

INDUSTRY-WIDE INFORMATION SYSTEMS STANDARDIZATION AS COLLECTIVE ACTION: THE CASE OF THE U.S. RESIDENTIAL MORTGAGE INDUSTRY¹

By: **M. Lynne Markus**
Department of Information and Process
Management
Bentley College
175 Forest Street
Waltham, MA 02452-4705
U.S.A.
mlmarkus@bentley.edu

Charles W. Steinfield
Department of Telecommunication, Information
Studies, and Media
Michigan State University
East Lansing, MI 48824-1212
U.S.A.
steinfie@msu.edu

Rolf T. Wigand
Departments of Information Science and
Management, Cyber College
University of Arkansas at Little Rock
Little Rock, AR 72204-1099
U.S.A.
rwigand@ualr.edu

Gabe Minton
Vice President of Industry Technology
Mortgage Bankers Association
1919 Pennsylvania Avenue NW
Washington, DC 20006-3438
U.S.A.
gminton@mortgagebankers.org

Abstract

Vertical information systems (VIS) standards are technical specifications designed to promote coordination among the organizations within (or across) vertical industry sectors. Examples include the bar code, electronic data interchange (EDI) standards, and RosettaNet business process standards in the electronics industry. This contribution examines VIS standardization through the lens of collective action theory, applied in the literature to information technology product standardization, but not yet to VIS standardization, which is led by heterogeneous groups of user organizations rather than by IT vendors. Through an intensive case analysis of VIS standardization in the U.S. residential mortgage industry, VIS standardization success is shown to be as problematic as IT product standardization success, but for different reasons.

VIS standardization involves two linked collective action dilemmas—standards development and standards diffusion—with different characteristics, such that a solution to the first may fail to resolve the second. Whereas prior theoretical and empirical research shows that IT product standardization efforts tend to splinter into rival factions that compete through standards wars in the marketplace, successful VIS

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standards consortia must encompass heterogeneous groups of user organizations and IT vendors without fragmenting. Some tactics successfully used to solve the collective action dilemma of VIS standardization (e.g., governance mechanisms and policies about intellectual property protection) are also used by IT product standardization efforts, but some are different, and successful VIS standardization requires a package of solutions tailored to fit and jointly resolve the specific dilemmas of particular VIS standards initiatives.

Keywords: Vertical IS standards and standardization, collective action, public goods theory, governance, intellectual property rights, technical design issues, institutional support, heterogeneity of resources and interests

Introduction

It is generally agreed that open standards such as the Internet and open source software development methods have significant potential implications for information systems theory and practice. For example, open standards increase the connectivity of devices and software, thereby enabling the development of new information technology applications and new strategies of electronic business and, consequently, the restructuring of IT-using industries (Wigand et al. 2005). Open source software development threatens the hegemony of proprietary IT products and services, thereby leading to changes in the structure of the IT industry. Both trends are converging in new forms of cooperation among IT-using organizations, for example, the user-led development of voluntary, open, industry-specific interorganizational coordination standards, here called vertical information systems (VIS) standards.

Among the first VIS standards were the bar code and electronic data interchange (EDI). The bar code, intended to facilitate coordination among grocery manufacturers and retailers, spread rapidly beyond its grocery industry origins to become a "universal" product code. By contrast, EDI did not diffuse widely, despite massive standardization efforts by both international standards development organizations (e.g., EDIFACT) and specific industry groups. Because of its high costs and technical limitations, only the largest organizations were able to implement EDI with significant benefits; to this day, the majority of smaller organizations cannot take advantage of seamless electronic data interchange (Beck and Weitzel 2005). In addition, EDI standards were character-based, which were costly to implement and maintain. As an "in-between" format straddling the open source and proprietary software worlds, XML satisfies the needs both of

users that are tired of high systems integration costs and of IT vendors that want to retain control over their applications.

The availability of open Internet technology standards promises to lower the costs of interorganizational collaboration significantly, leading to major improvements in the efficiency and effectiveness of electronic business. Achieving these gains, however, will depend on (1) the successful *development* of standardized business grammars and processes in specific industries and (2) widespread *adoption* of these standards by both large and small organizations. Unfortunately, standards development and standards diffusion are failure-prone processes. Thus, it is important to understand how and why these processes unfold, succeed, or fail.

In 2002, the first three authors began to study the consequences of the use of Internet technology in the mortgage industry. Along the way, we became aware of an initiative to develop XML data and business process standards in that industry, which parallels similar efforts in other industries: RosettaNet in electronics and high tech, CIDX in chemicals, PIDX in petroleum, FIX in financial services, and ACORD in insurance, among others. Since its founding in 1999, the Mortgage Industry Standards Maintenance Organization (MISMO) rapidly amassed a community of dedicated volunteers from various segments of the industry; many releases of MISMO data standards have been developed and taken up by numerous IT products and services vendors as well as user organizations. The apparent sudden success of this standardization effort intrigued us, because, although the interests of participants differed considerably, the participants cooperated in a single structured standardization process rather than through multiple competing voluntary efforts or *de facto* standards wars.

Of the several theoretical perspectives from which this phenomenon could be viewed, collective action theory seemed the most promising, because it focuses on the conditions under which organizations collaborate to achieve common goals. However, despite a long tradition in the standards literature, collective action theory has not yet been applied to VIS standardization, which is led by users rather than IT vendors and involves qualitatively different participant interests. Through an intensive case analysis of the U.S. residential mortgage industry, we find that the success of VIS standardization is as problematic as that of IT standardization, but for different reasons.

We argue that VIS standardization involves two linked collective action dilemmas—standards development and standards diffusion—with different characteristics, such that a solution to the first dilemma may fail to solve the second.

Whereas prior theoretical and empirical research shows that IT product standardization efforts tend to splinter into rival factions that compete with each other through standards wars in the marketplace, we argue that successful VIS standards consortia must encompass heterogeneous groups of user organizations *and* IT vendors *without* fragmenting. Some of the tactics successfully used to solve the collective action dilemmas of VIS standardization (e.g., governance mechanisms and policies about intellectual property protection) are also used by IT product standardization efforts, but some are different, and we argue that successful VIS standardization requires a package of solutions tailored to fit and jointly resolve the specific dilemmas of particular VIS standards initiatives.

Prior Literature

Standardization has been examined through multiple theoretical lenses. Perhaps best known is the network effects/standards wars literature (Besen and Saloner 1989; David and Greenstein 1990; Katz and Shapiro 1985; Kleinaltenkamp 1993; Weitzel et al. 2006). In other theoretical streams, Damsgaard and Lyytinen (2001), Graham et al. (2003), and King et al. (1994) discussed standardization as a process of institutionalization, and Graham, Spinardi, Williams, and Webster (1995) employed actor-network theory to explain standardization. The view of standardization as collective action overlaps somewhat with the network effects tradition, but, as we show below, it has distinct features with considerable potential for shedding new light on VIS standardization.

Standardization as Collective Action

In his discussion of all sorts of standards, including those developed by “governments, trade or professional organizations, and even companies,” Kindleberger (1983, p. 377) argued that the difficulties of standards *diffusion* are great,

partly because of the *free-rider problem* that inhibits the production of *public goods*: *each firm, household, individual waits to undertake to change [to] the standard until the rest of society has conformed and the costs and benefits to the single unit are clarified* (p. 388, emphasis added).

Situations in which competing vendors put forth alternative standards proposals led to a sizable body of research on stan-

dards wars. (For reviews, see David and Greenstein 1990; Stango 2004.) In this literature, the diffusion of open standards is believed more problematic than the diffusion of vendor-sponsored standards, because vendors have the incentive to subsidize adoption of their proprietary technologies, whereas open standards have no “owner” that can monopolize standardization benefits (Stango 2004).

Because market competition is not the only means by which multi-organizational standards emerge, scholars have also addressed the difficulties of standards *development*, whether through formal, government-backed standards initiatives or voluntary committees (David and Greenstein 1990). In order to secure industry members’ involvement in standards development and their eventual adoption of the standards, voluntary committees must undertake to preserve the competitive interests of participants (David and Greenstein 1990). This policy tends to result in technically complex standards, perhaps because industry members strive to ensure backward compatibility with their installed technology base. Paradoxically, the complexity of committee-developed standards might work *against* their widespread adoption. Even with assurances that their competitive interests will not be threatened, the willingness of organizations to participate in standards development is problematic. David and Greenstein (1990) called for research addressing “the costs borne by private companies, and the incentives that appear to justify the resource expenditure entailed in having personnel participate regularly in standards-writing groups” (pp. 28-29). Or, as Cargill (1989) put it,

[Standards] committees are composed of volunteers who believe enough in consensus standards to participate in the process. There is no rational explanation for why the volunteers volunteer. The work is hard and/or boring, and they must pay to do it (p. 117).

Greenstein (1992) argued that standards set by *consortia of organizations*² are more likely to attract adherents than standards set by *dominant product vendors*, whose competitive interests lead them to pursue proprietary, incompatible solutions that are resisted by buyers and other vendors. Standards-developing consortia arise when “*all component suppliers have an interest in seeing the emergence of standards and the growth of a network [but when] structural impediments...lead no firm to sponsor a standard that others will adopt*” (p. 543, emphasis added). According to Greenstein, consortia and other voluntary standardization organiza-

²A consortium is a collective actor, although Greenstein never used this term.

tions frequently fail to produce standards acceptable to buyers and other vendors, and they cannot ensure that standards will diffuse, because, by definition, "using the standard is optional," and dominant product vendors need not follow their recommendations. Thus, "these groups are most likely to succeed when market participants mutually desire standardization, need to establish a mechanism for communication, and need a mechanism to develop or choose a standard from one of many technical alternatives" (p. 544).

Greenstein also noted that standards are sometimes sponsored by *dominant buyers*, but he regarded this situation as less controversial than sponsorship by a dominant vendor and largely unproblematic from a social welfare point of view. He did not consider the situation in which standards are sponsored by a consortium of *buyers*.

Weiss and Cargill (1992) continued the analysis of standards-setting consortia using Mancur Olson's (1965) seminal work on public goods and collective action. Weiss and Cargill argued that standards *development* is problematic, because "once a standard exists, any firm is free to implement it, regardless of *whether* it contributed to the development" (p. 563). Therefore, every firm prefers to rely on others to do the work of standards development. In addition, Weiss and Cargill observed that *IT* product standards exhibit *network externalities*, a factor that influences the successful *solutions* to the collective action dilemmas of standards setting and diffusion, specifically in terms of the number and type of consortium participants that are needed for successful standards development and diffusion.

According to Weiss and Cargill, formal standards development organizations like the International Standards Organization (ISO) tend to be slow and to produce solutions that go against the interests of some members, because they necessarily include groups with divergent interests. *IT consortia* are "a *vendor solution* to the problem of long delays and ambiguous compromises in the formal standards process" (Weiss and Cargill 1992, p. 563, emphasis added). Two different types of *IT* consortia—those devoted to promoting the acceptance of *existing* technical standards and those attempting to develop *new* technical solutions to existing problems—have different collective action dynamics. Consortia that attempt to achieve widespread adoption of existing standards have incentives to get *as many firms as possible* to join, because a large network of members would translate into an adoption bandwagon. By contrast, consortia attempting to develop new technical standards have incentives to limit membership to

small groups with a relatively uniform preference

structure in order to be effective....[Standards development consortia] would have the incentive, however, to include *all participants with a compatible preference structure*, because doing so maximizes the potential size of [the adopter population]. In particular, they would wish to include *large firms* to the largest extent possible [because large firms are more likely than small ones to influence others to adopt the standard] (pp. 563-564, emphasis added).

Through examples such as the Open Software Foundation and their discussion of consortia as a vendor solution, Weiss and Cargill made it clear that their focus was on *vendor-led* IT product standards-setting consortia. However, they also mentioned an example of a *user-led consortium*, MAP (Manufacturing Automation Protocol), initiated by GM to resolve interconnection problems among its 40,000 IT-enabled manufacturing tools. The role of *user* organizations in IT product standards-setting consortia was explicitly analyzed by Foray (1994).

Foray was concerned with the often-acknowledged problem that users so infrequently participate in IT standardization efforts (Jakobs 1998). According to Foray, without user input, standards do not meet the needs of users, and the result is lack of standardization or the existence of multiple standards. Foray reasoned that the formation of user coalitions was a necessary condition for the successful involvement of users in standardization efforts, and he used the collective action theorizing of Schelling (1978) to investigate the conditions under which user coalitions would form. Because users are the ones who suffer from the lack of standards, they have the incentive to try to force IT product vendors to standardize. When a *dominant user firm* "is able to recruit kindred spirits" (Foray 1994, p. 273), the formation of a user coalition is virtually automatic—GM's MAP initiative being a good example. Generally, however, creating a user coalition for purposes of standards setting is problematic, because there is "little inducement for an individual to take part" (p. 275) in standards development.

Standards development has the characteristics of the classic public goods problem—the so-called prisoner's dilemma³—because "use of the standard by an individual in no way prevents other people from using it" (Foray 1994, p. 275). However, the costs of standards setting decline when

³The label *prisoner's dilemma* is applied to noncooperative games in which the payoffs are such that, by trying to maximize individual results, each actor is worse off than all participants would have been through cooperative behavior (Wigand et al. 1997).

there are more participants to share the costs, so “users *with a common interest* must band together” (p. 177). Furthermore, when the number of users involved in standards development becomes too large, the costs of coordination rise unacceptably, leading to free-riding behavior. Thus, Foray concluded that user coalitions for standards development would take the form of a club with a *limited number of members with homogeneous interests*. Two situations favor the formation of such clubs: *large user companies with pre-existing partner networks* and *industry associations*. To avoid becoming unworkably large or diverse, user coalitions must quickly develop appropriate *governance mechanisms*—such as *restricted membership*, which can result in fragmentation and competing efforts (Axelrod et al. 1995).

Having established the conditions surrounding the formation of user coalitions, Foray turned to the integration of users into existing *vendor-led* IT standardization efforts. He noted that problems would arise owing to the *divergence of interests* between vendors and users. Therefore, the standards-setting body would need to find mechanisms to reduce this divergence. Among the mechanisms he cited were *designing the standard de novo* so that it meets all participants’ needs—as opposed to selecting an existing standard proposed by a vendor, instituting certain *voting rules*, and avoiding strong protection of *property rights*.⁴

Updegrove (1993) offered practical legal advice on “forming, funding, and operating” standards-setting consortia. He recommended multitiered funding structures in which the most interested parties pay fees large enough to sustain operations and that other organizations, whose interests are less but whose participation is essential for success, be charged a membership fee low enough to avoid discouraging them from joining. Differential membership fees imply differential voting rights, and Updegrove discussed alternative governance structures for standards-setting consortia. Since consortia often develop intellectual property whether or not they set out to do so, Updegrove recommended giving careful attention to intellectual property rights (IPR) upfront.

Empirical research finds considerable variation across standards-setting consortia in terms of purpose, openness of membership, rules governing participating and voting, transparency of decision-making, and ownership of IPR (Vincent and Camp 2004; West forthcoming). Although some authors

(e.g., Foray 1994; Updegrove 1993) are optimistic about the use of such mechanisms to promote standards-setting success, others (e.g., Graham et al. 1995; West forthcoming) are far less sanguine. Graham et al. (1995), for instance, noted that a particular EDI forum “failed because it proved impossible to agree [on] a structure acceptable to all parties” (p. 15). West (forthcoming) suggested that it is challenging to accommodate in a single forum the divergent interests of vendors, who prefer proprietary solutions and desire to exclude their competitors from standards-setting consortia, and users, who prefer open solutions and desire to avoid being locked-in to a single vendor.

Assessment of the Literature

Differences in the ways various authors have characterized the nature of the collective action dilemma(s) in standardization, why the dilemmas occur, and how they can be resolved (if at all) make it challenging to integrate and generalize the findings, raising a number of questions about the specific case of VIS standardization. Heterogeneity of *interests* is believed to be detrimental to standards development success (Greenstein 1992; Weiss and Cargill 1992). Standardization theorists such as Foray (1994) and Greenstein (1992) focus on the differences in interests between IT vendors and users and assume that users are relatively homogeneous, united by their common interests in forcing vendors to standardize. The implication is that the success of user-led standardization efforts is likely.⁵ However, there are reasons to believe that the success of VIS standardization is problematic, owing to heterogeneity of interests *among user participants*.

First, VIS standardization efforts are initiated in order to enable interoperable business processes involving groups of users of *different structural types*, such as buyers and suppliers. The empirical literature suggests that conflicts of interests in VIS standardization among structurally different groups are common (Salmi and Tuunainen 2001; van Baalen et al. 2000; Webster 1995). Second, *within* each structural type, members can vary considerably in their interests in standardization. For example, dominant members might believe that their proprietary interorganizational information systems lock in their channel partners and that standardization could make it easier for partners to defect (Salmi and Tuunainen 2001). In addition, large players might have

⁴See also Besen (1990) on voting rules in standards-setting bodies, Farrell’s (1995) arguments for weaker intellectual property protection as a means of promoting technology diffusion in the presence of strong network effects, and the work of Bekkers et al. (2002), which shows how strong property rights can shape the structure of IT product marketplaces.

⁵The extraordinary success of open source software development efforts (Markus et al. 2000) is analogous to Foray’s (1994) notion that standardization coalitions of user organizations would “almost automatically” form.

higher costs of standardization owing to the heterogeneity of their legacy systems environment (Howard et al. 2001; Jakobs 1998; Wigand et al. 2005) and consequently oppose standards on the grounds that standardization would level the technological playing field for smaller competitors (Markus et al. 2003). Therefore, in some cases, dominant members of an organizational field might prefer their partners to adopt their proprietary formats for interconnection, rather than industry-wide standards (see also Reimers and Li 2005). For example, assembler-specific, as opposed to industry-wide, EDI standards typify the automobile industry (Gerst and Bunduchi 2005; Webster 1995). Third, unless a voluntary standard meets the needs of all relevant user groups, it will not be widely adopted throughout the industry; therefore, some members of all relevant groups must participate in standards development (Hills 2000). In the case of the bar code, grocery manufacturers wanted industry-wide standards because they feared they would suffer if retailers adopted proprietary approaches to automated product identification (Brown 1997). When grocery retailers showed no interest in standardization, grocery manufacturers used the threat of creating their own standard, which might not have met the needs of retailers, to bring the retailers to the standardization table.

We conclude that VIS standardization efforts cannot fragment into rival, homogeneous groups, as often happens in IT product standardization (Cargill 1989; Greenstein 1992), and still be successful in developing a standard that meets industry-wide needs for intercommunication. For example, automotive assemblers did not involve their suppliers in the process of developing VIS standards for the Covisint electronic marketplace. The resulting standards did not meet the needs of suppliers, who boycotted Covisint and set up their own rival marketplace (Gerst and Bunduchi 2005). This line of argument suggests our first research question.

Research question #1: How (if at all) does heterogeneity of interests among users, as well as between IT vendors and users, threaten the success of VIS standardization?

The literature discusses two collective action dilemmas with respect to standardization: the dilemma of standards *development* (Cargill 1989; Foray 1994) and the dilemma of standards *diffusion* (Kindleberger 1983). According to collective action theorist Peter Kollock (1998), many people assume that there is only one type of collective action dilemma: the classic prisoner's dilemma (Wigand et al. 1997). Actually, there are several types, which differ in structure according to the shape of the production functions linking participants' interests and resources to the likelihood of successful collective action (Kollock 1998; see also Oliver and Marwell 2001.) Standards *development* appears to exhibit the characteristics of the

prisoner's dilemma (Foray 1994), in which no one has the incentive to contribute to the development of the standard, because others who have not contributed cannot be excluded from enjoying the results. On the other hand, standards *diffusion* (see Kindleberger 1983) has the attributes of an *assurance game* (Kollock 1998), also called *penguin effects* (see Weitzel et al. 2006). Because standards are only useful when they are generally adopted or because potential adopters are uncertain about the costs, benefits, and risks of standards implementation, each participant is motivated to delay adopting until convinced that others will also adopt. Because the best assurance lies in others' actual adoption, diffusion of standards tends to be slow and uncertain. Table 1 compares the two dilemmas as they apply to VIS standardization and illustrates the relationship between them.

Most research examines either standards development or standards diffusion, but not both (Fomin et al. 2003). Yet, the two dilemmas are logically linked: unless a standard is successfully developed, it cannot diffuse. However, successfully developed standards do not always diffuse (Greenstein 1992). One possible explanation is that differences in the structures of the standards development and diffusion dilemmas make it possible to solve the first dilemma without solving the second. For example, IT vendors and certain powerful users might be induced to participate in standards development even though they have no intention of adopting standards or promoting their diffusion, owing to competitive interests.⁶ Or, organizations might agree to participate in standards development with the expectation of influencing the outcome but fail to implement the standard when the agreed-upon content of the standard does not favor their interests.⁷ Another explanation, discussed more fully below, is that measures employed to solve the dilemma of standards adoption might result in complex or otherwise problematic standards that will not diffuse easily.

The likelihood of successfully resolving collective action dilemmas is a function, not only of participants' interests in the public good, but also of the resources participants are able to contribute to achieving the public good (Kollock 1998; Oliver et al. 1985). Whereas heterogeneity of interests is believed to be detrimental to the success of collective action, heterogeneity of *resources* is believed to *favor* successful collective action, because it increases the chances that some resourceful individual(s) will be able to provide the collective

⁶They might participate with the aim of gathering competitive intelligence or appearing cooperative while trying to block the effort.

⁷A prominent scanner hardware vendor failed to support the bar code after users rejected the symbology the vendor had proposed (Brown 1997).

Table 1. The Collective Action Dilemmas in VIS Standardization

	VIS Standards Development	VIS Standards Diffusion
Collective Good	Completely developed VIS standards, available for adoption, that would meet the interconnection needs of all members of an industrial community, if they were widely adopted.	Widespread use of complete VIS standards within an industrial community, leading to interconnection benefits for adopters.
Collective Action Dilemmas	Prisoner's dilemma—because participation is costly, organizations might choose not to participate (the free-rider problem), hoping that others will do the work.	Assurance game—early adopters get few benefits, because there are few other adopters with whom to interconnect via the standards; therefore, the tendency is for organizations to wait until others adopt. Penguin effect—because of uncertainty about the costs, benefits, and risks of adopting the standards, early adopters wait for others to adopt.
Consequences of Non-Resolution	VIS standards for an industrial community might be only partially developed or not be developed at all; organizations would be unable to adopt the standards, leading to reliance on proprietary approaches, or unable to use the standards with all trading partners, limiting their potential benefits, if they adopted the incomplete standards.	Non-adoption or partial adoption, followed by abandonment or perpetuation of multiple approaches, including proprietary approaches; limited solutions to industry-wide interconnection needs; limited benefits to adopters.
Implications of Heterogeneity of Resources	Each sector of an industrial community can contribute knowledge only of its own business requirements to VIS standards development. Knowledge about all sectors is needed for complete VIS standards that meet the interconnection needs of the industry. Therefore, all sectors must contribute to standards development.	Some sectors (e.g., IT vendors and dominant users) can contribute heavily to standards adoption by others, for example, through providing software that lowers the cost of standards adoption or by requiring their many business partners to adopt the standards. Therefore, unless those sectors agree to adopt VIS standards, the standards will not diffuse, even if they are complete and theoretically meet industry needs for interconnection.
Implications of Heterogeneity of Interests	It will be difficult to design rules of engagement for VIS standards development that assure all sectors that their interests will be served. The tendency will be for the standards development effort to fragment, in which case the standards developed are likely to be incomplete and fail to meet industry needs for interconnection. In addition, some sectors of an industrial community (e.g., IT vendors and dominant users) might view VIS standardization as not in their interests and therefore might be unwilling to participate in standards development, leading to failure of the effort.	Some sectors of an industrial community (e.g., IT vendors and dominant users) are likely to view VIS standardization as not in their interests and might therefore not adopt the standards, even if they participated in standards development, and even if the completed standards meet industry needs for interconnection.
Interdependence between VIS Standards Development and VIS Standards Diffusion	Some sectors of an industrial community (e.g., IT vendors and dominant users) might view widespread diffusion of VIS standards as not in their interests, but might still be willing to participate in standards development (e.g., for reasons of personal interests, public relations, or competitive intelligence) without the intention of adopting the completed standards. If sectors with high resources for VIS standards diffusion participate in standards development without the intention to adopt the completed standards, other participants will have wasted their time. Therefore, assurances that sectors with high diffusion resources will actually adopt the completed standards are likely to be necessary to encourage other sectors to participate in standards development.	Measures employed to resolve the VIS standards development dilemma (e.g., ensuring vendors' participation in VIS standards development through strong IPR protection; excluding certain participants with divergent interests), might fail to resolve the diffusion dilemma and might even inhibit diffusion (e.g., because they enable vendors to charge high prices for software or result in standards content that does not meet needs of all sectors of the industrial community).
Implications of Interdependence	Unless the VIS standards <i>diffusion</i> dilemma can be apparently resolved in advance, the VIS standards development effort is likely to fail.	Even if the VIS standards <i>development</i> dilemma is resolved successfully, the VIS standards diffusion dilemma might not be; particular solutions to the VIS standards development dilemma might cause VIS standards diffusion to fail.

good for all (Heckathorn 1993; Oliver et al. 1985). Just as structurally different types of VIS participants can differ in their interests in standardization, as discussed above, they can also differ in the resources they can contribute. Furthermore, the resources participants are able to contribute to VIS standards adoption can differ from the resources they can contribute to VIS standards diffusion. For example, members of a single group of organizations in an industrial community can contribute relatively little to successful development of industry-wide VIS standards, because all sectors must participate in order for the standards to be complete. However, a few groups of organizations, such as IT vendors and dominant users, can contribute much more than other groups to successful VIS standards adoption (Foray 1994), because they can influence *other organizations* to adopt the standards, too. Both dilemmas—standards adoption and standards diffusion—must be resolved for successful VIS standardization. However, because the two dilemmas can differ in participants' resources and interests, it is possible that one of the dilemmas could be resolved, but not the other. Thus, our second research question is,

Research question #2: How (if at all) do the dilemmas of VIS standards development and VIS standards diffusion differ in the heterogeneity of participants' resources and interests, such that it might be possible to resolve the first dilemma without resolving the second?

As noted above, successful VIS standards development requires the participation of all relevant industry groups; otherwise, the resulting standard might not meet their joint needs for interconnected business processes. This implies that user participants might need assurances that their competitive interests will be preserved (David and Greenstein 1990). For example, the bar code standardization committee agreed to a basic operating principle early on: "The symbol... shall not place an undue competitive burden on any segment of industry" (Brown 1997, p. 59). However, the theoretical literature on standards adoption stresses the importance of membership exclusivity (excluding competitive rivals), rather than broad-based participation, as a factor in standards success. This raises the question of whether other success-promoting mechanisms discussed in the standards literature, such as membership and voting rules and weak intellectual property rights (Besen 1990; Farrell 1995; Foray 1994), will also help solve the dilemmas of VIS standards development.

Research question #3: How (if at all) can the dilemmas of VIS standardization be successfully resolved?

Resolving the dilemmas of standardization, for example, harmonizing the heterogeneous interests of participants, can take its toll on standards content. David and Greenstein (1990) noted that avoiding threats to participants' competitive interests can lead to standards that are overly complex or not very innovative. Such an outcome could in turn affect the success of the standards diffusion. This line of reasoning directs attention to the content of standards as the link between the two dilemmas: standards content can be seen both as an *outcome* of the mechanisms employed by a VIS standards-setting consortium to resolve collective action dilemmas and as an *input* to diffusion of the VIS standards developed. Therefore, we inquire,

Research question #4: How (if at all) could resolving the dilemmas of VIS standardization affect the content of VIS standards in ways that might alter the chances for successful standards diffusion?

Methods

To answer our research questions we conducted an exploratory case study of VIS standardization in the U.S. residential mortgage industry, using a holistic single case research design (Yin 1999). The case study research method is particularly appropriate for answering *how* and *why* research questions in settings in which the phenomenon of interest, VIS standardization, cannot easily be distinguished from its context, interrelations among organizations in an industrial community (Yin 1999). Our questions, concerning how and why collective action dilemmas in industry-specific standardization efforts arise and can be successfully resolved, meet Yin's criterion. The unit of analysis in our research questions is the VIS standardization effort—an industry-level phenomenon. We chose a single case design over a multiple case design owing to the demands of gaining access for intensive data collection. Our research design involves holistic, rather than embedded units, analysis; that is, although we necessarily examine the interests and resources of the organizations making up the industry as they contribute to the collective action of standardization, our outcome of interest and explanation are at the *industry level*, not at the organization level, of analysis.

The U.S. residential mortgage industry is a particularly appropriate setting for a study of vertical industry standardization. Computer automation of core business processes occurred relatively later in this industry than in many other information intensive industries. Because the phenomenon is recent and ongoing, it is more accessible to study than in a context in

which automation occurred much earlier. At the same time, MISMO standards development has been under way since 1999, and many standards sections have been completely developed and implemented by IT vendors and vertical industry participants. A recent IT cost study conducted by the Mortgage Bankers Association found that 77 percent of respondents had at least partially implemented MISMO's data standards. According to standardization experts, the mortgage industry is considered an exemplar of VIS standardization by other industry groups. Thus, we believe this initiative is a particularly appropriate setting for studying the collective action dilemmas involved in VIS standardization.

Evidence to support our analysis comes from three sources: in-depth interviews, direct observation in standardization meetings, and documents. A major source of information was the mortgage industry's primary industry association, the Mortgage Bankers Association.⁸ Key informants at the MBA helped identify potential interviewees who were well placed to comment on the industry's standardization organization. In addition, we observed and conducted interviews at two industry meetings: the Mortgage Technology Conference in Orlando, Florida (March 2003) and the MISMO Trimester Workgroup Meeting in Dana Point, California (January 2004).

In all, we conducted formal interviews with three people from the MBA (one was interviewed several times), six additional people active in MISMO who represented other areas in the mortgage value chain (including a government sponsored enterprise, a mortgage information and document services provider, a mortgage insurer, a mortgage credit reporting company, and two mortgage information technology vendors), three people in the Data Interchange Standards Association (DISA—a support organization for standards organizations like MISMO), five mortgage industry executives, and numerous informal interviews at industry meetings. Interviews were taped and transcribed to facilitate analysis. We hand-coded interview transcripts for key theoretical themes, documenting our evolving understanding in numerous theoretical memos. Quotations from interviewees were selected to illustrate our findings. We elaborated our growing understanding through weekly conference calls and periodic face-to-face meetings over the three years we have worked on this

project. Versions of this manuscript have been reviewed for factual accuracy by interviewees and other industry experts.

Additional data came from archival sources such as MISMO's public website (<http://www.mismo.org>), its members-only discussion databases, and articles in *Mortgage Banking* (an MBA publication) and *Mortgage Technology* (published by Core Source/Thompson). Among other document analyses, we reviewed and coded 25 years of articles related to information technology, electronic data interchange, and standards in the industry. This material substantially increased our understanding of key historical events and the concerns of industry participants.

We devised an overall data analysis and presentation strategy to fit the nature of our research questions and holistic single case study design. We used stakeholder theory (de Vries et al. 2003) to identify the key groups of actors in the mortgage industry, to analyze their interests in, and resources for, vertical industry standardization, and to articulate the specific collective actions problems facing MISMO. Then we used data from interviews, observation, and archival data analysis to identify the set of solutions that correspond to, and resolve, MISMO's collective action dilemmas in standards development. Third, we examined the potential implications of MISMO's solutions to the standards development dilemma for the standards diffusion dilemma. The final phase of our analysis was to consider how our analysis might generalize—arguments summarized in the "Discussion." Before we present our findings in answer to each research question, we provide an overview of the U.S. residential mortgage industry.

The U.S. Residential Mortgage Industry

This section provides background information on the U.S. residential mortgage industry and its vertical IS standardization effort.

Mortgage Industry Processes, Participants, and Structure

Historically, the entire mortgage lending process in the United States—assessing borrowers' credit worthiness, evaluating property value, collecting mortgage payments, etc.—was capitalized by one type of organization: local savings and loan banks. To increase the flow of funds available for mortgage lending, the U.S. government chartered certain private corporations to buy, securitize, and sell mortgages. In

⁸Often referred to as the MBA, the Mortgage Bankers Association (<http://www.mortgagebankers.org>), founded in 1914, is the leading industry association for companies in the real estate finance business, the largest segment of the U.S. capital market. Its approximately 2,800 members cover all industry segments, including mortgage lenders, mortgage brokers, thrifts, insurance companies, etc. The MBA represents the industry's legislative and regulatory interests and conducts educational activities and research for its members.

conjunction with other environmental changes, the growth of two government-sponsored enterprises (GSEs)—Fannie Mae and Freddie Mac—resulted in massive changes in the U.S. mortgage industry structure. Although some mortgage lenders continue to hold the mortgages they underwrite in their own portfolios, more than half of all mortgages are sold to investors (Van Order 2000), thus segmenting mortgage lending into the “primary” segment, where borrowers obtain loans from lenders, and the “secondary” segment, where mortgages are sold by lenders and bought by investors (Cummings and DiPasquale 1997). Servicing refers to the collection and remittance of payments once the loan is closed.

Today, the primary mortgage market is both vertically disintegrated (Jacobides 2001a) and fragmented. There are many specialized organizational types, including mortgage bankers, mortgage brokers, credit reporting companies, mortgage insurers, title companies, escrow companies, and other types of insurers. And, within each of these segments (except mortgage insurance), there are many providers. However, there are signs of rapid consolidation on the banking front: It is estimated that the top five lenders currently originate over 50 percent of residential mortgage loans and that the top ten firms service over 50 percent of such loans. There is also some evidence of vertical reintegration, at least at the top end of the lender size spectrum (Van Order 2000).

By contrast, the secondary market can, for most intents and purposes, be considered a duopsony. The GSEs, Fannie Mae and Freddie Mac, have grown rapidly into dominant players: Roughly 50 percent of the \$6.3 trillion (2003 figure) in outstanding U.S. 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 two companies⁹ generates considerable controversy (McKinnon and Kopecki 2003), heightened by recent accounting investigations.

For the purposes of this study, we simplify the current mortgage process and industry structure as shown in Figure 1,¹⁰

⁹For example, as quasi-governmental organizations, they are exempt from SEC reporting requirements.

¹⁰Figure 1 leaves out many common exceptions. For example, consumer borrowers can still obtain mortgage loans directly from their local banks, which may continue to hold the loans in portfolio rather than sell them to GSEs (or to other investors, not depicted in Figure 1). Some brokers fund mortgage loans themselves, before selling the whole closed loans to mortgage bankers, who may then separately sell mortgage-backed securities to investors and loan-servicing rights (rights to collect payment on behalf of investors) to other lending institutions.

which depicts the direction of the business process flow; funds flow in the reverse direction. Physical or online mortgage brokers, which tend to work with only one or a few lenders, help match individual borrowers with mortgage loan products and assemble the documentation needed to apply for loans. Most mortgage lenders sell some or all of their loans to the GSEs in order to obtain funds to continue lending. Although many lenders maintain relationships with both GSEs, the GSEs' pricing policies tend to promote near-exclusive relationships with particular mortgage bankers.

Because sale of loans to the GSEs is contingent on meeting the underwriting policies of the GSEs, lenders' underwriting decisions are most efficiently made at the time when the consumer applies for a loan, often with the help of an independent broker. Although much data exchange continues to take place via courier and fax, electronic data interchange is increasingly common. In a typical scenario, brokers use automated underwriting software developed by a GSE or by a large lender to merge the borrower's application data with credit data from reporting agencies and data about the property, resulting in an automated underwriting decision acceptable to the GSEs within a matter of minutes; the Internet is used for electronic data exchange. Thus, completing the mortgage lending process requires flows of electronic data back and forth across numerous organizational boundaries, providing strong impetus for VIS standardization in this industry.

VIS Standards in the U.S. Residential Mortgage Industry

The origins of the Mortgage Industry Standards Maintenance Organization (MISMO) lie in the *electronic data initiative* launched by the Mortgage Bankers Association (MBA) in the late 1980s to support the automation of interagency mortgage lending processes (Opelka 1994). Working with the GSEs (Fannie Mae and Freddie Mac), the MBA's first targets for standardization were paper forms, such as mortgage applications (Anonymous 1988; Braitman 1990; Hershkovitz 1992). Next on the agenda were EDI standards for credit data exchange (Lebowitz 1990; Slesinger 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.

With the coming of the Internet, the economics of interconnection began to change. eXtensible Markup Language (XML) promised a low-cost solution for industry interconnection. Various mortgage industry EDI workgroups began to discuss the potential of XML. As software develop-

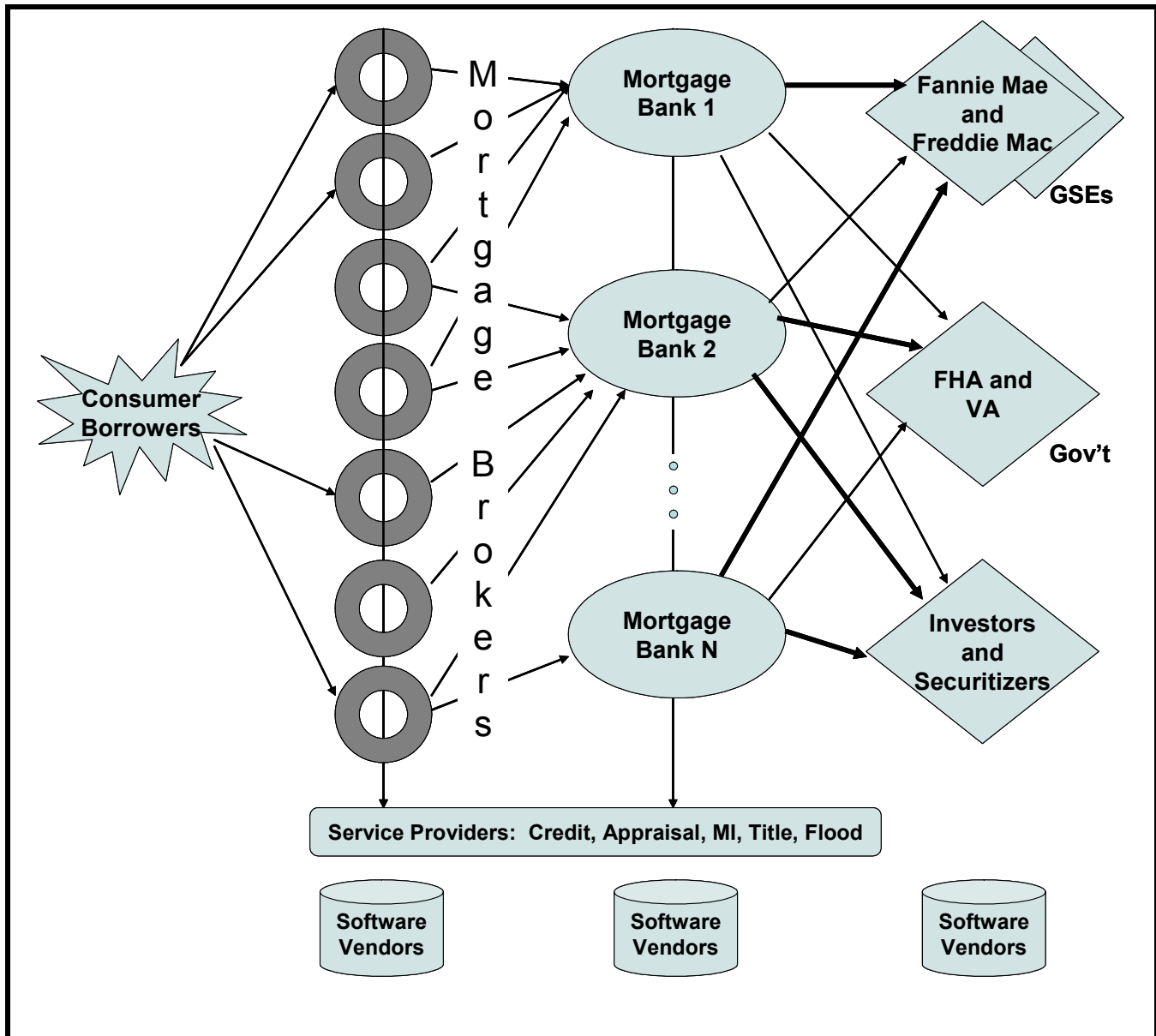


Figure 1. U.S. Residential Mortgage Industry

ment accelerated in the 1990s, new players in the mortgage industry also needed data standards and saw XML's potential for better and faster standards development. In January 2000, the MBA, in partnership with mature EDI standards groups and a newer standards development organization named XML-XP, launched MISMO to pursue the development and maintenance of vendor-neutral XML-based interconnection standards for all segments of the mortgage industry. Membership in MISMO is open to IT vendors as well as to vertical industry members.

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 for each process include application, closing, and underwriting for loan origination; bulk pool transfer, commitment, and funding for secondary marketing; cash transactions, credit reporting, and default management for servicing; and appraisal, credit, escrow, and settlement for real estate services. This standards-setting activity is quite

Table 2. Users' Common Motivations for Participating in MISMO Standards Development

<p>Motivations: Vertical Industry Organizations</p>	<p>Ability to influence the standard:</p> <p>"Standards tend to be oriented towards the individual companies that contributed their time to developing them." (9/30/03)</p> <p>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.</p> <hr/> <p>New business opportunities:</p> <p>"When [the company] was first getting involved in this, they had very little ability to have electronic interfaces with anyone and one of the reasons they brought me on was to help out in that area. By participating in data standards development and having a prominent position, it helped them establish themselves, build their name. And over the past six, seven years, [the company] had gone from kind of a nobody in the industry to [one of the top companies in the country by volume in its segment]. It's helped them grow a lot." (9/30/03)</p> <p>"As you move into the electronic world, some opportunities disappear and new opportunities arise, and maybe it's a little different way of doing business, but you kind of always readjust yourself." (10/20/03)</p>
<p>Motivations: Individuals</p>	<p>Personal interest:</p> <p>"I was involved in the beginning of the development in the early stages of what MISMO calls the 'SMART document'. [My client] doesn't have any direct interest in that and I was more or less participating on my own time just because it was something I was interested in. The idea of e-mortgages sounded interesting to me, and I saw a lot of potential from it. I'd gone through like everyone has in the last two or three or four years of refinancing, and anybody who goes through that sees what a total mess the whole process is. I mean it's ridiculous. So I have my own experiences with that and so I wanted to understand more about it. And also, from a personal level, I'm interested in data design; I mean it's what I do. That's what I'm interested in." (9/30/03)</p> <hr/> <p>Belief in the cause:</p> <p>"I'm like a preacher in this industry where I'll talk about this to anybody"—10/20/03</p> <hr/> <p>Social ties:</p> <p>[Interviewer: You sound like one of the 'same ten people' we were told about.]</p> <p>"I am one of those We've made lots of great strides. You know I think we have 1000 people registered on listservs and call groups. But when you cut down the people in the face-to-face meetings to consistent people who cross into more than one process area, the group just gets smaller and smaller. And for those people that are very actively involved, it's very easy to transition to the next workgroup or the next initiative There's a learning curve." (9/30/03)</p> <p>[Interviewer: Do these 'same ten people' participate because they personally really want to or because their companies want them to?]</p> <p>"I think both. Obviously their companies want to participate and I think these are the right individuals. And we have a really good mix of both business and technical knowledge, not always from the same company and we rely on each other. We know each other's strengths and we make good use of that." (9/16/03)</p>

similar to EDI standards setting, just much faster because of today's advanced tools and XML.

The second MISMO standardization effort concerns *process standards* to enable fully electronic mortgages, from initial application, through closing and recording, to the sale and transfer of mortgage servicing rights. The passage of the Uniform Electronic Transactions Act (UETA) in 1999 and the Federal Electronic Signatures Act (E-SIGN) in 2000 made it possible to envision a mortgage lending process that produces legally binding mortgages entirely without paper. In January 2001, MISMO launched its eMortgage Workgroup, which developed "SMART docs"—Secure, Manageable, Archivable, Retrievable, and Transferable documents that lock data and document presentation into a single computerized file using the underlying 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 readable both by computers and by humans along the entire mortgage value chain.

Starting with only around 50 participants in 2000, MISMO membership now exceeds 3,000 with approximately 200 people attending each MISMO trimester meeting. Version 2 of the standard was published in mid-2001, with a major update to Version 2.4 completed in January 2006. Many vendors have already announced that they use MISMO data standards, and a high percentage of large lenders have begun to implement them. Considerable progress has also been made on the eMortgage front. The eMortgage Implementation Guide 1.0 was published in January 2004, and institutional mechanisms designed to promote diffusion of electronic mortgages have been created, for example, a registry for locating the official version of an electronic loan document.

Findings

In this section, we answer our research questions in the context of the MISMO VIS standardization initiative.

Heterogeneity Among Users

Research question #1: How (if at all) does heterogeneity of interests among users, as well as between IT vendors and users, threaten the success of VIS standardization?

To answer this question in the case of the mortgage industry, we first used stakeholder theory (de Vries et al. 2003) to

identify the relevant groups of structurally equivalent organizations participating in VIS standardization. We identified four primary groups—the GSEs (Fannie Mae and Freddie Mac), mortgage bankers, mortgage brokers, and mortgage service providers, such as credit reporting agencies, property appraisers, insurers, etc. Our interviewees covered this spectrum. When we asked them why they participated in MISMO, they offered a range of participation benefits, both personal and professional, summarized in Table 2.

When we probed for details of competitive concerns that might inhibit cooperation in standards development, we found significant differences across the groups. For example, mortgage service providers had long accepted industry trends toward commodification, owing in part to increasing use of IT. They recognized that MISMO's data standardization initiative did not infringe on their bases of competition and that standardization would actually help them focus on their areas of differentiation. For example, one interviewee noted,

If you believe you're going to have a commodity product at some point, do you want to become widely accessible [or do you continue] thinking there's a competitive advantage in how you get connected to people? There's always some aspects [of our business] that are more competitive that everybody withholds [in standards-setting meetings] to a certain extent. But some of the basics, you just know there's no magic to it. (Interview, 9/30/03)

Similarly, another mortgage service provider responded,

We mortgage insurers recognized very early on that [by collaborating in standards development] we could streamline our practices for ourselves and our customers [mortgage lenders]. Really, we all need the same data to do our business and so there's no reason to try to compete on data.

Mortgage insurers compete on service. It's *how* we execute, not *what* we're executing. All mortgage insurers have proprietary risk models and so at any given point in time, there may be a business need that one mortgage insurer or another might not be willing to insure. As far as I know there is no lender that does business with only one mortgage insurer [and, therefore, we make it difficult for our customers if we employ different business practices. Because of the standards], if they [the lenders] do business with one of us [mortgage insurers], they can do business with all of us. (Interview, 9/16/03)

Members of other groups, however, were not always united in support of industry-wide standards. The two GSEs, for

example, were fierce rivals both in the secondary mortgage market and in providing revenue-generating IT support for mortgage industry processes. They pioneered the use of EDI with mortgage bankers for the sale of closed loans in the 1980s, but each GSE had its own proprietary data requirements and EDI message formats. When they introduced automated underwriting technology in the mid-1990s,¹¹ the GSEs continued their practice of offering technology support based on proprietary data formats. In our review of 20-plus years of articles in *Mortgage Banking* magazine, we found repeated calls by other industry participants for the GSEs to adopt *industry-wide* standards—calls that were not heeded until well into the MISMO standardization effort, as discussed below.

Mortgage bankers similarly preferred *proprietary formats* in their dealings with mortgage brokers. National mortgage lenders rely on mortgage brokers for detailed local knowledge about borrowers and properties; thus, the relationship between lenders and brokers is generally exclusive. Consequently, the need for industry-wide standards at the interface between bankers and brokers appears to be low, except for information that must pass through to other industry participants. Furthermore, industry-wide standards raise the threat of brokers shopping around for lenders (Hess and Kemerer 1994), which lenders naturally do not believe to be in their interests. Indeed, in 1997, the GSEs attracted vehement protest from mortgage bankers by proposing to put automated underwriting technology in mortgage brokers' hands, effectively enabling brokers to bypass lenders and giving the GSEs direct access to brokers (Jacobides 2001b).

Table 3 summarizes the interests of MISMO participants with respect to VIS standards development and the types of benefits they might receive if industry-wide standards were successfully developed and widely diffused. This analysis makes it clear that there was considerable heterogeneity of interests among MISMO participants, such that, at the outset, it was by no means a foregone conclusion that all relevant segments of the mortgage industry would participate in standards development, or adopt the standards, once developed. For example, although they might benefit from widespread standards diffusion, two groups—the vendors and the GSEs—had possible incentives to block industry-wide standards; in addition, the proprietary formats that the GSEs traditionally required are almost exactly opposite to the industry-wide standards the mortgage bankers favored. Because participation by all relevant segments of the industry is essential to ensure that the content of an industry-wide VIS

standard actually meets the needs of participants (Hills 2000), we conclude that MISMO had to find a way to reconcile divergent interests *among users*, as well as between vendors and users, in order to achieve successful development of the standard.

Differences in the Dilemmas

Research question #2: How (if at all) do the dilemmas of VIS standards development and VIS standards diffusion differ in the heterogeneity of participants' resources and interests, such that it might be possible to resolve the first dilemma without resolving the second?

The structure of collective action dilemmas depends not only on the interests of participants (as shown in Table 3), but also on the resources they have to contribute to the public good (Kollock 1998; Oliver et al. 1985). Table 4 summarizes the resources of MISMO participants for standards development and for standards diffusion.

Tables 3 and 4 suggest that the two dilemmas of standards development and standards diffusion have different structures and solutions. Broadly speaking, each user participant can contribute only a small amount of the public good in standards *development*—a complete VIS standard, because it has knowledge only of its own business domain. In practice, some participants, especially the GSEs and the large mortgage bankers, could contribute more to standards development in the following sense: their participation might encourage others to participate. However, no one participant type alone could provide a completely developed standard. By contrast, two groups have the ability to provide enormous resources for successful standards *diffusion*—IT vendors, through providing software, especially for smaller participants, and the GSEs, through their function as dominant customers with the power to effectively “legislate” adoption of the standards by others. Or, as one interviewee put it,

I think there are certainly cases where you could argue that their influence over the [standardization] process is inappropriate. [But] as long as they're purchasing the loans, it's going to continue to be that way. (Interview, 9/16/03)

Unfortunately, as shown in Table 3, IT vendors and the GSEs are the two groups that were *least likely* to participate in standards development, because they were likely to have viewed standards as a threat to their competitive interests. Consequently, some solutions that might have brought these groups

¹¹The GSEs charged a fee for using their automated underwriting engines, but they guaranteed to purchase automatically decisioned loans. At the same time, they offered a for-fee VAN service, but they did not require its use.

Table 3. Heterogeneity of MISMO Participants' Interests in Standardization

Participant	Structural Conditions	Interests in Standards Development	Ability to Benefit from Standards Diffusion
IT Vendors	<ul style="list-style-type: none"> • Compete with each other 	<ul style="list-style-type: none"> • (Dominant vendors) potential loss of competitive advantage 	<ul style="list-style-type: none"> • Possible benefits from large market for standardized software
Government Sponsored Enterprises	<ul style="list-style-type: none"> • Compete fiercely with each other on product/service offerings plus IT services • Seek exclusive relationships with mortgage bankers • Seek widest possible source of mortgage supply (brokers) 	<ul style="list-style-type: none"> • Potential loss of competitive advantage; historic resistance to common standards for transactions with mortgage bankers • Industry-wide standards for efficient transactions with brokers and service providers 	<ul style="list-style-type: none"> • Possible benefits from efficient interconnections resulting from industry-wide standards
Mortgage Bankers	<ul style="list-style-type: none"> • Compete with each other • Seek to play GSEs off against each other • Generally have exclusive relationships with brokers • Deal with many service providers 	<ul style="list-style-type: none"> • Competitive leverage from common standards across GSEs • Industry-wide standards for efficient transactions with service providers • Increased competition and potential disintermediation from industry-wide standardization with respect to brokers 	<ul style="list-style-type: none"> • Benefit from efficient interconnections resulting from industry-wide standards • Possible benefit from use of standards for internal systems integration
Mortgage Brokers	<ul style="list-style-type: none"> • Generally have exclusive relationships with bankers • Generally work with multiple service providers 	<ul style="list-style-type: none"> • Banker-specific or industry-wide standards for efficient transactions with bankers • Industry-wide standards for efficient transactions with service providers 	<ul style="list-style-type: none"> • Benefit from efficient interconnections resulting from industry-wide standards
Service Providers	<ul style="list-style-type: none"> • Seek ability to work with as many bankers and brokers as possible 	<ul style="list-style-type: none"> • Industry-wide standards for efficient transactions with customers, as long as standards do not infringe on sources of competitive advantage 	<ul style="list-style-type: none"> • Benefit from efficient interconnections resulting from industry-wide standards

Table 4. Heterogeneity of MISMO Participants' Resources for Standardization

Participant	Resources for Standards Development	Resources for Standards Diffusion
IT Vendors	<ul style="list-style-type: none"> • Technical knowledge • Business knowledge of industry segments in which they specialize 	<ul style="list-style-type: none"> • Ability to promote widespread adoption by users (especially small ones) through development of standards-compliant software
Government Sponsored Enterprises	<ul style="list-style-type: none"> • Business knowledge of own industry segment • Participation encourages others to participate in development 	<ul style="list-style-type: none"> • Own adoption • (As dominant buyers) ability to influence adoption by many other participants
Mortgage Bankers	<ul style="list-style-type: none"> • Business knowledge of own industry segment • Participation encourages partners to participate in development 	<ul style="list-style-type: none"> • Own adoption • Ability to promote partners' (brokers' and service providers') adoption
Others	<ul style="list-style-type: none"> • Business knowledge of own industry segment 	<ul style="list-style-type: none"> • Own adoption

to the standards development table might have worked against successful diffusion of the standard. For example, the GSEs might have been induced to participate in developing a standard that did not touch upon their proprietary interfaces with mortgage bankers, in which case adoption by the bankers would have been unlikely. Similarly, a prominent vendor might have been induced to participate in standards development in return for exclusive software development rights, but bankers were likely to have spurned such a standard through fears that the vendor would pursue monopoly profits.

Solutions to the Dilemmas of VIS Standardization

Research question #3: How (if at all) can the dilemmas of VIS standardization be successfully resolved?

As discussed above, the standardization dilemmas of the mortgage industry seem every bit as challenging to resolve as those facing a voluntary IT product standards committee involving rival vendors. However, whereas IT product standards committees often fragment into competing consortia (Axelrod et al. 1995), each hoping to win a standards war in the marketplace, this option does not make sense for VIS standardization in industrial communities such as the mortgage industry. Rival standards development efforts would not meet industry interconnection needs and so would have little chance for market acceptance. Nelson et al. (2005) similarly note that VIS standardization efforts are rarely competitive with each other. Furthermore, even though any one organization, or even one type of organization, has relatively little to contribute to the success of mortgage standards development, the GSEs are absolutely essential for standards diffusion. This means that MISMO could not hope to achieve its goals without both the participation of GSEs in development *and* their agreement to adopt the standards, once developed. Indeed, MISMO spokespeople described gaining the commitment of GSEs as a major, if not *the* major, factor in the success of the effort to date.

“Moral Suasion” and GSE Support

The GSEs participated in MISMO since its founding in 1999. However, despite earlier standardization efforts, they had long published unique data requirements for electronic interconnection. For example, in 1988 a contributor to *Mortgage Banking* magazine complained,

[W]hile both systems require much of the same data, a mortgage banker must do a significant amount of

manual work before transmitting to either system. In addition, if a lender changes delivery agency, the work must be re-done *because the two systems are not uniform* (Jezioro 1988, p. 37, emphasis added).

This situation stood until July 2001 (Anonymous 2001), when the GSEs bowed to “moral suasion” (Interview, 1/28/03) by the MBA¹² and agreed to adopt MISMO standards.

One of the big pluses was when FreddieMac said: one of the ways to request an automated underwriting decision from Loan Prospector [an automated underwriting tool] is to use MISMO’s AUS Version 2.1 data set.... That was like, okay, so this is here to stay (Interview, 10/2/03).

Additional Solution Tactics

We analyzed our interview transcripts, archival data, and observation notes for evidence of additional solutions to the set of collective action dilemmas summarized in Tables 3 and 4. We especially looked for details about governance and voting rules, which the standards literature predicted to enforce exclusionary membership (Weiss and Cargill 1992), and property rights, which the literature argued would be strong to ensure vendor participation in standards development (Bekkers et al. 2002) or weak to ensure widespread adoption (Farrell 1995). In addition, we found tactics related to the scope of technical development that worked with other tactics to help resolve MISMO’s collective action dilemmas.

Governance

MISMO, now a standalone nonprofit corporation under Internal Revenue Code Section 501(c)(6), was set up “to promote and support the common business interests of the real estate finance industry” (*Mortgage Industry Standards Maintenance Organization, Inc. Policies and Procedures*, V1.1 2004, p. 1). Industry member organizations and IT vendors can participate in MISMO’s activities as subscribers, which pay a fee of \$2,550 for MBA members or \$4,500 for non-MBA members, or non-subscribers, which do not pay fees.¹³ These fees are well below those cited in other standards litera-

¹²Given the controversies surrounding the GSEs, it seems likely that public relations considerations contributed to the GSEs’ decisions to support MISMO standards.

¹³Both types of participants are bound by MISMO’s antitrust and IPR policies.

ture (see Nelson et al. 2005; Updegrave 1993) and hence seem clearly aimed at maximizing participation, rather than at restricting membership.

Some MISMO roles and activities are restricted to subscribers, but non-subscribers can and do play active roles, including voting roles, in MISMO's workgroups. There are rules regulating participation by "related entities," that is, subscriber organizations that report to a common parent, and what happens to membership status when subscribers merge or are acquired. Each subscriber must designate a single full-time employee as its representative. No subscriber can represent another subscriber.

MISMO's Governance Committee consists of 20 subscribers, allocated by specified number across the following mortgage industry segments: mortgage bankers and brokers, servicing technology companies, origination technology companies, mortgage insurance companies, credit companies, technology companies, service providers, GSEs, plus members of MISMO's commercial mortgage lending workgroups. Membership on the Committee rotates in staggered 2-year terms by election. No subscriber can have more than one representative on the Governance Committee at a time.

Non-subscribers can participate as members of MISMO workgroups and even vote on noncontroversial proposals. 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. MISMO participants follow a strict antitrust policy, also on MISMO's website, for this purpose. 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 its 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 versus theoretical purity

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

Each participating organization, subscriber, or non-subscriber, is required to pay the participation costs (travel, etc.) of its delegates. Costs of participation are minimized by holding only three in-person meetings annually, supplemented by the use of listservs, teleconferences, electronic file-sharing, web conferencing, and electronic balloting. MISMO standards are available for downloading on the organization's public website at no charge.

These policies and procedures serve multiple purposes with respect to MISMO's collective action dilemmas. They help ensure fair representation of organizations from all industry segments, regardless of size. In so doing, they encourage broad participation, increasing the likelihood that the standards will in fact meet the interconnection needs of many players in the industry. By publicly disseminating the standard at no charge, MISMO promotes widespread adoption of the standard. Finally, by allowing IT vendors to participate as subscribers and Governance Committee members, which is not the case in all such efforts (see Brown 1997), thus enabling them to influence the content of the standards, MISMO's governance rules help reduce disincentives to vendor participation caused by their competitive interests.

MISMO's IPR Policies

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. In a similar vein, the bar code was never patented, but its unclear intellectual property protection caused problems for a number of years. Several individuals brought suit, unsuccessfully, claiming patent infringement (Brown 1997).

MISMO considered and rejected several IPR approaches used by other collaborative ventures, such as the "copyleft" license of the open source software movement, which extends royalty-free usage rights to all software that modifies and/or incorporates the open source code. Instead, MISMO opted for a royalty-free license approach to IPR. Each participating company is bound, through its participation in MISMO acti-

Exhibit 1. 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, 2004

vities, to an IPR agreement that requires the company to license any written contributions to MISMO free of charge, and to allow MISMO and subsequent organizations that download MISMO standards to derive products from its contributions and make these products available to others (i.e., to sublicense them) via the Web or other means. (See Exhibit 1 for the key provisions of, and rationale for, MISMO's IPR agreement.)

MISMO's IPR provisions were expressly designed to prevent IT vendors or other participants from pursuing a "submarine patent" approach, whereby participants privately file process patents and later claim royalties on what was supposed to have been an open and freely available standard. Although adopted in response to a particular threat, MISMO's IPR policy has additional benefits in helping solve collective action dilemmas. First, they ensure that IT vendors *do* have

the ability to benefit from commercial products that embody the standard, because they retain their contributed IP, but that they *do not* have the ability to hold users up for monopoly profits on the collective standards themselves, because any vendor or user can adopt the standard without charge. This decision helped promote the adoption of the standard by increasing the availability of software options, reducing adopters' implementation costs. Thus, MISMO's IPR policy contributes to the successful development and adoption of the standard by reconciling the conflicting interests of IT vendors and mortgage industry members.

Scoping Decisions

Three key "scoping" decisions made early in MISMO's history helped resolve the dilemmas of standards development or adoption. First, MISMO standardization focuses on the data needed for *interorganizational* processes; standardization of data needed only for *intraorganizational* processes was defined as out of scope. A prominent MISMO staffer explained the rationale for this decision.

I've seen too many standards efforts be derailed by attempting to do too much. They try to include everything and the kitchen sink. In MISMO we decided to isolate the data that is truly between organizations. Let each company keep their own proprietary formats for their own databases, but then invoke the standard when exporting data to other firms. (Interview, 5/28/03)

Ironically, some large lenders have adopted MISMO standards for *internal* use as well as external, particularly lenders that had grown through mergers and acquisitions of other lending institutions.

A second key decision was to limit the early MISMO efforts to *data* standards, rather than trying also to specify *process* standards¹⁴ (Markus 2000), whereas several other industries, such as electronics and chemicals, have started with process standards. Admittedly, there is a fine line between specifying the data needed for a business process and specifying the process itself. In either case, discussions usually start with a participant volunteering his or her company's business

process as a model from which standard data or process elements can be identified. MISMO's workgroups actually started by trying to build process standards, but quickly ran into a conflict with a vendor's perceived self-interests.

We started down the process road because you have to have some kind of "use case" to understand what happens. But we were actually quickly faced with a lawsuit because of a patent that one of the participants [a software firm] held on a particular process. [The firm later went out of business before the matter escalated.] We had to back off...we kind of drew the line that all we focused on was the data. That, we agreed, can be standardized and what we build with that data, each organization, that's our competitive advantage. (Interview, 10/2/03)

So MISMO limited its scope to data standards and file formats, which had the significant additional advantage that it did not encroach on potential competitive concerns among mortgage industry participants, because "there's no reason [for industry members] to try to compete on data" (Interview, 9/16/03).

A third key scoping decision was to rationalize data elements. As each workgroup proposes a transaction set, it is scrutinized by MISMO's Core Data Group to enforce consistent naming and avoid unnecessary duplication. This contributes to greater efficiency and interconnection by improving data quality and ensuring valid transactions.

What we have done with MISMO that will last longer than anything else in the XML formatting, is we went back to the business data on the forms and said define that field for me from a business perspective and give me a unique name for that field, and we created our logical data dictionary—a *Webster's*, if you will, for the mortgage industry. So even if you format it differently, if I at least have confidence that it is the same data point that I asked for here from the credit company that you're now loading into the servicing system and I'm buying that loan and it's transferring into a secondary transaction using that same data and that same definition. And that helps our data quality throughout the process and our quality assurance and checking and all that. (Interview, 10/2/03)

Even with rationalization, MISMO's lexicon is large, containing over 4,000 business terms. Without rationalization, the costs of implementing the standard in software would be much higher.

¹⁴ MISMO's e-Mortgage initiative, started in 2001, is actually attempting to build process standards to enable a seamless end-to-end mortgage process. However, this initiative was not started until the data standards initiative was already far along. Furthermore, some interviewees suggested that the e-Mortgage initiative faced far more difficult development and diffusion dilemmas than did the data standardization effort.

Table 5. Resolving MISMO's VIS Standardization Dilemmas

Dilemma	Application in the MISMO Case	Resolution in the MISMO Case
Standards Development	All sectors, including mortgage bankers, mortgage brokers, service providers, IT vendors, and the GSEs, had to participate in MISMO standards development in order for the resulting standards to be complete and meet industry needs for interconnection, even though IT vendors and the GSEs might not have viewed standardization as in their interests.	<p>Governance—helped assure all parties, regardless of size or sector, that they had a chance to influence the nature of the standards and that the standards would not be unduly influenced by any one organization or sector</p> <p>IPR agreement—balanced the conflicting interests of bankers, brokers, and service providers versus IT vendors and GSEs (as IT services providers) by ensuring the latter two groups the opportunity to benefit commercially from software products and services compliant with the standards while reassuring the former three groups that no IT vendor or service provider would be able to extract monopoly profits for standards-compatible technology</p> <p>Scoping decisions—limited the potential negative strategic consequences of standardization for mortgage bankers, brokers, and service providers</p>
	Because IT vendors and the GSEs might not have seen standardization as in their interests and hence might not have adopted the standards, even if they had participated in developing them, mortgage bankers, mortgage brokers, and service providers needed reasonable assurance at the outset that IT vendors and the GSEs would adopt the standards, once they were developed.	See below
Standards Diffusion	Adoption by the GSEs was critical for successful diffusion, since without adoption by the GSEs, others' benefits from adoption are small. Conversely, the GSEs' adoption encouraged their many partners (most of the industry) to adopt the standards and encouraged IT vendors to adopt them, since GSE adoption assured vendors of a market for standards compliant software.	<p>Moral suasion—helped convince the GSEs that adopting the standards was the right thing to do for the industry; possibly raised the specter of bad public relations in the event of non-adoption</p> <p>IPR agreement—enabled GSEs to profit commercially from standards-compliant software and services</p> <p>Data rationalization—reduced the cost of developing standards-compliant software</p>
	Implementation by IT vendors was critical for successful diffusion, since there are many small organizations in the industry for which custom software development is not a standards implementation option.	<p>GSE support—assured IT vendors that others would adopt, thus ensuring a market for standards-compliance software</p> <p>IPR agreement—enabled IT vendors to profit commercially from standards-compliant software and services</p> <p>Data rationalization—reduced the cost of developing standards-compliant software</p>

The key to it all for me is what we call the logical data dictionary. And what that does is establishes a tag name and a consistent naming convention. And then all of these different transactions, when they refer to loan amounts, they're referring to the same tag. So as a software developer it makes it much easier to start to integrate all the different transactions. (Interview, 10/2/03)

Thus, the decision to rationalize the data dictionary proved a real boon for IT vendors by lowering the costs of developing compliant software, which in turn should help promote adoption of the standard. Our interviewees were unanimous that MISMO's greatest achievement to date had been its data dictionary.

In short, we found a set of tactics (GSE support, governance, IPR protection, and technical scoping decisions, including data rationalization) that jointly addressed the majority of the issues identified in our analysis of MISMO's collective action dilemmas. (See Table 5 for a summary.) There is no one-to-one correspondence between tactics and issues: Some tactics address both dilemmas and issues pertaining to multiple stakeholders. Although some of these tactics have been mentioned in prior literature, the way the tactics were effective in the MISMO case sometimes differed from predictions in the literature. For example, MISMO membership rules served to ensure a broad base of participants, rather than to exclude rivals. Similarly, prior literature did not explain how various tactics *worked together* to resolve the collective action dilemmas of standardization. Our case suggests that successful resolution of VIS standardization dilemmas might require tight correspondence between the structure of the dilemmas and the nature of the tactics employed.

Implications of VIS Standards Content for VIS Standards Development

Research question #4: How (if at all) could resolving the dilemmas of VIS standardization affect the content of VIS standards in ways that might alter the chances for successful standards diffusion?

The literature suggests that the compromises involved in achieving successful development of VIS standards can lead to complexity or lack of innovation in standards, which might, ironically, work against their eventual successful diffusion. MISMO *data* standards have already started to diffuse widely, owing to the tactics summarized in Table 5, such as data rationalization. Although it is too early to predict the widespread diffusion of MISMO eMortgage *process* standards, a

vivid example from our data suggests that the concern about standards complexity hindering diffusion might not be unfounded. An interviewee argued that the three-part eMortgage SMART document was unnecessarily complex; a simpler and easier-to-implement solution was not incorporated in the standard, he said, because it would have worked against the interests of certain industry participants. Had the consortium continued in the direction of the simpler, more radically different standard, the threatened participants might have withdrawn from standards development or declined to adopt the standard, once developed.

[The SMART document] started out as a two-part document. There's an XHTML generated view of the document that will be [printed and] signed or viewed on the screen. Separate from that is another section called the "data section." One of the problems with that basic structure is that, since the data is in two places, there's the possibility for potential fraud or [errors], where the data could be different in the data section and in the view section.

To get around that, an extra layer was added; it became a three-part document: the third part is what they call an "arc map"—basically a section that identifies the data in the view and links it to the data in the data section. [Now] whenever somebody processes a SMART document, they have to validate the document. They have to run it through a program they create that makes sure that the data in the view section matches the data in the data section. So that's an extra process.

Early on I proposed: why don't we simplify the process and instead of having a view, let the SMART document consist of a data section, the XML data, and then the other part would just be a form, like an XSLT form that has the instructions for how you combine the data into the form to generate the output. I demonstrated that you can get the exact same output either on screen or on paper by using this XSLT and XML combination. Then I made my mistake: I said that this entire process could be simpler because the generation of the documents could then be done by the browser software, not by what's called "doc preparation" software." (Interview, 9/30/03)

His "mistake" was that some other participants represented leading document preparation firms.

The people that were contacting me didn't actually come out and say it in so many words, but [my

proposal] would basically eliminate whole sections of the industry. I had never realized this before. I had just looked at things from a pure technocrat point of view. And then I saw, from the political side of things, yes, there may not really be a need for it, but there's a whole really significant portion of [MISMO] that is [the document preparation] industry. (Interview, 9/30/03)

Other participants disagreed that the decision was made on the basis of 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) to creep in without proper validation.

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. (SMART Document Overview: Frequently-Asked Questions Version 1.0, Date: 10/9/2002)

Taking these considerations into account, 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 document 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. "I mean, 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" (Interview, 9/30/03). In the meantime, however, the concern remains that the complexity of the three-part eMortgage SMART document might hinder the adoption of MISMO process standards. As another participant said,

I think we should have started with a little simpler structure to encourage adoption and keep costs of implementation lower and then we could have evolved it to another level of a technology framework. But the SMART doc framework [is] pretty complicated, and for an industry where we don't even have standards around all the forms, it's a

pretty big leap to go from what we call the "doc prep process" today, to [a] framework [that is] open-ended and [can handle] any document. (Interview, 9/30/03)

In short, this example illustrates the technical and political compromises in VIS standards development in the complex area of fully electronic mortgages. Some of those compromises may result indirectly from tactics, such as policies designed to maximize membership inclusiveness, employed by a standards-setting consortium to resolve collective action dilemmas. Thus, even though VIS standards might be successfully developed through widespread industry participation, the content of those standards might still inhibit their eventual widespread diffusion.

Discussion

This study has two major limitations, one unique to the study, another common to all single case research. First, we cannot yet evaluate the success of MISMO standards diffusion quantitatively, because very few objective data exist on the extensiveness (infusion) of standardized data transfer (as opposed to early implementation efforts). Eventual data about diffusion outcomes and the explanations for them might alter our analysis of the MISMO case. An obvious direction for future research is to follow this case forward, revisiting our interpretations as necessary. Second, all single case research designs involve the risk of focusing on unique conditions and events, rather than on general concepts and trends (Brady and Collier 2004; Yin 1999). The best way to avoid this threat to validity is to analyze additional cases. We tried to minimize this threat by basing our analysis on prior theoretical literature and by triangulating our results against those of other case studies, such as Brown (1997). Nevertheless, a second clear direction for future research is to replicate this study in other industries.

We have more suggestions for future research below. Before turning to them, we consider the theoretical implications of our findings, assuming they are valid. We consider the generalization of our findings first to VIS standardization and then to other types of standardization and collective actions.

Toward a Theory of VIS Standardization as Collective Action

What can be learned from the MISMO case about VIS standardization more generally? We believe that, because

VIS standardization efforts are intended to promote interconnection among user organizations of different structural types, e.g., grocery manufacturers and retailers, automobile assemblers and suppliers, *all* VIS standardization efforts involve qualitative¹⁵ heterogeneity of interests among participating user organizations, not just between users and vendors. Heterogeneity of interests threatens the success of VIS standards development by inhibiting collaboration. Unfortunately, the most obvious solution to the problem—fragmentation into rival efforts, which can then compete in the marketplace—will not work for VIS standards. The reason is that participation by members of all relevant structurally different groups is necessary to ensure a solution that meets industry-wide needs for e-business interconnectivity. This suggests

Proposition 1: In order to succeed in developing a VIS standard that will meet industry-wide needs for interconnection, VIS standardization efforts must find a way to ensure the collective participation of representative members of heterogeneous user groups (including IT vendors), while avoiding the natural tendency to splinter into rival homogeneous groups.

We further argue that it is not enough to solve the dilemma of VIS standards development if the solution to that dilemma increases the difficulty of solving the imperfectly linked dilemma of VIS standards diffusion. This might happen, for instance, if user groups that are key to standards diffusion are excluded from standards development or are allowed to influence standards development at the expense of other user groups.

Proposition 2: In order to achieve successful diffusion of industry-wide VIS standards, VIS standardization initiatives must ensure that user groups (including IT vendors) having the greatest ability to ensure that *other organizations* adopt VIS standards participate in developing the standards and commit to adopting them without exerting disproportionate influence on the content of the standards developed.

VIS standardization efforts have a variety of mechanisms open to them in attempting to reconcile heterogeneous interests and marshal the heterogeneous resources of IT vendors and different user groups. These tactics include moral suasion, open or exclusive membership, rules of

governance, IPR agreements, and technical decisions regarding the scope of the VIS standardization effort. We believe that two important conditions will characterize the tactics employed by successful VIS standardization consortia. First, in successful VIS standardization efforts, the set of tactics should *jointly* resolve the linked dilemmas of VIS standards development and diffusion. Second, in successful VIS standardization efforts, the set of tactics used should *fit* the dilemmas particular to each specific case. Not all industries will resemble the mortgage industry in having two nearly equal, dominant and competitive customers that are susceptible to demands for standardization justified on the basis of the common good. An obvious counterexample is the retailing industry, dominated by Wal-Mart, which clearly puts its own economic interests first in discussions of industry-wide standards. Effective tactics in the mortgage industry, then, are unlikely to work in retailing. Furthermore, according to institutionalization theory, VIS standardization consortia are likely to borrow organizational models from earlier initiatives. Therefore, individual VIS standardization efforts could easily select tactics that are inappropriate for their unique collective action dilemmas. This leads to

Proposition 3: In order to achieve successful diffusion of industry-wide VIS standards, each VIS standardization initiative must employ a set of tactics that jointly solves its particular standards development dilemma, without jeopardizing the solution to its particular standards diffusion dilemma.

The case of MISMO also suggests that solving the linked dilemmas of VIS development and standardization is very challenging indeed. Despite best efforts, the compromises involved in reconciling heterogeneous interests in the face of equally heterogeneous resources is likely to require compromises that affect the nature and quality of the standards developed, thereby increasing the challenges of subsequent standards diffusion. The MISMO case also points to the lowest-common-denominator or “keep it simple, stupid” approach as promoting diffusion better than a perfectly designed technical standard. Therefore,

Proposition 4: The success of VIS standards diffusion is affected by the technical content of the developed standard, which is, in turn, affected by the tactics used to resolve the dilemma of VIS standards development.

Generalizing Beyond VIS Standardization

Might our propositions about VIS standardization also generalize to IT product standardization (Hawkins 1999;

¹⁵By qualitative we mean different in kind, not just in degree. In this case, we observed qualitative heterogeneity in participants' interests in, and resources for, both VIS standards development and VIS standards adoption.

Rosenkopf et al. 2001), to standardization efforts in general (Brunsson et al. 2000; de Vries 1999), or even to other types of organizational collective action such as open source software development (Lee and Cole 2003; von Hippel and von Krogh 2003), technical communities (Wade 1995), industry associations (Astley and Fombrun 1983; Barnett 2004; Flanagan et al. 2001), or research and development cooperatives (Katz and Ordover 1990)? At this point, we hesitate to make such generalizability claims. In the first place, many analysts, including Axelrod et al. (1995) and Cargill (1989), have noted the tendency of IT product standardization efforts to fragment into rival groups that exclude direct competitors. As we have argued above, whereas an IT product standardization consortium might hope to beat rival consortia in a standards war, a VIS standardization consortium lacking representatives from relevant, if heterogeneous, user organizations is unlikely to develop a VIS standard that wins industry acceptance. (See also Gerst and Bunduchi 2005; Nelson et al. 2005.) Thus, we believe that the collective action dilemmas facing the two types of standardization efforts are different and, therefore, that effective solutions to those dilemmas will differ as well.

Using a similar line of reasoning, we believe that the dilemmas involved in such collective actions as open source development projects, technology communities, industry associations, and research and development cooperatives are also different from VIS standards consortia. The former collectives tend to be more homogeneous in terms of members' structural roles in the collaboration (e.g., all software developers, all chip designers, etc.) and in their interests in the outcome of the collective actions (e.g., the desire to develop commercially viable products). Indeed, one clear conclusion from several decades of collective action research and theorizing is that there are many types of dilemmas, each with different solutions (Kollock 1998; Oliver and Marwell 2001). In any case, it is ultimately an empirical question whether our propositions generalize beyond the VIS standardization context, and we encourage future research on this question.

It would not worry us, however, if our propositions did not generalize beyond VIS standardization initiatives. VIS standards consortia abound (Nelson and Shaw 2003). VIS standardization is a phenomenon of great practical relevance. Cooperation among user organizations in developing specifications that will ultimately be embedded in software and services has enormous implications for IT management, for realizing business value from IT investments, for the structure of the industries in which such standards are used, and for the structure of the relevant segments of the IT products and services industry. Explaining how and why VIS standardization efforts succeed or fail is important for the IS com-

munity, even if the explanation differs from that developed for other kinds of standardization efforts or collective actions.

Conclusion

Several promising avenues for future research are suggested by this study. First on the agenda are to replicate the study for VIS standardization initiatives in other industries and to reevaluate the emergent theory in light of eventual diffusion outcomes. Second is to explore the theoretical conditions under which the emergent theory might or might not hold. One such condition is industry structure or network topology (Weitzel et al. 2006). Another condition is the effect of legacy investments in earlier, partially diffused, interconnection technologies, principally EDI, on the success of VIS standards development and diffusion. A third area for future research is to examine the relationships among VIS standardization initiatives: To what extent are they borrowing from each other or proceeding independently? What problems, if any, are created by the many industry-specific initiatives currently underway when it comes to cross-industry interconnection, and how can those problems be resolved? A fourth research program involves mapping the similarities and differences between VIS and other kinds of standardization initiatives and between VIS standardization and other collective actions. How are they similar or different, and what are the implications for standardization success? For example, many IT product standardization efforts involve separate organizations for standards-setting and for standards promotion (Cargill 1989). Does this situation also occur in the case of VIS standardization, and does such a division of labor increase or decrease the prospects for successful VIS standards development and diffusion? A final suggestion for future research concerns theoretical comparisons: What are the contributions and blindspots of collective action theory versus other theoretical perspectives such as network effects, institutionalization theory, and actor-network theory for understanding VIS and other standardization initiatives and other collective actions?

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About the Authors

M. Lynne Markus is the John W. Poduska, Sr. Professor of Information Management at Bentley College. Her research interests include electronic business, organizational change management, enterprise systems integration, and knowledge management. Lynne formerly taught at City University of Hong Kong, the Peter F. Drucker Graduate School of Management at Claremont Graduate University, the Anderson Graduate School of Management (UCLA), and the Sloan School of Management (MIT). She is the author of three books and numerous articles in journals such as *MIS Quarterly*, *Information Systems Research*, *Organization Science*, *Communications of the ACM*, *Sloan Management Review* and *Management Science*.

Charles Steinfield is a professor in the Department of Telecommunication, Information Studies, and Media at Michigan State University and recipient of MSU's Distinguished Faculty Award and its Teacher-Scholar Award. He has been a visiting professor and researcher at the Institut National des Télécommunications in France, Delft University of Technology in the Netherlands, Bellcore, and the Telematica Instituut in the Netherlands. He has published five books and numerous articles in journals such as *Organization Science*, *Information Systems Research*, *Communication Research*, *Electronic Markets*, and the *Journal of Computer-Mediated Communication*.

Rolf T. Wigand is Maulden-Entergy Chair and Distinguished Professor of Information Science and Management in the Departments of Information Science and Management at the University of Arkansas at Little Rock. His research interests lie at the intersection of information and communication technology (ICT), business issues, information management, the role of newer ICT, and public policy. He has published five books, and his research has appeared in journals such as the *Sloan Management Review*, *Journal of Information Technology*, *Electronic Markets: The International Journal*, *Information Management*, *Information Management Review*, and *The Information Society*.

Gabe Minton is vice president of Industry Technology at the Mortgage Bankers Association, where he is responsible for overseeing MBA's leadership role in the establishment of technology standards for the residential real estate finance industry. He was formerly the vice president of standards and alliances with Ultraprise Corporation and has more than 10 years of experience working with and creating software systems and standards, including work at the U.S. Naval Research Laboratory and the U.S. Naval Facilities Engineering Command.

