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# Information Sharing Beyond Firm Boundaries: A Taxonomy and Research Framework

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## ABSTRACT

Information Technology has brought significant business benefits to organizations. IT has allowed greater information sharing within and across firms leading to performance improvements. However, a comprehensive understanding of how information sharing beyond firm boundaries results in business value for the firm and what factors affect the resulting business value is still lacking in both research and practice. This paper presents an integrated taxonomy and a research model that provides a framework for studying business value of information sharing beyond firm boundaries.

## Keywords (Required)

Information Sharing, Business Value, Firm Boundaries

## INTRODUCTION

The old adage: “Information is power!” is representative of how information has traditionally been viewed: as closely guarded secrets, as assets that need to be protected and even as something to be hidden and disclosed only when mandated by regulatory requirements like financial disclosures. A popular example of this approach of closely guarding information within the firm is how Apple fosters a culture of secrecy. As the Wall Street Journal noted: “*Apple keeps customers, workers and business buyers in the dark, leading to frustration*” (Wingfield 2006). Starting from Apple’s product development plans - even code names for future products, to the health status of CEO Steve Jobs, Apple has created such a culture of secrecy that the New York Times wrote that “... *to be blunt about it, ... Apple simply can’t be trusted to tell [the] truth ...*” (Markoff 2005; Nocera 2008).

On the other hand, numerous contrasting examples can be found of firms that are running more open and transparent businesses that share surprising amount of information with suppliers, partners, customers and even to general public (Kumar 2009). Peter Drucker identified information sharing as a key element of the “*new organization*” (Drucker 1988). Netflix shared 100 million movie ratings to anyone who wants to attempt building a recommendation system that can outperform the in-house system at Netflix (Hafner 2006). Google has shared the entire source code for Android, the operating system for mobile phones, as open source software that can be viewed, modified and further developed by any interested person (Claburn 2008). The business model of Prosper.com, a peer to peer financial market, depends upon sharing anonymized credit history details of potential borrowers and letting the distributed community of lenders make decisions regarding creditworthiness of the borrower (Hof 2006; Kumar 2007).

The examples above are a part of the growing trend towards firms sharing more information beyond firm boundaries to outside entities including suppliers, partners, customers and even general public. However, information sharing beyond firm boundaries is not without business objectives - it involves specific business benefits for the firm. Information shared by firms to an outside entity results into positive business value for the firm when the shared information is utilized by the entity to make decisions that positively influence the common operational elements between the firm and the entity. Increased information sharing beyond firm boundaries is enabled by recent advances in Information Technology (IT) that allow firms to share large volume of data with a large number of recipients at low cost. Technologies like Service Oriented Architecture (SOA) allow firms to seamlessly connect with corresponding systems on the suppliers or partners side and share information efficiently (Kumar, Dakshinamoorthy et al. 2007).

Even though IT, especially emerging technologies like SOA and the Web2.0, is central in the growing trend of information sharing beyond firm boundaries and the resulting business value, there is little research that addresses technology’s important role. Further, research on business value of information sharing beyond firm boundaries is dispersed across several different research streams such as Management Information Systems (MIS), Operations Management, Knowledge Management,

Business Strategy and Decision Sciences. It is important that the disparate research streams be integrated into a single vocabulary and a unified research model is generated that depicts the current level of understanding. This paper attempts to address this need by building an integrated research model of business value of information sharing beyond firm boundaries. We begin by extracting the relevant research themes and constructs from the extant literature.

## CONTEMPORARY EXAMPLES

We consider four contemporary examples to illustrate information sharing beyond firm boundaries: Dell, eBay, Google and Prosper.com.

### Dell: Sharing Information with Suppliers

Dell Inc. is one of the world's largest manufacturers of personal computers (PC). Dell pioneered the direct marketing approach coupled with a make-to-order and just-in-time manufacturing system. Dell manufactures PCs configured to customer specifications that are manufactured after customer places the order. Dell has a very lean supply chain with less than 72 hours of inventory across its entire operation (Breen 2007). To achieve this Dell has developed extensive capabilities to share information related to quality, relationship management, design, daily production requirements and inventory levels even on an hourly basis with some suppliers (Magretta 1998).

As a customer places an order on Dell's website or other sales channels, the detailed order information is shared with relevant suppliers with details such as expected delivery lead times, component type and delivery destination. Based on the stream of real time information coming from Dell, the supplier can make decisions on its production schedule and batch size to ensure that the delivery is made on schedule without the need for excessive safety stock. Dell benefits by sharing information with suppliers as the orders are fulfilled on schedule while maintaining a lean supply chain with relatively little inventory.

### eBay: Sharing Information with Customers

eBay is the world's largest Internet auction website. Millions of buyers each day bid on items put for auction by sellers on eBay. As buyers and sellers conduct business anonymously, the prospect of a dishonest buyer or seller is always around the corner. A dishonest seller can list a particular quality of product for sale and deliver an inferior quality. Such dishonest participants in the eBay marketplace need to be identified otherwise unsuspecting market participants can fall victim.

eBay shares transaction histories of all buyers and sellers with all market participants in the form of a reputation system to help market participants identify dishonest buyers or sellers (Resnick, Kuwabara et al. 2000). Information such as number of transactions, positive or negative feedback, membership duration etc are shared. Based on this information, market participants can make a decision about the reliability of other sellers or buyers and make appropriate decisions regarding whether to participate in an auction. This provides incentive for buyers and sellers to behave responsibly so as to not accumulate a negative reputation and provides an environment of trust in eBay among market participants.

### Google: Android - Open Source Mobile Device Platform

Google is the world's largest Internet search and advertising company. Android is a software platform and operating system for mobile devices, initially developed by Google and later released as an open source software that can be downloaded, viewed, modified and further developed by anyone (Claburn 2008). Google also provides a SDK (Software Development Kit) so that independent developers can easily develop applications that run on Android. Google even offered prizes totaling 10 million USD for the competition called Android Developer Challenge, for the most innovative application for Android (Krazit 2008).

In contrast to other operating systems like Microsoft Windows, where Windows source code is jealously guarded by Microsoft; Google has released more than 11 million lines of code for Android to public under open source licenses. Google's manager of mobile platform groups elucidated Google's approach: "*We feel fairly strongly, and it's resonating loudly through the industry, that innovation is maximized when no one entity controls a platform*" (Shankland 2008). The response from developers has been strong – within one week of launch, the number of applications available for Android increased from 62 to 167 (Siegler 2008).

### **Prosper.com: Information Sharing in Electronic Markets**

Prosper.com is a peer to peer financial electronic market that individual lenders and borrowers to interact and transact in an eBay like online auction environment (Hof 2006). Borrowers list their loan requests and lenders bid small amounts at a desired interest rate against the listing. If there are enough bids then the loan is originated at the lowest market clearing interest rate.

Peer to peer electronic markets like Prosper.com leverage the “new” Internet or Web2.0, to allow individuals to collaborate and harnesses the collective intelligence and decision making power of large groups of individuals (Oreillynet.com 2007). Prosper.com’s business model depends upon sharing anonymized credit history details of potential borrowers with hundreds of thousands of potential lenders and allowing the distributed community of lenders to make decisions regarding creditworthiness of the borrower and the interest rate to be charged (Hof 2006; Kumar 2007).

Information sharing between Prosper.com and the lender group is central to the operations of Prosper.com. Interest rate charged in Prosper.com is an aggregation of individual interest rate decisions made by lenders. However, unlike a traditional bank, lenders do not have access to information such as detailed credit reports, market research, loyalty programs or previous purchase history. Instead lenders depend on Prosper.com to provide them with information relevant to decision making and base their decision on the information shared.

### **LITERATURE BACKGROUND: BUILDING A TAXONOMY**

Research on information sharing beyond firm boundaries spans several research disciplines. For generating a taxonomy of constructs that are important in studying business value of information sharing, we surveyed the relevant literature in operations management, knowledge management, business strategy and information systems.

The constructs identified through the literature review can be grouped into clusters of similar constructs. Each of these clusters can be considered a component of the overall process of business value of information sharing beyond firm boundaries. We have grouped the constructs into the following four clusters: Origin, Process, Environment and Action. The four components are introduced below:

**Context of Information Sharing:** The first component includes constructs that relate to the objective, enablers and constraints related to information sharing beyond firm boundaries at the firm sharing information. The three main elements of the context component are the objective of information sharing, capabilities needed to effectively implement information sharing and the role of organizational culture in success of information sharing.

**Information Sharing Process:** The process of information sharing includes elements related to how information is shared. Important elements that are part of the process component are the degree of information sharing (transparency), the complexity of the information sharing process, richness of the information medium used for sharing information and the technology platform used to enable information sharing beyond firm boundaries.

**Information Sharing Environment:** Information sharing beyond firm boundaries is conducted within a regulatory and business environment that affects the resulting business value. Three main elements of the environment are regulatory concerns including privacy requirements, incentive alignment between information sharing firm and information recipients and the level of trust between the firm and information recipient. The environment component is crucial in determining the business value of information sharing as it affects the next component - actions taken based on the shared information.

**Action Based on Shared Information:** The firm shares information with the expectation that the recipient will use the information to take actions or make decisions that will result in business value for the firm. The quality of decision making by information recipient can have a significant impact on the resulting business value. Constructs that affect the quality of decision making include learning and information processing including information overload.

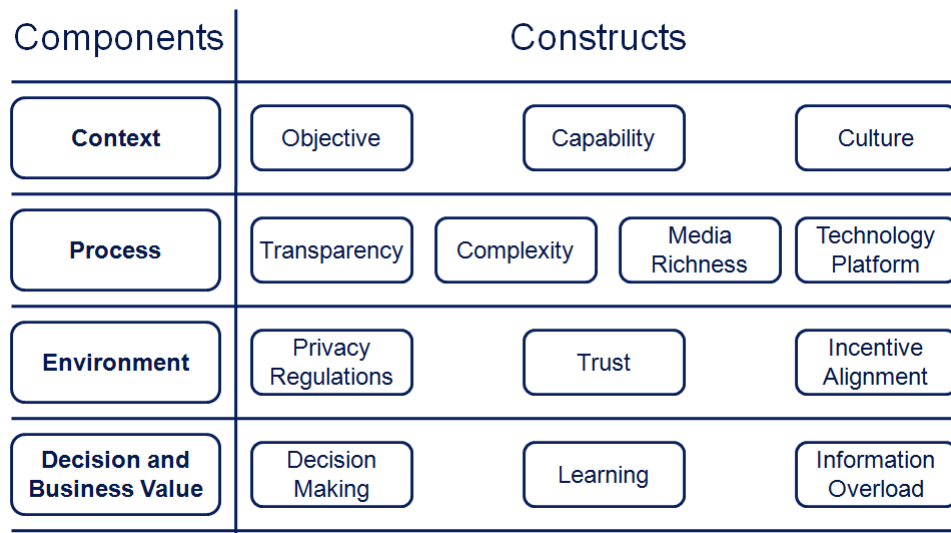
Literature sources for the constructs identified as part of the taxonomy are summarized in the table below (Table 1).

Component	Construct	Literature Sources
<b>Origin</b>		
	Objective	Barrett et al. (1982): Managing boundary spanning processes; Malone (1987): Managing economic activity using markets; Bakos (1991; 1998): Electronic market based business models
	Capability	Barrett et al. (1982), Alavi et al. (2001): Technical capability – inter-organizational information systems, knowledge and content management systems; Widom (1995), Inmon (1996): Information capability - data warehouse and data mining
	Culture	Schein (1996), McDermott et al. (2001): Organizational culture as barrier to information sharing; Sunassee et al. (2002), Holsapple et al. (2000), Davenport et al. (1998): Overcoming cultural resistance to information sharing
<b>Process</b>		
	Transparency	Lee et al. (1997), Cachon et al. (2000), Lee et al. (2000), Yu et al. (2001): Transparency in supply chain; Barua et al. (2004): Degree of information sharing in electronic integration with suppliers
	Complexity	Kim et al. (2006): Importance of complexity in information sharing process; Roberts et al. (2004), Bystrom et al. (1995), Plumlee (2003): Impact of complexity on performance
	Technology Platform	Barrett et al. (1982), Iacovou et al. (1995), Mukhopadhyay et al. (1995): Inter-organizational systems, EDI; Albrecht et al. (2005): Limitations of EDI; Murtaza et al. (2004), Lim et al. (2003): Service oriented architecture
	Media Richness	Mayer (2001), Card (1996), Pu et al. (2003): Advantages of visual interface; Moore (1989), Kozma (1991): Impact of interaction on learning and comprehension; Terdiman (2006), Wagner (2007): Visual interactive media like virtual worlds
<b>Environment</b>		
	Privacy Regulations	Milberg et al. (2000): Privacy regulations; Goodwin (1991; 1992), Phelps et al. (2000): Consumer concerns on privacy; (Hann, Hui et al. 2007): Overcoming privacy concerns
	Trust	Mayer et al. (1995), Schoorman et al. (2007): Integrative model of trust; Goffman (1971), Zucker (1986): Trust in economic transactions; Buskens et al. (2002): Improving the level of trust; Zaheer et al. (1998), Gefen et al. (2003), Ba (2002): Impact of trust on performance
	Incentive Alignment	Eisenhardt (Eisenhardt 1989): Principal agent conflict; Jensen et al. (Jensen and Meckling 1976), Holmstrom (Holmstrom 1982), Fama et al. (Fama and Jensen 1983): Efficient contracts for incentive alignment – outcome based and behavior based;

Action		
	Decision Making	Tversky et al. (1974), Einhorn et al. (1986): Decision making based on incomplete information – anchor and adjustment model; Resnick et al. (2000): Recommender systems to assist in decision making
	Learning	Tversky et al. (1974), Einhorn et al. (1986): Learning in anchor and adjustment model of decision making; Klayman et al. (1987): Drag effect in adjustment; Edmunds et al. (2000): Learning to process information
	Information Overload	Lewis (1996), Klapp (1986): Negative impact of information overload; Koniger et al. (1995): Information use limited by processing effort required; Edmunds et al. (2000): Mitigating information overload with learning.

**Table 1: Theoretical Background for Research Framework**

The four components and the constructs that comprise the components are shown in the figure below (Figure 1):



**Figure 1: Research Framework – Components and Constructs**

Considering the word limit for this submission, for the sake of brevity, the Components and Constructs identified above are not being detailed in this abridged version of the paper.

**DEVELOPING RESEARCH MODEL**

The taxonomy developed above provides a foundation for building research models identifying potential empirical research opportunities that explore how different components and constructs interact. For illustrating the approach in this abridged paper, we take the example a key consideration – antecedents or drivers of the business value of information sharing. We can use the components and constructs identified above to build a theoretical approach for studying various aspects of the business value of information sharing. We illustrate the approach for the specific case of antecedents or drivers or business value.

## Antecedents of Business Value of Information Sharing

All constructs identified in the taxonomy for business value of information sharing beyond firm boundaries are expected to have a significant role in determining the business value that results from information sharing. Potential relationships between different constructs and business value of information sharing are briefly presented below.

### 1. Context of Information Sharing

- a. *Objective and Culture*: Objective of information sharing beyond firm boundaries need to be in alignment with the organizational culture for the information sharing initiative to succeed. Previous research on information sharing within the organization suggest that for any information sharing initiative to succeed, it need to adapt to the organizational culture (McDermott and O Dell 2001). A misalignment between objective of information sharing and the organizational culture is likely to negatively affect resulting business value of information sharing.

Cultural barriers to successful information sharing can be reduced by demonstrating a strong connection between objective of information sharing and tangible business goals and objectives (McDermott and O Dell 2001) and overall business strategy of organization (Sunassee and Sewry 2002). Negative impact of cultural barriers on business value of information sharing can be further mitigated by top management leadership and support (Liebowitz 1999; Holsapple and Joshi 2000).

- b. *Capability*: Technical capability and information capability have a significant impact on successful implementation of information sharing initiatives. Davenport et al. (1998) note that the organization needs to provide the required technical and organizational infrastructure for a knowledge management or information sharing initiative to succeed.

### 2. Information Sharing Process

- a. *Transparency*: Transparency is expected to have a positive relationship with business value of information sharing. Previous research suggests that higher transparency provides more information for decision making and leads to performance improvements (Cachon and Fisher 2000; Barua, Konana et al. 2004).
- b. *Complexity*: Complexity of the information sharing process is expected to have a negative impact on the business value of information sharing. Complexity affects information seeking behavior (Bystrom and Jarvelin 1995), efficiency of decision making (Plumlee 2003) and results in delays in information processing that is expected to negatively impact business value of information sharing.
- c. *Service Oriented Architecture*: SOA is expected to provide seamless integration across different systems and make it easier to share information. Hence, SOA can be expected to have a positive moderating role on the relationship between transparency and business value of information sharing.

SOA is expected to make IT systems more flexible and accommodative of change. SOA, by bringing flexibility to the IT architecture, is expected to help in managing complexity (Carter 2007). Thus, SOA is expected to mitigate the negative effects of complexity and have a moderating impact on the negative relationship between complexity and business value of information sharing.

- d. *Media Richness*: Richer media interfaces have been shown to be more effective in enabling better understanding of the subject (Mayer 2001). Further, media allowing interaction with the content, peers or the information sharing source leads to better learning and comprehension of received information (Kozma 1991). Media richness in both their aspects – interface and interaction, are expected to lead to better decision making by information recipients as a result of better understanding and comprehension of the received information.

Internet provides the platform for media richness – both interface and interaction. Internet based information sharing can include rich media interfaces like images and 3D simulations like Second Life. Interaction is also a natural part of Internet based information sharing through facilities like discussion boards and distributed decision making. Internet based information sharing that leverages the media richness allowed by the Internet is expected to have a positive impact on business value of information sharing.

### 3. Information Sharing Environment

- a. *Trust*: In contexts where the information recipients need to make decisions based on incomplete information and without formal incentive contracts, recipient's trust level significantly impacts the quality of decision making. High level of trust is expected to lead to better decision making. However, the level of trust itself depends on information sharing and communication (Bhattacharya, Devinney et al. 1998). Trustors who receive more frequent and more diverse information about trustees can better adjust their expectation about actions and outcomes.

Trust can be further supported by specific measures such as third party certification. Information from other trustors or third parties can help an individual form or update his/her belief about characteristics of a trustee (Mayer, Davis et al. 1995; Buskens and Buskens 2002). Thus, such trust building measures are expected to have a positive impact on decision making using shared information.

- b. *Incentive alignment*: A misalignment of the objective of information sharing and the incentives of information recipients is expected to negatively impact the business value of information sharing as the decisions made by the information recipient would not be in line with the expectations of the information sharing firm. Incentive misalignment can be corrected by formal contractual relationships (e.g. a profit sharing arrangement with a business process outsourcing provider) or by devising specific business models that align information sharing objectives with incentives of information recipients. Such incentive alignment measures are expected to have a positive impact on business value of information sharing.

#### 4. Decision Making and Business Value

- a. *Learning and Disruption*: In repetitive decision making, decision heuristics get adjusted in time as decision makers get feedback and observe the performance of their decisions. This learning mechanism implies that the efficiency of decision making is expected to improve with time.

Decision making by information recipients can be further supported by providing additional information. However, the learning process can get disrupted if there is a substantial change in the information sharing regime as decision heuristics need to be adjusted. Such disruptions are likely to cause a short term decline in decision making efficiency. The impact of disruptions will be compensated in time through the learning effect as information recipients learn to make appropriate use of the additional information.

- b. *Information Overload*: Large amount and high rate of information act like noise when they reach the overload situation represented by a rate too high for the receiver to process efficiently (Klapp 1986). Information overload reduces the efficiency of decision making. However, negative impact of information overload can be mitigated by training, learning or using rich media that allows information recipients to process information better (Edmunds and Morris 2000).

The potential relationships identified above as antecedents of business value of information sharing need to be validated using real data. Closely related relationships can be put together as part of theoretically motivated research models that can then be empirically tested. The example above explores how the taxonomy developed can be used to develop research models for studying aspects of information sharing beyond firm boundaries.

## CONCLUSION

Recent advances in IT have led to a dramatic increase in information sharing both within and beyond firm boundaries. Although information sharing has attracted significant research interest, most of the focus has been on either information sharing within the firm or with traditional partners like suppliers. As more firms share significant amount of information with partners, suppliers, customers and even with public, there is a research need to take a deeper look at business value of information sharing beyond firm boundaries.

Studying complex inter-disciplinary subjects like business value of information sharing beyond firm boundaries is difficult as it involves integrating insights from different research streams and theoretical backgrounds. Often the approaches taken by different research streams are in conflict with each other and use a parallel set of constructs, language and nomenclature. Thus, as a first step, it is important to building an overall taxonomy and research framework that integrates insights and constructs from different research streams and provides the foundation for future inter-disciplinary research. Such



frameworks also provide the opportunity to study interactions between constructs belonging to different research streams. This study attempts to perform this essential step of integrating relevant previous research to build an inter-disciplinary taxonomy and research framework of business value of information sharing beyond firm boundaries.

Combining previous literature with insights from contemporary practice examples of information sharing beyond firm boundaries, we first developed a four component framework for studying business value of information sharing. Constructs that comprise each of the components were further detailed using past literature and their potential impact on business value of information sharing identified (many details were omitted from this version of the paper to fit in the word limit). These constructs and their potential impact on business value of information sharing form the taxonomy that defines the research space and builds a common vocabulary. As an illustration of how the taxonomy can be used to build research models, the study then identifies potential relationship between the constructs in the taxonomy and the dependent variable of business value of information sharing.

Managers responsible for designing or managing information sharing initiatives need to take into account factors belonging to different functional areas. In addition, interactions between factors belonging to different areas may also have significant impact on success of information sharing initiatives. The integrated framework developed in this chapter is beneficial to practitioners as well since it provides a consolidated view of different constructs from different research and practice domains that may influence the success of information sharing beyond firm boundaries. The framework further contributes to practice by providing the framework for identifying potential interactions between constructs that may influence (for example) the business value of information sharing.

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