current NSF-funded research has focused on the global impact of electronic commerce in ten nations, the impact of electronic commerce on the real estate and mortgage industries, as well as IS standards development in the mortgage industry. He is the author of five books and has published in such journals as *Sloan Management Review*, *Electronic Markets*, *International Journal of Electronic Commerce*, *The Information Society* and *Telecommunications Policy*. Wigand has taught on the faculty of Syracuse University, the Helsinki School of Economics and Business Administration, Stuttgart Institute of Management and Technology, University of Bayreuth, Arizona State University, Michigan State University, Universidad Iberoamericana, Mexico City, and the University of Munich. Some of his research has been supported by the National Science Foundation, the Volkswagen Foundation, the International Social Science Council, Rome Laboratory, and other funding agencies. In 2003 he held the Ludwig Erhard Foundation Distinguished Visiting Professorship at the University of Bayreuth, Bayreuth, Germany.

**Charles Steinfield** is a professor in the Department of Telecommunication, Information Studies, and Media at Michigan State University. He holds a B.A. in Communication from Michigan State University, and an M.A. and Ph.D. in Communication Theory and Research from the Annenberg School for Communication at the University of Southern California. His research focuses on the organizational and social impacts of new communication technologies. He has published five books as well as articles in such journals as *Communication Research*, *Journal of Computer Mediated Communication*, *Electronic Markets*, *International Journal of Electronic Commerce*, and *Organization Science*. Steinfield participates with the MSU Eli Broad College of Business Information Technology Management Program and is a member of the campus-wide Faculty of Computing and Information. He is also a research associate in the Quello Center for Telecommunications Management and Law at MSU and a Faculty Associate for the MSU College of Law Intellectual Property and Communications Law Program. He has been a visiting professor and researcher at a number of institutions in the U.S. and in Europe: the Institut National des Telecommunications in France, Delft University of Technology in the Netherlands, Bellcore, the Telematica Instituut in the Netherlands, and the Helsinki School of Economics and Business Administration. He is a recipient of MSU's Distinguished Faculty and Teacher-Scholar Awards, and was awarded a nine-month Fulbright research grant to study information services usage in France. He has also been a summer visiting researcher at the French national telecommunications research laboratory, CNET.

**M. Lynne Markus** is the John W. Poduska, Sr. Chair of Information Management, Bentley College. Professor Markus's research interests include enterprise and inter-enterprise systems, IT and organizational change, and knowledge management. Dr. Markus was formerly a member of the Faculty of Business at the City University of Hong Kong (as Chair Professor of Electronic

Business), the Peter F. Drucker Graduate School of Management at Claremont Graduate University, the Anderson Graduate School of Management (UCLA) and the Sloan School of Management (MIT). She has also taught at the Information Systems Research Unit, Warwick Business School, UK (as Visiting Fellow), at the Nanyang Business School, Singapore (as Shaw Foundation Professor), and at the Universidade Tecnica de Lisboa, Portugal (as Fulbright/FLAD Chair in Information Systems). She has received research grants and contracts from the National Science Foundation, the Office of Technology Assessment (U.S. Congress), the Advanced Practices Council of SIM International, the Financial Executives Research Foundation, and Baan Institute. She is the author of three books and numerous articles in journals such as *MIS Quarterly*, *Information Systems Research*, *Organization Science*, *Communications of the ACM*, *Sloan Management Review* and *Management Science*. She has served as AIS VP for Education, SIM VP for Academic Community Affairs, and on the editorial boards of several leading journals in the information systems field. She was named an AIS Fellow in 2004. Markus holds a B.S. in Industrial Engineering from the University of Pittsburgh and a Ph.D. in Organizational Behavior from Case Western Reserve University.

## INTRODUCTION

It is now widely agreed that effective use of IT can provide business value at the firm level of analysis. But it is also known that not all firms benefit equally from investments in IT, raising questions about the possible effects of IT use on industry structure. The question we address in this paper is whether the introduction of Internet-based standards for interorganizational coordination could enable structural changes in particular industry sectors.

Some research has emphasized the potential of IT to reduce the costs of *coordination* among firms, leading to industry structure changes such as consolidation, vertical disintegration, or disintermediation [27, 37, 45, 61, 62]. Other research has focused more on IT's potential effects on *production* processes in information-intensive industries such as news and music than on IT's potential effects on interfirm coordination costs [12, 23, 24]. Despite this shift in interest, there are reasons to reexamine the potential industry structure effects of IT-enabled interfirm coordination standards.

Until quite recently, IT support for interorganizational coordination was provided by electronic data interchange (EDI). Despite much promotion, only an estimated 2% of the world's businesses [2], including just 300,000 U.S. companies ([www.disa.org](http://www.disa.org)), adopted EDI, because of its high costs and low compliance with its standards. For the most part, only larger firms benefited from EDI, allowing them to grow at the expense of smaller firms, thus contributing to industry consolidation [27]. The advent of the Internet has prompted many industry sectors to revisit, revise, or significantly expand interfirm coordination standardization efforts employing the technology of extensible markup language (XML). These efforts, such as RosettaNet (electronics), CIDX (chemicals), ACORD (insurance), PIDX (petroleum), AIAG (automotive), and AIA (aerospace) address product identification, data definitions, business document layout,

and/or business process sequences—or what we call *vertical information systems (IS) standards*. The vision of these efforts is to bring electronic interconnection within the reach of the smallest firms. Their potential effects are to put smaller firms on a more equal footing with larger ones, thereby moderating or countering trends toward industry consolidation.

In this paper we explore such potential industry structure changes through a case study of the XML standardization initiative in the U.S. home mortgage industry. We first review the theoretical arguments about IT and industry structure change in general and then specifically consider the research on EDI and how the introduction of Internet standards might alter prior trends. We argue that technical implementation choices by both small and large organizations could make a significant difference in the outcomes observed. After a brief description of our research approach and an overview of the mortgage industry and its standardization process, we analyze possible structural changes in the mortgage industry and show their dependence on the technical implementation choices of individual firms in the industry.

## **THEORY**

Industry-level structural change results from choices made by individual firms, for example, decisions about whether to produce goods or services in-house or to outsource production to third-party specialist firms. Much theory and research leads to the conclusion that firms' choices about whether and how to implement IT could contribute, along with other factors, to industry structure change [26, 40, 45]. For example, if many firms in an industry make use of IT capabilities to coordinate with specialist firms rather than to produce goods and services in-house, the industry-level result will be smaller industry participant firms on average and an increase in the types, numbers, and/or size of third-party specialist firms [17].

Research on the business value of IT investments in general, and EDI and other types of interorganizational systems (IOS) in particular, strongly suggests that not all firms benefit equally [49]. Firms making complementary changes in business processes along with their IT investments do better than firms that do not [16, 21, 43]. Firms supporting their IT investments with high-quality IT infrastructures, e.g., through systems integration, do better than those that do not [51, 54, 66, 74]. In addition, where EDI and IOS are concerned, the benefits individual firms receive from their investments depend not only on their own implementation choices but on those of their business partners [56]. Failure of business partners to make process changes or to integrate EDI with their back-end systems can lead to lower benefits for an IOS-initiating firm.

Historically, only the largest firms were able to make the kinds of investments in IT, business processes, and system integration required to achieve full benefits from EDI and IOS for themselves and for their partners [9, 19, 55, 67]. Consequently, to the extent that EDI and IOS were adopted (though not very extensively, as the research shows), the adoption of these technologies tended to create winners and losers. By and large, the losers were smaller firms and new entrants. The result was to promote consolidation at the industry level [27]. New Internet-enabled electronic interconnection strategies are claimed to be able to change this situation, enabling smaller firms to adopt electronic interconnection technology with their partners and thus to compete on a more equal basis with larger firms. If so, the result might be qualitatively different from ever-greater industry consolidation; it might be, for example, greater vertical disintegration or disintermediation. The next sections review the theoretical arguments.

### **Industry Structure, Information Technology and Vertical Information System Standards**

Complementing a long tradition of research that has explored the influence of IT on firm-

level productivity [13, 14, 15, 64] is a good deal of work examining the potential consequences of IT innovations for changes in industry structure. Below we examine arguments about IT effects on consolidation, vertical disintegration (from increased outsourcing), disintermediation, and new entrants. Although it is tempting to associate use of the Internet with a range of industry-level effects, such as increased entry (and perhaps exit) of some kinds of firms, research suggests such effects are not easily observed. Simons [62], in a long-term study of the consulting industry found little evidence for such long term structural changes. Theoretical analysis can help us to anticipate the likely effects of vertical information standards.

**IT and Industry Consolidation.** Industry structure change can emerge from the aggregation of operational efficiencies made possible by IT, for example, creating scale economies that favor larger firms and thus more concentration at the industry level [27]. In a classic study, Clemons and Row [27] illustrated how IT-enhanced order entry systems allowed McKesson to reap the benefits of scale in warehousing and other operations. This encouraged growth, but because the technology was easily imitated, competing wholesalers also were able to expand. Rapid consolidation in pharmaceutical wholesaling follows, but the market positions of leading firms were not radically affected.

Not all industries experience the same effect; in some cases there are clear winners and losers [61]. Segars and Grover [61] argued that, although electronic order entry did not reconfigure the “strategic groups” in drug wholesaling, it did alter the strategic groups in the airline and industrial chemical industries.

The mortgage industry has experienced significant consolidation in recent years [47]. Yet, greater use of IT has also been implicated in the break-up of the mortgage value chain into specialized functions like servicing, with consolidation occurring within these stages of the chain

[36, 68]. Greater use of coordination standards within the industry might exacerbate these trends – specialized organizations can capitalize on their greater production capacities through improved transaction capabilities with adjacent players in the value chain, creating a cycle of vertical aggregation accompanied by consolidation within value chain stages [38].

**IT and Vertical Disintegration.** A frequently discussed potential industry-level impact of using IT for interfirm coordination is increased outsourcing [26, 40, 42, 45], leading to more fragmented value chains. These arguments rest on transaction cost theory, which analyzes organizations' make or buy decisions in terms of the differential governance costs of internal production versus market coordination [72, 73]. Transaction cost theory is mainly used to explain situations of market failure [33], but IS researchers have emphasized how computer networks can result in greater outsourcing [45].

According to the electronic markets hypothesis [34], many of the costs of coordinating with the market are reduced through the use of electronic networks. Malone et al. [45] argued that electronic networks *enable brokerage* effects, facilitating match-making between buyers and sellers. By increasing access to a greater number of potential suppliers, as well as improving the transparency of offers, the use of electronic networks is proposed to reduce organizations' vulnerability to opportunism. Moreover, improved coordination afforded by network-based transactions further encourages organizations to take advantage of more efficient producers rather than to rely on their own internal production. Electronic market researchers used this perspective to anticipate significant industry structure changes due to organizations' abilities to reduce search and coordination costs, especially in dealing with distant trading partners [6, 7, 45].

Theoretical and empirical critiques of the electronic markets hypothesis have been advanced, suggesting that somewhat different types of industry structure changes might result from the use of networks [70]. Indeed, in the original Malone et al. [45] paper, an alternative industry structure outcome was the potential for what were called *electronic hierarchies*. Empirical work in a number of different industries, including the mortgage industry, suggests that electronic hierarchies are more prevalent than would be expected from the electronic markets hypothesis [8, 22, 26, 34, 42]. Explanations emphasize the reduced exposure to opportunistic behavior afforded by more tightly-coupled linkages with a smaller number of suppliers, the need to ensure adequate return on transaction-related investments, obligations arising from social embeddedness, and the need to account for non-contractible investments such as quality, responsiveness and innovation.

Whether via electronic markets or electronic hierarchies, the increased use of IT for interfirm coordination is argued to yield greater reliance on outsourcing. However, much of the work in the area has occurred prior to the evolution of low cost, vertical IS standards across organizations. What additional industry structure effects might the widespread use of such standards create? First, if indeed the use of standards lowers costs so much that even smaller organizations can use networks to engage in transactions easily with all other industry participants, then some of the relationship-specific investment effects noted above might be diminished. Malone et al.[45] refer to the growing use of standard network protocols as an important reason why the electronic market effect would prevail. Moreover, a multi-decade study of the mortgage industry has, in fact, linked episodes of vertical disaggregation in the value chain to the use of standardized coordination mechanisms (e.g., automated underwriting and credit scoring) [37]. So vertical IS standards may finally enable the proliferation of electronic markets in the industry, and encourage more disaggregation and specialization in the value chain.

**IT and Disintermediation.** The growing use of standardized electronic networks has also been theoretically linked with the potential for buyers and sellers to bypass middlemen (intermediaries) in the value chain—an effect often called *disintermediation*. Certain types of organizations might become unviable when interorganizational networking becomes pervasive [69]. This effect has also been linked to transaction cost theory, in that networks reduce the costs that organizations incur when they access non-adjacent participants (e.g., a producer directly selling to end buyers rather than selling through wholesalers and retailers).

The potential for manufacturers to bypass wholesalers for direct exchange with downstream retailers has been raised in a variety of contexts [27]. With the growth of Internet-based electronic commerce, the bypassing of traditional intermediaries was increasingly predicted [10, 69]. The predicted trends did not materialize. Electronic networks can also reduce the costs of using intermediaries, reinforcing existing value chain structures [59, 60]. Traditional intermediaries sometimes re-establish themselves online in a process called *reintermediation* [20]. Furthermore, the Internet can open the door to new forms of intermediation due to changes in transaction costs and the need for new types of skills for e-commerce.

Whether widespread use of vertical industry standards for interorganizational coordination promotes or inhibits disintermediation might depend upon the nature of the standards themselves. If the standards obviate the need for services provided by intermediaries, then the intermediaries must either redefine their role or risk bypass. This risk could encourage threatened organizations to be more active in the standards-setting process, in order to limit the scope of the work undertaken and preserve their position in the value chain [47, 63].

**IT and New Entrants.** The special case of information goods has attracted much recent attention. In these analyses, IT lowers the costs of producing and distributing information goods,

threatening industry incumbents by promoting bypass by content creators as well as entry by new distributors [12, 23, 24].

Our focus is not on internal production of information goods, but on the impact of vertical coordination standards. Such standards can make it easier for new players to enter the market and compete with established organizations by reducing consumer search costs, for example. In the mortgage industry, at least two types of players are competing with traditional lenders. First, national mortgage brokers and lenders have appeared in what was formerly a relatively local market, prompted by the ease with which consumers can now search for the best rates. Second, new Internet-based intermediaries have appeared that encourage direct competition among lenders for a requested mortgage loan, creating downward pressures on prices [24]. With more widespread use of Internet-based standards, this trend might accelerate.

In the next section, we consider how the specific nature of vertical coordination standards might play a role in industry-level outcomes.

### **EDI Vs. Vertical IS Standards: Effects on Industry-Level Outcomes**

The vast body of research on the adoption, assimilation, and effects of EDI and IOS provides a strong platform for predicting the potential industry structure changes associated with the introduction of vertical IS standards. In general, the benefits of using EDI/IOS (EDI henceforth) for individual organizations can be categorized as follows [18, 25, 52]: 1) operational benefits from better business document handling (e.g., reduced administrative costs), 2) operational benefits from better use of electronically-captured information (e.g., reduced cycle time, better deployment of customer-related resources), 3) strategic benefits (e.g., new products/services, increased revenue), and 4) non-economic benefits (e.g., better relationships with business partners). The literature supports the conclusion that many companies (generally suppliers,

generally smaller in size) implemented EDI largely because they were requested (coerced) to do so by larger, powerful customers. Some reluctant EDI adopters obtained economic benefits [43, 51, 65], however, many failed to do so [39, 44, 46, 67].

The consensus in the literature is that, whether initiators or adopters, organizations cannot get advanced operational benefits (e.g., information use benefit) or competitive benefits from use of EDI without *both* improving their business processes [21, 43] and integrating EDI with high-quality (i.e., internally integrated) systems [51, 54, 66]. This conclusion does not imply that all EDI adopters would achieve benefits if only they made process changes and integrated EDI with their internal systems: Both process improvement and system integration are seriously hampered by the lack of universally accepted EDI standards. Even where industry-level agreement exists on the structure of EDI transaction sets, differences in the interpretation of standards or unique company requirements contribute to high electronic interchange costs by requiring multiple parallel system integrations and business processes [30, 41, 53, 71].

Even though universally-adopted data and document standards would make it easier for organizations to change their processes and integrate systems, several authors have persuasively argued that some potential EDI adopters have virtually *no* ability to benefit from electronic interchange even given the existence of standards. The reasons are several: some small organizations have no “processes” to reengineer, since they have so few transactions to perform; they may have no internal systems with which to integrate; and they may have few partners with whom they could use EDI, thereby leveraging their initial investment [9, 44, 46]. Thus, almost any cost of adoption might be too high to promote full adoption of electronic interconnections, leaving larger partners with the costs of maintaining parallel processes. Consequently, some argue, the larger organizations that benefit most from electronic interconnection should be

willing to provide significant benefits for the partners' to adopt EDI (such as substantially improved payment times) and to absorb or subsidize the majority of their partners' adoption costs [9, 32, 57].

How could vertical industry XML-based standards improve this situation? Table 1 breaks down the cost elements involved in adopting EDI and compares them with vertical IS standards. The comparison suggests two major conclusions.

INSERT TABLE 1 ABOUT HERE

First, vertical IS standards substantially lower the costs of participating in electronic interchange for smaller organizations. The reason is that XML-based standards involve not simply agreement on transaction formats, but also standardized data definitions. This level of standardization could eliminate the need for parallel processes and multiple electronic interfaces. Furthermore, the existence of XML-based standards could increase the market for IT products and services conforming to the standards, thereby increasing the incentives of IT vendors to develop such products and services. Small companies are much more likely to purchase packages than to develop them internally. If standards are built into the packages that small businesses would use to manage their businesses in any case, the cost of vertical IS standards adoption is virtually nil, and many such small businesses can be expected to adopt electronic interconnection with standards-compliant partners.

Second, larger companies that already have servicable EDI connections face substantial conversion costs to adopt vertical IS standards because of their installed legacy systems. The problem is compounded for larger companies that do not already have a fairly high level of internal systems integration, since they would be required to make a standards-compliant interface for each of their affected internal systems. Furthermore, since these large organizations

may have strategies of trying to lock in their business partners via proprietary interfaces, converting to vertical IS standards would appear not to be in their interests [28].

Together, these conclusions suggest that vertical IS standards do have the *potential* to trigger changes in industry structure *other than consolidation* by leveling the playing field between larger and smaller organizations. However, whether such an outcome occurs will depend in part on the responses of larger organizations. Will they attempt to increase their operational benefits from electronic interconnection by using vertical IS standards to expand the range of electronically connected partners and automated transactions? Or will they attempt to minimize conversion costs or to maintain strategically advantageous proprietary linkages by failing to adopt the standards or by implementing standards in a way that decreases benefits for their smaller partners?

## **APPROACH**

Our research strategy for addressing these questions is a case study of the vertical IS standardization effort in the U.S. home mortgage industry, known as MISMO for “Mortgage Industry Standards Maintenance Organization” ([www.mismo.org](http://www.mismo.org)). MISMO was established in 1999 to coordinate the development and maintenance of vendor-neutral XML-based transaction specifications to support data sharing among the many participants in mortgage lending processes. MISMO’s founders included the Mortgage Bankers Association of America (MBAA) ([www.mbaa.org](http://www.mbaa.org)) and several of its most prominent members. The MBAA is the leading association for companies in the commercial and residential real estate finance business. Its approximately 3,600 members cover all industry segments, including mortgage lenders, mortgage brokers, thrifts, mortgage insurance companies, and many types of software

companies. The MBAA represents the industry's legislative and regulatory interests, and conducts educational activities and research for its members.

Evidence for our analysis comes from in-depth interviews, documents and observation over a thirty-month period. Our primary data source was interviews with key informants involved with mortgage industry standardization activities. All three authors conducted face-to-face interviews with MBAA staffers in Washington, DC. We also conducted telephone interviews with six additional active MISMO participants from different parts of the mortgage value chain, including a government sponsored enterprise (GSE), a mortgage information and document services provider, a mortgage insurer, a mortgage credit reporting company, and two mortgage information technology vendors. In addition, we 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 executives in leading mortgage industry companies. An additional source of information was observations and interviews at two industry meetings: the Mortgage Technology Conference in Orlando, FL in March 2003, and the MISMO Trimester Workgroup Meeting in Dana Point, CA in January 2004.

## **THE MORTGAGE INDUSTRY**

The U.S. home mortgage industry is characterized by high fragmentation, with several thousands of mortgage bankers and brokers, and a high degree of vertical disintegration, with numerous players such as bankers, brokers, credit agencies, appraisal, title, escrow companies, etc. [35]. Rapid consolidation and some re-integration appears to be occurring among the larger mortgage banks [68]. Automation and IT-enabled standards are said to be playing an important factor in both structural evolutions [36, 68].

There are two mortgage industry markets: the primary market, where borrowers obtain loans from originators, and the secondary market, where mortgages are sold by originators and bought by investors [29]. The key primary market processes are *origination* (including application and underwriting—which considers the borrowers’ credit and property characteristics), *closing and recording* (legal transfer of the property), and *servicing* (receiving payments, managing tax and insurance escrows, monitoring delinquencies, managing foreclosures, and making payments to investors) [29]. Today, more than half of all mortgages are sold to the secondary market, with the remainder held in portfolio by lending depository institutions [68]. Originating mortgage bankers can sell their loans directly to investors or to one of the GSEs, who package and securitize the loans and sell interests in the securities to investors [29]. The GSEs, including Federal National Mortgage Association (FNMA, also called Fannie Mae, [www.fanniemae.com/index.jhtml](http://www.fanniemae.com/index.jhtml)) and the Federal Home Mortgage Corporation (FHLMC, also called Freddie Mac, [www.freddie.com](http://www.freddie.com)), are private corporations chartered by the U.S. federal government to create and grow the secondary mortgage market [29]. In 2003, roughly 50% of the \$6.3 trillion in outstanding U.S. mortgage debt for single-family residences was held in portfolio by the GSEs or by investors in the form of mortgage-backed securities guaranteed by the GSEs [29].

### **The Need for Mortgage Industry Standards**

Value chain fragmentation and other features of the mortgage industry (such as considerable regulation) create numerous coordination problems that electronic interchange via XML standards are expected to solve. According to our interviews, the major reasons for pursuing vertical IS standards in the mortgage industry include:

- **Rekeying.** Industry experts estimate that some mortgage lenders manually key-enter basic mortgage application data as many as seven times due to unintegrated back office systems.
- **Forms proliferation.** Because of differences in state and local regulations, as many as 30,000 different proprietary forms are used in the industry today, making forms management a major challenge.
- **Lost documents.** Major mortgage banks expend considerable labor in filing and retrieving paper documents. One major mortgage bank operates a Lost Mortgage Department with over 200 employees.
- **Customer frustration.** 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.
- **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).
- **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—transfer processes that offer many opportunities for errors.

Another frequently-stated rationale for mortgage industry standardization is to 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.” [11]*

## **Standardization in the U.S. Home Mortgage Industry**

The two major forces for standardization in the industry are the MBAA and the GSEs. The major milestones of standards development in the mortgage industry include:

- **1970s:** GSEs mandated underwriting guidelines and documentation requirements
- **1988-89:** GSEs standardized the mortgage application form; EDI standards groups were formed in several industry segments: mortgage banking, credit, insurance
- **1994:** GSEs rolled out automated underwriting (AU) software
- **1999:** MISMO was formed, enfolding many earlier EDI standards groups
- **2001:** GSEs agreed to adopt MISMO standards for transactions with other industry participants, vastly increasing the chances of widespread adoption of the standards.

## **MISMO Standards and Governance**

MISMO can be viewed as two standardization efforts in parallel. The first concerns *data standards* for mortgage transactions related to loan origination, secondary marketing, servicing, and real estate services. Examples 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, launched in 2001, concerns *process standards* to enable fully-electronic mortgages, from initial application, through closing and recording, and through sale in the secondary market and transfer of mortgage servicing rights. 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 made it possible to envision a mortgage lending process that produces legally-binding mortgages entirely without paper, by allowing for electronic signatures. A true e-mortgage is originated, closed, recorded, stored (in an electronic registry) and delivered to a secondary purchaser entirely in electronic form.

More than 250 organizations and 1,000 individuals are involved in more than 30 MISMO workgroups. Our observations at MISMO workgroup meetings and interviews with industry players confirm that MISMO employs an open and democratic approach to the development and maintenance of standards. Members describe the behavior of participants as altruistic. Large and small members each have one vote and many decisions are made by consensus, in sharp contrast to other standards-setting organizations in which members are often fiercely competitive. A Governance Committee, elected from a cross-section of the industry, provides oversight for MISMO's administration and policy development.

### **Implementing MISMO Standards: Anticipating and Achieving Benefits**

Achieving the hoped-for benefits of vertical IS standards depends on widespread adoption. Rogers [58] defined *adoption* as a decision to make full use of a new idea as the best course of action available. As in many other spheres, widespread adoption of mortgage industry XML standards adoption is problematic. As Mase [48] (p. 123) writes: *Despite the fact [the mortgage] industry has a lousy track record of successful technology implementations, I think the real challenge is getting mortgage participants to use the technology. That's because it requires them to change the way they do business."*

Regardless of industry, organizations can be expected to adopt standards when the benefits of standards adoption outweigh the costs [58]. Few organizations are likely to adopt an innovation extensively without trying it first on a probationary basis, but it can be very difficult to

implement vertical IS standards on a limited trial basis. Because vertical IS standards adoption might be perceived as an all-or-nothing choice, organizations might delay adopting as long as possible, observing the actions their competitors and evaluating first-mover experiences. Au and Kauffman referred to this situation as “rational expectation adoption” [5] and the “should we wait?” dilemma [4].

## **MISMO STANDARDS: POTENTIAL INDUSTRY-LEVEL EFFECTS AND THE ROLE OF IMPLEMENTATION CHOICES**

Because MISMO standards are currently being introduced in the mortgage industry, it is too early to measure specific industry-level outcomes. However, we report on the emerging trends that surfaced in our study. Next, we discuss how technical implementation choices might affect the mortgage industry structure changes that eventually unfold.

### **Potential Structural Changes in the Mortgage Industry**

We earlier questioned whether vertical IS standards are likely to result in greater consolidation of the mortgage industry or will lead to other forms of structural changes including vertical disintegration and more outsourcing, bypass of intermediaries, or growth of new entrants.

**MISMO Standards and Industry Consolidation.** The mortgage industry has undergone considerable consolidation in the past decade—changes attributed by many experts to IT [36]. Since 1992, 17 of the 25 largest residential lenders in the mortgage industry have disappeared from the market [31]. Today, the top five lenders provide over 50% of loans, while the top ten mortgage servers control more than 50% of this segment [47]. This trend, however, predates the availability of MISMO standards. Interviewees noted that small organizations continue to prosper in niche markets, and it is not just the larger organizations that are enabled by standards

to grow: “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.” (Executive, mortgage-related services company A, 9/30/2003)

What seems to be emerging is a two-tier structure of a few very large and growing organizations and many small organizations, but few organizations of intermediate size. This evidence suggests that industry-level structural changes resulting from the introduction of low-cost vertical IS standards differ qualitatively from simple consolidation favoring large organizations.

**MISMO Standards and Vertical Disintegration.** At the same time that consolidation among the largest players is occurring, there is evidence of increased outsourcing, driven by the reduced coordination costs afforded by vertical IS standards [37]. For example, Jacobides described several episodes of vertical disintegration of the mortgage industry value chain—the separation of mortgage brokering from mortgage banks, the separation of loan provision from the secondary investment market, and the separation of mortgage origination from mortgage servicing—and attributed them in part to the use of standardized coordination mechanisms such as automated underwriting and credit scoring [34].

Greater outsourcing has not diminished organizational performance in the industry. On the contrary, overall efficiency seems higher than in the past. Interviewees reported that credit scoring and automated underwriting had shortened the loan approval process from four to six weeks thirty years ago to a few minutes today. This improvement was enabled in part by

mortgage bankers outsourcing the labor-intensive in-house evaluation of borrowers' creditworthiness through the use of standardized, externally-produced Fair Isaac Credit Organization (FICO) scores. Vertical IS standards can also promote outsourcing by eliminating lock-in effects caused by proprietary technology: "*[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 locked into the company that they're doing business with.*" (Senior IT specialist, credit services company, 9/30/2003)

**MISMO Standards and Disintermediation.** Hess and Kemerer's [34] 1994 study of the mortgage industry explored whether loan origination systems encouraged wholesale mortgage lenders to develop direct relationships with real estate agents, leap-frogging over the mortgage brokers and the traditional mortgage lenders. Although they did not find evidence of disintermediation at that time, new threats to intermediaries in the mortgage value chain have recently emerged. Interviewees expressed particular concern that vertical IS standards, in general, and e-mortgage standards, in particular, reducing the value of the intermediary role played by document preparation companies, forcing them to change their role or exit the business. In the words of one interviewee: "*As you move into the electronic world, some opportunities disappear and new opportunities arise, and maybe it's a little different way of doing business, but you ... always readjust yourself*". (IT executive, mortgage-related services company B, 10/20/03)

**MISMO Standards and New Entrants.** Widespread implementation of MISMO standards can be expected to open the door to additional new entrants, including new types of intermediaries. Internet standards have already promoted the emergence of successful new online

lenders including Quicken Loans ([www.quickenloans.com](http://www.quickenloans.com)) and e-Loan ([www.e-loan.com](http://www.e-loan.com)).

Another new entrant, Lending Tree ([www.lendingtree.com](http://www.lendingtree.com)), consolidates lenders' offerings to allow consumers easier access to a wider range of mortgage products. By enabling more efficient transfer of information among organizations, MISMO standards may promote the development of even more innovative business models.

Yet another way that MISMO standards can promote industry structure change is by enabling new forms of individualized mortgage products, which may open the door to newer, more nimble competitors. Industry experts give automation the credit for the development of adjustable rate mortgages [36]. Some mortgage lenders offer more than 350 mortgage product variants today, compared with about thirty just ten years earlier [31]. One interviewee described the potential as follows: *"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."* (CEO, major mortgage lender, 7/25/2003)

**Summary.** Our case analysis suggests that the widespread use of vertical IS standards could lead to a number of industry structure changes, over and above a simple continuation of the trend towards consolidation, whereby less efficient smaller organizations are absorbed by more efficient larger players. Larger organizations are likely to continue to grow as they reap the scale benefits arising from enhanced efficiency. However, increased disintegration, greater

opportunities for intermediation, and ease of entry for new organizations are also plausible outcomes of standards-enabled improvements in interorganizational coordination. Whether these alternative outcomes occur is likely to depend on implementation choices as we discuss below.

### **MISMO Implementation—Issues That Could Affect Industry Structure Change**

The vision of MISMO’s data standards is “straight-through processing” across the mortgage industry value chain. Each participating company (brokers, credit agencies, appraisal companies, lenders, GSEs) would employ the IT of its choice. Whenever a participant needed to pass documents to another party, it would be able to generate automatically, and transmit electronically, MISMO-compliant output. Recipients could accept that output automatically as input to their own systems without rekeying or translation. The envisioned benefits include: 1) no need for labor-intensive and expensive use of printing, couriers and fax, 2) elimination of rekeying, 3) increased process speed from nearly instantaneous documents transfer, and 4) a platform for higher order benefits, such as better decision making, process streamlining, new products and services, and new forms of interorganizational collaboration.

Mortgage industry participants could, however, implement MISMO standards in ways that will not result in straight-through processing. Table 2 describes the options. Perhaps the most important consideration is whether participants deploy the capability to send and receive standards-compliant messages or whether they employ translations programs to convert system outputs into compliant format.

#### TABLE 2 ABOUT HERE

**Translation.** Employing translation appears to be the lowest cost option for becoming standards-compliant. This choice does not require replacing legacy systems or modifying them to produce standards-compliant output. However, the disadvantages of translation are several.

Translations always entail the possibility of errors that require manual correction. In addition, commercial translation programs or 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 translation often operates on batches of documents, reducing transfer speed relative to straight-through processing, and might involve separate manual processing. Even though the output of batch translation is MISMO-compliant, the receiving party has to perform manual processes to accept this input. In brief, under this scenario, the two parties would be “compatible” but would not be fully “interoperable” [1].

Because of the disadvantages of translation, it is useful to consider the alternatives.

**Upgrading/Conversion.** Companies that already employ off-the-shelf mortgage industry software or IT services from an application service provider often find it quite straightforward and inexpensive to become MISMO-compliant. Many vendors of software for the mortgage industry have already announced the MISMO-compliance of their software. Examples include Atone Software ([www.atone.com](http://www.atone.com)) and a joint development of Dynatek ([www.dynatek.com](http://www.dynatek.com)) and a la mode, inc. ([www.alamode.com](http://www.alamode.com)) [3]. Not only is the upgrade approach relatively hassle-free, it is also likely to result in straight-through processing.

The smaller players in various segments (credit, brokerage, lending) are most likely to adopt this solution. They probably already use commercial packages for which MISMO-compliance is

under development. Alternatively, their relative costs for switching packages to achieve MISMO compliance are likely to be lower than those of larger organizations.

**New development.** Another option is to develop software from scratch. MISMO has published implementation guides to support software development by end-users as well as vendors. New entrants and small- and medium-sized companies with strong IT skills may be able to develop new MISMO-compliant capabilities from scratch at relatively low cost, because they are not hampered by the need to incorporate legacy IT components.

**Retrofitting existing software.** Many vendors and larger organizations have significant investments in legacy systems that would be too costly or too risky to replace all at once. These organizations face the choice of building and using translation programs, with the disadvantages discussed above, or of retrofitting software to achieve MISMO compliance. Either approach can be difficult and failure-prone. Implementers will likely experience one or more of several challenges outlined in MISMO's "XML Implementation Guide: General Information" [50]:

- 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 XML reserved characters; otherwise [special programming will be required]"* (p. 3-1)
- Location of the 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. 3-3)
- Handling attributes with no data. *"When processing XML data from your business partners, you should be aware that there are two valid ways of showing (or not showing)*

*that an attribute has no data value. The preferred method is just to not include the element name in the XML file.” (p. 3-6).*

In addition, implementers of translation programs and software retrofits can face challenges due to legacy system fragility.

**Coping with internal integration challenges.** Large mortgage industry participants face three sources of complexity when pursuing MISMO compliance. First, they could have multiple unstandardized and unintegrated instances of the same type of system because of growth through acquisition. 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 when it started developing a single processing platform. (The company had concluded that available software packages were inappropriate.) Second, large lenders often do business through multiple channels (e.g., retail, wholesale/broker, correspondent, and web) and could have separate systems to support each sales channel. Third, large lenders could have different mortgage loan products (e.g., fixed-rate, adjustable, home equity), each supported by a different system.

Lenders with complex, unintegrated systems must either implement MISMO standards on a system-by-system basis or create an integrated service delivery platform. Either way involves challenges. In the first place, legacy mainframe systems do not readily lend themselves to XML-based web services: *“[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” (Executive, mortgage-related services company C, 9/30/03)*

This interviewee further explained that their very size might 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.”* (Executive, mortgage-related services company C, 9/30/03)

The challenges of implementing MISMO standards without significantly upgrading the legacy environment first could lead some large lenders to delay adoption. Because most large lenders long ago deployed proprietary EDI connections with their major business partners, they 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 in 1996 and is only now in the final stages of the 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).

**MISMO standards as a spur to integration.** Although lack of internal systems integration might discourage some large organizations from implementing MISMO standards, the existence of MISMO standards could ironically convince other large lenders to develop integrated

platforms. MISMO-compliant small companies and start-ups would have significant advantages in their ability to grow, to implement process innovations, and to introduce new products and services that large non-compliant companies would not have.

The earlier-quoted 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.*" (CEO, major mortgage lender, 7/25/03)

Other interviewees emphasized the potential of integrated systems across the value chain to support process innovations: *"[Improved business processes] 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?"* (Senior executive, mortgage services firm, 8/27/04)

In addition, some interviewees emphasized that internally and externally-integrated systems could support data mining and enable mass-customized development of customer-specific products and pricing. Other industry experts anticipate new forms of interorganizational collaboration based on advanced IT capabilities: *"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.” [2, p. 59].*

Because of potential benefits such as these, some large companies will undoubtedly choose to implement MISMO standards by redeveloping their internal systems, despite costs and risks that would otherwise delay their adoption. Indeed, one industry expert told us that a few large lenders were using the MISMO standards as a way to build *internal* systems integration, not just interchange with external partners. Nevertheless, other large companies will undoubtedly avoid implementing the standard or implement it in ways that fall short of the straight-through processing ideal, diminishing their own benefits and those of their partners.

**Implications.** In this section we discussed what is required to reap the benefits of MISMO standards. We characterize the short term prospects of adopting and implementing MISMO standards as follows:

- 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.
- Nevertheless, many small organizations will be able to adopt MISMO standards easily at relatively low cost through vendor offerings. These organizations may have the ability to hold their own and grow in the face of competition from larger organizations.
- Some large organizations will be unable to implement MISMO standards because of their poor internal IT environments.
- 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 the level of benefits possible with 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.
- 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. Transitional problems will occur.

## **DISCUSSION**

Our case analysis of the mortgage industry suggests that the effects of Internet-based vertical IS standards may not parallel earlier experiences with EDI, despite the fact that both are industry-specific standards for interorganizational transactions. Whereas EDI was too costly for small organizations to adopt and deploy advantageously, the benefits from XML-based vertical IS standards are likely to be experienced by smaller as well as larger organizations. Consequently, whereas EDI promoted simple consolidation, with large companies getting larger, XML-based standards could promote more complex industry structure changes. For example, in addition to greater consolidation at the top end of the size spectrum, the industry might experience even greater vertical disintegration, disintermediation, and the emergence of new entrants, including new types of intermediaries.

Our case analysis enables us to explain that these industry-level outcomes may differ from the earlier experience with EDI not simply because of relative technology. Lower costs do imply

that more companies will adopt and implement standards-based technologies in the mortgage industry. However, as our case demonstrates, organizations will implement vertical IS standards in ways that yield differing degrees of integration with existing systems. Some large organizations will implement MISMO standards by redeveloping their internal systems, despite high costs and risk. Indeed, many large lenders are making already significant progress toward a technical and organizational infrastructure enabling a leaner, end-to-end mortgage process. Other large players are likely to avoid standards implementation or implement the standards in ways that will not achieve straight-through processing. Many small organizations are likely to implement MISMO standards due to low cost and attractive vendor offerings. Finally, benefits will further depend upon the choices made by transaction partners, who take their own approaches to implementation. Our interviewees explained that even large organizations with significant IT sophistication may have conflicting priorities regarding standards adoption. Collectively, these results argue for theoretical developments and more empirical research on the links between patterns of standards implementation and their industry-level effects.

Our data suggest that specific characteristics of the standards proposed in particular industries are important factors in the nature and extent of industry structure changes observed. For example, the RFID standards emerging in retail supply chains help organizations locate and account for products, but they do not directly address the content and format of business transactions among organizations in the same way that MISMO standards do. Thus, an analysis unique to the particulars of RFID standards would be required for plausible hypotheses about industry-level effects of those standards. Hence, we do not claim that our specific conclusions about the mortgage industry would generalize to other contexts. However, we do propose our broader conclusion—that patterns of standards implementation affect industry-level structural

changes—as a generalization that can and should be tested in other contexts.

## CONCLUSION

Our paper contributes to the literature on interorganizational systems by extending prior EDI research to include newer XML-based vertical IS standards. We develop theoretically-guided expectations for industry structural change moderated by the technical choices organizations make in implementing standards. We illustrate with a case study of the U.S. home mortgage industry how the implementation of vertical IS standards can lead to a variety of industry-level outcomes beyond simple consolidation. We also describe a range of implementation strategies available to organizations that adopt vertical IS standards.

The increased affordability of Internet-based vertical IS standards implies that their effects will be far more pervasive, while at the same time providing greater flexibility in implementation strategies. Clearly, new analyses in other industries are required, as is the need to monitor changes at the industry level over time. At this early stage, our case analysis highlights the need for IS researchers to reconsider interorganizational systems in this new emerging technology context.

## REFERENCES

1. Alvord, G. SOAP and standardization. Gallagher Financial Systems, (no date), ([www.gogallagher.com/whitepaper02.htm](http://www.gogallagher.com/whitepaper02.htm), last accessed on April 20, 2005).
2. Anonymous. XML for the world. *Computer Business Review Online*, (2001), ([www.cbronline.com/research\\_centres/b7f9971eada4d46f80256d350047ceec](http://www.cbronline.com/research_centres/b7f9971eada4d46f80256d350047ceec), last accessed on January 4, 2005).
3. Anonymous. Dynatek and a la mode leverage the Mercury Network to connect lenders and appraisers, a la mode, inc., May 23, 2003, ([www.alamode.com/pr/press%20releases/dynatek.html](http://www.alamode.com/pr/press%20releases/dynatek.html), last accessed on April 20, 2005).
4. Au, Y., and Kauffman, R. Should we wait? Network externalities and electronic billing adoption. *Journal of Management Information Systems*, 18, 2, (2001), 47-64.

5. Au, Y., and Kauffman, R. What do you know? Rational expectations and information investment. *Journal of Management Information Systems*, 20, 2, (2003), 49-76.
6. Bakos, J.Y. Reducing buyer search costs: Implications for electronic marketplaces. *Management Science*, 43, 12, (1997), 1676-1692.
7. Bakos, J.Y. The emerging role of electronic marketplaces on the Internet. *Communications of the ACM*, 41, 8, (1998), 35-42.
8. Bakos, J.Y., and Brynjolfsson, E. From vendors to partners: Information technology and incomplete contracts in buyer-seller relationships. *Journal of Organizational Computing*, 3, 3, (1993), 301-328.
9. Beck, R.; Weitzel, T.; and König, W. Promises and pitfalls of SME integration. In *Proceedings of 15th Bled Electronic Commerce Conference: e-Reality: Constructing the e-Economy*, Bled, Slovenia, 2002.
10. Benjamin, R., and Wigand, R.T. Electronic markets and virtual value chains on the information highway. *Sloan Management Review*, 36, 2, (1995), 62-72.
11. Bixby, M., and Alvord, G. Data Standards and Mortgage Credit Reporting, in S. Bolin, ed., *The Standards Edge*, Washington, DC: Bolin Communications, 2004, 331-339.
12. Bockstedt, J.; Kauffman, R.J.; and Riggins, F.J. The Move to Artist-Led Online Music Distribution: Explaining Structural Changes in the Digital Music Market, in R. Sprague, ed., *Proceedings of 38th Hawaii International Conference on Systems Sciences*, Kona, HI, January 2005, Los Alamitos, CA: IEEE Computing Society Press, 2005.
13. Brynjolfsson, E. The productivity paradox of information technology. *Communications of the ACM*, 36, 12, (1993), 67-77.
14. Brynjolfsson, E., and Hitt, L. Paradox lost? Firm-level evidence on the returns to information systems spending. *Management Science*, 42, 4, (1996), 541-558.
15. Brynjolfsson, E., and Hitt, L. Beyond the productivity paradox. *Communications of the ACM*, 41, 8, (1998), 49-55.
16. Brynjolfsson, E., and Hitt, L. Beyond computation: Information technology, organizational transformation and business performance. *Journal of Economic Perspectives*, 14, 4, (2003), 23-48.
17. Brynjolfsson, E.; Malone, T.W.; Gurbaxani, V.; and Kambil, A. Does information technology lead to smaller firms? *Management Science*, 40, 12, (1994), 1628-1644.
18. Chatterjee, D., and Ravichandran, T. Inter-organizational information systems research: A critical review and an integrative framework. In R. Sprague, ed., *Proceedings of 37th Hawaii International Conference on Systems Sciences*, Kona, HI, January 2004, Los Alamitos, CA: IEEE Computing Society Press, 2004.
19. Chen, J.-C., and Williams, B.C. The Impact of electronic data interchange (EDI) on SMEs: Summary of eight British case studies. *Journal of Small Business Management*, 36, 4, (1998), 68-72.
20. Chircu, A., and Kauffman, R. Reintermediation strategies in business-to-business electronic commerce. *International Journal of Electronic Commerce*, 4, 4, (2000), 7-42.

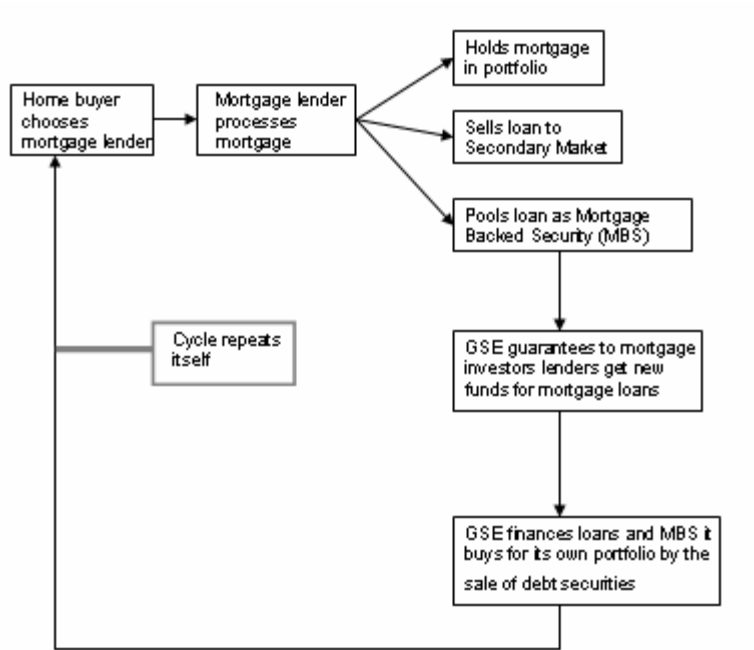
21. Clark, T., and Stoddard, D.B. Interorganizational business process redesign: Merging technological and process innovation. *Journal of Management Information Systems*, 13, 2, (1996), 9-28.
22. Clemons, E.K. Information technology and the boundary of the firm: Who wins, who loses, and who has to change. In S. Bradley, J. Hausman, and R. Nolan, eds., *Globalization, Technology and Competition: The Fusion of Computers and Telecommunications in the 1990s*, Boston, MA: Harvard University Press, 1993, 219-242.
23. Clemons, E.K.; Gu, B.; and Lang, K.R. Newly vulnerable markets in an age of pure information products: An analysis of online music and online news. *Journal of Management Information Systems*, 19, 3, (2003), 17-41.
24. Clemons, E.K., and Hitt, L. The Internet and the future of financial services: Transparency, differential pricing and disintermediation. Report 00-35, Wharton Financial Institutions Center, University of Pennsylvania, Philadelphia, PA, September 2000.
25. Clemons, E.K., and Lang, K.R. The decoupling of value creation from revenue: A strategic analysis of the markets for pure information goods. *Information Technology and Management*, 4, (2003), 259-287.
26. Clemons, E.K.; Reddi, S.; and Rowe, M. The impact of information technology on the organization of economic activity: The "move to the middle" hypothesis. *Journal of Management Information Systems*, 10, 2, (1993), 9-35.
27. Clemons, E.K., and Row, M.C. McKesson Drug Company: A case study of Economost: A strategic information system. *Journal of Management Information Systems*, 5, 1, (1988), 36-50.
28. Clemons, E.K., and Row, M.C. Limits to interfirm coordination through information technology: Results of a field study in consumer packaged goods distribution. *Journal of Management Information Systems*, 10, 1, (1993), 73-95.
29. Cummings, J., and DiPasquale, D. *A Primer on the Secondary Mortgage Market*, Boston, MA: City Research, 1997.
30. Damsgaard, J., and Truex, D. Binary trading relations and the limits of EDI standards: The Procrustean bed of standards. *European Journal of Information Systems*, 9, 3, (2000), 142-158.
31. Duncan, D.G. MISMO evolution. *Mortgage Banking*, December, (2003), 46-50, 52.
32. Gebauer, J., and Buxmann, P. Assessing the value of interorganizational systems to support business transactions. *International Journal of Electronic Commerce*, 4, 4, (2000), 61-82.
33. Gurbaxani, V., and Whang, S. The impact of information systems on organizations and markets. *Communications of the ACM*, 34, 1, (1991), 59-73.
34. Hess, C.M., and Kemerer, C.F. Computerized loan origination systems: An industry case study of the electronic markets hypothesis. *MIS Quarterly*, (1994), 251-275.
35. Jacobides, M.G. Mortgage banking unbundling: Structure, automation and profit. *Mortgage Banking*, 61, 4, (2001), 28-40.

36. Jacobides, M.G. Technology with a vengeance: The new economics of mortgaging. *Mortgage Banking*, 62, 1, (2001), 118-131.
37. Jacobides, M.G. Industry change through vertical disintegration: How and why markets emerged in mortgage banking. *Academy of Management Journal*, (forthcoming).
38. Jacobides, M.G., and Hitt, L.M. Vertical scope, revisited: Transaction costs vs. capabilities and profit opportunities in mortgage banking, in *Proceedings of Academy of Management*, 2001.
39. Juul, N.C.; Andersen, K.V.; and Korzen-Bohr, S. Challenging the paradigms on up-stream B2B e-commerce? In R. Sprague, ed., *Proceedings of 37th Hawaii International Conference on Systems Sciences*, Kona, HI, January 2004, Los Alamitos, CA: IEEE Computing Society Press, 2004.
40. Kauffman, R., and Walden, E. Economics and electronic commerce: Survey and directions for research. *International Journal of Electronic Commerce*, 5, 4, (2001), 5-116.
41. Kimbrough, S.O., and Moore, S.A. Message management systems: Concepts, motivations, and strategic effects. *Journal of Management Information Systems*, 9, 2, (1992), 29-53.
42. Kraut, R.; Steinfield, C.; Chan, A.; Butler, B.; and Hoag, A. Coordination and virtualization: The role of electronic networks and personal relationships. *Organization Science*, 10, 6, (1999), 722-740.
43. Lee, H.G.; Clark, T.; and Tam, K.Y. Research report. Can EDI benefit adopters? *Information Systems Research*, 10, 2, (1999), 186-195.
44. Mackay, D. Measuring organizational benefits of EDI diffusion: A case of the Australian automotive industry. *International Journal of Physical Distribution and Logistics*, 26, 10, (1996), 60-78.
45. Malone, T.; Yates, J.; and Benjamin, R. Electronic markets and electronic hierarchies: Effects of information technology on market structure and corporate strategies. *Communications of the ACM*, 30, 6, (1987), 484-497.
46. Marcussen, C. The effects of EDI on industrial buyer-seller relationships: A network perspective. *International Journal of Purchasing and Materials Management*, Summer, (1996), 20-26.
47. Markus, M.L.; Steinfield, C.W.; and Wigand, R.T. The evolution of vertical IS standards: electronic interchange standards in the U.S. home mortgage industry, in *Proceedings of Proceedings of the Workshop on Standard Making: A Critical Research Frontier for Information Systems*, Seattle, WA, 2003, 80-91.
48. Mase, S. A warm bundle of technology and services. *Mortgage Banking*, 65, 6, (2005), 123-124.
49. Melville, N.; Kraemer, K.; and Gurbaxani, V. Review: Information technology and organizational performance: An integrative model of IT business value. *MIS Quarterly*, 28, 2, (2004), 283-322.
50. MISMO, XML Implementation Guide: General Information, MISMO, 2000, ([www.mismo.org/mismo/docs/MISMOGeneralGuide1\\_x.pdf](http://www.mismo.org/mismo/docs/MISMOGeneralGuide1_x.pdf), last accessed on April 18).

51. Mukhopadhyay, T., and Kekre, S. Strategic and operational benefits of electronic procurement in B2B procurement processes. *Management Science*, 48, 10, (2002), 1301-1313.
52. Mukhopadhyay, T.; Kekre, S.; and Kalathur, S. Business value of information technology: A study of electronic data interchange. *MIS Quarterly*, 19, 2, (1995), 137-156.
53. Philip, G., and Pedersen, P. Inter-organisational information systems: Are organisations in Ireland deriving strategic benefits from EDI? *International Journal of Information Management*, 17, 5, (1997), 337-357.
54. Ramamurthy, K.; Premkumar, G.; and Crum, M.R. Organizational and interorganizational determinants of EDI diffusion and organizational performance: A causal model. *Journal of Organizational Computing and Electronic Commerce*, 9, 4, (1999), 253-285.
55. Raymond, L., and Bergeron, F. EDI success in small and medium-sized enterprises: A field study. *Journal of Organizational Computing and Electronic Commerce*, 6, 2, (1996), 161-172.
56. Riggins, F.J., and Mukhopadhyay, T. Interdependent benefits from interorganizational systems: Opportunities for business partner reengineering. *Journal of Management Information Systems*, 11, 2, (1994), 37-57.
57. Riggins, F.J., and Mukhopadhyay, T. Overcoming EDI adoption and implementation risks. *International Journal of Electronic Commerce*, 3, 4, (1999), 103-123.
58. Rogers, E.M. *Communication of Innovations*. New York, NY: The Free Press, 1971.
59. Sarkar, M.B.; Butler, B.; and Steinfield, C. Intermediaries and cybermediaries: A continuing role for mediating players in the electronic marketplace. *Journal of Computer Mediated Communication*, 1, 3, (1995), ([jcmc.indiana.edu/vol1/issue3/sarkar.html](http://jcmc.indiana.edu/vol1/issue3/sarkar.html)), last accessed on April 20, 2005).
60. Sarkar, M.B.; Butler, B.; and Steinfield, C. Cybermediaries in the electronic marketplace: Towards theory building. *Journal of Business Research*, 41, 3, (1998), 215-221.
61. Segars, A., and Grover, V. The industry-level impact of information technology: An empirical analysis of three industries. *Decision Sciences*, 26, 3, (1995), 337-369.
62. Simons, K. Information technology and the dynamics of firm and industrial structure: The British IT consulting industry as a contemporary specimen. Report 2001/83, United Nations University, World Institute for Development Economics Research, Helsinki, Finland, September 2001.
63. Steinfield, C.W.; Wigand, R.T.; and Markus, M.L. Promoting e-business through vertical information systems standards: Lessons from the U.S. home mortgage industry. In S. Greenstein and V. Stango (eds.), *Standards and Public Policy*, Cambridge, England: Cambridge University Press, forthcoming.
64. Strassmann, P. *Information Payoff*. New York, NY: The Free Press, 1985.
65. Subramani, M. How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly*, 28, 1, (2004), 45-73.

66. Truman, G.E. Integration in electronic exchange environments. *Journal of Management Information Systems*, 17, 1, (2000), 209-244.
67. Tuunainen, V.K. Opportunities of effective integration of EDI for small businesses in the automotive industry. *Information & Management*, 34, (1998), 361-375.
68. Van Order, R. The U.S. mortgage market: A model of dueling charters. *Journal of Housing Research*, 11, 2, (2000), 233-255.
69. Wigand, R.T., and Benjamin, R. Electronic commerce: Effects on electronic markets. *Journal of Computer Mediated Communication*, 1, 3, (1995), ([jcmc.indiana.edu/vol1/issue3/wigand.html](http://jcmc.indiana.edu/vol1/issue3/wigand.html)), last accessed on April 20, 2005).
70. Wigand, R.T.; Picot, A.; and Reichwald, R. *Information, Organization and Management: Expanding Markets and Corporate Boundaries*. Chichester, England: John Wiley and Sons, 1997.
71. Williams, M.L., and Frolick, M.N. The evolution of EDI for competitive advantage: The FedEx case. *Information Systems Management*, Spring, (2001), 47-53.
72. Williamson, O. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York, NY: Free Press, 1975.
73. Williamson, O. *The Economic Institutions of Capitalism*. New York: Free Press, 1985.
74. Zhu, K. The complementarity of information technology infrastructure and e-commerce capability: A resource-based assessment of their business value. *Journal of Management Information Systems*, 21, 1, (2004), 167-202.

**Figure 1: The Mortgage Industry Value Chain and Markets**



**Table 1. Comparing EDI with XML-based Vertical Industry Standards**

<b>Cost Factor</b>	<b>Vertical Industry EDI Standards</b>	<b>Vertical Industry XML Standards</b>	<b>Comments</b>
Set up standalone, unintegrated connection with one partner	Minimal: need input-output devices and telecommunications connections	Same	Solution provides no benefits for the implementer; worse, implementer with internal systems bears costs of dual entry and potential error reconciliation problems
Set up connection with one partner, integrated with own back-end systems	High, because of need to program or purchase and configure translation software/hardware; knowledge burden	Issue still exists; the problem is much worse for organizations with legacy systems environments, particularly those lacking internal systems integration; costs could be sharply reduced for organizations using packaged software that is build or upgraded by vendors to conform to standards	(Large) organizations with existing EDI connections are likely to balk at replacing them; existence of XML standards increases the potential market for packaged software, providing incentives for vendors to develop conforming software (smaller organizations are most likely to adopt such packages)
Expand EDI to other partners/transactions	High, because different partners require different data standards and transaction formats	Cost is substantially reduced through widespread adoption of the standards; each new partner/transaction is the same as earlier ones	XML standards are extensible, so some partners could require additional data fields or transactions, increasing the cost of expansion
Operating cost—technical resources	High, because of the use of VANs	VANs can be bypassed through direct partner access via the Internet	Some partners might require the use of VANs for reasons of security, etc.
Operating cost—human resources	High cost for parallel manual and /or parallel automated operations, because not all partners use EDI or use the same version of EDI standards (some partners do not adopt; partners and vendors do not adopt or implement new standards versions at same time)	XML standards are extensible, so some partners could require additional data fields or transactions creating costs for parallel operations; transitional problems (failure of partners or vendors to implement changes at the same time) still exist	The problem of some parties persisting in manual transactions is less likely to occur in highly information intensive industries; parties that transact heavily outside the industry still face the problem of parallel operations (two sets of standards for similar transactions)

**Table 2. Levels of Integration with MISMO Standards**

Non-automated interchange	One party's voice, paper, fax, email, or web standards-compliant output is manually reentered by other party.
One-sided Automation	One party automatically produces standards-compliant output, possibly through a batch translation process; the other party receives it electronically but manually reenters it.
Manually-assisted interchange	One party's standards-compliant output is electronically processed by the other party after manual file extraction, uploading 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.