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RESEARCH PAPER

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Deconstructing Information Sharing

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Abstract

Information sharing between actors working in different institutions, is proposed by much literature to improve aspects of both intra- and interinstitutional performance. However, it is unclear from the literature what exactly information sharing is and why it is important to institutional performance. This paper seeks to deconstruct the concept of information sharing, particularly within aspects of the supply chain. We shall argue that the central problem with the concept of information sharing is that it relies on a notion of information as stuff that can be manipulated, transmitted, and used in an unproblematic manner between organizations. We wish to question conventional notions of this construct by examining and analyzing a case of information sharing, applicable within an international supply chain, as well as several problems experienced with such sharing. Through deconstructing this case we demonstrate how certain perceived problems in information sharing are better conceptualized as breakdowns in the interinstitutional scaffolding of data structures.

Keywords: Information, Information Sharing, Scaffolding, Data Structure, Breakdown, Institutional Ontology, Supply Chain.

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1 Introduction

Information sharing between actors, working in different institutions, is proposed by much literature to improve both intra- and interinstitutional performance. For instance, much has been published about the value of information sharing in improving supply-chain performance (Kembro, Selviaridis, & Naslund, 2014). But what exactly is information sharing and why is it important to institutional performance? Surprisingly, from an examination of extant literature this question is quite difficult to answer, because the notion of information sharing is either never explicitly defined or defined in a tautological manner using concepts which remain unquestioned. The literature presumably skirts this definition because the concept of information sharing is assumed to be unproblematic and hence not worth defining explicitly. The more limited literature, which does attempt to define this concept, presumes that there is clarity concerning the notion of what is shared—the information itself.

This paper seeks to deconstruct the concept of information sharing, particularly within aspects of the supply chain. Deconstruction, as applied in the work of

Derrida (1971), is a philosophical and linguistic endeavor that seeks to expose the arbitrary nature of the relationship between signs and meaning in the sense that a signifier relates to a signified only in terms of convention. We shall argue that the central problem with the term *information sharing* is that it relies on a rather brittle convention of signifying information as stuff that can be manipulated, transmitted, and used in an unproblematic manner both within and between organizations. This article is primarily conceptual but through a process of abductive reasoning, we wish to question such conventional notions of this construct by examining and analyzing certain instances of so-called information sharing. Abductive reasoning is a form of logical inference which starts with certain observations and then seeks to find the most likely explanation for such observations. We are particularly interested in explaining more clearly what certain problems experienced with information sharing constitute in institutional terms, and, specifically, in relation to operational areas such as supply-chain management.

To help ground our thinking we have been researching the practical experience of information sharing as it pertains to two organizations participating in an international supply chain. Our research has identified certain apparent problems in information sharing within this case, which are not adequately explained by employing conventional notions of information and its flow through intra- and interorganizational processes. This has led us to question the efficacy of employing the term information sharing in this manner and to look for a more sophisticated way of accounting for both the information situations and information problems evident in our case. Within this paper we seek to reconstruct an account of what information sharing means in practice using a theoretical framework devised by one of the authors and published in previous work (Beynon-Davies, 2015; Beynon-Davies, 2016a). We apply this framework, in particular, to explain aspects of our case material, but tentatively propose its usefulness for making better sense of information sharing within other domains of institutional action.

This paper provides a critique of four essential elements comprising the conventional world-view on information sharing. First, that everybody knows what information is. We discuss at least five different interpretations of what information is, based on the literature. Second, that everybody knows that information can be shared. We demonstrate through our work that information cannot, in fact, be shared, because it is not "stuff"—it is an accomplishment of and between institutional actors (Boland & Hirschheim, 1987). This leads us to suggest that what the literature presumes to be information sharing between institutions is more accurately described as a set of mutually coupled patterns of action evident between two or more institutional domains (Beynon-Davies, 2015). Third, that everybody knows that information sharing necessarily improves institutional action. In terms of a close examination of our case we explain how situations in which information is "accomplished" are a necessary but not a sufficient condition for improvements in institutional action. Finally, that everybody knows that the application of information technology inherently improves information sharing. Our work shows how the application of information technology cannot guarantee, in and of itself, the accomplishment of information and consequent improvements in interinstitutional coordination. Indeed, the way that information technology sometimes erects the scaffolding of action may sometimes serve to degrade rather than improve institutional performance.

2 What Is Information Sharing?

Having conducted a systematic search, we have found a vast literature on information sharing. Some of this literature overlaps with cognate areas, such as knowledge management (Orlikowski, 2002), standards-making (Agarwal, Dai, & Walden, 2011) and boundary objects (Star, 2010). We do not have space to consider such linkages here but raise this task as a goal of further work. In this section, we describe mainly the way that information sharing is framed in relation to the supply chain.

For well over three decades, the concept of information sharing has been central to developing notions of the digital economy and digital society (Schmid, 2001). The notion of sharing information also underlies much of the strategic impetus for aspects of electronic business and electronic commerce (Beynon-Davies, 2013a). It also is seen as a major catalyst for innovation in areas such as electronic government, and to a more limited extent, within aspects of electronic democracy (Lenk & Traunmüller, 2002). However, although much has been published about the value of information sharing within such diverse areas, there is surprisingly little attempt within this literature to make sense of the concept itself. From our reading of the extant literature, we see two distinct orientations toward the concept of information sharing. In the largest section of the literature, a concrete definition of what information sharing means is never actually provided. We assume that the literature neglects such a definition because the concept of information sharing is assumed to be unproblematic and hence not worth defining explicitly. There is also a much more limited literature that provides some definition—albeit frequently vague—of what information sharing means. But such literature relies on a further assumption which is itself open to critique. The literature that does attempt to define this concept presumes that there is clarity concerning the notion of what is "shared"—information itself. Our work is an attempt to address

the lack of rigor evident in the conventional applications of the concept of information sharing in such as supply chain.

In a major segment of the literature, information sharing is considered as an unproblematic background to institutional action. Yang and Maxwell (2011) provide a comprehensive review of the literature on information sharing among public sector organizations. Similarly, comprehensive reviews of information sharing in the supply chain, are evident in the work of Sahin and Robinson 2002, Huang Lau and Mak, 2003, Kembro et al. 2014, Montoya-Torres and Ortiz-Vargas 2014. Many studies deploy a mathematical modeling and/or simulation approach, typically trying to evidence the content (Mason-Jones, & Towill, 1997; Li, Wang & Yan, 2006; Jonsson & Mattsson, 2013; Moghaddam & Nof, 2014) and the extent (Sahin & Robinson, 2002; Zhou & Benton, 2007; Titah, Sharaida & Rekik, 2016) of information sharing on supply-chain performance. There is also some research investigating barriers to information sharing such as power, willingness, trust, lack of quality information, incompatible IT systems, and asymmetric allocation of cost/benefits (Fawcett et al. 2007; Kembro, Osterhaus & Magnan, 2014; Wu, Chuang & Hsu, 2014). Interestingly, in all such literature the concept of information sharing is either not defined at all or defined in unenlightening ways. For instance, Lee, So and Tang (2000) develop a complex mathematical model of information sharing within the supply chain without ever defining it. From an analysis of the paper itself, it is apparent that information sharing for these authors means sharing attributes or properties of "things" important to the supply chain such as sales order quantities. Likewise, Zhou and Benton (2007) never explicitly define the construct, even though they characterize important dimensions, such as supporting technology, information quality and information content.

Only a handful papers have attempted to explicitly offer a definition of information sharing. Where such definition is provided it is frequently tautological: information sharing is the sharing of information. This again suggests that information is regarded as unproblematic stuff that can be shared readily and without issue. In their classic paper, Barrett and Kosynski (1982) refer to information sharing merely as the interchange of information. Lotfi, Mukhtar, Sahran and Zadeh (2013) state that "information sharing means distributing useful information for systems, people or organizational units". Tong and Crosno (2015) hold a similar view and refer to information sharing as "the proactive exchange of timely, useful information between exchange partners". Among the comprehensive literature review articles mentioned, the concept of information sharing is largely assumed. Only Kembro et al. (2014) offer a brief definition of information sharing within the supply chain as "the exchange of data, information and/or knowledge among independent organizations." Probably the most explicit view is provided by Carr and Kaynak (2007) who make the distinction between information sharing within and between firms and assert that:

> *information sharing within the firm is defined as the sharing of critical information between operations and other departments such as sales/marketing, purchasing/supply management, logistics, and engineering. Information sharing between the firms refers to information shared between a buyer and key suppliers that is detailed enough, frequent enough, and timely enough to meet a firm's requirements*.

So even when conventional definitions of information sharing are provided, it is particularly unclear as to what the relationship is between what is shared or exchanged, what part technology plays in such sharing, and how such sharing leads to consequent improvements in institutional performance. Miranda and Saunders (2003) move closer to the view of information sharing proposed in this paper. They cast doubt on the conventional view of information sharing, which suggests a process involving the dissemination of information that holds the same meaning for everyone. They raise the notion that what is shared must be interpreted and that such interpretation may be sometimes problematic in terms of such exchange.

Despite this lack of conceptualization, the literature abounds with studies about the proposed benefits of information sharing. Generally, the literature proposes that information sharing inherently improves institutional action, frequently in measurable ways. For example, in the field of supply-chain and operations management, considerable effort has been devoted to investigating the impact of sharing information on supply-chain dynamics. Lee, So and Tang (2000) propose that one of the remedies for the "bullwhip effect" (the amplification within the supply chain where orders to suppliers tend to have larger fluctuations than sales to buyers) is sharing information along the supply chain. Information sharing is portrayed by many authors as a generic cure-all to supply-chain ailments and one of the most important of good supply-chain design practices (Towill, Naim & Wilkner, 1992; Sahin & Robinson 2002; Childerhouse, Hermiz, Mason-Jones, Popp & Towill, 2003; Patnayakuni, Rai & Seth, 2006).

The recent literature also tends to suggest that the application of information technology unproblematically improves situations of information sharing. For instance, timely sharing of undistorted demand information through technology is believed to benefit the whole supply chain (Mason-Jones &

Towill, 1997), while technology-enabled information-sharing initiatives, such as vendor management inventory, collaborative planning and forecast and replenishment, are seen as benefiting both suppliers and customers within supply chains (Disney & Towill 2003; Holweg, Disney, Holmström & Småros, 2005). Technology-supported information sharing is perceived as being critical to substituting inventory, speeding new product design, shortening order fulfilment cycles, driving process reengineering, and supporting long-term supply-chain collaboration (Fawcett et al. 2007, Tai & Ho 2010, Caridi, Moretto, Perego & Tumino, 2014).

3 The Problem of Information

In the current section we deconstruct the concept of *what is shared* in the literature considered in the previous section. In the next section, we build what we believe to be a more sophisticated and grounded account of how information situations are located within interinstitutional practices evident in domains such as the supply chain. The concept of information is mundane and accepted background to many disciplinary endeavors, but has many different meanings as applied in diverse literature (McKinney & Yoos, 2010; Boell, 2017). To help deconstruct the concept of information we use an ideal-type of information situation to highlight what information sharing is and is not. This ideal-type is used to demonstrate that information, as such, cannot be shared or transmitted because information is not *stuff*. Information is best viewed as an accomplishment made with and through data structures in the enactment of certain patterns or systems of action. Information is accomplished through a shared ontology and deontology between institutional actors.

Figure 1 illustrates the essential elements of our theorization of situations in which information would typically be seen as being shared. Such situations of information sharing consist of actors, structures, messages, and actions, all taking place within some environment. Actors (A1 and A2) are represented as cyclical entities. By this we are attempting to signify that an actor is continually reproducing its internal environment in continuous interaction with some external environment. The actor is continuously evaluating the results of its completed actions on the external environment and feeding back such evaluations to help continuously form its internal environment. Through such continual reconstruction, as well as improvisation, the actor learns or acquires certain conventions which implement decision strategies. Such decision strategies enable the actor to make effective choices between alternative courses of future action within certain environments.

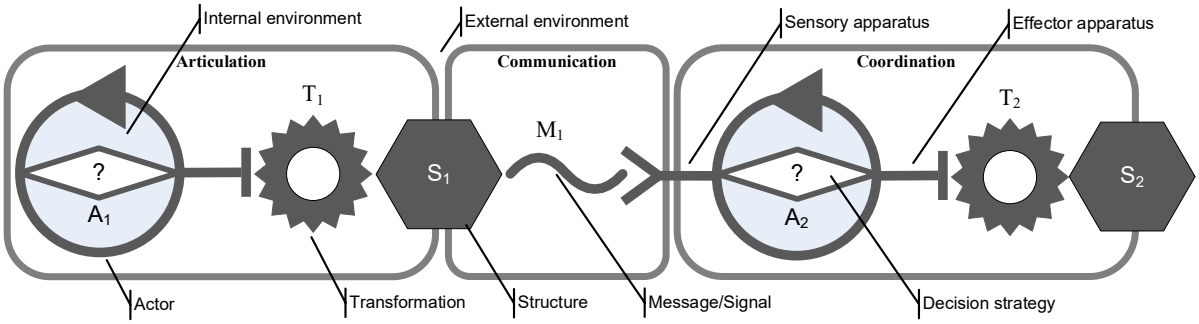


Figure 1. Ideal-Type of Information Situation

We assume here that actors are embodied (Varela, Thompson & Rosch, 1993, Mingers, 2001) meaning that an actors' agency (its capacity to act) involves interaction with its external environment, and that such interaction relies on two critical forms of apparatus making up the body of the actor: a sensory apparatus and an effector apparatus. A sensory apparatus consists of a series of sensors which continually monitor differences in the state of the external environment. An effector apparatus consists of a series of effectors that allow the actor to perform instrumental action in relation to this external environment—to manipulate structures within the external environment and through so doing to change the state of the external environment.

Consider the minimal situation in which an actor A1 articulates some physical structure S1 using his/her effector apparatus. This corresponds to a domain of action we refer to as the articulation domain. The articulation T1 of structure S1 is sensed by the sensory apparatus of some other actor A2. The sensed physical state of structure S1 serves to communicate, through acquired conventions, some message M1 to actor A2. These actions take place in what we refer to as the communication domain. Finally, the message M1 acts as a stimulus to the transformation T2 of some structure S2 within some work or coordination domain. This coordination may lead to further articulation of S1 in the articulation domain, and so on.

Consider one instantiation of this abstraction of an information situation, visualized in Figure 2, and which is taken from our case study. An actor A1 (an outbound logistics manager) articulates a physical structure S1 (an electronic packing list) in interaction with some IT system. The articulation of structure S1 is sensed by the sensory apparatus of another actor A2 (an outbound logistics operative) in interaction with the IT system. The sensed physical state of structure S1 serves to communicate through certain acquired conventions some message M1 to actor A2. The message M1 directs him to manipulate some structure S2 within the coordination domain; namely, to load some shipping item. But this transformation only occurs if the actor evaluates both the content and the intent of the communication and decides to take the action communicated in the message. This coordination may lead to further articulation of structures such as S1 in the articulation domain, and so on.

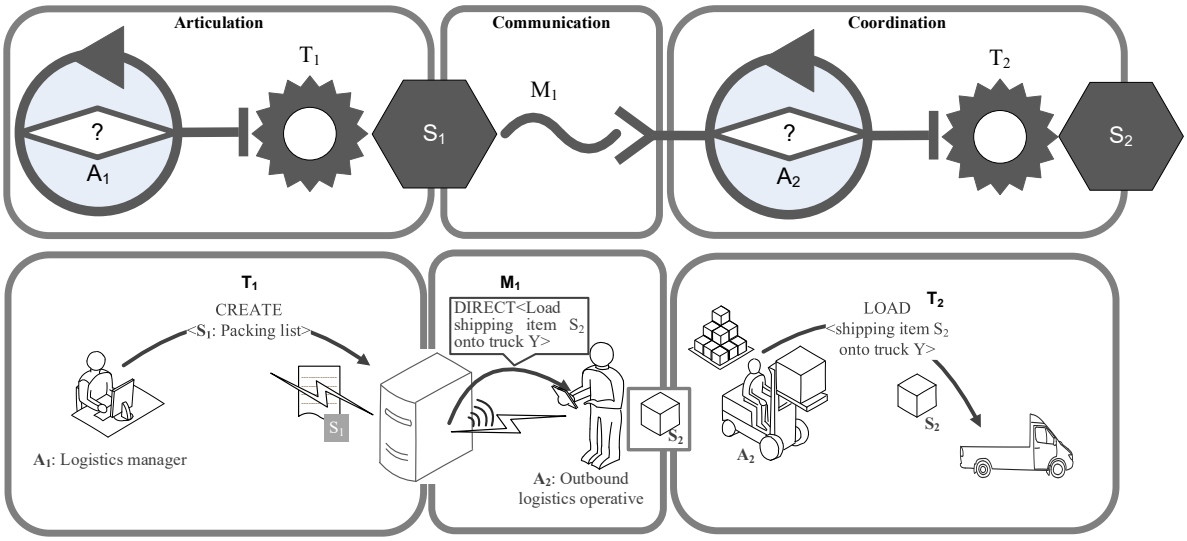


Figure 2. An Information Situation in the Supply Chain

4 Perspectives on Information

In relation to this ideal-type of information situation we may ask where lies information? From an analysis of the literature on the nature of information, described in some detail in previous work (Beynon-Davies, 2013b), we discern at least five distinct perspectives on information positioned against different elements within this ideal-type: information lies in structures, in the organization of signals, in the coding and decoding of signals, in shared intentionality and in coordinated action.

4.1 Information Lies in the State of Structures (Environment)

One particularly prevalent characterization of information important within recent branches of the physical sciences is to think of information as fundamental "stuff" which helps any physical system maintain organization (Stonier, 1994). This is what Boell (2017) refers to as the physical stance on information. As such, information is faceted as a phenomenon independent of the actor and associated with the state of physical structures (such as S1 and S2) in the environment.

4.2 Information Is in the Signal

Another important conception of information locates it within the signal which conveys some message. This conception which Boell (2017) refers to as the objective stance on information underlies the information theory of Shannon & Weaver (1949). According to such theory, information lies in the physical differences formed in the substance of some signal which conveys some message (M1). Information is associated with the degree of order (negentropy) in the signal.

4.3 Information Is in the Coding and Decoding of Signals (Message)

Another particularly dominant perspective is to conceptualize information as the act of interpretation of some signal by some actor(s). In this sense, which Boell (2017) refers to as the subject-centered stance, information is seen as being created within acts of sensemaking by individual actors (Boland & Hirschheim, 1987). In this guise, it is faceted as a subjective phenomenon, bound to actors. Here, information is located within some processing

undertaken within the internal environment of actors—particularly with the information or encoding of the message as a signal by its sender A1 and the associated information or decoding of the message by its receiver A2.

4.4 Information Is in the Shared Intentionality (Actors)

More recently, information has been considered an intersubjective phenomenon; reliant on the negotiation of collective (Searle, 1983) or shared intentionality (Tomasello & Carpenter, 2007). Boell (2017) refers to this as the sociocultural stance in which information is considered an intersubjective accomplishment among communities of actors. Here, information is related to the shared ways that actors build an aboutness between sensed aspects of the environment and mental states. In our ideal-type, one aspect of such collective intentionality involves the aboutness between the state of the environment S1 and some internal state that causes the actor to emit the message M1. In turn, message M1 becomes a state of the world that causes some change to the inner state of a receiving actor A2, causing him or her to effect further transformations of the environment. Shared intentionality is therefore evident in the common conventions with which actors both sense and effect transformation of their environment.

4.5 Information Is in the Coordination (Joint Action)

Finally, we should mention the most radical position, which some have seen as the proposal that, at a fundamental level, information does not exist (Beeson, 2009). Stimulated by the work of Maturana and Varela (1980) and their idea of an autopoietic (self-producing or self-organizing) system, this viewpoint, which is not covered in Boell's (2017) framework of stances, maintains that information is merely a convenience imposed by observers on situations of behavioral coordination through structural coupling. In this sense, we observe patterns of order in some situations, such as the one we have considered in our ideal-type. But such patterns merely correspond to invariances between the actions of certain actors in relation to the environment. We impose upon such patterning the convenient idea of information being conveyed or communicated or shared as a useful way of accounting for the behavioral coordination that corresponds to such invariances.

5 What Information Is

It is evident that the literature on information sharing tends to adopt one or more of the first three positions on the nature of information evident in our ideal-type of information situation. Information is either equated with the structure of stuff, solely with the order inherent in some signal or sometimes also with the coding and/or decoding of a message within some signal. For instance, in a classic paper by DeSanctis and Poole (1994) they begin their introduction by stating that "development and evaluation of technologies to support the exchange of information has become a research tradition within the organization and information sciences". These positions in isolation, or in combination, make it valid to speak of the transfer of information as physical substance and the possible sharing of codes by which messages may be constructed as differences within such substance.

However, we want to suggest that adopting solely these aspects of information situations is not only limiting, it frequently serves to obscure ways in which transformation of physical substance necessarily serves to scaffold systems of action. In this manner, the literature shows bias towards the material and objective facets of information, while undermining the subjective, intersubjective, and coordinative facets of information. In doing this, the literature tends to conceptualize information as stuff that can be separated from both the actors and the systems of action in which it is accomplished (Boell & Cecez-Kecmanovic, 2015b). Further, in doing this, the design of information situations become merely a technological act divorced from any consideration of social structures and institutionalization.

Researchers such as Boell (2017) and others (Boell & Cecez-Kecmanovic, 2015a) suggest that the different conceptions of information evident in our ideal-type are in many ways incompatible and that they direct us in different ways to conduct both IS research and IS practice. Based on the abductive reasoning from our case (which we describe in the next section), we wish to propose an alternative position—namely, that it is possible to develop a view of information that encompasses all five positions identifiable within our ideal-type of information situation, but in one holistic, enacted whole. Indeed, we would go further and tentatively suggest that is not possible to engage with information situations effectively in areas such as the supply chain without adopting this enacted viewpoint.

Information is inherently physical in that it comprises physical differences formed in some substance and that conveys some message as a signal. Information is objective because data structures are physical entities that have an independent life over and above the actors that created them. Information is subjective because it involves acts of making sense of certain structural changes in the environment (data structures) by individual actors. Information is also intersubjective in that both the sensing and transformation of data structures rely on a background of shared intentionality among a community of actors. Finally, information is only ever evident ultimately in the consequences or differences that data structures make to the coordination of activities of multiple actors working in different places and at different times. However, each conception of information is only valid in terms of the dynamics of

the whole of some situation of enactment and not as part of some system of enactment: structures, actors, messages, actions, and environment.

6 A Case of Information Sharing

This section describes a piece of research in which we have been exploring the issue of information sharing in relation to an international supply chain. Part of the reason we were provided access to people working within this domain was because information sharing or information flow between the two companies was, and still is, seen as problematic. We detail both the methods used and context of the organizations involved in this supply chain. This leads us to provide a narrative description of a critical bounded area of this supply chain and some problems with information sharing identified from our analysis. Our narrative is limited to part of our supply chain merely because of the constraints of presenting an understandable piece within the constraints of a journal paper. Similar information problems were experienced across aspects of the supply chain not described here.

Data was primarily collected through a series of semistructured interviews with various people occupying key roles within supply-chain activities run between these two companies. All the interviews were conducted in a face-to-face manner and usually lasted for about 2-3 hours. Interview notes were then written up before being sent back to company informants for validation. Table 1 lists our key sources.

Table 1: Sources of Data Collection

Interviews ***(first round)***	**Interviewees (role/name abbreviations)**	**Company**	**Duration (hrs)**
	Global head of strategy and innovation, logistics (LA)	X	2
	Global corporate governance manager (DP)	X	2
	UK head of logistics (WR)	X	2
	IT system development manager	X	3.5
Interviews (second round)	Warehouse manager (BG)	X	2.5
	Inbound logistics manager (HJ)	X	3.5
	Outbound logistics manager (MD)	X	3.5
	Reverse logistics manager (CV)	X	1.5
	Corporate key account manager (PN)	X	1.5
	Country manufacturing manager (HD)	A	2.5
	Country supply chain partner (JE)	A	2.5
No. of site visits	3		
No. of system demonstrations	4		4
Attendance at company meetings and workshops	2		5

There were two rounds of data collection. The first round was used to gain an overview of the supply chain operated by the case company in the UK and to explore with informants their understanding of what information flow meant to them and why they felt it important to supply-chain activity. The second round focused more particularly on exploring the exchange of data structures within the supply chain and certain problems experienced with the articulation of such data structures. Therefore, the interviewees that engaged in our first round of interview were senior executives at the corporate and country levels, as it was felt that they were best positioned to offer strategic insights regarding supply-chain challenges and issues faced by the company, as well as the impact of these challenges on business performance. Interviewees from the second round consisted of managers dealing with supply-chain planning and execution at the operational level. These organizational actors were felt to be the most suitable informants to provide detailed accounts of what data structures were being shared within operational processes and how such data structures were being used by actors within the supply chain.

Our data collection was further enhanced by attendance at a company-organized workshop focused on understanding information management issues arising within this interinstitutional domain. We also attended a series of demonstrations of the various IT systems used by our case companies as well as observing some of the work flow that these systems support. Use of documentation provided on things such as key performance indicators offered us insight into how well the supply chain is perceived to perform in terms of cost, lead time, adherence to schedule, quality and service. Finally, frequent email communication was used between researchers and company informants to follow up and clarify any ambiguities that were not resolved during interviews. Such data triangulation facilitated the validation of data through cross-verification and helped to reduce any bias induced by a single source, thus providing more robust research insights (Benbasat et al, 1987; Stuart et al, 2002).

The focal company in this supply chain was Company X, a multinational logistics service provider that manages several supply chains in various sectors, such as fashion and telecommunications, for its clients. Its partner in the case study was a major player in an asset intensive industry (hereafter referred to as Company A). Company A was a world-leading telecoms provider and supplies network equipment such as optical network terminals, fiber-optic cabinets, cables, and drums to telecommunication carriers.

At the commencement of our research, Company X had been working with Company A for one year and was responsible for handling inbound logistics, warehousing, and outbound logistics activities for Company A. The scope of the case description in the current paper covers inbound logistics, outbound delivery, and demand forecasting. However, we focus particularly on the management of inbound logistics in which goods were delivered from a factory in Hungary to a warehousing facility situated in the UK. This warehouse then managed outbound deliveries of goods to customers of Company A in the UK. Figure 3 visualizes the pattern of articulation evident in this case. Each cell describes certain transformations of data structures by designated actors. Dotted arrows indicate the sequencing of articulation. The pattern commenced when an email from the European factory of Company A, based in Hungary, was sent to Company X by a so-called "in-plant" supply-chain coordinator. This in-plant coordinator was a representative sent by Company X to work on-site at Company A's factory. His or her primary role was to support communication between the manufacturer (i.e., Company A's factory in Hungary) and the logistics service provider (i.e., Company X in the UK). This role managed the delivery of finished products from the manufacturer to Company X's warehouses in the UK.

The email sent by the in-plant coordinator was a prealert of shipment to Company X. A shipping advice was attached to the email that identified purchase order number, trade term, the number of cases, transport mode, pick-up date, and estimated date of arrival of the shipment. A delivery note, as a Microsoft Excel attachment, was also included within the shipping advice and detailed high-level customer-oriented data associated with the shipment such as the sender, consignee address, delivery site number, delivery date, details of the items shipped, and any special instructions.

Upon receipt of this email, the inbound logistics coordinator in Company X forwarded this email with attachments to Company A's logistics manager based in the country receiving the shipment, who used it to update an inventory record in A's supply-chain management system. This record detailed the shipment at box or case level and included data items such as storage location, box name, item number, quantity, box status and an item flag.

Following this update, the supply chain management system of Company A automatically generated an electronic data interchange (EDI) link that updated Company X's warehouse management system by producing a data structure, known as a packing list. Through this data structure, which contained more detailed product related information at an item level than the delivery note, the whole order details were then available to Company X's inbound logistics team. A packing list detailed a customer reference number, a purchase order number, and a list of cases.

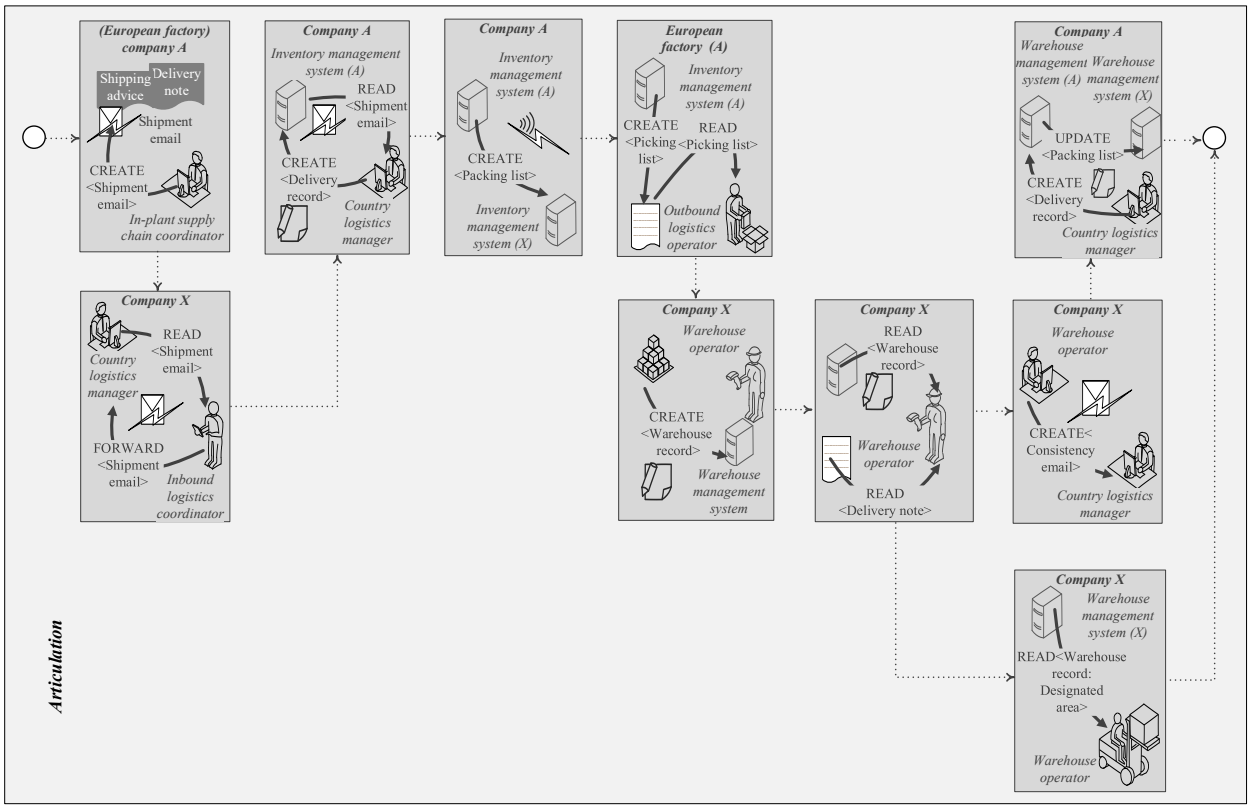


Figure 3. Pattern of Articulation in Our Supply-Chain Case

Each case had a specific reference number and might contain a few items. Further, each item was detailed in terms of a part number, model, item description, serial number, quantity, weight, size, and volume dimensions, as well as a destination reference number. The in-plant supply-chain coordinator produced a picking list some time later within the outbound logistics process performed at Company A in Hungary. This directed outbound logistics people within the Hungarian factory of Company A to load identified items onto particular trucks for dispatch. Shipped items were each tagged with a bar code, which, upon arrival at Company X's warehouse, were scanned by inbound logistics operatives into Company X's warehouse management system. Such actions created warehouse records detailing what the products were and where they had been assigned in the warehouse.

Items on delivery trucks were then checked against the delivery notes carried by delivery drivers, and which were produced at the factory of Company A at the time the trucks were loaded. Consistent shipments would be allocated to designated warehouse areas for dispatch. The warehouse management system would work out an optimum location based on the size, weight, and volume of shipments. In the case of inconsistent shipments, the whole batch of items detailed by the relevant packing list would be kept on hold until Company A's warehouse manager updated the relevant data structure.

7 Problems in Information Sharing

Within this case narrative there are many apparent situations in which information could be said to be shared between supply-chain actors. However, in speaking with informants, it soon became apparent to us that many such situations of apparent information sharing were perceived as problematic.

As a key example, certain problems can occur with the consistency of shipments. For example, Company A's factory may not produce enough items due to machine breakdowns, lack of raw materials, etc. Alternatively, changes to the order quantity may be communicated to the in-plant supply-chain coordinator at some point in the outbound logistics process by Company A. Such exigencies create inconsistencies in the delivery of shipments. For instance, a certain delivery may arrive early, causing it to be held for some time before unloading, or a shipment may arrive late causing uncertainties in the assignment of labor. The consequence of this is that there is a frequent mismatch between the data structures exchanged and the activities occurring within the supply chain. Specifically, there is a frequent disparity between the packing list as held by Company X and the items dispatched on a nominated trailer by Company A. Any inconsistency between the data pertaining to items delivered as compared to the items detailed on the delivery note are corrected manually by organizational actors. This involves the

inbound logistics coordinator contacting Company A's country manager via email and indicating the exact number of items received. The manager then adjusts the record held in Company A's warehouse management system, which updates Company X's warehouse management system via the EDI link.

But this is not the only problem of information flow evident in our case. For instance, when an order needs to be dispatched from the warehouse to Company A's client, Company A will send a delivery note generated by its supply-chain management system to Company X's outbound manager. This delivery note dictates items to be picked (i.e., what item needs to be picked from which box) and dispatched as well as the clients' address, project name, contract reference number, and special loading instructions. Picking a whole box is usually quite straightforward. However, problems tend to happen when Company A breaks the box into a partial order. This means that only a few items will typically be picked from a single box. For example, a delivery note sometimes may give the following instructions: pick one piece of item A from box 1, pick one piece of item A from box 2, pick two pieces of item A from box 3, etc. Box 1 itself would normally have sufficient amounts of item A to fulfil the picking request.

Another problem experienced is in the handling of urgent orders. Frequently Company A will ask Company X to assign priorities to what it designates as urgent orders. Company A would normally pay a premium rate for customs clearance and speedy delivery (for instance, same- or next-day delivery to its clients) for such orders. However, on many occasions, Company A will request that urgent orders be put on hold at their last-mile delivery stage. Frequently and subsequently, Company A may then change the status of the order from being urgent to normal. This change in signification creates resource and capacity issues, double-handling, as well as frustration among actors at Company X.

Finally, sharing demand forecast is perceived in the operations management literature as being one of the most effective mechanisms for ensuring efficient supply-chain management. However, this instance of information-sharing practice, although observed in our supply-chain case was perceived as "inaccurate", "useless", and "unhelpful" by Company X in terms of enabling them to cope with demand peaks and troughs from Company A. The demand forecast is shared on a quarterly basis via email between Company A and Company X and consists of details of quantities of products expected to be delivered to various clients for up to four weeks ahead. However, according to the warehouse manager and inbound logistics manager at Company X, there is normally a large deviation experienced between what is being forecast and what eventually happens. Since quantities forecast for delivery to designated clients were often the same for several weeks ahead, they suspected that many such forecasts were just "made up".

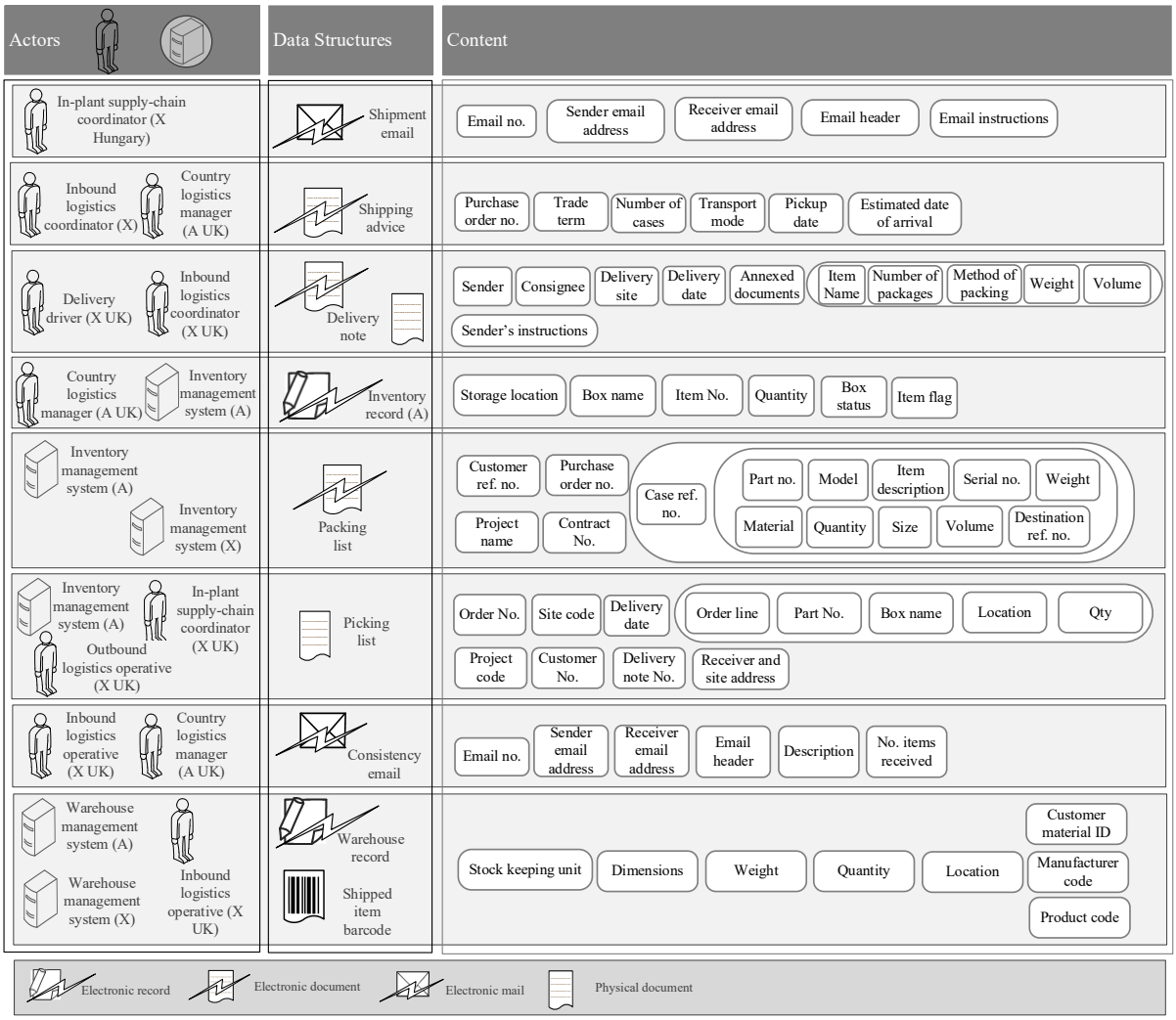
8 The Ontology and Deontology of Data Structures

In this section and the one that follows we begin to reconstruct an account of our case, which is both faithful to our ideal-type of information situation and indicative of how elements within this ideal-type, as a unity, are critical to the constitution of institutional action. We begin by considering the nature of the structures within the institutional environment that serve as a critical foundation to any conception of information sharing—data structures. Our case study of an international supply chain has many instances of data structures (such as packing lists) being exchanged. However, the exchange of data structures does not equate to information sharing—information must be accomplished with and through data structures. We will show that data structures serve as communicative acts and that the messages of content and intent conveyed by such structures act as critical coordination mechanisms both within and between institutions. This account of the accomplishment of information with and through data structures by a multitude of dispersed actors is critical to what we refer to as institutional scaffolding (Beynon-Davies, 2015). However, such scaffolding is, by its very nature, prone to occasional breakdown. The idea of institutional scaffolding is addressed in the next section. Within the current section we contrast the conventional view of data structures with one that sees them as constitutive of institutions; this suggests a social ontology view of data structures built on the work of Searle (2006; 2007).

The term data structure is used broadly to refer to a systematic form for organizing data. Treated purely as artifact, a data structure can be considered a set of data elements, which in turn consist of a set of data items (Tsitchizris & Lochovsky, 1982). For instance, in our case study various warehouse management systems involve the manipulation of inventory files (data structures), which consist of inventory records (data elements), which, in turn, consist of inventory fields (data items). Table 2 provides a list of data structures evident in our case study along with corresponding detail of which actors within the supply chain articulate such data structures and what such structures are composed of in terms of data elements and items. Conventionally, and as conceived in the dominant literature, a data structure is viewed purely as a technological artifact. Data structures or their elements are taken to represent propositions about things in some institutional reality. The institutional reality is also assumed to be observer-independent, meaning that it is the same for all actors. Hence, in terms of our case, a picking item, which relates a given identifier for a shipping item with a given identifier for a truck, serves

as a proposition about these things in the reality of our international supply chain. Within formal logic, data items as propositions may take only one of two values—namely, true or false. We either assert the truth of a given proposition by writing a data element or data item to the data structure, or we retract a given proposition by deleting the corresponding data element or data item from the data structure. This implies that the state of a data structure at any given time consists of true statements about the real-world domain it represents—in this case the loading of shipping onto transportation. This so-called correspondence view of truth implies that there is a necessary separation between institutional reality and data structures. It also implies that a data item as representation is taken to correspond to some real-world thing, or more likely a set of things important to some institutional reality.

Table 2: Data Structures Within Our Case



9 A Social Ontology View of Data Structures

We have made the case in previous work (Beynon-Davies, 2015) for positioning data structures as critical to institutional ontology through the part they play within communicative acts (Searle 1995; 2005; 2010). As a communicative act a data structure can be considered from several interrelated viewpoints—as a locution consisting of an utterance and proposition, as an illocution, and as a perlocution.

The first viewpoint considers a data structure as a locutionary act—an utterance that refers to or predicates something. Searle (1970) distinguishes between the act of physically creating some form in some substance (an utterance act) and the act of using such form to refer to or predicate something (a propositional act). Consider a simplification of the notion of a packing item in such terms. The material form of a packing item such as [26643 LOAD T0102] constitutes an utterance act—in this case a sequence of characters. However, each utterance within a data element such as this also corresponds to a propositional act because the symbols

comprising the utterance are used to refer to things or to describe things. The use of this packing item as a propositional act relies on the status of the symbols 26643 and T0102 as identifiers. The relation LOAD serves to describe the existential association between these two identifiers within this institutional context.

But each communicative act is not only a locutionary act it is also an illocutionary act. In other words, a data structure, element, or item is typically created with the idea of communicating intent between one actor and others within some institutional context. Hence, a packing item such as [26643 LOAD T0102] is likely to have been created by an actor, such as an outbound logistics manager with a particular intent in mind—to direct that the receiver of this message such as an inbound logistics operative take certain action—namely, that a production container with this identifier should be loaded onto a particular truck.

Finally, every illocutionary act has an effect that Searle refers to as a perlocutionary act. As well as an illocutionary act producing in the receiver an understanding of the utterance, such utterances are also normally intended to produce some effect on the subsequent behavior of the receiver (Searle & Vanderveken, 1985). For instance, by making a directive an actor may get another actor to do something—namely, to load a production container on to an indicated truck.

It should be evident from reading this account that there is an inherent association between the component elements of a communicative act and the three types of action designated in our ideal-type of information situation (Figure 1). Data structures as utterances are physical structures articulated by actors. Elements of such physical structures act as propositional acts in referring to or designating "things", both physical and institutional. This can be seen as constituting the content of some message. But data structures as communications also have intent in the sense of being illocutionary acts. They serve to make assertions, issue directives, make commitments, express feelings, and declare changes to states of the environment. Finally, as perlocutionary acts, data structures get things done, they serve to help people make decisions about how to coordinate their further action within delimited institutional domains.

It should be apparent that what is shared in the part of the international supply chain we have been studying are data structures such as emails, packing lists, and inventory records. The creation, update, and transfer of these data structures are meant to communicate both content and intent between actors working both within the same institution and between institutions. This distinction between content and intent is important because it helps us understand how the same content can be used with different intent by actors. For instance, in our case study, many data structures share aspects of similar content—data elements and items that identify and designate items of manufactured material. Hence, a part or product number is used to identify a material item, while other data items, such as quantity, weight, and size are used to designate properties of the material identified. Therefore, we might think of a standard data element making up a simple data structure within this supply chain as having the form:

[productNo; quantity; weight; size …]

But this data structure can be used for different purposes by different institutional actors. For instance, as a component data element of the data structure of a picking list, this data element might be used to direct picking operatives to select products from a warehouse. In contrast, as a component element of a delivery note, it asserts the presence of a batch of products on a delivery truck.

Figure A1 in the Appendix visualizes what we refer to as the institutional scaffolding of data structures evident within our case material. Vertically, the scaffold indicates the ways that articulation of data structures within our case serve to communicate intent and content to various actors in this international supply chain, and in turn, how such communication facilitates coordination. Horizontally, the figure illustrates the sequencing of information situations, which constitute this way of organizing.

10 The Deontology of Data Structures

An order, delivery, and inventory are all institutional things important to the interinstitutional setting of our case domain. These things are all realized through the articulation of data structures, and such data structures not only refer to and describe things of interest to the relevant institutions, they bring such things into existence for such institutions. However, the ways that facts are instituted in relation to such things is not only a matter of ontology, it is also a matter of deontology. The term deontic is derived from the ancient Greek déon, meaning that which is binding or proper. Its binding quality is provided through power and its exercise. This means that data structures not only scaffold institutional order through the ways that they institutionalize facts (Searle, 2010), but such facts are critical to scaffolding the powers associated with actors taking action within both intra- and interinstitutional orders. Searle (1995) believes that a data structure, data element, or data item (X) serves to count as some institutional thing (Y). The count as relation between X and Y, relies on a collective acceptance among institutional actors of this so-called status function. But Searle then extends this to include the notion that the collective acceptance of some status function imposes a related deontic status onto the X term, which he expresses as (S has P [S does A]). Here, S, an actor

within some institution, is granted power P within a certain domain of action A. P can be either positive power (rights, permissions, authorizations) or negative power (obligations, duties, responsibilities). Relating this to the articulation of data structures we might express this deontic status in its entirety as *We (the institution[s]) accept that S (the actor articulating X) has P (S does/does not do A)*.

This means that, a data item, such as an identifier, and the properties it stands for, need relate to not only a physical thing, such as a person, but to a conceptual and institutional thing, such as a picking item. In this case, the identifier and the data structure of which it is a part relate to a whole series of rights, responsibilities, obligations, and commitments associated with the thing. Hence, the act of placing a product code on a packing list puts in motion a series of responsibilities, which serves to frame certain institutional actions undertaken by nominated institutional actors. This means that the articulation of particular data structures, data elements, or data items carries with it not only ontological assumptions (about what things are seen as existent) but also deontological assumptions (about not only what actors are expected and enabled to do, but also what they are prohibited from doing) (Searle, 2005). One convenient way of thinking about this is that the articulation of a data structure comprises a communicative act that serves, in turn, to prescribe or proscribe certain acts of coordinated performance on the part of designated institutional actors' breakdowns in institutional scaffolding

The term scaffolding, used in the previous section, has been used to refer to augmentations that allow humans to achieve goals that would normally be beyond us. The scaffold helps structure human action by supporting and guiding it. But such scaffolding also serves to discipline or guide such action. Data structures are particularly important to interinstitutional domains such as the supply chain because of the part they play in what we have referred to in previous work as institutional scaffolding (Beynon-Davies, 2015). Within this section we highlight the brittleness of such scaffolding and introduce the idea of breakdowns in such institutional scaffolding as a useful way of understanding various information problems experienced within our case study. The term scaffold is deliberately chosen in relation to the augmentative capacity of data structures. Just like physical scaffolds, institutional scaffolds are temporary, flexible, and portable structures (Orlikowski, 2006). Although we tend to regard our data structures as permanent, they are in fact temporary structures with a lifespan typically determined by the duration of the institutional order they scaffold (Ciborra, 2002). Hence, the packing list as a data structure has a lifespan that corresponds to the movement of certain material between one company and another. The very value of data structures lies in their flexibility. As symbolic artifacts, the general principles of identifying and designating things through data structures, are applicable and adaptable to many different situations. For example, the data structures of delivery note, shipment advice, picking list, and packing list, as we have seen, all share certain data items in common, but these data structures are used for different purposes by different institutional actors. Data structures are particularly portable artifacts in the sense that we can expand and contract them to account for, direct, and commit to action in many different institutional situations. Hence, within the case described, the delivery note is expanded from its original form to a workaround accommodating details of inconsistencies in actual deliveries.

Data structures are necessary because they are generative of institutional facts (Searle, 2006). And such facts effectively constitute the very notion of the institution itself, because they communicate to actors within the institution what has happened, what is happening, or what should happen. Hence, in the supply-chain case, data structures are particularly used to account for supply-chain activities—the past movement of goods, the current movement of goods, and the planned movement of goods between actors of two or more institutions.

The purpose of the articulation of data structures such as packing lists, delivery notes, and warehouse records is to scaffold communication across time and space to multiple actors, sometimes working in different and dispersed institutions. The purpose of such communication is, in turn, to scaffold coordinated action. The scaffolding of data structures within this supply chain relies on two further prerequisites—namely, a shared ontology and deontology. In terms of ontology, when data structures are transmitted across the interinstitutional space, to communicate effectively, actors need to share understanding of what data elements or items of such structures refer to and designate. For instance, the elements or items of a packing list, as we have seen, are used to refer to different things. Hence, a customer reference number identifies a customer, a purchase order number identifies another data structure (a purchase order), and a case reference number identifies a package of products. But data structures not only identify or describe, they also prescribe. The data items on a packing list, for instance, prescribe when and where certain actions should be taken, and frequently by whom.

Finally, data structures, just like physical scaffolds, are potentially dangerous in the sense that the scaffolding of such structures contains within them the potential for breakdown. We use the term breakdown here in the sense adopted in the philosophy of Heidegger (Winograd, 2006, Riemer & Johnston, 2014), which insists that things and their properties are not inherent in

the world but arise only in an event of breaking down, a process in which human actors undergo an experiential shift in which things change from being ready-at-hand to being present-at-hand. Data structures, as we have argued in the previous section, are typically ready-at-hand. They are mundane and accepted augmentations to everyday institutional action. Only when there is some breakdown in the way that data structures scaffold action, do data structures become present-at-hand to institutional actors.

Figure 4 illustrates the way that various instances of breakdown can be understood in relation to a certain brittleness in the institutional coupling between articulation and communication and the coupling of communication to coordination. Within the discussion that follows we describe practical experiences of problems in identification and designation as instances of breakdowns in the coupling between articulation and communication. Likewise, we highlight certain problems with the intention imparted to data structures as breakdowns in the coupling between communication and coordination. The three-dimensional structure in Figure 4 is meant to illustrate that breakdowns can clearly occur within both intrainstitutional scaffolding but also across interinstitutional scaffolding (which is the primary focus of the current paper), which impacts the performance of institutional actors.

10.1 Identifying the Wrong Things

When an identifier from some data structure fails to identify something or identifies or classifies the "wrong thing" in institutional terms, we experience a data structure that is normally ready-at-hand as being present-at-hand. For example, the packing list is clearly an equivocal data structure within our case in that it cannot be trusted in many cases by institutional actors. This data structure typically breaks down in terms of detailing what has happened in relation to the dispatch of items from Company A. In mechanical terms this is evident in a mismatch between the case reference numbers on the packing list and the number of cases on the delivery note. Here, we have a clear example of a breakdown in the coupling between articulation and communication implied by a certain data structure. In other words, there is a lack of coupling between the data structure and what it communicates to diverse actors within this interinstitutional setting—what the packing list asserts as comprising a delivery and what the inbound logistics operative asserts as comprising the delivery.

10.2 Describing Things Inappropriately

Certain shipments, as we have seen, are described by actors within Company A as urgent within transmitted data structures. However, frequently Company A will request urgent orders to be put on hold at their last mile delivery stage and then change the designation shortly after to normal. Designating a shipment as urgent should put in motion a whole series of special actions by Company X warehousing staff—not least of which is to place the shipment in a priority holding bay for speedy dispatch. However, since experience tells warehouse people that most items designated priority items are later assigned nonpriority or normal status, many warehouse staff have become proactive and now typically locate such stock in nonpriority holding bays as a norm.

10.3 Asserting Things That Cannot Be Confirmed

The example discussed previously of the packing list identifying the wrong things acts as an assertion to actors of things as happening when they have not actually happened. Such an interinstitutional breakdown causes problems further up the chain of action in that the activities of numerous people must readjust to the reference problems of this data structure. As a result, time and effort is expended by actors, both within Company X and Company A, in addressing aspects of this breakdown. The workarounds (Alter, 2014) used by various actors within this pattern of action to reconstitute the institutional order also consume resources.

10.4 Committing to Things That Never Happen

The exchange of the demand forecast can be seen as acting as a commitment (intent) between critical actors within Company A and Company X. In other words, the act of articulating this data structure serves as a promise that certain quantities of material will flow between the two companies in the future. However, as we have seen, breakdowns in such commitment have caused relevant actors to mistrust and even to ignore such data structures as a means of guiding institutional action.

10.5 Directing People to Do the Wrong Things

Finally, as a data structure, the picking list generated in relation to a partial order frequently directs the warehouse operative to do the wrong things. The picking list given to a warehouse operative in this situation might direct him to pick three items identified as item 1, item 2, and item 3. There are three boxes or cases at the designated production location each containing 1, 2, and 3. However, the warehouse management system directs the picking operative to pick item 1 from box 1, item 2 from box 2 and item 3 from box 3. This clearly misdirects coordinated action.

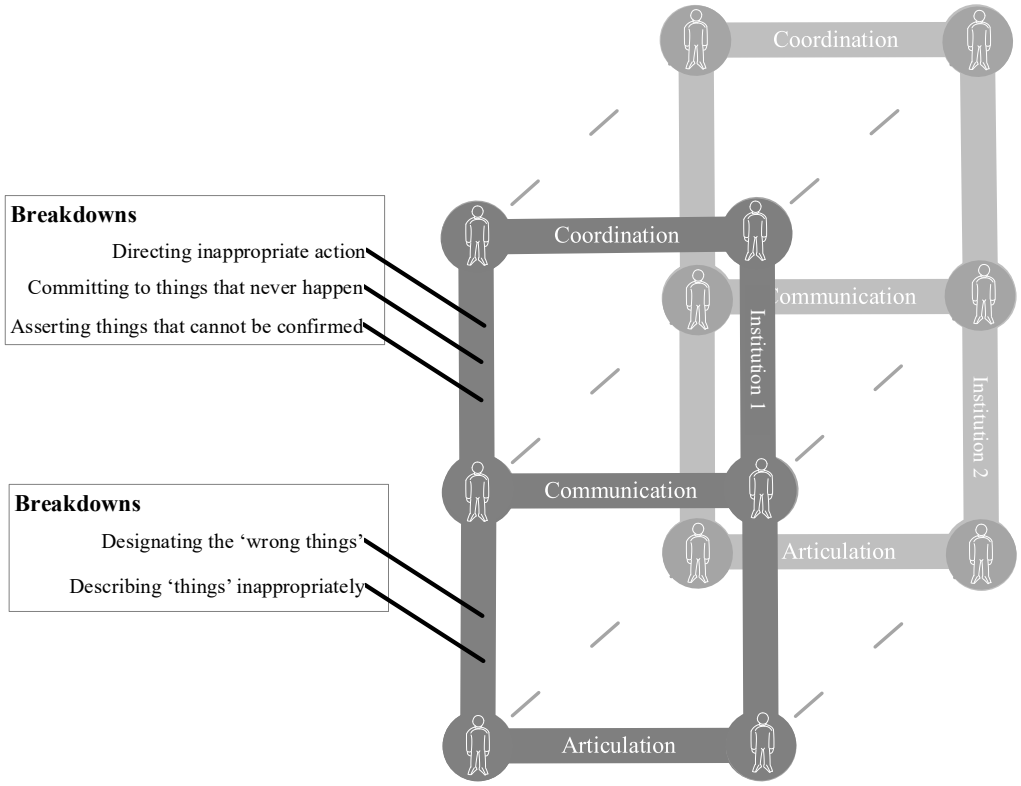


Figure 4. The Scaffolding of Intra- and Interinstitutional Action

11 Conclusion

This paper has sought to deconstruct the concept of information sharing, particularly as this concept is used in relation to supply-chain management. From our analysis of the literature, we identified certain implicit assumptions embedded within extant published material on information sharing.

- That everybody knows what information is;
- That everybody knows that information can be shared;
- That information sharing necessarily improves institutional action;
- That the application of information technology inherently improves information sharing.

We have spent some time questioning these conventional assumptions by examining and analyzing instances of so-called information sharing within an international supply chain and reflecting such instances against an ideal-type of situations in which information would normally be seen as being shared. Our work serves as a challenge to this conventional view and suggests that the fragility of the third and fourth assumptions are built on the fragility of the first and second assumptions.

11.1 Everybody Knows What Information Is

The first contribution is that we have identified the way that most of the literature on information sharing assumes that the concept of information is well-understood. We have used an ideal-type of information situation to demonstrate that there are at least five distinct ways of signifying the term "information". Selecting one or more signifieds from this list tends to privilege certain associations between the signifier "information" and certain aspects of the practical accomplishment of institutional action.

However, the tentative conclusion we draw from our ideal-type of information situation is that information as a practical accomplishment must be a holistic and enacted phenomenon. In other words, all five conceptions of information have an inherent truth, but each conception only gains its veracity within the full context of some system of action. Also, each conception of information is only valid in terms of the interactions or dynamics of the whole of this system of action, rather than any single part of this system of action: structures, actors, messages, patterns of action, and environment.

11.2 Everybody Knows That Information Can Be Shared

The second key contribution is that our work provides greater clarity as to what information sharing accomplishes in practice. Only certain connotations of the term—namely, that information is in the structures, signaling, or perhaps the coding of messages—allow information to be shared between institutional actors and actions. But these connotations tend to blinker the way that we approach information as an institutional phenomenon. Thinking of information as "stuff" lends it an objective quality and blinkers us to thinking that such stuff can be created, transmitted, and stored in a relatively unproblematic manner through technology— even in cases where it is not clear what the sharing of such stuff offers.

It is clear, that when one investigates closely practical instances of so-called information sharing, as we have done through our case, that information is never shared—rather, data structures are exchanged. Information is an accomplishment performed with and through data structures, but information is not equivalent to the notion of a data structure nor is information a necessary consequence of manipulating a data structure. Although information may be accomplished with data structures, in the sense that such structures communicate content and intent between dispersed institutional actors, this is not a given.

Actors within institutions that exchange such artifacts accomplish information with data structures but only through some sharing of not only what things should count as (Searle, 2010) in terms of being identified and described (ontology), but also in relation to what such data structures prescribe or proscribe (deontology) (Searle, 2005). Hence, the concept of improving visibility of information across areas such as the supply chain (Caridi et al., 2014), which is much discussed in the literature on information sharing, is more accurately conceived as the exchange of data structures within the continuing accomplishment of shared ontology and deontology.

11.3 Everybody Knows That Information Sharing Necessarily Improves Institutional Action

The third key contribution is that we have provided a critique of the necessary proposed linkage between information sharing and interinstitutional performance. Clearly, most of the situations in which information is accomplished within and between the institutions described in our case are relatively unproblematic. In such situations, the sharing of data structures is mundane and ready-at-hand augmentation to the daily accomplishment of communication for coordination.

Our theorization allows us to better explain how breakdowns become possible in institutional scaffolding and how such breakdowns have the potential to degrade rather than upgrade performance. More effective coordination of interinstitutional performance is predicated on effective coupling between the articulation of data structures and the communication this entails. As we have seen in our case, exchanging certain data structures can sometimes degrade performance in situations where coupling between articulation, communication, and coordination is brittle. When data structures identify the wrong things or describe things inappropriately, the nature of the structure is only constituted as such within the entire system of action of which it forms a part. Frequently, as we have seen, institutional actors spend considerable time and effort managing both communication difficulties that arise in relation to such data structures or in resolving difficulties involved with the relationship between what such data structures are meant to contribute to coordinated action. Indeed, within our case many of the breakdowns described occurred on a regular and sometimes daily basis within the supply chain and consumed many valuable resources in their resolution. Our perspective on the scaffolding of data structures explains why the exchange of data structures is critically important to interinstitutional coordination but may not necessarily lead to performance improvement.

11.4 Everybody Knows That the Application of Information Technology Inherently Improves Information Sharing

The fourth key contribution is that our abductive reflection of theory against practice leads us to question the assumption widely held that the application of information technology to situations of interinstitutional coordination necessarily improves information sharing, and as a natural consequence causes improvements to interinstitutional performance. Within our case there are many examples of data structures being created, updated, transmitted, and stored much more efficiently through digital computing and communication systems across dispersed locations by multiple actors. But the application of this technology cannot guarantee, in and of itself, the accomplishment of information and consequent improvements in interinstitutional coordination. Indeed, the way that such scaffolding is erected through information technology may serve to degrade rather than improve institutional performance. Hence, without careful design, the speed with which articulation happens may simply increase the speed with which breakdowns occur and need to be dealt with.

Appropriate design of information technology can undoubtedly improve communication and coordination, but only if designed with the scaffolding of data structures in mind. For example, one solution to certain

supply-chain breakdowns described in our case material would be to involve the in-plant coordinator more closely in the packing and dispatch of goods. This would allow them perhaps to signal to Company X very early on within this system of action when and if there is a potential problem with a designated delivery. Such a change to the pattern of interinstitutional action could largely work through current IT infrastructure, but might help improve the agility of this supply chain in terms of its ability to adapt to further exigencies.

11.5 So, What Is Information Sharing and How Does It Relate to Institutional Action?

We have demonstrated through our deconstruction and reconstruction of the concept of information sharing that what the literature presumes to be information sharing between institutions is more accurately described as a set of mutually coupled domains of action evident between two or more institutional settings, which we refer to as scaffolding through data structures. From a close examination of situations of so-called information sharing experienced and practiced within an international supply chain, it is evident that what is exchanged in this interinstitutional space is not information but various forms of data structure. The use of such data structures by institutional actors is meant to communicate both intent and content to such actors. Such communication, in turn, is meant to coordinate the instrumental action of institutional actors.

However, the effective use of data structures for communication and in support of coordinated action presumes a shared ontology between institutional actors. Such actors must share understandings about not only the structure of data but what such data are meant to refer to and describe. The sharing of data structures is also predicated on a shared deontology. This is because the exchange of data structures is not only used to identify and describe, it is also meant to prescribe and proscribe certain shared institutional actions on the part of actors working within different institutions.

So, in conclusion, we would question whether the term information sharing offers any real utility to the IS community. Information can never be shared, but information is always based on the presumption of shared ontology and deontology existing among a community of actors. Information can also never be isolated from situations in which it is accomplished and can never be equated with the application of certain technologies. This suggests to us the need to reorient both our studies of and our engagement with the key locus of our discipline—systems of information.

11.6 So, How Should the IS Community Take This Work Further?

Our deconstruction and consequent reconstruction of the concept of information sharing suggests numerous avenues of further theoretical and empirical research for the IS community, as well as certain concerns for IS practice.

Theoretically, there are certain evident synergies between notions of institutional scaffolding and structuration (Giddens, 1984). Research needs to be undertaken into the question of whether the perspective of institutional scaffolding helps resolve some of the traditional difficulties of applying structuration theory to examples of information technology application and use (DeSanctis & Poole, 1994, Markus & Silver, 2008). As a theory developed originally to explain the constitution of society, structuration has been utilized within IS primarily as a means of providing macrolevel explanations of technological innovation. Our theorization of institutional scaffolding preserves many of the constitutive properties of structuration but offers researchers ways of unpacking the microdynamics of technological innovation in practice.

Our account of the ideal-type of information situation could also be seen as offering a useful way of engaging with a network of affordances between IT use and its effects on work (Volkoff & Strong, 2013). Much IS research proposes the organization-level affordances of IT usage. This implies that in some way manipulation of an IT artifact has effects within the area of work, such as improving or supporting group collaboration. Clearly an IT artifact (such as a logistics IT system) affords actors certain actions—such as being able to make an electronic packing list. However, the affordances of structures within the IT artifact apply purely within the domain of the IT artifact itself. The concept of affordance cannot explain how articulations performed in relation to the IT artifact are used as cues or triggers to further action by actors in another context or domain—the domain of coordinated work. Our theorization of information situations offers a useful way of bridging this affordance divide. Or alternatively, our account of the accomplishment of information might be fruitfully unpacked in terms of the semiotic analysis proposed by Mingers and Wilcocks (2014).

Empirically, much further research is needed to apply, test, and refine this way of understanding the positioning of information technology within interinstitutional scaffolding in terms of further studies with organizations. We have focused on information situations in the supply chain, but other domains of action need to be examined to see if the same way of reconstructing information sharing holds. For instance, proposals have been in place since the 1990s to share a common patient record between different parts of the health service in the UK, such as general practices and general hospitals (Nygren & Henriksson, 1992; Kohli

&Tan, 2016). However, part of the problem with this idea has been the difficulties experienced in agreeing on a common ontology and deontology for the scaffolding of this data structure between diverse institutional stakeholders involved in the provision of national healthcare. In other words, decisions as to what should go on a common patient record or what should be omitted from such a record can only be taken in terms of the action, or more likely actions, taken with this record. In other words, you cannot design an effective electronic patient record without knowing not only who is likely to use such a record and how, but for what communicative purposes and to initiate what sorts of coordinated action.

Our typology of breakdowns in institutional scaffolding has also been abduced largely in relation to our engagement with the case material presented. There is opportunity not only to test whether this typology is relevant for understanding other situations of information sharing but also in refining and extending it. Finally, our linkage between breakdowns and degraded interinstitutional performance is based largely on the inference that such events occurred regularly and frequently within our studied supply chain, leading us to speculate on the considerable resources devoted to resolving such breakdown rather than achieving normal courses of action. This inference clearly needs to be substantiated in studies of domains outside of the supply chain.

The concept of information sharing would appear to have much in common with notions of data administration, data sharing, and data integration. In these areas, conventional notions of data and data structures in terms of a correspondence view of representation tend to dominate. Therefore, research needs to be conducted into whether the conception of institutional scaffolding offers a useful way of deconstructing such data practices. There is also much need to investigate whether our way of thinking through what information sharing means in practice helps better explain the role of electronic document standards as structures of compliance between domains of institutional action (Markus, Steinfield & Wigand, 2006; Steinfield, Markus & Wigand, 2011). Much potential also exists for exploring how company mergers and public-sector reorganization is predicated on the feasibility of erecting appropriate interinstitutional scaffolding through data structures.

Practically, our unified conception of information sharing would suggest that organizations, such as the ones described in our central case, are in a continual state of imbrication (Ciborra, 2006) in relation to both their intra- and interinstitutional scaffolding (Bowker & Leigh-Star, 1999). If we consider such scaffolding as designs for interinstitutional coupling, then such practical situations of institutional accomplishment, are critically interesting and important to the IS practitioner community. In practical terms, it is therefore important to further investigate what our way of unpacking information situations contributes to generating more effective suggestions for dealing with the issue of what good design means in relation to institutional infrastructure. For instance, our theorization of the scaffolding of data structures would suggest certain ways of approaching the design of IT infrastructure as well as evaluating its effective use, which is not present in current practice (Volkoff & Strong, 2013).

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Appendix

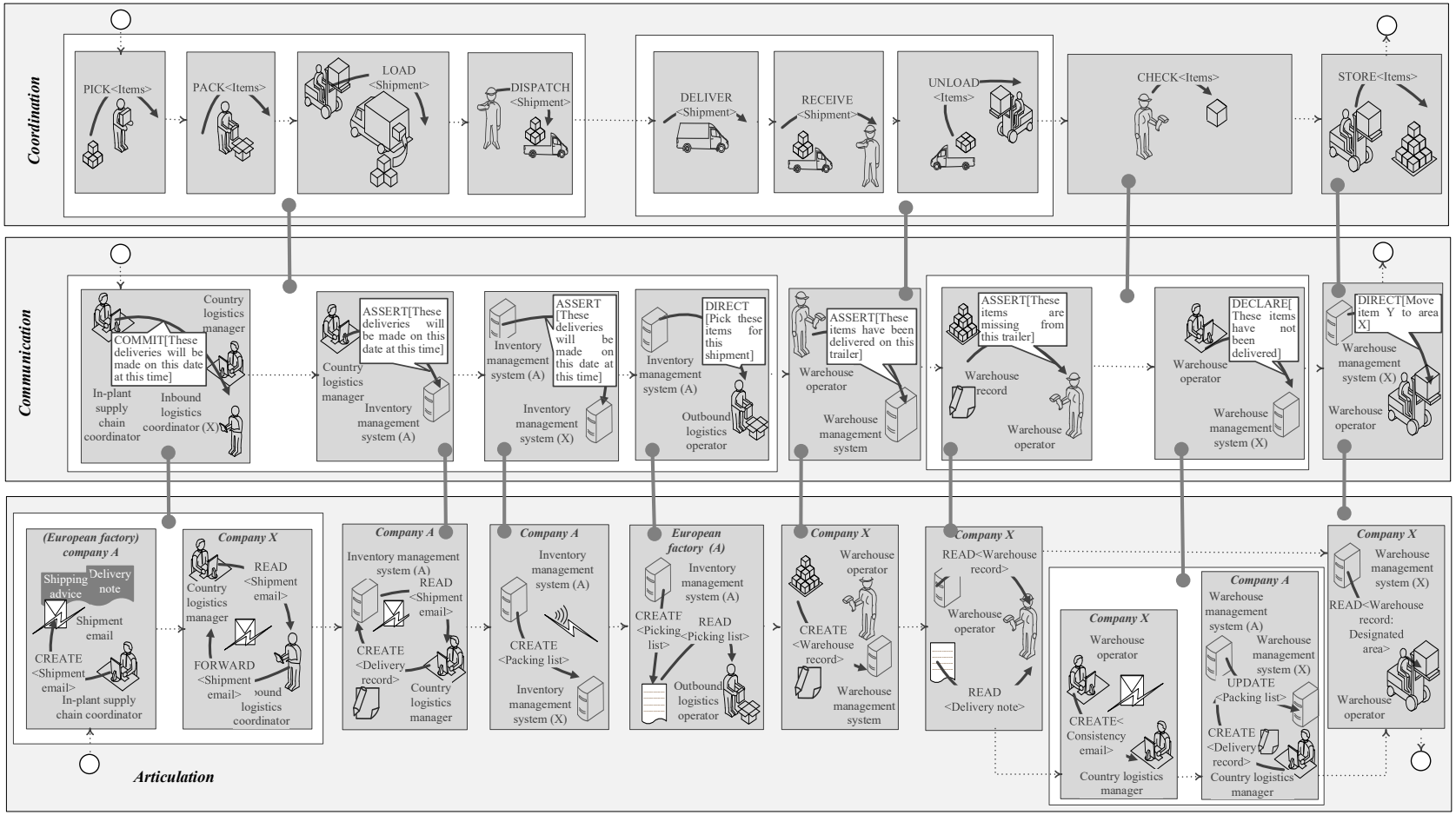

Figure A1. The Interinstitutional Scaffolding of Data Structures Evident in our Supply-Chain Case

About the Authors

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Yingli Wang is a senior lecturer at Cardiff University in logistics and operations management. Before embarking on her academic career, she worked at Nestlé China in various senior managerial roles. In over a decade of research work she has engaged with technological innovation in over 70 organizations including shippers, logistics service providers, IT service providers, and manufacturers. More recently she has begun exploring how technological innovation may help address "wicked" problems and "grand" challenges such as food poverty and health inequality.