PROMOTING E-BUSINESS THROUGH VERTICAL IS STANDARDS: LESSONS FROM THE US HOME MORTGAGE INDUSTRY[1][2]

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ABSTRACT

Vertical information systems standards are designed to promote communication and coordination among the organizations comprising a particular industry sector; these standards may address product identification, data definitions, business document layout, and/or business process sequences. A case study of the emergence of vertical information systems standards in the US home mortgage industry is used to provide insights into three processes: (1) the way that the standardization process is structured to facilitate participation and consensus, (2) the approaches used to promote adoption of open and transparent standards, and (3) the steps taken to ensure the ongoing maintenance and integrity of the standard. Interviews with participants involved with the Mortgage Industry Standards and Maintenance Organization (MISMO), as well as meeting observations inform the case analysis. Findings emphasize the importance of company and individual incentives to contribute to the process, the formal and informal governance mechanisms used to minimize conflict and develop consensus, inclusive and proactive policies regarding membership, a limited scope of standardization activities, an explicit intellectual property rights policy, and efforts to institutionalize the entire standardization process into a formal structure. Implications for theory and practice are discussed, with specific attention to recommendations for policy makers regarding their potential role in the promotion of vertical IS standards development.

PROMOTING E-BUSINESS THROUGH VERTICAL IS STANDARDS: THE CASE OF THE US HOME MORTGAGE INDUSTRY

INTRODUCTION

Information systems (IS) standards--standardized business documents, data definitions, and business processes--have been seen as key to effective interorganizational commerce since the 1980s, when electronic data interchange (EDI) became the technology of choice for business-to-business coordination. Unfortunately, despite much promotion, EDI standards achieved only limited adoption; an estimated 2% of the world's businesses (Anonymous 2001b), including just 300,000 US companies (http://www.disa.org), have adopted EDI. Low penetration of electronic interconnection standards, particularly around business semantics (Jain and Zhao 2003), is believed to hinder electronic business and supply-chain integration (Songini 2001).

Recently, the availability of open Internet protocols and technologies, particularly eXtensible Markup Language (XML), has given a boost to both the adoption of EDI (Vollmer 2002) and the development of vertical (that is, industry-specific) XML-based data and process standards (Babcock 2004). Vertical, that is industry-wide, efforts to develop such standards have emerged in electronics (RosettaNet), chemicals (CIDX), insurance (ACORD), petroleum (PIDX), and several other industries. Many observers expect these developments to lower the cost of electronic connection and spur adoption, particularly among smaller firms. Further, many firms view vertical IS standards creation like they would National Public Radio (NPR), where larger companies with larger capital bases will invest in the creation and maintenance of the standards, and these and the smaller companies will benefit from their adoption.

Despite considerable prior economics research on standards and standardization, many important theoretical and empirical problems remain (Stango 2004). Furthermore, prior literature does not address the aspects of standardization from the perspective of information systems research, such as the tendency of companies to modify EDI standards to facilitate doing business with key business partners (Damsgaard and Truex 2000) and the barriers to adoption posed by companies' legacy information systems.

This paper contributes to the small but important literature on vertical IS standards by presenting a case study of the emergence of electronic interconnection standards in the US home mortgage industry. Owing to the early stage of standards development in that industry, our case focuses on the process of standards development, rather than on the adoption or impacts of standards. Drawing on several streams of theoretical and empirical literature on standards-setting processes, we develop a set of research questions to structure our case analysis. We focus on the Mortgage Industry Standards Maintenance Organization (MISMO), and consider questions about how the standardization process is being structured (e.g., what motivates participants, and how are the sometimes competing interests of participants managed?), how adoption of the standard is being promoted (e.g., by change management efforts and efforts to preserve participants' competitive positions), and what steps are being taken to ensure the maintenance and integrity of the standard (e.g., formation of a support organization, legal protection, and compliance monitoring).

Based on our case analysis, we attempt to draw implications for three different audiences. First, we explore the theoretical implications of our case, highlighting how our findings provide

new directions, particularly for information systems researchers interested in collective behavior and interorganizational issues. Implications for industry practitioners are also developed, although these can be merely suggestive given our singular focus on the home mortgage industry. We draw parallels, particularly to historical cases such as the development of the bar code in the grocery industry, to help generalize our findings across industries. Finally, we attempt to draw out implications for the policy-making community, suggesting potential actions that might facilitate broader development and use of interorganizational information systems standards that can improve industry performance.

In the next section, we define vertical IS standards, review relevant theoretical and empirical literature, and derive a set of research questions to structure the case analysis. Following an overview of the mortgage industry, the standards development organization (MISMO), and the specific vertical IS standards MISMO is developing, we answer our research questions. Lastly, we discuss the implications of our findings for research, practice and policy.

THEORETICAL BACKGROUND AND PRIOR RESEARCH

Standards are usually defined in the economics literature as "specifications that determine the compatibility of different products" (Stango 2004); an example of such product standards is the Windows operating system. Another type of standard allows adopters to form a communication network (Stango 2004). Here information technology standards can be defined at many levels of abstraction from (in the Open System Interconnection model) physical connectivity, through the data link, network, transport, session, and presentation layers, to the application level. Standards at the presentation and application levels are often referred to as semantic standards, while below these levels they are called syntactical standards. The Internet protocol is an example of a syntactical communication network standard. EDI standards are an example of semantic information systems standards—the type of standards of interest in our paper. Semantic IS standards can focus on a single industry sector or purport to be applicable across sectors. An example of a cross-industry standard (under development) is ebXML (Babcock 2004). Our focus in this paper is on industry-specific semantic IS standards, which we efer to as vertical IS standards. Vertical information systems standards are designed to promote communication and coordination among the organizations comprising a particular industry sector; these standards may address product identification, data definitions, business document layout, and/or business process sequences.

Standards are usually categorized as sponsored (or proprietary) or unsponsored (open) and as de facto or de jure (Stango 2004). Proprietary standards (e.g., Windows) are owned by a company that may license them to others; open standards (e.g., MISMO standards) are available to all potential users, usually without fee. This distinction is relevant in standards research, because the adoption of open standards is believed to be more problematic than proprietary standards; the reason is that the owner of a proprietary standard often has the incentive to subsidize adoption, whereas that is not the case with open standards (Stango 2004). De facto standards achieve adoption through a standards competition (e.g., Windows vs. OS/2); de jure standards achieve adoption through consensus, which is sometimes formally expressed through industry committees or formal standards organizations like the American National Standards Institute (ANSI) (Stango 2004). De jure standards are rarely proprietary.

These distinctions define the bodies of theory that are relevant to our research. For example, because we are interested in open standards promulgated by industry-wide committees,

the sizable economics literature explaining the outcome of standards competitions does not directly apply. In the sections that follow, we briefly review three theoretical perspectives that we believe are relevant to an understanding of the emergence of vertical IS standards: the economics literature on committee-based standards development efforts, the institutional perspective on the process of standardization, and the public goods perspective on the standards-setting process.

Committee-based standardization efforts

According to David and Greenstein (1990), standardization occurs through the widespread adoption of four kinds of standards: (1) standards that exist in the public domain but are not sponsored by an organization with proprietary interest in them (e.g., Linux), (2) standards that are sponsored by one or more organizations with a proprietary interest (e.g., Windows), (3) standards that are mandated by government (e.g., HIPPA in the health care industry), and (4) standards that are published by voluntary standards developing organizations (e.g., ISO). There is reason to believe that standardization through voluntary committees is the most likely route to success for vertical IS standards. As Hills (2000) noted, in the absence of regulation, no standard will actually be adopted unless it fits the needs of the users, and users are in a better position to determine what fits their needs than vendors or outsiders. Because users of vertical IS standards are companies that do business with each other, and these companies are of different kinds (e.g., manufacturers and retailers, hospitals and insurance companies), no one user is in a position to design a standard that would meet the needs of all users. Consequently, a voluntary association of industry participants is most likely to succeed in developing an approach to interorganizational coordination that many industry participants would be willing to adopt.

Surprisingly little is known about standardization by committees (David and Greenstein 1990); what research there is generally falls into two categories: how standards committees operate in practice (the structure of decision-making, the "rules of engagement" to facilitate reaching agreement) and the strategic behavior of participants attempting to influence the nature of the standard agreed upon). In the specific case of vertical IS standards, the majority of the research has focused on the *adoption* of such standards (e.g., EDI). To our knowledge, only a few case studies (Brown 1997; van Baalen, van Oosterhout, Tan and van Heck 2000) provide an in-depth look at the processes by which such standards emerge.

Institutional perspective

In contrast to the economic perspectives, institutional theorists view standards and standards development as institutions or as a form of institution building. Although we may not find an accepted definition for the term "institution", the following description will suffice: "… institutions are socially constructed, routine-reproduced (ceteris paribus), program or rule systems. They operate as relative fixtures of constraining environments and are accompanied by taken-for-granted accounts" (Jepperson 1991, p. 149).

One characteristic of institutions is that they bring order to things. In doing so they often counter social and organizational uncertainty. They provide context for interorganizational interaction by limiting the available courses of action. According to Jepperson (1991, p. 146), institutions unify constraint and freedom. In this sense, institutions are reproduced autonomously in that actors (e.g., firms) presume their existence and refer to them. Institutions may influence (indirectly) the actions of actors. Institutional behavioral patterns are perceived as the only way

to do things. In time, new institutions replace older institutions. They define the interactions among actors and create the arena or setting in which specific actors meet or make a joint decision about an issue while following certain decision rules (Mayntz and Scharpf 1995).

Vertical IS *standards* can themselves be viewed as institutions that, once adopted, regulate the behavior of industry actors, possibly stifling future innovation. But our interest lies in the *process of standardization*, not in the post-adoption impacts of standards. As argued by Mayntz and Scharpf (1995), we believe that the process of vertical IS standardization can be viewed as an institution that guides actors through the uncertain process of collaborating, often with competitors, to fashion a new way of doing business together. For example, rules about who can join the standardization effort and about the handling of intellectual property can be viewed as reducing uncertainty for participants and legitimating standards-setting as a normal, taken-for-granted activity.

Public goods perspective

A third theoretical perspective on vertical IS standards is public goods theory (Olson 1965). The theory argues in essence that public goods are unlikely to be provided because of the characteristic of public goods that people cannot be prevented from enjoying them even if those people have not participated in providing them. The open source software movement seems to fly in the face of public goods theory; consequently, researchers have begun to explore the collective action literature for clues to why people voluntarily engage in the production of collective goods (Markus, Manville and Agres 2000). For example, recent theoretical and empirical work suggests that public goods theory underestimates the benefits of early contributors to organizational federations such as vertical IS standardization efforts (Flanagin, Monge and Fulk 2001; Monge, Fulk, Kalman and Flanagin 1998). Such benefits could come from the opportunity for standards participants to participate in advice networks (Flanagin et al. 2001; Monge et al. 1998).

The relevance of these arguments to the development of vertical IS standards is clear. The success of committee-based standardization efforts is problematic, because people might lack the motivation to work on developing standards as public goods. However, it is possible that early contributors in vertical IS standards could benefit from the opportunity to use the standard for internal systems integration or as the basis for a new service offering, thus reducing the motivational barriers to participating in standards creation.

The Processes of Standards Development

A close reading of the empirical literature on vertical IS standards-setting processes (Brown 1997; van Baalen et al. 2000) suggests that standards development committees engage in at least three conceptually distinct business processes: *structuring the collaboration* (i.e., designing a process that engages participants in the activities of standards creation), *facilitating standards adoption* (e.g., educating participants and ensuring that the standard built by the committee has attributes that will favor its adoption), and *providing for the preservation and maintenance of the standard* after it is developed. In the sections below, we synthesize the theoretical perspectives of committee-based standards, institutionalism, and public goods to inform our examination of the three standards formation processes.

Structuring the Collaboration

As mentioned above, developing a standard that meets the needs of industry participants requires industry players to actually participate in the design of the standard (Xia, Zhao and Shaw 2003). Enlisting participation can be difficult because standards have public goods characteristics—companies that do not participate in standards development cannot be prevented from enjoying the benefits of the standard once developed (Flanagin et al., 2001; Monge et al., 1998; Olson, 1965). Nor in fact would the committee want to exclude them, since widespread adoption of electronic interconnection standards is essential for significant benefits. Because participation can be quite expensive for organizations in terms of the time of key organizational personnel, the risk exists that not enough of the right kinds of organizations and individuals might choose to participate. Thus, it is important to understand what motivates firms and individuals to participate in such efforts.

Additional complications arise when one or more potential participants in a standardization effort believe that they should not participate because they will gain greater advantage by going it alone or by developing a proprietary approach that they hope will become a de facto standard. Their failure to participate in (or their withdrawal from) a standardization effort can have a chilling effect on the whole cooperative exercise or even cause it to fail (van Baalen et al., 2000).

Even organizations that are willing in principle to participate in standards development may need to be reassured that the effort will be worth their while. Specifically, most participants would evaluate the costs of participation against the reasonable likelihood that the outcome of the standardization effort would in fact meet their needs, at least in the long run. Therefore, the standardization process would have to be set up in such a way that it could not easily be dominated by a few vested interests.

Promoting Standard Adoption

The development of a standard does not ensure its adoption, even by the organizations that participate in the process. It is important to consider future adopters' choices from the adopters' perspectives: what their major reasons would be for choosing to use a standard, or, conversely, which barriers firms face in adopting. Adopters must know about the standard and have the knowledge and skills they need to adopt it. And in many cases, complementary resources must be made available before would-be adopters are in fact able to adopt the standard. In addition, for adoption to be likely, the standard finally agreed upon must in fact meet adopters' business needs. It must not unduly disadvantage particular companies or segments in their ability to compete. Rather the standard should provide a level playing field, with adoption creating a common good from which all players benefit. Standards-writing committees emphasize consensus to ensure broad participation and to satisfy participants' needs, encouraging them to adopt (Hills 2000). But these very strengths can spell some weaknesses. Committees are said to take longer than markets to arrive at standards and the standards they produce are said to be less innovative, in part owing to the need to preserve the competitiveness of industry participants (David and Greenstein 1990). And, although preserving participants' industry positions may promote their adoption of the standard, committees are also said to produce technically more complicated standards (David and Greenstein 1990), perhaps because of the need to preserve backward compatibility with an installed base of technology. Paradoxically, this attribute might seem to work *against* widespread adoption of the standard.

This line of argument suggests the need to understand the ways in which standards development committees try to ensure that the standard they develop will actually be adopted.

Maintaining the Standard

The work of standards developers does not end even when widespread adoption of the standard has been achieved. Although the nature of post-adoption processes will vary with circumstances, required activities can include routine administration, updating or extended the standard as technology or needs change, and defending the standards against threats to its existence or success. In this last area, intellectual property threats often come into play, particular when participating firms attempt to profit from prior patent holdings that were not disclosed during the standards development process. These considerations suggest the need to understand how standards development organizations plan in advance for the ongoing operation and protection of the standard.

Research Questions

The foregoing conceptual framework suggests the following research questions that we use to structure our case analysis.

1. How can the process of collaboration on vertical IS standards be structured?

a) What motivates organizations and individuals to participate in efforts to create vertical IS standards?

b) How does the governance of vertical IS standards development organizations help balance the sometimes-competing interests of different industry segments?

2. How can the adoption of vertical IS standards be promoted?

a) What actions do vertical IS standards development organizations take to promote the adoption of the standard?

b) Does the nature of the committee-based vertical IS standards work to promote adoption by preserving industry structure and participants' competitive positions?

3. How are vertical IS standards maintained?

a) How do vertical IS standards development organizations defend against potential legal threats to the standard?

b) How do vertical IS standards development organizations defend against the threat of fragmentation or drift, owing to participants' reinterpretation of the standard?

c) What steps do vertical IS standards development organizations take to ensure ongoing governance of the standard?

METHODS

Evidence to support our case analysis of the standards-setting process in the mortgage industry comes from three sources: documents and other archival sources, in-depth interviews, and observation. For the first type of data source, we worked with the primary industry association, the Mortgage Bankers Association of America (MBA), in order to obtain access to previous internal studies that revealed costs and trends, especially related to IT usage, within the mortgage industry. Other data sources for our overview of the mortgage industry included US

Census data as well as the National Mortgage Association's periodic study results of loan volumes by segment and company. Standards documents, meeting minutes, and other documents available from MISMO further contributed to our case analysis. In addition, we gathered documents at the MBA annual conference on mortgage technology and a trimester meeting of the MISMO Workgroups.

Our primary data collection efforts centered on the conduct of interviews with key informants involved with mortgage industry standardization activities. We conducted interviews with three people from the MBA (one several times); six additional people active in the standards organization who represented other areas in the residential mortgage value chain including a government sponsored enterprise (GSE), a mortgage information and document services provider, a personal mortgage insurer, a mortgage credit reporting company, and two mortgage technology vendors; and three people from the Data Interchange Standards Association, which served as the secretariat to MISMO in addition to other industries developing vertical IS standards. Interviews were taped and transcribed to facilitate our review and analysis.

A third critical source of information came from 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). The Technology Conference enabled us to identify key mortgage technology vendors and better understand their role in the standards process. At this meeting we also gained an excellent overview of mortgage industry structure and the importance of IT in industry participants' strategic positioning. The MISMO Workgroup Meeting allowed us to observe standards activities and governance processes in action, including how the Workgroups made decisions about future standardization efforts.

We hand-coded our interview transcripts for key themes related to our theoretically derived research questions. We also 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. Various versions of this manuscript have been reviewed for factual accuracy by interviewees and other industry experts.

CASE BACKGROUND

Because every industry is unique, some of the ways in which Internet-related changes play out will vary from industry to industry (Porter 2001). We start with a brief overview of the mortgage industry, highlighting unique structural aspects that may influence the course of the industry's vertical IS standards development process.

Brief Overview of Mortgage Industry

The US home mortgage industry today is highly fragmented, with thousands of mortgage bankers and brokers, although it is consolidating rapidly. (It is estimated that the top five lenders originate over 50% of residential mortgage loans today, and that the top ten firms service over 50% of such loans.) It is also highly vertically disintegrated (Jacobides 2001a), although some analysts claim that it appears to be reintegrating, at least at the top end of the size spectrum (Van Order 2000). Automation and IT-enabled standards appear to be playing an important role in both structural evolutions (Jacobides 2001b; Van Order 2000).

Because of vertical disintegration, most business processes in the mortgage industry require the efforts of more than one organization—a situation that appears to be natural for electronic interchange. But the industry has been slow to adopt technology, and interorganizational standards-setting initiatives have only made progress in the last fifteen years. Since the widespread adoption of Internet standards in the last five or so years, the pace of standards-setting initiatives and the level of standards adoption in the industry have noticeably increased.

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 (Cummings and DiPasquale 1997). 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) (Cummings and DiPasquale 1997).

Today, more than half of all mortgages are sold to the secondary market, with the remainder held in portfolio by lending depository institutions (Van Order 2000). The secondary market has two major threads: 1) originators who sell loans directly to investors who hold loans in portfolio, and 2) originators who sell loans to a conduit who packages and securitizes the loans and sells interests in the securities to investors (Cummings and DiPasquale 1997). Most frequently, the conduits to the secondary market for residential mortgages are government sponsored enterprises (GSEs), especially Fannie Mae and Freddie Mac. GSEs are private corporations that were chartered by federal government mandate to create and grow the secondary mortgage market through securitization (Cummings and DiPasquale 1997). The GSEs have grown rapidly into major players: roughly 50% of the $6.3 trillion (2003 figure) in outstanding US mortgage debt for single family residences is either held in portfolio by the GSEs or is held by investors in the form of mortgage-backed securities guaranteed by the GSEs (Cummings and DiPasquale 1997). The perceived and real power and privileges of these companies (for example, they are exempt from SEC reporting requirements) generates considerable controversy (McKinnon and Kopecki 2003), requiring their own oversight body (Office of Federal Housing Enterprise Oversight, or OFHEO), and resulting recently in Congressional reviews.

In addition to the GSEs, the Mortgage Bankers Association of America (MBA) has been a major force for standardization in the mortgage lending industry. Founded in 1914, the MBA is the leading industry association for companies in the commercial and residential real estate finance business, the largest segment of the US capital market. 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 MBA represents the industry's legislative and regulatory interests and conducts educational activities and research for its members.

History of MISMO Standardization Effort

The origins of MISMO probably lie in the "electronic data initiative" launched by the MBA in the late 1980's to support the automation of "interagency" mortgage lending processes (Opelka 1994). In 1988, an article in *American Banker* reported that an MBA task force of 15 member companies had concluded that streamlining mortgage lending could reduce processing

time by as much as 50%. "Among the changes the report recommends are standardized loan applications and underwriting terms, EDI, uniform appraisal guidelines, and uniform secondary market procedures" (Trigaux 1988). Since then, the MBA has been working at this agenda one step at a time.

Working with Fannie Mae and Freddie Mac, the MBA's first targets were paper forms such as mortgage applications and appraisal forms (Anonymous 1988; Braitman 1990; Hershkowitz 1992). Next on the agenda was EDI. In 1990:

> "… the MBA mortgage data standards tasks force 'submitted three transaction sets for adoption as standard: the residential loan application, the private mortgage insurance application and the request for credit reports. It has been the third party providers of services to the industry that have been among the earliest to see the potential importance of EDI in the industry'." (Lebowitz 1990)

EDI standardization efforts proceeded over the next few years (Slesinger 1994). In 1994, the MBA set aside $20,000 for an industry-wide survey of the current and planned use of EDI (Campbell 1994). In the meantime, the GSEs pursued proprietary technology efforts, including automated underwriting systems, "electronic partner networks" and other tools:

> "The Fannie Mae financial network will have at its core a group of proprietary software products that virtually hard-wire customers to Fannie's mainframe." (Pizzo 1994)

As in many other industries, EDI was adopted by the larger companies in the mortgage industry; smaller companies generally found EDI cost prohibitive and declined to participate. This low level of EDI penetration was especially problematic in the mortgage industry because the industry is so fragmented: even the largest mortgage lenders deal with many small service providers. The lack of a low cost technology of interconnection held the industry back, despite the industry's progress toward data standardization.

With the coming of the Internet, the economics of interconnection began to change. XML promised a low-cost solution to the interconnection dilemma. Mortgage industry EDI work groups began to discuss the potential of XML. Then, in January 2000, the MBA, in partnership with Fannie Mae, Freddie Mac and other industry participants, launched the Mortgage Industry Standards Maintenance Organization (MISMO, see http://www.mismo.org). (Pronounced, the acronym MISMO is the Spanish word for "the same"—indeed 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.

Description of MISMO Standards

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. This standards-setting activity is quite similar to EDI standard-setting, although the technology of choice today is XML; itself a horizontal standard like TCP/IP.

The third major release of the MISMO data standards is currently under development. Version 1 started from the core concept of an electronic loan package. Data elements from various segments (credit, mortgage insurance, title, appraisal, etc.) were developed separately with the idea that they could then be merged into a loan package. This starting point was viewed as limited by many participants, because it did not specify the actual interorganizational transactions (Bixby and Alvord 2004). Version 2, published in mid-2001, employed the core metaphor of the transaction. But this version has the drawback of not consolidating all the information needed for a single loan. Version 3 is expected to be some blend of the two (Bixby and Alvord 2004). A major achievement of the data standardization effort to date is a data dictionary of over 3,600 elements with business definitions and corresponding XML data element tag names, and a reference data model to illustrate the relationships among the data elements in the dictionary. An excerpt from the data dictionary showing several elements from the automated underwriting specifications section is provided in Exhibit 1.

Exhibit 1: MISMO/ Mortgage Bankers Association of America, Inc. Data Definitions Excerpt: AUS (Automated Underwriting Specifications) Logical Data Dictionary

AUS Logical Data Dictionary

Version 2.1
Generated on 11/8/2001

Processes included in this dictionary: AUS

Name	Description	Source	Context	Processes	Datatype
Additional Borrower Assets Considered Indicator	The income or assets of a person other than the borrower (including the borrower's spouse) will be used as a basis for loan qualification.	URLA	Loan Qualification	Underwriting, AUS	Boolean
Additional Borrower Assets Not Considered Indicator	The income or assets of the borrowers spouse will not be used as a basis for loan qualification, but his or her liabilities must be considered because the borrower resides in a community property state, the security property is located in a community property state, or the borrower is relying on other property located in a community property state as a basis for repayment of the loan.	URLA	Loan Qualification	Underwriting, AUS	Boolean
Agency Case Identifier	The FHA-assigned case number for FHA loans or VA-assigned case number for VA loans. The number is used by the FHA or VA to identify a loan. Collected on the URLA in Section I (Agency Case Number).	URLA	Mortgage Terms	Underwriting, AUS	String
Alimony Child Support Obligation Indicator	Borrowers declaration regarding obligations for alimony, child support, etc. Collected on the URLA in Section VIII line g.	URLA	Declaration	Credit Reporting, Underwriting, AUS	Boolean

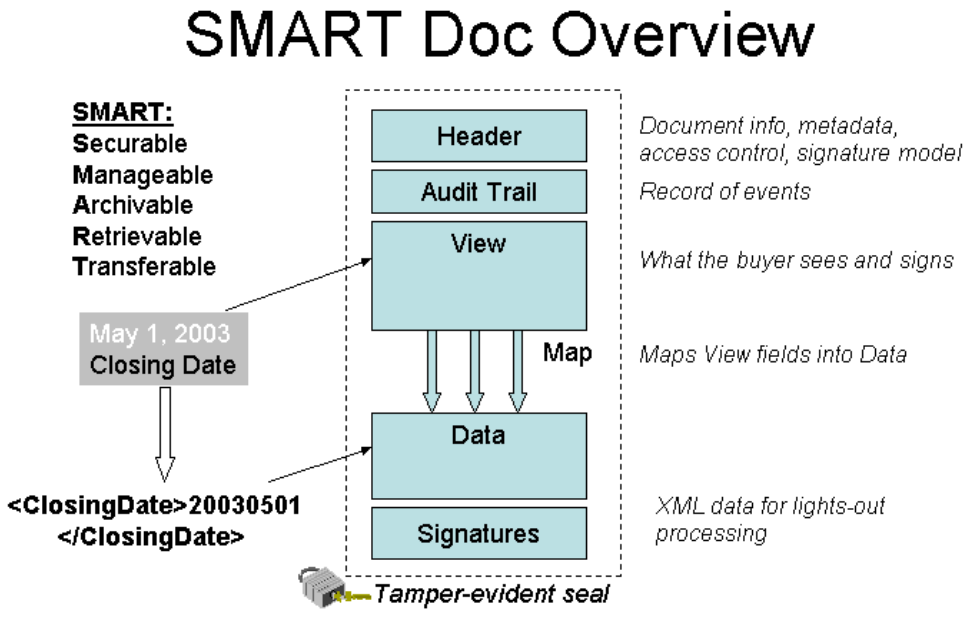
Source: MISMO, AUS Logical Data Dictionary, 2004.

The second track in the MISMO standardization effort concerns 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.

To accomplish fully electronic mortgages, the eMortgage Workgroup developed "SMART docs": Secure, Manageable, Archivable, Retrievable, and Transferable documents that lock data and document presentation into a single computerized file using the underlying data formats of XML (for data transfer) and XHTML (a combination of HTML and XML, for document presentation). SMART doc standards ensure that information is transferred in a form that is readable both by computers and by humans, thereby enabling the requirements for filing with county recorders' offices to be met along with those of the GSEs and investors.

The SMART Document contains three sections: a header section comprised of metadata indicating the document type, version and other information about the elements in the document; a data section with the raw data tagged with MISMO's data DTDs, such as the borrower name, and address, as well as tags that link, format, and verify the data elements to the appropriate entries in the view section; and a view section, which is the actual presentation of the document in html, pdf or other viewable format (Gudobba n.d.) Exhibits 2 and 3 provide an illustration of the SMART Document structure.

Exhibit 2: SMART Document Structure



Source: MISMO, SMART Doc Overview, 2004.

Exhibit 3: Illustration of the Three Views of a SMART Document in a 'California Deed of Trust'

***HTML View*:**

Recording Requested By:
Branch One Title

Return To:
William S Grant
65874 Main Street

San Diego California 55558

Prepared By:
Patrick Hartford

6548 Maple Grove
Irvine California90807

[Space Above This Line For Recording Data]

DEED OF TRUST

DEFINITIONS
Words used in multiple sections of this document are defined below and other words are defined in Sections 3, 11, 13, 18, 20 and 21. Certain rules regarding the usage of words used in this document are also provided in Section 16.

(A) "Security Instrument" means this document, which is dated 10/07/03, together with all Riders to this document.
(B) "Borrower" is Patrick L. Smith, .

Data View:

XPath	Raw Data	Formatted Data
/LOAN/_APPLICATION/LOAN_PRODUCT_DATA/LOAN_FEATURES/@LoanMaturityDat	20331007	10/07/33
/LOAN/_APPLICATION/MORTGAGE_TERMS/@LenderLoanIdentifier	999-75	999-75
/LOAN/_APPLICATION/MORTGAGE_TERMS/@OriginalLoanAmount	150000.00	150,000.00
/LOAN/_APPLICATION/PROPERTY/@_StreetAddress	18050 15 Mile Road	18050 15 Mile Road
/LOAN/_APPLICATION/PROPERTY/@_City	Fraser	Fraser
/LOAN/_APPLICATION/PROPERTY/@_PostalCode	48026	48026
/LOAN/_APPLICATION/PROPERTY/@AssessorsParcelIdentifier		
/LOAN/_APPLICATION/PROPERTY/_LEGAL_DESCRIPTION/@_TextDescription		
/LOAN/_APPLICATION/PROPERTY/_DETAILS/@RecordingJurisdictionName		
/LOAN/_APPLICATION/PROPERTY/_DETAILS/@RecordingJurisdictionType		
/LOAN/_APPLICATION/BORROWER/@_FirstName	Gary	Gary
/LOAN/_APPLICATION/BORROWER/@_MiddleName	R	R
/LOAN/_APPLICATION/BORROWER/@_LastName	Smith	Smith
/LOAN/_APPLICATION/BORROWER/@_NameSuffix	Sr.	Sr.

XML View:

```
<?xml version="1.0" ?>
- <SMART_DOCUMENT _ID="MD01" MISMOVersionIdentifier="1.0"
    PopulatingSystemDocumentIdentifier="VMP_20031015T171046Z">
  - <HEADER _ID="Head01">
      <DOCUMENT_INFORMATION SMARTDocumentCategoryType="1"
        _FormNumberIdentifier="3005" _Type="SecurityInstrument"
        _StateType="Signable" NegotiableInstrumentIndicator="False"
        MustBeRecordedIndicator="False" _Name="California Deed of Trust" />
    - <SIGNATURE_MODEL>
        <SIGNER SectionIDREF="View01Borrower" AreaIDREF="BorrowerSig1"
```

Source: VMP Mortgage Solutions, 2004

FINDINGS ABOUT THE MORTGAGE INDUSTRY VERTICAL IS STANDARDIZATION PROCESS

In this section we discuss the answers to the research questions we earlier developed about each of the three processes that standards development organizations engage in: structuring the standardization effort, promoting standards adoption, and planning for standards maintenance.

Structuring the Process

Our concern in this section is with how MISMO structured the process of standards development: how it marshaled the energies of participants and managed the sometimes competing interests of various industry segments.

Harnessing Participants' Motivations

The motivations of two types of participants are relevant to vertical IS standardization efforts: organizations (including both technology vendors and users) and individuals. We start with the organizations.

Why companies participate. To some extent, the question of why organizations participate in the development of MISMO standards is unremarkable: many companies participate in MISMO because they previously participated in the EDI standardization initiatives in their industry segment. But the larger question here is why companies believe it in their interests to participate in any vertical IS standardization effort. After all, in some industries, companies have declined to participate on the grounds of competitive advantage. For example, Wal-Mart has been reported as being unwilling to join e-business interconnection hubs because its participation would dilute the huge advantage that company gained from deploying proprietary systems.

In the mortgage industry, the perceived benefits and risks of participating in standards-setting vary by segment. Traditional mortgage products are increasingly commoditized, so competition is shifting to the development of innovative products and services, to the creation of distinctive service and relationship advantages, and (for a few particularly efficient producers) to low prices. Vertical IS standards enable efficiencies that help companies reduce their costs; at the same time, collaborating on EDI or MISMO data standards does not threaten other bases of competitive advantage. Therefore, barriers to companies' participation in these standards-setting efforts are low. As noted by one interviewee from the mortgage insurance sector, collaboration on data standards would help streamline industry business practices since "we all need the same data to do our business and so there's no reason to try to compete on data. [We] compete on service." In another mortgage industry segment—credit—competition has historically centered on data presentation—the unique layout of a bureau's credit reports. According to interviewees, format-centered competition initially formed a barrier to data standardization efforts in that segment. Nevertheless, the credit segment was an early participant in EDI standards as well as in MISMO. Regardless of sector, the participants we interviewed were unanimous in the belief that the standardization effort works, because "we do not compete on data."

The absence of barriers to participation in standards-setting efforts is not the same as a positive incentive to participate. And positive incentives do exist. For example, although MISMO standards are expressly intended for interorganizational interconnection, some large

companies with diverse lines of business or nonintegrated legacy systems have already benefited from using MISMO standards for *internal* integration, according to an interviewee from MISMO. This is an example of what Liebowitz and Margolis (1998) call "autarky" (or standalone) benefits from a network technology, which can help overcome the critical mass needed for adoption.

Another direct benefit of participation is that "standards tend to be oriented towards the individual companies that contributed their time to developing them." (9/30/03) During MISMO meetings, discussions usually start with a participant volunteering his or her company's business data types as a model from which standard data elements can be identified. Naturally, some of the finalized standards bear a resemblance to those models. Even without serving as a model, participants in discussions can make sure that the standard meets their data needs. For example, an interviewee from one of the GSEs explained that one transaction set contains some XML tags with a designation for his company, representing unique data requirements not shared by the other GSE.

Other interviewees explained that participating in the EDI and MISMO standardization efforts created new business opportunities for their companies. One systems expert we interviewed noted that his formerly small company benefited greatly from his early and prominent participation in the data standardization effort because it increased his company's visibility in the industry, resulting in rapid growth. This example is reminiscent of arguments that the opportunity to participate in advice or influence networks is a benefit that motivates participation in the creation of public goods (Flanagin et al. 2001; Monge et al. 1998).

Another type of business opportunity was described by an interviewee from a mortgage document preparation company. e-Mortgage standards plausibly have the potential to disintermediate document preparation companies. But the interviewee claimed to be unworried about that possibility, because constant change in the industry had made his company nimble, and the company was constantly on the lookout for new opportunities—some of which arose during the data standardization effort. The company developed a viewer for e-Mortgage SMART docs (analogous to the Abode Acrobat reader for PDF documents); the reader was given away free to companies in the industry, but a more functional software product was available for sale.

In summary, companies reported receiving a variety of benefits from their participation in data standardization efforts. But the expectation of benefits is only part of the story about why companies participate. In many ways the more interesting story concerns why individuals participate, often on their own time.

Why individuals participate. According to MISMO's operating policies, each company is expected to pay the travel expenses for its own MISMO delegates. But company financial support for travel is only part of the cost. It is the individual participants who have to travel to meetings and manage MISMO activities in addition to their regular jobs. Consultants who participate in MISMO may not be able to bill clients for the time they spend on MISMO activities; although there may be an eventual payoff in "business development," in the short term MISMO participation competes with fee-generating work.

In light of these personal costs, we found it surprising that some participants are heavily involved and have been for years (including the earlier EDI efforts). Industry insiders speak of the "same ten (or twelve) people" who seem to be involved in every activity. Many of the people we interviewed for this study were identified to us as belonging to the "same ten people"; they

served on multiple work groups and often held leadership roles. Although they are empathically supportive of MISMO's efforts, they are also quite clear about the personal costs and motives for participating. To illustrate personal costs, one interviewee described the effort as being "like a night job on top of our day job." Another interviewee revealed the importance of personal motives when he explained that "I was more or less participating on my own time just because it was something I was interested in."

It is clear from these comments that participation in MISMO cannot be fully explained by company motivations. Personal and social factors also play a key role. People may become involved out of personal interest, but they stay involved because they become committed to the cause or to each other. When personal motivations are compatible with organizational goals, all goes well. But sometimes they do not: a key player in the bar code standardization effort devoted so much time to creating the public good that he eventually lost his job (Brown 1997).

Management of Competing Interests

From the discussion above, it is clear that MISMO (with the help of its participants) has created a structure that is capable of marshaling the effort of volunteers from various parts of the industry around the design of the standard. But such voluntary efforts are fragile structures, vulnerable to threats from the competing interests of a diverse membership. This raises the question of how MISMO tries to prevent conflicts of interest and copes with them when they arise. At least three factors can be identified: MISMO's explicit scope of effort, its formal governance mechanisms, and social give and take.

MISMO's explicit scope. Two key "scoping" decisions early in MISMO's history have proved critical in limiting divisive conflicts that could cause the process to fail. First, MISMO standardization focuses on the data needed for *inter*organizational processes; data needed only for *intra*organizational processes is defined as out of scope. According to a prominent MISMO staffer we interviewed, the rational for this focus was to allow companies to "keep their own proprietary formats…, [and only] invoke the standard when exporting data to other firms."

A second key decision was to limit the MISMO effort to *data* standards, rather than trying also to specify *process* standards (Markus 2000), as has been done in several other industries, such as electronics and chemicals. Admittedly, there is a fine line between specifying the data needed for a business process and specifying the process itself. In either case, one has to start with the process—what needs to be done. But MISMO is scrupulous in its focus on data, for two reasons. First, as noted earlier, interviewees felt that firms in the industry did not compete on data, but *process* standardization begins to encroach upon the bases of competition. Second, one interviewee reported that early attempt to develop a process standard was challenged by one of the participating technology vendors that felt it had patent that covered that particular process.

As a result of the threatened patent legislation, several steps were taken to forestall future conflicts. First, MISMO developed its Intellectual Property Rights policy, discussed below. Second, although data standards discussions often start with example processes of participant firms, as put by one interviewee, "we just have to be careful that you will never see 'do A, B, C, D, E, F, G in this order' as a MISMO specification."

MISMO governance. The formal governance of MISMO is a second way in which the effort seeks to manage potentially conflicting interests. In particular, a key concern is to ensure participation from all segments of the industry and from both large companies and small, so that

the effort is seen as truly representing the needs of all industry players. The entire governance structure of MISMO is set up to fulfill this goal.

Membership in MISMO is voluntary and open to all, regardless of company size or the specific segment of the mortgage industry value chain within which a company operates. MISMO is subdivided into a number of "Workgroups" reflecting every aspect of the mortgage industry value chain, as well as groups focusing on foundational data definition standards. Participants in MISMO can join the Workgroups of their choice and participate in all activities except the leadership positions, which are filled in annual elections held by subscriber organizations (organizations that pay a membership fee annually to support MISMO).

To ensure a fair and efficient process, Workgroups are required to follow published agendas. A code of conduct published on MISMO's website defines conflicts of interest and acceptable behavior, particularly with regard to potential violations of antitrust regulations. Members are reminded at each meeting that industry associations like MISMO are perfectly legal, but that discussions of such things as rates, terms, prices, and conditions of service are not legal. Members are encouraged to raise any concerns they might have about the direction of discussion in MISMO meetings.

Individual Workgroups go even further to promote open communication. For example, at the January 2004 MISMO meeting, the Architecture Workgroup discussed the following rules to guide their deliberations:

- "No issue is over until the final vote
    - New facts appear daily
    - Interim votes give guidance to the path to be followed
- Will seek consensus, if not possible, then vote as a last resort
- Everyone deserves respect
- Everyone has a contribution
- Freedom to speak your mind
- Seek Nash equilibrium
    - Enlightened self interest
    - Practical acceptance vs. theoretical purity"

(Points discussed in Architecture Workgroup Meeting Dana Point, CA 1/30/04)

The Governance Committee oversees the organization and gives final authorization for changes in the standards architecture after reviewing the recommendations of the relevant Workgroup. The MISMO Governance Committee reflects a balance between large and small players, as well as the breadth of the mortgage industry value chain. Seats on the governance committee, which is elected by the full membership, are provided to lenders, servicers, GSEs, insurers, credit reporters, and technology vendors representing different industry segments. In addition, the MBA has non-voting seats on the committee, reflecting the Association's role as neutral facilitator.

MISMO holds three in-person meetings per year and periodic interim meetings. Costs of participation are minimized by limiting the number of in-person meetings in between the regular trimester events; instead MISMO relies on the use of listservs, teleconferences, and electronic balloting. Hence, smaller firms are not kept out of the process by steep participation costs. Email notifications of upcoming votes are sent out, and electronic balloting ensures that each company can influence election outcomes. MISMO operates on a "one company, one vote" process, both for elections to committee governance positions as well as for actual standards submissions and change requests. (Each member company gets only one vote regardless of the number of that

company's representatives.) Moreover, the costs of using MISMO standards are minimized by making specifications freely available—even to non-participants—through downloadable documents available on the MISMO web site.

Informal give and take. Structures alone cannot bear the full burden of managing potentially conflicting interests. Just as the proof of the pudding is in the eating, the proof of a governance structure lies in how it operates in practice. Interviewees explained that the standardization process was sometimes contentious at two levels: which interorganizational processes are addressed in which order, and which data elements are included and in which transaction set. Generally, these questions are resolved informally by consensus or by the same commonsense norms of interaction that are useful in any volunteer effort.

Interviewees agreed that the ideal way to resolve conflicts of all types is via consensus. And, with the long-standing social relationships among the "same ten people" smoothing the way, MISMO participants generally try for consensus. Deciding which data elements belong in a transaction set is fairly easy to resolve by consensus, since, as one interviewee noted, "if somebody needs a piece of data, we're all going to take it." However, deciding on which transaction to work on next can be a bit more contentious. Here, the solution is different, but inherently simple—to rely on volunteers. If enough people indicate their willingness to work on a transaction, then it will be taken up by the group. If not, then the transaction is left out.

"Step up to the plate" is a great rule for fairly allocating volunteer effort, but it does have drawbacks. First, important processes may not be addressed if participants from those processes are lacking. For example, this appears to have happened in the hazard insurance domain, as one interviewee reported that "the lenders say they want hazard industry data standards, but there hasn't been enough participation from the hazard insurance industry, the people who really know the data." Second, it doesn't really address the situation where some people want to work on a transaction, but others believe it's not in their interests to standardize that transaction. How these issues work themselves out and the implications for adoption are discussed in a later section.

Intraorganizational conflict. Intriguingly, there is one area of conflicting interests for which MISMO has no satisfactory answer—conflict over standards *within* the companies participating in standards development. One MISMO insider explained that is common for participants from the same firm to have different interests in what the standard should be. In one example, conflicting opinions regarding the structure of data elements surfaced between those in a mortgage lending firm responsible for loan origination and those who processed loans for sale.

A consequence of such conflict is that a company's participation in standards-setting does not ensure that the company will adopt the standard eventually built. Participants in standards-setting often must fill the role of internal change agent, selling the standard in their own companies. Because participation in standards-setting does not assure adoption, we next consider the role of the standards development organization and the standard itself in facilitating the standard's adoption.

Promoting Standards Adoption

The literature on network technologies suggests that adoption of a new standard is inherently problematic. Even in the case of de jure standards, where standards competition is not a major concern, adoption can be problematic. As a result, standards development organizations frequently wage campaigns to educate potential adopters, to enlist the support of influential

players, and in various ways to lower the cost of adoption, such as by providing specific implementation guidelines.

Committee-based standardization efforts are also said to have another characteristic relevant to adoption—the nature of the standard itself. Because they rely on consensus to ensure participation and because consensus tends to preserve the interests of industry participants, committees tend to produce standards that are not very innovative (Hills 2000). An advantage of this outcome is that participants are more likely to adopt such standards than standards that might put them at a competitive disadvantage. On the other hand, the need to preserve participants' interests (e.g., an installed base of legacy systems) can lead to standards that are overly complex technically, thus posing a barrier to standards adoption (Hills 2000).

In this section, we examine both the steps taken by MISMO to ensure standards adoption and how the process of standardization is resulting in standards characteristics with implications for adoption success or failure.

MISMO Tactics to Promote Adoption

To promote adoption of the standard, MISMO has not only engaged in substantial communication and educational efforts but has also worked behind the scenes to enlist powerful supporters to help overcome barriers to adoption. In the area of communication and education, MISMOs efforts are substantial. Sessions are devoted in every MBA national conference and mortgage technology conference to providing updates on MISMO's progress. The MISMO website contains much publicly available information as well as protected resources for subscribers. MISMO's efforts are regularly reported in leading industry publications such as *Mortgage Banking* and *Mortgage Technology Magazine.*

In addition to these public efforts, MISMO insiders have worked hard to ensure the commitment of the GSEs, which have long pursued proprietary technology initiatives. In the terms of one interviewee, the MBA built "moral suasion" for the standardization process. Perhaps the biggest boost to the adoption of MISMO standards occurred when the GSEs agreed to support them in July 2001 (Anonymous 2001a). News accounts confirm the significance of GSE support, not only for MISMO's data standards, but also for its e-Mortgage initiatives:

> "Fannie Mae has opened the door to widespread origination of paperless mortgages with the release of its formal requirements for lenders … Fannie says its rules will not create dual business processes by mirroring many of today's selling servicing requirements. Further, it said the requirements will conform to the Mortgage Bankers Association of America's Mortgage Industry Standards Maintenance Organization SmartDoc data format." ("Fannie Mae Releases Its Requirements for E-Mortgages 2002)

Gaining the GSEs' commitment was critical because, had these powerful organizations decided to go their own way with information technology, any "industry-wide" standardization effort would provide much less benefit to members. Conversely, although strong support by the GSEs might smack of undue influence, it also removes a major barrier to the widespread adoption of the standards.

MISMO's efforts to secure standards adoption have not been limited to "moral suasion." Like the committee that developed the bar code, MISMO has had to involve itself in the details of many complementary changes (e.g., in technology or business processes) that would be required for the standard to be successfully adopted. The eNote registry is a prime example. Because many digital copies of an electronic mortgage are likely to exist, uncertainty about who

holds the authoritative copy could be a deterrent to adoption. To address this problem, MBA released requirements for an eNote registry in March, 2003 that would track the location and the owner or controller of electronically originated and closed mortgage notes (Anonymous 2003).

Nature of the MISMO Standards and Adoption Implications

The goal of committee-based standardization efforts is not just to produce standards, but to ensure that the standards are adopted. Therefore, a large part of the work of standards committees is to select standard characteristics, not just for technical goodness, but also for implementability. On the other hand, the outcomes of consensus decision-making processes are inherently emergent; as a result, standards may have characteristics that work either for or against eventual adoption. Although it is too early in the MISMO initiative to predict adoption success and impacts, the MISMO case provides good illustrations of standards characteristics with the potential both to favor and to inhibit adoption.

Characteristics that might favor adoption. A key early decision was that the MISMO standards would not merely identify needed data elements, but also define and rationalize them. In past EDI efforts, the meaning of data elements was often incorrectly assumed to be understood; as a result, pairs of trading partners reinterpreted the terms, leading to standards drift (Damsgaard and Truex 2000). Furthermore, there is no guarantee that proceeding with one transaction set at a time will result in a parsimonious set of business terms. The same data element differently named or similar terms with the same name could be used in several transaction sets, making it very expensive to develop software that supports the standard.

Our interviewees were unanimous that MISMO's greatest achievement to date has been its data dictionary with rigorously defined and standardized terms. As each working group comes forward with a proposed transaction set, it is scrutinized by MISMO's core data group to enforce consistent naming and the avoidance of unnecessary duplication. Even so, the lexicon is large, containing over 3,600 business terms.

In addition to improving data quality, MISMO's data dictionary reduces developers' cost of implementing the standard in software. One interviewee reported that the consistent naming convention used in the data dictionary made it much easier to write software that integrated across different transactions. In the mortgage industry, where technology adoption has historically lagged others, the increased availability of low cost software to support MISMO standards should certainly promote the standard's adoption.

Independently of the payoffs for developers and subsequent adopters, there is enough flexibility in the standards-setting process to allow participants to meet their needs in ways that increase the likelihood that they will adopt the standards. For example, one interviewee explained that the GSEs wanted to pursue a certain transaction set—investor reporting—but that the affected software vendors were reluctant to participate for fear that the proposed changes would negatively influence their revenue. The basic concern was that their contract required them to maintain compliance with GSE standards, so if a new transaction is added to the standard, software vendors would be forced to implement it without being able to gain from additional charges. However, participants found a way to put the data needed by the GSEs into another transaction set, addressing both the GSEs' and vendors' interests.

Characteristics that might hinder adoption. Other aspects of the MISMO standard might have a less positive or even negative impact on adoption. As noted earlier, consensus-based

standards-setting processes are hostages to those who participate and devote their time and effort to develop the standards. When key stakeholders don't participate, either an important piece of the standard does not get built, or it gets built in ways that do not meet the needs of the absent group.

We previously mentioned that the failure of hazard insurers to participate in MISMO has delayed the tackling of hazard insurance transactions. Another instance of low participation has led to even less desirable results. Several interviewees commented that mortgage lenders have been underrepresented at MISMO meetings. Several reasonable explanations for their absence were offered. Large lenders were early adopters of EDI and might be satisfied with their existing approaches to interorganizational data exchange. As a group, lenders have been well served by the technology products offered by GSEs and software vendors. They simply might not see the benefit of XML standards, or they might not see the business issues inherent in standardization; accordingly they might be content to allow their interests to be represented by their software vendors.

Interviewees deplored the low participation of the mortgage lenders and argued that their failure to participate has had less than optimal results. The concern is that the resulting standard might not be adopted or might have negative consequences if it were adopted. In particular, without heavy influence from lenders that were involved in a variety of different aspects of the mortgage process, the more numerous vendors that focused on specific transaction subsets were able to vote to treat each transaction independently. As one interviewee put it, the standard took on a "stovepipe view of the world, where we're not going to have an origination data structure that's broad enough to be used in all different transactions." Vendors were more interested in having each transaction set fit their own precise needs, even though this was less than optimal from the lenders' perspective. Fortunately, the version of the architecture currently under development is giving the participants the opportunity to revisit that decision.

Even without an absence of participation by a critical stakeholder group, the outcome of standards discussions can be unnecessarily complex and hence unfavorable for adoption, because committee-based standardization efforts tend to preserve the competitive interests of the participants. One interviewee gave the vivid example of the (in his view) unnecessarily complex three-part e-Mortgage SMART document (see Figures 2 and 3). One part contains the data, a second part maps the data into the viewable third part, and verifies that the data in the view is consistent with the underlying data section, and a third part is the generated viewable document. According to this participant, a simpler and easier-to-implement solution exists but was not adopted because the simpler solution would have worked against the interests of certain industry participants. He had proposed a two-part document structure, with one section being XML data and a second section being an XLST form that contains the instructions to generate the output. However, when he said that this would simplify the process by allowing browser software rather than the specialized software prepared by document preparation companies to generate documents, his proposal lost support. It would have, in effect, eliminated the value added by these companies, and threatened their role in the home mortgage value chain.

Other participants disagreed that the decision was made on the basis of such political considerations. Publications and presentations of the SMART Doc Focus Group argue that, because XSL is a programming language with conditional statements, the potential exists for fraud or error (in which for example, different loan amounts are computed each time a document is generated) could creep in without proper validations.

> "The MISMO working group needs to resolve how an XSLT stylesheet will be validated and how standard conversions will be performed in XSLT. Validation and consistently generated conversions will ensure that what was seen on the computer screen the first time is immutably the same as those generated at a later date." (MISMO, "SMART Document Overview: Frequently-Asked Questions Version: 1.0 Date: 10/9/2002 2002", 2004)

Consequently, the majority of workgroup members believed that it was simpler to provide an explicit linking between the "data" and the "view" parts of the SMART Doc (via the third part, the arc map) than to eliminate the redundancy of information in the two parts by using XSLT.

The interviewee who "mistakenly" proposed the XSLT solution now believes that change in the industry will eventually occur, it will just take time. He observed that "I'm involved [too]: my livelihood comes from the inefficiencies of the industry. [Eventually, MISMO standards will be a] catalyst for bigger and bigger changes." In the meantime, however, the concern that the complexity of the three-part e-mortgage standard might hinder adoption remains, as evidenced by another interviewee who felt that the Smart doc framework was quite complicated, and would have preferred a simpler structure at the start to keep the costs down.

MISMO Standards Maintenance

The need for standards development organizations often continues well after widespread adoption of the standard. Especially where vertical IS standards are concerned, numerous "environmental" changes can call for the need to update or revise the standard. For one thing, technology changes, requiring modifications. The plans to explore the future use of Schema in the data domain and of XSL in the e-mortgage standards are examples related to MISMO. For another thing, business needs can change. New mortgage products might be developed that require new data elements to be defined and added to the data dictionary. In addition, the history of the bar code showed that vertical IS standards can be vulnerable to a variety of threats, such as legal challenges or gradual erosion as companies try to customize the standard to their individual needs.

In this section, we examine how MISMO is addressing the potential threats of legal challenges and fragmentation and how MISMO is planning for its continued existence.

Defense Against Legal Challenges

As discussed earlier, MISMO did not initially have a comprehensive policy for the protection of intellectual property rights (IPR), but, after a threatened lawsuit (that fortunately never materialized), it was clear that IPR was a topic that could no longer be ignored. MISMO considered and rejected several IPR approaches used by other collaborative ventures (such as the "copyleft" license of the Open Source movement). Instead, MISMO opted for a royalty-free license approach to IPR. All companies participating in MISMO activities are bound by an IPR agreement that requires the company to pay for its own peoples' time on the project, to license any contributions to MISMO free of charge, and to allow MISMO to derive products from their contributions and make these products available to others (i.e., to sublicense them) via the Web or other means.

These provisions were expressly designed to prevent companies from pursuing a "submarine patent" approach, whereby participants file for their own business process patents while waiting for the technologies to reach a point where they can be implemented. Then, once companies attempt to implement the standard, the opportunistic patent filer can claim royalties

on what was supposed to have been an open and freely available standard. MISMO proactively implemented its IPR approach to prevent undisclosed and submarine patents from surfacing. (See Exhibit 4 for the key provisions and rationale for MISMO's IPR policy.)

Exhibit 4 MISMO Intellectual Property Rights Policy, 1/30/03

> Gabe Minton, Vice President of Industry Technology MBA
>
> Dear Colleagues,
> Two weeks ago, at the MISMO meetings in LA, we rolled out an Intellectual Property Rights Policy framework for the MISMO initiative. This IPR Policy will cover all MISMO activities: residential and commercial, data standards, eMortgage standards, and any other standardization activities we choose to pursue. This policy is the culmination of over one and a half years of legal research, vetting, discussing, and agreeing between MBA inside, and outside counsel, as well as other large organizations. We feel very strongly that we have come up with a fair, easy (all things considered), readable, concise policy. The MISMO Governance Committee has been involved in the development of the policy and stands behind it.
>
> If you boil it down to its simplest form, it is a two-part agreement: an 8-page Participant Agreement, and a 1-page End-User Agreement. All standards efforts have been working on IPR Policies. Why? Because companies exist that will participate in an open-standard setting process like MISMO, knowing that MISMO is developing standards around a system or method (business process) that the company has sought or has been awarded a patent for, and they sue everyone implementing to the standards later on down the road for infringing on their IP, or they charge fees. These organizations patents are known in the legal world as "submarine patents." No, we have no reason to believe there are any organizations within the MISMO community currently doing this, which is why it is all the more important to get the IPR in place now!
>
> It is important to take a step back philosophically and explain to you the three basic IPR philosophies that are known in the standards communities and also what we considered. First, there is the well-known GNU license scheme, otherwise known as "Copyleft." The main reason this approach doesn't work for MISMO is that it calls on anyone implementing the standards or creating a custom extension (a derived product) to also make that open and freely available. From a survey of MISMO implementers and users, most of the custom derived products that are being developed need to remain private. There may be proprietary fields or data involved.
>
> The second approach we considered is the Reasonable And Non-Discriminatory (RAND) fees approach (a patent holder can impose fees but they must be reasonable). We chose not to pursue this approach mainly because of the high administrative overhead.
>
> The third approach, which is what we followed, is simply the "Royalty Free" license approach. Looking at the Participant Agreement, a MISMO Participant (which we will focus on in a second) agrees that it pays for its own people's time, even when those people are on the phone or attending MISMO meetings. Therefore, MISMO recognizes that MISMO as a legal entity will not own any of the Participants "contributions of IP. However... the Participant agrees to license to MISMO these contributions free of charge, and agrees to let MISMO derive products (i.e. alter the contribution), and "sublicense" these contributions (i.e. make the standards available on the MISMO website and otherwise).

Source: MISMO, 2003

Defense Against Fragmentation

A more frequent threat against MISMO standards is likely to be the risk that companies would modify the standard to their own needs, thus diluting the standard. This certainly happened with EDI (Damsgaard and Truex 2000), and it could happen with XML data standards as well. Contributing to the tendency could be the inherent flexibility of XML—the ability to add new data elements without significant rework. As one interviewee noted, a key benefit of XML is that it affords any company the ability to add extra data elements to suit its particular needs in

any given transaction. This can create problems, however, if numerous companies needed those same extra fields, and they all added them, but they each called them something else. Although the original data elements would remain standardized, the new ones would not. Like any living language, new terms are occasionally added to industry lexicons, and MISMO needs to provide for standards evolution.

One interviewee explained how the need to respond quickly to business changes without creating burdensome changes for their customers led companies in the mortgage insurance industry to try to "tweak" the existing standards rather than to rewrite them from scratch when business needs change. But as he further noted, simple tweaking may not be enough to meet all needs and other groups may choose to completely start over from scratch.

From this example, it is clear that maintenance of the MISMO data standards is an ongoing activity. So is effort required to test for compliance with the standard, for example, when new software products are built that claim to support it. Not surprisingly, the question of compliance testing has become an urgent item on the agenda at MISMO meetings. For instance, in the January 2004 meeting of the Origination Workgroup, participants debated various issues such as the following:

- Whether compliance should be judged in relationship only to required extensions of the standard, or also to optional extensions
- Whether compliance should be assessed on an annual basis (versus periodic or permanent) or only with respect to specific software versions
- Whether compliance should be evaluated at the logical database level, at the transaction level, or some other level
- How much should be charged for compliance testing
- How compliance should be tested, e.g., by a test suite that runs behind the scenes.

A Permanent Organization

The ongoing needs for standard extension, compliance testing, and protection of the standard against various external threats argues strongly for the formation of a permanent organization. In the January 2004 MISMO meetings, preliminary plans were unveiled for setting up a permanent 501(c)(6) organization as a wholly owned subsidiary of the MBA.

DISCUSSION AND IMPLICATIONS

Our study of the development of standards in the mortgage industry contributes to the scant literature on the evolution of vertical IS standards. In this section, we first argue that there are many similarities between the mortgage industry case and the development of vertical IS standards in other industries, suggesting that our findings should generalize well to other contexts. We then revisit our key findings and discuss how they augment our knowledge about IS standards creation, adoption, and maintenance and offer not only guidance for other standards groups, but also insights for further research and theoretical development. Following these discussions, we continue with the implications of the mortgage industry case study for policy makers, with a particular emphasis on what it might suggest for the role of the government in vertical IS standards development.

Generalizing the Home Mortgage Case to Other Industries

How well does the mortgage industry case generalize to other industries? To support this discussion, we refer to the case of the development of the bar code in the grocery industry (Brown 1997), as well as to supplementary interviews conducted with the Data Interchange Standards Association (DISA), an organization that has assisted several industries with vertical IS standards making.

The development of the bar code illustrates the challenges an industry faces in using standardized data formats and information systems across firms, and reveals remarkably similar strategies in the process of developing vertical IS standards (Brown, 1997). In the context of structuring the collaboration over standards formation, grocery manufacturers and retailers had long held informal discussions about the need to standardize product identification, but they couldn't agree on what the standard should be. Fearful that leading retailers would require them to adopt multiple different labeling conventions, grocery manufacturers finally got the retailers to join a standards committee by threatening to come up with their own standard, although they freely acknowledged that this solution would not be best for the industry as a whole. Formation of the committee required exquisite attention to rules governing who would be allowed to participate and vote. Throughout the committee's deliberations, balancing the interests of different industry participants, especially smaller players lacking resources as well as vendors with interests in their own proprietary technology, was a constant consideration. Consultants to the committee expressed amazement when members unanimously voted on a solution that increased costs for manufacturers, because that was the best solution for the industry as a whole.

There are also many interesting parallels with the bar code standardization committee's efforts to spur adoption by firms in the sector by limiting the scope of the effort and engaging in educational and promotional activities. Early on, the committee agreed on an operating principle that undoubtedly contributed to the standards' adoption: "The symbol … shall not place an undue competitive burden on any segment of industry" (Brown, 1997, p. 59). An additional principle was that symbol selection would be based on performance in in-store tests, so that the test results could speak for themselves to skeptical would-be adopters. Because the bar code required complementary resources in printing and scanning innovations, the committee worked tirelessly with vendors to ensure that industry participants would have the wherewithal to adopt. (Vendors didn't always cooperate. The leading vendor of scanners withdrew from the market when the committee did not choose the symbol it had proposed and developed.) Committee members conducted endless presentations about their efforts to industry groups and even individual companies. All these decisions and activities helped promote adoption of the standard.

Standards maintenance was not initially a focus of the bar code committee, but it ultimately became an important consideration. The best illustration of the on-going nature of the standardization committee's work is the ineffective plans of bar code developers to put themselves out of business (Brown 1997). The bar code requires central administration for assigning numbers to manufacturers (who then assign numbers to their products). The bar code developers expected that the job of administration would diminish to the point where it could be handled by a part-time assistant in an industry association—and, on the basis of that assumption, they funded the role on a declining basis over five years. Eventually, committee members had to admit the fact that the job was actually continuing to grow sharply, and they had to create a permanent non-profit organization, the UCC (Uniform Code Council), and governance structure for it. They also had to cope with a variety of ongoing issues, such as defending the standard

from encroachment or alteration by other standards groups and from various legal threats. Indeed, their experience offered an important lesson about the need to have a very clear intellectual property policy. The bar code was never patented, and some individuals later brought suit, unsuccessfully, claiming patent infringement.

There are a few significant differences between the bar code case and the standardization effort addressed in this paper. First, the bar code standardization effort required the development of hardware for printing and scanning; MISMO data standards do not have hardware requirements to any significant degree. Second, partly as a result of the hardware requirement, adoption of the bar code could not begin until the standard development process was completed. By contrast, development of MISMO standards is occurring in versions, as is common with software-based innovations, and adoption is proceeding in parallel with further development. Finally, it is still too early in the mortgage industry IS standardization process to foresee the full range of issues that will arise during adoption and maintenance of the MISMO standards. Despite these differences, the many parallels between the experiences of the grocery industry in developing bar codes and those of the mortgage industry suggest that some generalization is appropriate. At a minimum, both of these cases reveal how important it is to develop an adequate structure for collaboration, emphasize strategies to encourage adoption, and ensure ongoing maintenance of standards.

According to interviews with DISA, many other industries have had some success in developing vertical IS standards following much the same process as the mortgage industry, including chemicals, travel, insurance, and others. DISA representatives highlighted a few of the characteristics they felt differentiated successful from unsuccessful standardization efforts. In keeping with our findings regarding the need to structure collaboration appropriately, it appears that quite similar governance approaches have been successfully used elsewhere. Indeed, the MISMO governance structure was to some extent inherited from the earlier EDI ASC X12 standardization efforts. DISA served as the secretariat for that earlier effort, and has also been assisting MISMO. Secretariats facilitate the process in many ways behind the scenes, including by registering members, collecting dues, providing legal services, maintaining web sites, and publishing standards documents. Given that the participants from the industry all have their regular company work to do on top of any standards activity, it suggests that some outside help may be important for any industry.

The scope of standardization efforts was also an important issue in other industries, according to DISA interviewees. They were particularly cautious about efforts in other industries to move beyond data definition standards into business process guidelines (sometimes known as “best practices”), which they felt makes it more difficult to gain consensus and adoption.

Also associated with difficulties in vertical standardization efforts were having high costs of participation, technical complexity that is beyond the level of automation found in an industry, and too great a perceived role for a dominant technology vendor. In situations where high participation costs and technical complexity are present, DISA has found that smaller players are discouraged and it is difficult to create the critical mass needed for consensus-based standards development. When dominant technology vendors attempt to drive the standards process, DISA has found that other vendors view these efforts with suspicion and are reluctant to participate.

Collectively, these cross industry comparisons suggest that the basic logic followed in this case does generalize to other industries, and those that fail to adequately structure participation, keep costs low, and limit the scope of efforts may not succeed.

Contributions to Theory and Practice

Having established that of the MISMO standards case generalizes to other industries, we next turn to what the findings imply for theory and practice. We organize this discussion following our tri-part framework of structuring the process, promoting standards adoption, and maintaining the standard.

Contributions in the Area of Structuring the Process

Our first set of research questions focused on the issue of how the standards development process is structured. We observed that both from a public goods theory perspective, and the analysis by David and Greenstein (1990) on committee-based standards processes, little was known about why companies and individuals participate given the costs they incur. One finding that emerges from our interviews is that industry characteristics can strongly influence costs of participation in standards development. In particular, the fact that the traditional mortgage industry products had become somewhat commoditized allowed otherwise competing firms to find a basis for focusing efforts on standards. In addition, our observations and interviews revealed a number of important incentives that motivate companies, suggesting that the resulting benefits of the public good are not the same for all firms in the industry. That is, participating firms may experience somewhat higher benefits than non-participating firms in at least two ways. First, through their participation they can help ensure that the committee works on standards that will be useful for their business and will fit their needs. Second, firms can use their participation to enhance their own legitimacy as a player in the industry, and improve their visibility and reputation – potentially leading to increased future business. This latter benefit suggests the surprising outcome that smaller or lesser-known firms may have a disproportionate incentive to participate – perhaps resulting in an overrepresentation of smaller, less influential firms. Balancing this tendency, however, are the more limited financial and personnel resources of smaller firms. This finding contributes to earlier empirical work showing that public goods theory underestimates the benefits received by early contributors in standards making efforts (Flanagin et al. 2001; Monge et al. 1998).

Additional theoretical implications derive from our finding that, despite the at times significant personal costs not fully reimbursed by company contributions, individuals were motivated for personal, altruistic, and social reasons to participate in the process. The existence of a core group of highly interested people, who experience rewards by being embedded in a group of the "same ten people," was universally recognized by interviewees. These strong social bonds not only acted as an incentive for participation, they were also helpful in defusing conflicts and enabling compromise. Although the importance of personal relationships as a lubricant and governance mechanism in support of electronic transactions has been pointed out in prior literature (Kraut, Steinfield, Chan, Butler and Hoag 1999), the role of such relations in the standards-setting process has not yet received much attention.

Our analysis of the structure of the standards-making process in the mortgage industry also revealed a number of critical elements that committees can take to help manage competing interests and mitigate conflict. First, the scope of vertical IS standards-setting processes appears

to be important in the success of these efforts. MISMO deliberately avoided trying to develop standards for "everything and the kitchen sink", because the attempt to standardize members' internal processes and data structures would likely entail both *inter-* and *intra*organizational conflict. Instead, the decisions to focus only on the data flowing between organizations, and on data rather than process standards, limited the potential for conflict. Vertical IS standards often affect multiple stakeholder groups *within* the organizations that participate in standards-setting efforts—in the case of the mortgage industry, for example, originating units, servicing units, and legal departments may each view a proposed standard from different points of view. Managing the scope of standards-setting processes is a useful tactic for keeping intraorganizational conflict from affecting the successful completion of an interorganizational standard. A potential downside of this approach is that some participants may lack the level of internal systems integration needed to adopt or capture benefits from interoganizational standards (Markus 2000).

A second set of findings in this area emphasized the role of governance mechanisms as a tool to reduce the potential for conflict. Open membership, voluntary participation on particular workgroups, transparency in decision making, fair voting rules, efforts to reduce costs of participation, and a separate governance committee were some of the ways that MISMO increased participation and minimized conflict. These findings support and further inform the prior work on committee-based standards (Brown 1997; David and Greenstein 1990; van Baalen et al. 2000).

Additional insights are gained by attention to informal governance mechanisms. Prior analysis of committee-based standards suggest that, especially among user committees, work often proceeds by consensus (Hills 2000), and MISMO committees were no exception. Our findings also reveal some of the informal mechanisms that allow committees to function in this way, such as the importance of the core "same ten people" who can help broker compromises, as well as the method of choosing projects based on simply having a critical mass of people willing to volunteer. However, a cost of choosing projects in this way—that some important standards remain undeveloped due to lack of participation—was also revealed.

Contributions in the Area of Promoting Standards Adoption

Our second set of questions focused on what standards development organizations can do to help promote adoption of the standard, and what consequences such actions might have for industry structure and participants' competitive position.

Clearly, many of the structuring factors discussed above had consequences for the likelihood that standards would eventually be adopted by firms in the mortgage industry. The open and inclusive membership and governance mechanisms ensured that participants would not perceive that any one industry player had undue influence. Moreover, the active efforts to enlist further participation, educate members, and distribute standards via low cost Internet channels enhanced the probability of adoption.

Our analysis also emphasizes the critical importance of the focus on developing a data dictionary for vertical IS standards efforts. Interviewees all agreed that this was MISMO's greatest achievement, and that it paved the way for all future work done by the organization. It enhances the adoption by giving confidence that the resulting standards would not fall prey to standards drift caused by different interpretations of the meaning of elements in transactions (Damsgaard and Truex 2000). Whether such an approach would work in other industries is an important question for future research.

An open participation process is important, but the MISMO case suggests that standards development organizations must be more proactive in recruiting participants in order to promote future adoption of the standard. Many of the interviewees noted how important it was that the GSEs were brought into the process. Because of their dominance as buyers in the secondary market for mortgages, without their agreement no standard would have much chance of being adopted. Indeed, rather than a simple network effect characterizing the take-up of the standard in this case, this result suggests that depending on industry structure, adoption may depend on the decisions of a few key early adopters who furnish benefits for the remaining population (Olson 1965).

Our case analysis further suggests that the lack of inclusion of key stakeholders, coupled with a process whereby the standards projects to be addressed depended on having a critical mass of interested parties present, will hinder adoption. In particular, interviewees observed the relative lack of participation by large mortgage banks, which may have been a function of their desire to leverage prior heavy investment in proprietary EDI systems.

The actions taken to promote adoption did appear to have some observable consequences for the types of standards developed, which in turn might have implications down the road for industry structure and competitiveness. As predicted by Hills (2000), voluntary coalitions, such as MISMO, are more likely to develop standards that preserve members' interests, even if new technology might enable a more efficient solution. The three-part SMART doc standard developed by MISMO that appeared to preserve the role of document preparation companies illustrates the applicability of this theoretical expectation to the vertical IS standards arena.

Contributions in the Area of Maintaining the Standard

Our third set of research questions focused on the actions standards development organizations take in order to ensure ongoing maintenance of standards, defense against legal challenges to the standard, and defense against fragmentation and drift.

As noted in our review of the bar code case (Brown, 1997), vertical IS standards developed by voluntary committees require ongoing maintenance that may not have been anticipated by the initial standards group. As a result, a relatively impermanent organization may not be adequate, and a more formal institutional structure is required to structure participants' actions and reduce uncertainty (Jepperson 1991; Mayntz and Scharpf 1995). The actions taken by MISMO to create a permanent 501(c)(6) organization responsible for ongoing standards development and maintenance activities supports this conclusion.

Our findings further suggest that standards organizations must take steps early on to ward off future legal challenges that may negate any collective benefits from the standards being developed. The intellectual property rights policy was expressly designed to reduce the likelihood of such challenges, particularly coming from so-called submarine patents.

Finally, fragmentation and drift caused by reinterpretation of the standards were not only offset by the development of the data dictionary, but also by other strategic choices made early in the process. In particular, our case emphasizes the importance of considering how the standard can evolve as newer technology arrives. In the MISMO case, the choice of XML, and the explicit recognition of how the current standards can migrate to Schema and XSL will help avoid fragmentation and drift.

Policy Implications

Although our primary focus has been to reveal the underlying dynamics surrounding vertical IS standards development, the case does lend itself to a discussion of policy implications. We organize this section by addressing the potential roles that regulators and government institutions might play in facilitating the development and use of vertical IS standards. Governments have an interest in enhancing the efficiency of industries, and can encourage the formation of vertical IS standards in a variety of ways, including as a convener, a participant, a funding agent, a promoter, and user.

As a *convener*, government agencies might use their considerable influence to bring key players to the table. In this role, they can be viewed as objective facilitators, rather than as potential competitors. Such a role may be especially useful when attempting to stimulate cross-industry IS standards efforts. Not only do many transactions take place across industries, but also many transactions are structurally similar across industries and so a standard that already exists in one might benefit another. Loan data in the home mortgage industry, for example, has relevance for other large purchases such as automobiles, suggesting that some standards might be fruitfully applied in these other sectors. One project underway at NIST is attempting to bring together a number of vertical industry standards organizations to try to stimulate what is now being called e-business standards convergence (http://www.nist.gov/ebsc).

Government agencies can and should also be *active participants*, operating much as other industry participants in committee meetings. Participation by agencies with knowledge of important regulations can help ensure viable standards emerge from committee efforts. Within MISMO, a somewhat related example is the participation by the GSEs in the process, even though they essentially private companies with government charter.

In addition, government entities can play the role of *funding agent*. Selective funding may be used to assist smaller firms with the costs associated with membership and active participation. Moreover, the funding of foundational research and development efforts that might not be undertaken by industry members would be another example of this type of role.

As a *promoter*, the government may use financial support to spur adoption of the standard. This may be in the form of grants and other forms of assistance to firms under the condition that developed standards are adopted and used. Tax credits and other incentives may be supplied for firms that participate and adopt industry standards.

The government can also play a role as a *user* of vertical IS standards. As a buyer of goods and services from many industries, it can mandate that sellers use established vertical industry standards in all transactions. Such mandates can have a great effect on standards adoption. Our DISA interviewees, for example, noted that ASC X12 publications "flew off the shelves" when the government mandated use of this standard in the Health Insurance Portability and Accountability Act (HIPAA).

One role that the MISMO case suggests is *not* appropriate for the policy making community is as the sole *developer* of IS standards meant for a particular industry. Rather the case demonstrates how important it is to have full participation from all segments of the industry, especially from those companies that must use the standard in their daily operations. Moreover, the case emphasizes the need for vertical IS standards to be flexible, and allow for ongoing evolution.

In conclusion, the case of MISMO in the home mortgage industry sheds much needed light on the processes by which vertical IS standards emerge and suggests a number of potential roles for practitioners and policy makers. Although it is limited to one industry with unique characteristics, parallels to previous and contemporary vertical IS standards efforts are noteworthy. Further empirical work is needed to learn if the processes unfold similarly in different industry structures. In addition, further theoretical development and empirical work are important for understanding how the efforts of standards development organizations play out in terms of standards adoption and impacts.

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