The Standards Lens on IS Innovations—The Case of CPFR

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Abstract

What's in a name? In this paper we argue the importance of looking, not just at different definitions of the same concept, but also at different concepts applied to the same phenomenon. Concepts such as "organizing vision", "methodology", "technology artifact", and "standards" represent different ways of understanding IS innovations, each highlighting certain aspects while minimizing others. We show how the standards lens adds value to the insights afforded by other familiar ways of looking at IS innovations by examining the particular IT-enabled supply chain innovation of Collaborative Planning, Forecasting, and Replenishment (CPFR).

1. Introduction

The things we refer to as information technology (or systems) standards can also be labeled in other ways that are generally acceptable to researchers in the IS field. For example, the standards of the RosettaNet Consortium define how business processes should be performed; the traditional Systems Development Life Cycle can be viewed as a standard software development methodology; and the Windows operating system—a de facto standard—can be called a technology or an IT artifact. Also calling these things standards implies that they differ in essential ways from "non-standard" processes, methodologies, or technologies; it implies that the concept of standard has special value or meaning over and above other labels. The goal of this paper is to highlight the importance of how IT phenomena are labeled by showing that viewing a particular IS innovation through the standards lens adds value relative to viewing it as a philosophy, a methodology, or a technology.

The plan of the paper is as follows. In the theoretical background section, we discuss the importance of labeling in academic research. We argue that many IS innovations can be analyzed at various levels of abstraction, such as (from high abstraction to low) philosophies, methodologies, and technologies. The standards lens on IS innovations is orthogonal to classification by levels of abstraction, because a given innovation could be standardized or nonstandardization on any of the levels. We next describe a particular IS innovation—CPFR—that is especially useful for an analysis of the added value of the standards lens, because at various points in time CPFR proponents have described that innovation as a standard at all three levels of abstraction. Using data drawn from published research, practitioner literature, and our own preliminary fieldwork at a retailer we call Specialty Superstores, we describe CPFR in turn as a philosophy, a methodology, and a technology and in each instance we show how looking at CPFR though the standards lens offers valuable additional insights.

2. Theoretical Background

Debate about the meaning of particular concepts is a healthy academic enterprise. For example, [1] showed that IS researchers conceptualize "the IT artifact" in many ways, yet call for even further conceptualization. Similarly, [2] examined multiple definitions of standardization before combining the essential elements into a new definition. As important as these efforts are, they do not directly address the issue of interest in this paper: When a given phenomenon could be conceptualized via more than one label, does it matter which one is applied? In general we believe that the IS field has not paid enough attention to this important question.

Perhaps closest in spirit to our purpose here is [3]'s careful analysis of IS development methodologies. They noted that the concept of methodology occupies an intermediate level of abstraction between "paradigm" at the most abstract and "technique" at the most concrete. Because they were interested in a single class of things (development methodologies), their procedure was to sort a set of things exclusively into one or another of their conceptual buckets. Our interest is in the different insights to be had by viewing a single phenomenon at multiple levels of abstraction and, in addition, in the light of an orthogonal concept—that of standard.

"Standard" is a designation that can be applied to a wide range of entities, including product, process, service, material, equipment, systems, interface, protocol, function, method, or activity [2]. This observation naturally raises the question of what more we mean to imply about an entity when we say it is a standard than when we do not. When an entity can be described at multiple levels of abstraction, there are additional questions about the level at which the "standard" label does or does not apply. For example, can an entity only be considered a standard if that label applies at all levels of abstraction? What does it mean about an entity's

"standardness" when the "standard" label applies at only one level?

In this paper, we do not answer these questions, but we try to demonstrate the importance of asking them. In the next section of the paper, we briefly discuss facets of IS innovations that are highlighted by labeling them as philosophies, methodologies, technologies, and standards.

2.1. Philosophy, Idea System, or Organizing Vision

IS innovations have frequently been examined as philosophies or idea systems. For example, IS research in the social constructivist tradition has explored how the proponents of computerization movements "frame" technologies to mobilize others to take certain kinds of action [4]. In the diffusion of innovations theoretical tradition, [5] coined the term "organizing vision" to refer to a community's idea for how adopters should apply IS innovations. Organizing visions center on the business problem an innovation purports to solve and thus serve to legitimize the innovation to potential adopters. Organizing visions often considerably predate a workable solution that companies can actually implement; thus, they also serve to mobilize resources required to realize the vision (e.g., the development of enabling software). The organizing vision of an innovation may change over time, as influential parties (such as vendors or industry associations) promote their views, and as experience with the innovation accumulates. Organizing visions have "careers" in which they rise and fall in popularity [5, 6], perhaps eventually being replaced by newer organizing visions and/or innovations.

Viewing IS innovations as philosophies or idea systems highlights the need for their backers to appeal to potential adopters and other resource suppliers. Thus, assumed in this view is the need for IS innovations to achieve widespread use if they are to succeed. Furthermore, this view emphasizes the tendency of experience to disconfirm the organizing visions of IS innovations that do not solve the practical business problems they were intended to solve.

2.2. Methodology or Process

Many IS innovations have procedural characteristics that lend themselves to conceptualization as processes or methodologies. Methodologies have been defined as "codified set[s] of goal-oriented 'procedures' which are intended to guide the work and cooperation of … various parties"; [3] (p. 186). Methodologies are described as more concrete than philosophies or approaches [3], and thus might be understood as a later stage in the evolution of an IS innovation's organizing vision, when knowledge about the cause-effect relationships between actions and consequences has become more certain.

The implicit assumption behind the label of methodology is that following the prescribed procedures is both necessary and sufficient for success. Conversely, "misuse" of a methodology or failure to follow it properly is often cited as a factor in the lack of acceptance of innovations such as business process reengineering [7] or IS development methodologies [8]. An alternative perspective is that methodologies are convenient fictions intended to present "an image of control"; as such, they are "too mechanistic" to successfully guide practitioners' actions [9]. In the alternative view, what is beneficial about methodologies is not detailed, step-by-step procedures, but rather general, overall approaches to performing a task—that is, *essential* principles and practices. Consistent with this view, research suggests that, when expert practitioners use methodologies at all (and they often do not), they customize them extensively to local conditions and tastes and may not follow them literally [3]. Along similar lines, some researchers have found that novices using a methodology produce superior results to not using a methodology at all, but that there are no significant differences in performance across methodologies [10]. In short, the methodology view of IS innovations focuses on literal or flexible compliance with (i.e., repeated or continuous use of) a step-by-step procedure as a condition for achieving an IS innovation's intended benefits.

2.3. Technology

IS innovations are often analyzed through the lens of information technology. Despite its obvious centrality to the Information Systems field, there is as yet no consensus on how to define the "IT artifact" [1, 11]. Perhaps the most common approach is to view IT as a tool for accomplishing a particular goal [1]. Here, one would undoubtedly consider software packages, because, when methodologies and procedures are highly structured, it is often possible to embed them in software that either supports or replaces human activity. A focus on software leads naturally to consideration of features [12] that suggest "expected uses" [13, 14] and might therefore shape users' behavior [15].

The IT and business value literature suggest, however, that achieving hoped-for benefits often requires, not just IT, abut also other important changes such as restructured business processes and an integrated IT infrastructure. For example, [16] inquired about the relationship between electronic data interchange and a business process change (continuous replenishment); they found that the benefits of continuous replenishment in conjunction with EDI were far greater than the benefits of EDI alone (see also [17]). Similarly, [18, 19] emphasized the importance of an integrated IT infrastructure for benefit realization. [20] further noted that the benefits realized by an organization

using software for interorganizational coordination depend on its partners' choices around IT implementation.

In short, the technology view of IS innovations emphasizes the need for complementary changes in software, restructured business processes, and IT infrastructure integration. For the particular case of technology used for interorganizational coordination, this view also highlights the interdependent benefits of partners and the consequent need for partners to harmonize their technology implementations.

2.4. Standards

As with methodology and technology, there is a fair degree of disagreement in the definition of standard [2, 21]. Although economists tend to emphasize the network characteristics of standards [22], [2] argues that this is not an essential characteristic; rather, network characteristics might result from the particular entity being standardized, such as interfaces, protocols, and interorganizational business processes. Therefore, for a more general view of standards lens, we employ [2]'s definition, which is a synthesis of essential elements from several prior definitions. According to [2], "standardization is the activity of establishing and recording a limited set of solutions to actual or potential matching problems directed at benefits for the party or parties involved, balancing their needs, and intending and expecting that these solutions will be repeatedly or continuously used during a certain period by a substantial number of the parties for whom they are meant", where "matching problems" are "problems of interrelated entities that do not harmonize with each other."

This definition is intended to cover all instances of standardization and thus has many qualifiers. Here, we will emphasize only a few. "A limited set of solutions" is necessary, because, if the variety of solutions is too large, the goal of harmonization (solving the matching problem) will not be achieved. "Directed at benefits" and "balancing their needs" are essential, because "standard" is an economic concept implying a particular purpose (benefits for all parties) and a way of achieving that purpose (balancing). A "certain period of time" reflects the reality that standards are a solution for a current moment in time, likely to be displaced in the future. And "repeated use by a substantial number of parties" denotes that widespread adoption by relevant parties is essential for standards to fulfill their economic purpose.

Thus the standards lens on IS innovations emphasizes several key points. Some of them (widespread use or compliance, matching problems, and interdependent benefits) are found in the other lenses we examined above, but no one other lens contains all the elements of the standards lens.

3. Why CPFR?

The IS innovation examined in this paper is **Collaborative Planning, Forecasting, and Replenishment (CPFR)**, a supply-chain innovation in which business partners (e.g., retailers and manufacturers or manufacturers and suppliers) attempt to improve supply chain performance (e.g., on time deliveries and lower inventory costs) by sharing forecast information (e.g., promotions and planned orders, sales and inventory data). Thus, the interdependent nature of CPFR suggests that it might be vulnerable to network effects [22]. Its value increases with adoption by a large number of a company's business partners and, by extension, widespread adoption across relevant industry sectors.

CPFR is a particularly interesting IS innovation for our exploration of the value of different conceptual labels, because CPFR proponents have referred to it by *all four labels* at various times. First**,** a leading proponent defined CPFR in highly abstract terms that explicitly avoided any mention of technology—akin to our ***philosophy*** lens: "CPFR is an initiative among all participants in the supply chain intended to improve the relationship among them through jointly managed planning processes and shared information." [23] (p. 30). Second, the first version of CPFR Voluntary Guidelines, issued in 1998 (revised in 2002 and 2004) portrayed CPFR much more concretely as a ***methodology*** consisting of 9 required steps: 1) develop front-end agreement, 2) create joint business plan, 3) create sales forecast, 4) identify exception items for sales forecast, 5) resolve/collaborate on exception items, 6) create order forecast, 7) identify exceptions for order forecast, 8) resolve/collaborate on exception items, 9) order generation. As one analyst noted, "the core CPFR objective is to establish a common *process* that can be used not only between two trading partners, but across an entire marketplace" [24] (p. 21 added emphasis). Third, several vendors (Manugistics, SAP, i2, and Syncra) offer software packages labeled as "CPFR", underscoring a view of CPFR as a ***technology***. Finally, proponents repeatedly refer to CPFR in terms of ***standards***. For example, an industry association calls CPFR a "standards-based" innovation [23], because it depends heavily on EDI and XML standards. Indeed, the "CPFR Technical Specification" describes four areas in which technical standards could apply: 1) Data content and format (EDI and SIL [Standard Interchange Language]), 2) Communication vehicle (FTP [transport] and TCP/IP [network protocol]), 3) Security measures (e.g., authentication, encryption, non-repudiation, and origin), and 4) Application/Middleware (alternatives for location, coordination, and management of the data processing elements [servers, agents]). Other analysts argue that CPFR is (or should be) a standard, because otherwise supply chain collaboration with three partners could mean three interfaces and three processes; with standards,

collaboration with three partners could require only one interface and one process [25].

4. Analyzing CPFR Through Different Lenses

In this section, we examine CPFR sequentially through the lenses of philosophy, methodology, and technology. At the end of each view, we discuss the conceptual value added by the standard lens.

4.1. Philosophy, Idea System or Organizing Vision

Today, the philosophy of CPFR is improved supply chain relationships through "jointly managed planning processes and shared information" [23]. But that philosophy has changed considerably since 1986 when the **Voluntary Interindustry Commerce Standards Association (VICS)** was founded to implement the **Quick Response (QR)** program for improving the efficiency and effectiveness of supply chains in the soft goods industry.

4.1.1. Origins of CPFR. Like CPFR, QR was variously defined as "a management approach" [26], a technology-enabled process [27], and "a cross-industry standard" [28]. QR was envisioned as four levels of successively more sophisticated technologies and applications: Level 1: point-of-sale technology and price lookup, Level 2: automatic inventory replenishment and sales and inventory forecasting, Level 3: pre- and post-season planning and support for cross-docking, Level 4: seasonless retailing and the transfer of inventory management functions to suppliers [29], (p. 242). However, retailers did not implement QR according to those levels [29]. Furthermore, although the early focus of QR was on the flow of *materials* [30], over time the emphasis shifted to the flow of *information,* as people came to view short lead times as the way to reduce inventory.

As a result of experiments by companies like Procter & Gamble, Kmart, and Wal-Mart [31, 32], QR evolved into "the earliest example of **continuous replenishment planning" (CR or CRP)** [33]. The terms CR and CRP are often used synonymously with **vendor-managed inventory (VMI)**, an arrangement in which vendors create purchase orders for retailers, using the vendors' analysis of retailers' point of sale data and jointly agreed objectives; some analysts restrict the term VMI for the special case of CR in which retailers also transfer ownership of their inventory to the vendors, reaping additional gains.

In the food industry, a similar approach was known as **Efficient Consumer Response (ECR)** [29, 34] after publication of an influential report in 1993. Described by some as "the first robust initiative created to enable integration in the supply chain…." [35] (p. 267), ECR became an umbrella concept for a variety of efforts to improve and optimize food industry supply chains to provide better value for consumers while reducing costs for retailers and suppliers. ECR promised to move the grocery supply chain from a "push" to a "pull" system where the replenishment of store products would be initiated by point of sale data. ECR focused on trust-based relationships and improvements in four core business processes: efficient store assortment, efficient promotions, efficient product introductions—together known as "category management" on the demand side—and efficient replenishment—or "supply chain management" on the supply side. By combining the demand and the supply side into a single framework, ECR proponents hoped to reap additional benefits. In addition to the four core business processes, ECR also involved the use of enabling technologies for capturing and transmitting point of sale data (Universal Product Codes, scanners, and EDI); Activity-Based Costing and cross-docking were also recommended. Although ECR is a much broader concept in practice, it was often implemented solely as CRP/VMI [36, 37].

4.1.2. Supply chain collaboration. Marketing promotions and new product introductions involve demand uncertainty that is not addressed by basing replenishment decisions on historical data and inventory balances as is done in VMI. Experimentation with **collaborative forecasting and replenishment (CFaR)** began in 1995 when Wal-Mart and Warner-Lambert added sales and order forecasts to their CRP program. CFaR is "a formalized way for manufacturers and retailers to collaborate on future demand for products. By posting selected internal data on a shared Web server, supply chain partners could share and jointly develop more accurate forecasts" [38] (p. 12). CFaR can also involve the sharing of partners' strategies or the use of complex decision models [39].

Although it provided considerable benefits to retailers and manufacturers [40], CFaR still fell short of proponents' visions of supply chain management excellence. They began to promote CPFR, which went beyond CFaR by "enabl[ing] the forecast calculation to incorporate specific information about how much of an item will actually be available for delivery at some future date." [38] (p. 12). Thus, CPFR is seen as the successor of CFaR [41] and as a further refinement of ECR [23]. The CPFR web site (www.cpfr.org) describes CPFR as "a set of business processes that entities in a supply chain use for collaboration on a number of buyer/seller functions, towards overall efficiency in the supply chain … while satisfying customer needs." It creates "…collaborative relationships between buyers and sellers through co-managed processes and shared information. By

integrating demand and supply side processes CPFR® will improve efficiencies, increase sales, reduce fixed assets and working capital, and reduce inventory for the entire supply chain while satisfying customer needs." The benefits of CPFR can be great: The company we call Specialty Superstores, in which we have conducted preliminary fieldwork, has claimed improved relationships with vendors and forecast error rate reductions from 40% to 20% on average and to 1% with certain vendors. Despite the benefits claimed by Specialty Superstores and other companies [23], CPFR has not yet been adopted as widely as many expected a few years ago.

4.1.3. CPFR—philosophy versus standard. The philosophy lens focuses attention on the need for IS innovations to obtain widespread support from adopters and other resource providers such as software developers. Unless an innovation gains adherents, it will fail to provide the hoped-for benefits. Consequently, as an innovation's vision is disconfirmed by experience, promoters tend to refine or replace it (and possibly the innovation as well) with a new one that offers greater promise of solving a business problem.

That trajectory can clearly be seen in the history of CPFR. For various reasons, the precursors to CPFR did not solve the problem they were intended to solve [35, 42]. For example, warehouse data was often used in lieu of point of sale data, thus reducing the visibility of actual consumer demand [43]. Also, vendors often did not push retailer data back into their organizations to improve their own production and replenishment systems. Finally, VMI was not viewed as an appropriate approach for "innovative" products (for which demand cannot be predicted from past sales) [44, 45] or for products that the retailer planned to promote. Thus, from today's vantage point, "CPFR is simply the latest embodiment of knowledge and experience that has been compiled to continually improve a company's internal efficiencies while increasing external effectiveness" [33]. By directing attention to the shortcomings of earlier innovations, the philosophy lens provides a useful perspective on CPFR.

The philosophy lens addresses several points also highlighted by the standards lens: the temporal nature of standards, the need for a solution to matching problems, the need for widespread adoption. Does the standards lens offer anything that the philosophy lens does not? We think it does. An additional point emphasized by the standards lens is "a limited set of solutions". According to analysts, the great variety of technologies and applications in the early QR and ECR programs often bewildered potential adopters; not knowing where to start or what was essential, they did nothing or took very partial measures [46]. Thus, the standards perspective helps us see that the organizing vision of CPFR and its precursors evolved, not only in the direction of solving coordination problems among organizations, but also toward a simpler solution for adopters. (As we explain below, we believe CPFR has not gone far enough in that direction.) Furthermore, the standards lens emphasizes "benefits for the parties involved", which is not highlighted by the philosophy lens. Mutual benefit was lacking in some CPFR precursors. "VMI … shifted the ownership and responsibility from retailer to supplier" [42], which some vendors believe is not in their best interests unless the partners can come to an equitable agreement on responsibility for 'shrink' [i.e., theft]" [46]. In short, for the case of CPFR, the standards lens appears to subsume the insights of the philosophy lens and adds additional analytic value.

4.2. Methodology or Process

As noted earlier, CPFR was originally put forward as a 9-step procedure that adopters were expected to follow. Some analysts argued that faithfully following the 9 CPFR steps was key to the success of supply chain collaboration [35]. However, it soon appeared that "quite a few companies are collaborating with critical partners in a manner that is less complete than the full CPFR process" [23] (p. 90).

4.2.1. From required 9-step model to 4-activity process (with variations). For many potential CPFR adopters, a major sticking point in the ability to complete the 9-step model is step 5—"create order forecast." Although some retailers can produce reliable order forecasts—and at the level required by the 9-step model (by distribution center and store)—others cannot. Specialty Superstores is a case in point. With approximately 10 million SKU-store combinations, a forecast of 104 weeks would involve over one trillion records, and the company has not found a software package capable of managing that enormous volume of data. Even retailers with less extreme data requirements may be unable to produce an order forecast, and some manufacturers have been known to create the CPFR order forecast *for retailers* on the basis of retailers' sales data for use. Consequently, some analysts have argued the need for new collaboration approaches that do not depend as critically as CPFR does on the ability of retailers to generate an order forecast [43].

Even when a retailer *can* produce accurate order forecasts, it still might choose not to implement the full 9-step model with all its suppliers or for all the products it carries. Specialty Superstores purchases some products of minor importance both to it and to the vendor. For these products, neither Specialty Superstores nor the vendor finds it worthwhile to hold weekly collaboration meetings as suggested by CPFR steps 5 and 8. Second, Specialty Superstores sometimes does not collaborate on even its most important products: If the products are infrequently

promoted and not innovative [44] (such that demand is relatively certain), replenishment needs can be accurately predicted from past demand or target inventory levels. For innovative products of high strategic value, Specialty Superstores uses "ladder plans" to negotiate order commitments with vendors. A ladder plan is a manual forecast in which estimates of future orders are gradually refined as sales data becomes available. Owing to such considerations, Specialty Superstores conducts the CPFR process with only 2 percent of its over 500 vendors on less than 2,000 of its more than 10,000 stock-keeping units (SKUs). In addition, Specialty Superstores conducts two forms of collaboration, dubbed "CPFR Heavy" and "CPFR Lite". CPFR Heavy involves weekly performance of a series of daily activities consistent with the CPFR 9-step model. In CPFR Lite, Specialty Superstore uploads sales forecasts to its CPFR software; sales and inventory data are posted on an extranet for vendors to use as they wish.

From experiences like those of Specialty Superstores, CPFR promoters have realized that collaboration does not require all nine steps of the original CPFR model [23]. Nor do all companies need to use the same combinations of steps to perform CPFR. These insights were reflected in the recently released version of the CPFR Process Model [24] in which the 9 steps were replaced with 4 activities (strategy & planning, demand & supply management, execution, and analysis) comprising 8 tasks (account planning, market planning, market data analysis, demand planning, production & supply planning, logistics/distribution, execution monitoring, and customer scorecard). The new VICS model was designed to account for the fact that "…most companies are involved in all of [the activities] at any point in time. There is no predetermined sequence of steps." Furthermore, "collaboration may focus on just a subset of the four activities … . These partial implementations are sometimes called 'CPFR Lite' " [24](p. 7). The latest VICS model also describes four CPFR scenarios that further adapt the collaboration approach to particular needs: Retail Event Collaboration, Distribution Center Replenishment Collaboration, Store Replenishment Collaboration, and Collaborative Assortment Planning. Indeed, "trading partners are free to combine scenarios if appropriate" [24](p. 13).

4.2.2 CPFR—methodology versus standard. The methodology lens highlights the sequences of procedures that supply chain partners are expected to complete in tandem to solve their coordination problems. The methodology lens also features situations in which a particular sequence is not followed rigidly, but instead is customized to meet local circumstances, thus promoting widespread adoption of the prescribed process.

Thus, the methodology lens identifies an issue also identified by the standard lens—the importance of repeated or continuous use of a solution to a matching problem. This leads one to ask what more the standards lens adds (if anything) to the methodology-oriented view. By calling attention to harmonization of supply chain partners' needs, the standards lens helps explain another interesting facet of the case—the precise way in which the 9-step model broke down in practice. The reason the 9-step method could not be used in every situation was the difficulty many retailers have in supplying order forecasts. Although Specialty Superstores could not do so efficiently, because it lacks software capable of handling its massive data volume, a more fundamental problem is that retailers in general do not have the incentive to provide order forecasts to suppliers [43]. Retailers do not need to forecast orders for their own immediate purposes (although they do need to forecast sales). If not for concerns about the timeliness of suppliers' deliveries, most retailers would be perfectly content not to forecast their orders at all but instead simply to place them, relying on their suppliers to deliver on time. By contrast, it is manufacturers who benefit directly from having information about retailers' ordering plans, because that information helps them efficiently schedule production. The mandatory 9-step process did not adequately balance these divergent needs of manufacturers and retailers, leading to the evolution of more flexible approaches that balance them better. By explaining why the CPFR process changed in the precise way it did, the standards lens provides more analytic value than the methodology lens.

4.3. Technology

Although one popular definition of CPFR, quoted earlier ("CPFR is an initiative …"), denies or minimizes the importance of IT, several factors suggest the value of looking at CPFR through a technology lens. First are the specialized CPFR software offerings of several vendors (Manugistics, SAP, i2, and Syncra), which might automate or facilitate certain collaboration activities, making it more cost-effective. Second, prior research suggests that, although IT might *not be essential* for benefits from improved collaboration processes, using the improved processes *in conjunction with* IT and an integrated IT infrastructure might provide greater benefits than using CPFR alone.

4.3.1. IT and an enabler of, and constraint on, collaboration. According to VICS, "the CPFR process does not fundamentally depend upon technology" [47] (p.20). Indeed, Romanow contends that early-stage CPFR collaborations are adequately managed with limited technology, such as telephone, FAX, and e-mailed spreadsheets [48] (p. 2). Although experimenting with CPFR does not require advanced information technology, "specialized technology can make the process more scalable" [47] (p. 20), that is, expandable to additional

partners and SKUs. Consistent with this view, even though Specialty Superstores considers CPFR to be "80% business process and only 20% technology", the company opted for specialized CPFR software instead of spreadsheets and email on the basis that vital aspects of collaboration were lost without a higher level of IT support.

Although Specialty Superstores employs advanced IT support for the CPFR process, this tool is imperfectly integrated with the retailer's other IT components and those of its partners. For example, the CPFR process at Specialty Superstores also touches on the following IT components: 1) an enterprise data warehouse, fed by sales, inventory, and ordering systems, 2) an extranet, used to communicate point of sale data, inventory levels, and order status data to vendors, and 3) order forecasting software (discussed earlier as insufficient for Specialty's CPFR needs). At the farther reaches of this technology chain, manual processes are increasingly used to connect the IT components. Furthermore, reverse flows (e.g., getting agreed upon forecast data from the CPFR software into Specialty's enterprise systems) are generally manual. Over time, Specialty will undoubtedly increase the integration of these technical components, but, at the moment, their incomplete integration and missing elements (such as automated order forecasting) limit Specialty's ability to expand CPFR.

Specialty Superstores is not alone in having a complex and incompletely integrated collection of technologies in support of CPFR. In general, the IT components needed for CPFR include software, information and communications technologies, B2B platforms, and data standards and languages such as XML [23]. Across the companies that have implemented CPFR, one can find the use of multiple software tools (e.g., i2, Manugistics, Syncra), multiple communication methods (e.g., Web, FTP, email, and VAN), both real-time and batch operation, and multiple "deployment scenarios". Collaborating partners can deploy a CPFR application in a "shared" mode, in which partners use the same tool via an extranet, an application service provider, or an electronic marketplace, or they can share data across different applications using a "peer-to-peer" architecture (e.g., company-to-company, company-to-marketplace, marketplace-to-marketplace) [49]. Both the shared and the peer-to-peer deployment scenarios have advantages and disadvantages in terms of setup and operating cost, delays, likelihood of errors, etc. And "[a] company may need to deploy CPFR *using more than one approach to collaborate with its full set of trading partners*" [49] (added emphasis).

4.3.2. CPFR—Technology versus standard. The technology lens highlights the rather bewildering variety of loosely integrated technology components that support CPFR. Performing CPFR involves not only the processes of collaboration (e.g., sharing information and resolving exceptions), but also a set of routines for managing data and technology (e.g., FTPing files, manually entering updates, building system integrations and data extraction algorithms). Business partners' IT skills and infrastructures consequently appear to matter quite considerably for whether and how they adopt CPFR and the costs and benefits each partner receives.

Thus, the technology lens identifies a critical factor also identified by the standards lens—the need for (and in this case, the lack of) a limited set of (technical) solutions. Does the standards lens offer additional insights beyond those of the technology lens? Again, we think the answer is yes. The standards lens calls attention to the expectation that the limited range of solutions to the matching problem will be repeatedly or continuously used *by a substantial number of the parties for whom it is intended*. That criterion points to an important aspect of the case not featured by the technology lens: Widespread acceptance of CPFR is highly problematic because of both the varied technical solutions and *overlaps in the partner sets* of potential adopters that wish to collaborate via CPFR.

On the technology side, CPFR is clearly non-standardized. Superficially, CPFR requires common data formats: "All CPFR implementations must use the data formats described in this specification for message interchange. The selection of data transport, security scheme, and middleware is beyond the scope of the CPFR standard, however, and is subject to implementers' agreements" [47](p. 82). However, nonstandard elements quickly creep into CPFR data exchange: "Trading partners can use EDI messages, XML messages, or both to facilitate CPFR communications…The EAN.UCC Global Business Standard provides the most comprehensive coverage of the process, with a suite of eleven CPFR-specific XML message types. While there are no EDI mappings for some CPFR messages, some projects use XML to 'fill in' where EDI messages have gaps" [24] (p. 21). And, of course, each trading partner may choose different approaches to communication, security, and application/middleware.

Even more importantly, independent technology choices by *pairs* of supply chain partners lead to increasing complexity and lack of integration in each partner's internal IT infrastructure. Conversely, companies that insist upon maintaining their own internally integrated infrastructures impose substantial costs on the partners with whom they wish to practice CPFR. And because each partner may also work with several other partners, lack of technology standardization across all pairs represents a major constraint on the widespread adoption of CPFR.

We spoke to Consumer Products Manufacturer (CPM), a company that supplies Specialty Superstores and several of its competitors. CPM collaborates with about 6 different partners, and "by the law of averages", finds

itself forced to use every major CPFR software package on the market as well as low-tech approaches such as emailed spreadsheets. Even when two of CPM's customers use the same CPFR package, they use it in different ways. One might provide order forecasts, the other not. In addition, their forecast data might reflect different time periods and different levels of granularity (SKU, SKU-distribution center combination, SKU-store combination). CPM's IS specialists are required to develop and maintain a variety of special purpose programs to extract the data sent by partners and load it into CPM's systems. (Considerable manual effort is devoted to this task every week.) Once that is done, CPM's supply chain analysts must separately review and analyze each partners' data to account for differences in data quantity and quality. Although CPM believes that the benefits of collaborating with its customers outweigh the costs of nonstandard technologies and business processes, Specialty Superstores told us that other similar vendors declined to participate in CPFR because, in the absence of Specialty's ability to supply an order forecast, *their* perceived costs exceeded their potential benefits.

In short, where the standards lens really differentiates itself from the technology lens is by closing the link between the "standard" solution and *widespread* acceptance. Because the CPFR solution is intended to coordinate among multiple interdependent pairs of business partners, lack of standardization on the technology side acts as a serious impediment to CPFR's widespread adoption across the relevant industries.

5. Discussion and Conclusions

This paper is about what we in the IS field call the things we study. Labels like organizing vision, process, technology, and standard are central to our collective academic enterprise. Although we often debate the meaning of particular concepts, we rarely consider the implications of applying one label versus another to the same phenomenon.

All of the lenses we considered—philosophy, process, technology, and standard—shed useful light on the case of CPFR, but they generate *different* insights. This finding suggests that what we call IS phenomena critically influences the findings we report. Our analysis shows furthermore that, although an IS phenomenon can usefully be studied at several levels of abstraction (i.e., philosophy, process, and technology), there are important *interdependencies among those levels*. For example, the reason Specialty Superstores could not implement the full 9-step CPFR *process* was that it did not have the software *technology* capable of managing the huge volumes of data involved. Third, our analysis shows that the standards lens affords incremental value above and beyond each of the three other labels. The standards lens applied to an interorganizational process like CPFR is differentiated from the other views by its focus on *the consequences for widespread adoption* of 1) lack of standardization at all levels of abstraction and/or 2) the inability (or unwillingness) of partners to comply with standardization at various levels of abstraction. In the specific case of CPFR, noncompliance is currently less an issue than the very nature of the CPFR "standard" itself, which exhibits considerable openness of interpretation and implementation at all three levels.

Focusing on what we call things is not just an academic exercise. It has important consequences for empirical research: How we measure IS innovations and the conclusions we reach about them depend on the labels we apply. Our investigation of CPFR suggests that careful future empirical work on interorganizational systems might require use of all four lenses. Furthermore, conceptual labels have important practical implications as well. More than one company, we believe, has been misled by marketing literature that labeled CPFR as a technology or as a standard.

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