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Electronic Commerce Research: A Taxonomy and Synthesis

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Electronic commerce (EC) can be defined as an online exchange of value. This article presents an analysis of 172 published research articles and synthesizes their content by theoretical perspective (organizational, economic, and technical) and dominant research methods. We use this analysis to identify specific research themes within a framework that have the potential to become cumulative streams of research. One conclusion is that EC research to date has been widely scattered in a variety of journals and is often not self-referencing. This analysis provides a step toward remedying this problem by specifically synthesizing what is known to date from EC research and by proposing directions for future efforts. A second conclusion is that the field of information systems (IS) has a window of opportunity to become a primary producer and conveyer of EC research knowledge if cumulative streams of research can be nurtured and published in top-tier journals. The analysis presents a context for examining IS opportunity and the necessary antecedents.

interorganizational systems, organizational value chain, competitive use of IS, literature review

1. INTRODUCTION

The network era of computing [1], made visible by the proliferation of the public Internet, has made electronic commerce a ubiquitous topic in the popular business press. Although the use of computer networks for commerce can be traced to the 1960s, the rise of relatively inexpensive computing equipment, software, and communication networks has recently accelerated its use. In some industries such as automotive manufacturing, electronic data interchange (EDI) has become table stakes for

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participation as a vendor. Similarly, powerful retailers, such as Wal-Mart in the United States, have mandated that their suppliers use electronic communication with Wal-Mart's internal systems. Consumers have seen a plethora of goods and services made available via the Internet. Holiday shopping on the Internet, projected to double to $2.3 billion in 1998 [2], actually was reported to be between $3.5 and $5 billion [3], with 43% of computer users indicating they are likely to shop online for holiday gifts.

In similar fashion, the number of academic research articles regarding the conduct of commerce across public and private computer networks from 1982 to date is accelerating rapidly, from 42 articles published between 1982 and 1994 to 86 articles published in 1997 alone. Given the growing pervasiveness of EC in society and interest among academic researchers, now is a prudent time to assess the knowledge and insight that have been produced by electronic commerce (EC) research. We provide this assessment through a comprehensive literature review of 172 articles published in a variety of academic journals. We examine these articles for their theoretical perspectives, dominant research methods, and contributions to synthesize and map existing EC research. This assessment then provides the basis for inquiring about the next steps for EC researchers.

This article is organized as follows. First, we set forth a simple and inclusive definition of EC and briefly review EC's origins. Second, we present a framework of EC research to date by theoretical perspective. This is followed by a comprehensive synthesis of 172 published articles from research journals organized by related topics. Finally, we assess the potential roles for the information system (IS) discipline in the evolution of EC. We argue that IS is uniquely positioned to become the primary knowledge generator and repository for EC research if the discipline can nurture coherent streams of focused EC research and a cumulative research tradition.

2. DEFINING EC

A variety of definitions of EC have been offered (e.g., [3–7]), with each emphasizing particular aspects of the phenomenon. Although longer definitions lend themselves to greater precision and specificity, they also open many (often nonproductive) arguments regarding what is or is not a part of EC. Therefore, we offer the following necessarily inclusive definition as suggested in Hayashi [8], with the authors' modifications in italics: EC is the use of computer networks to conduct business—basically the buying and selling of goods and services *and information*—electronically with one's suppliers, customers, or competitors, *or among consumers.* This definition provides for two main requirements to be met before commerce can be classified as electronic commerce: It must be online in some format, and it must be an exchange of value. See also Holsapple and Singh [7] for additional synthesis of EC definitions.

2.1 Online

Online indicates the use of networked, computer-based information technology to support data accumulation, manipulation, or communication. Our focus is on the use of the public Internet and private networks for commerce-related activities.

This includes business-to-customer uses, such as a manufacturer publishing an electronic catalog on the Internet through which customers can browse, order, and pay for merchandise. This also includes business-to-business transactions, such as electronic inventory management and replenishment systems in the grocery industry's efficient consumer response initiative. In an effort to relate electronic commerce to the age of the computer, we exclude traditional uses of standard voice telephone calls from our definition of online.

2.2 Exchange of Value

We purposefully use the broad wording *exchange of value* because EC exchanges can involve goods, services, information, money, time, and convenience. For example, a manufacturer, wholesaler, or retailer can sell goods via the Internet. If the product is digital (e.g., software or music), it can also be delivered via the Internet. Similarly, a bank or a utility company can enable customers to pay bills or modify personal services over the Internet. Other services that can be provided through networks include computerized matchmaking, advertising, gaming, banking, and the establishment of electronic communities for social interaction. In some cases, customer support after the sale can also be provided online.

A hybrid of goods and services is information. This is perhaps the largest opportunity for the proliferation of EC. Stock quotes, library books, journals, and sports scores are all examples of information available through EC. Moreover, information need not simply be textual or graphic, but also could be audible, visual, and even in the future fragrant and touchable. Information can be delivered much more timely through electronic channels than through the print media, and news can be more easily manipulated through electronic channels than through television programs. Companies can also provide knowledge bases about their products through electronic means, where they are accessible by the consumer at any time of day and reduce the need for human operators. Software companies can supply patches and bug fixes to previously written programs along with this information. Many goods and services have an information component that is easily adaptable to this form of commerce.

These exchanges of value can take on interesting forms. For example, consider an exchange of value involving information where a consumer visits the Web site of Company A while shopping for price and product information, but then buys from Company B. The consumer spent time and a modest amount of money for the connection searching for information at Company A's Web site and in return gained valuable information. Company A spent money to provide the Web site and in return received customer exposure to the company and incurred practically no direct costs except for an expensive telephone conversation. All parties benefited from this online exchange of value.

Exchanges of money are perhaps the more familiar form of EC. Banks exchange money electronically for complex currency risk, hedging procedures and simple direct deposit tasks. Clearing House Interbank Payment System (CHIPS) in New York processes over $1 trillion in transactions daily. Companies use electronic exchange of money to complete deals. This can be done through wire transfers, or it can just be a

way of exchanging credit card numbers for a deal to be completed later. This may not be an actual exchange of money, but is an electronic method of providing settlement for the transaction. An example more consumers can relate to is the explosive growth of online brokerage houses. Customers can easily trade their currency for a stake in corporations and vice versa, and there is nothing that precludes the entire transaction from being completed electronically, assuming shares are being held in street name (the customer never takes physical delivery of the stock certificates). Ameritrade, Datek Securities, and eSchwab are several examples of firms operating in this market.

All the exchanges described here can occur between organizations and their partners, employees, or customers, which indicates the breadth and scope of EC.

3. ORIGINS OF EC

In the 1950s, the U.S. government and banks were among the first to make their computers available via networks and then to connect their networks. Soon after, organizations in other industries sought ways to facilitate work via "internetworking." For approximately 4 decades, nearly all of this networking was supported using proprietary networks, where one network could not communicate with another unless they both used the network solution from the same vendor and where participation in the network was tightly controlled.

Private (a.k.a. proprietary, or value-added) networks were the primary channels for business-to-business EC until the Internet became viable and widely available for commerce in 1994. Many organizations were (and still are) quite successful using these proprietary networks for competitive differentiation. The historical cases of Sabre, American Hospital Supply, and McKesson Drugs, and a host of firms using electronic data interchange are repeated throughout introductory IS textbooks as a means for achieving competitive advantage through information systems. The Internet's open and ubiquitous standards, such as the transmission control protocol/internet protocol, hypertext transmission protocol, HTML, and the use of standard uniform resource locators, have propelled EC to a mainstream practice for both business-to-business and business-to-consumer segments.

Academic research of EC has developed alongside its use as a business practice. Early academic research proposed plans for interorganizational systems (IOS) [8] and the creation of electronic markets [9]. Other researchers identified the development of computer networks as a fundamental technological and economic transition to the network era of computing [1].

4. LITERATURE REVIEW METHODS

The process of conducting the literature review spanned the summer and fall of 1998.[1] We attempted to find all published research articles for which EC was the primary focus. We began with searches via online databases, such as Academic Search FULL

[1]As an interesting aside, the term *electronic commerce* is a searchable subject heading within search services such as ABI/Inform and within the U.S. Library of Congress.

TEXT Elite, Business Source, and ABI/Inform. We included only articles that were research oriented and only full articles from research conferences, such as the International Conference on Information Systems and the Hawaii International Conference on System Sciences. These conferences seem to consistently present the highest quality research, which can be accepted by the field as a whole. There are also many topical conferences devoted solely to EC in some form or fashion whose concern for topicality and inclusion may contain a large number of articles that are not ready for general acceptance by the field. Our reason for not including papers from these conferences in our analysis is that we could not be as certain of the peer review processes required for acceptance and presentation as we could be with more mainstream conferences and journals. There is no question that good work is done in these conferences, and likely it will appear in other electronic or print outlets in the future.

Following the same reasoning, we excluded popular press sources like *Time* and *Newsweek,* and the trade press like *Wired* and *InfoWorld*. We excluded research that focused on subjects such as electronic mail or virtual organizations that were only indirectly related to EC, because although they may add value to an organization, either directly or indirectly, they are used more as organizational design and communication issues rather than a comprehensive redesign of business processes. We also excluded articles in areas such as computer science that dealt with underlying EC technologies at a very technical level. We then drew on the reference sections of the identified articles to backward-chain to other EC research articles that were not found in the database searches. We eliminated conference papers that later appeared as journal articles. These efforts yielded 202 research articles.

5. EC RESEARCH BY PERSPECTIVE

These articles were reviewed to develop a list of high-level theoretical bases, or perspectives, that guided the research. This sort of classification fundamental to science, as represented in chemistry, for example, by the periodic table of the elements [10], "has shown to be particularly revealing of the nature of things" [11]. We decided to use high-level theoretical perspectives, such as organizational, as a surrogate for pure reference disciplines rather than using traditional academic disciplines such as marketing, organizational behavior, or IS. The derivation of the high-level theoretical perspectives was a more natural grouping given the applied nature of the articles. In addition, this type of group is phenomenonologically based and is better suited to the interdisciplinary nature of EC research. The review identified three major perspectives, organizational, economic, and technical, each of which was comprised of a relatively large number of clearly related research articles. There were also three minor perspectives, societal, behavioral, and legal, each of which contained a relatively small number of articles. Table 1 describes the topics that were included in each perspective, and Figure 1 presents a taxonomy of each perspective and its subtopics representing the published EC research that was included. We reviewed each article separately for its specific classification(s) and contribution to EC research, and together determined the perspective of best fit. Obviously, some articles did fit into multiple perspectives. Figure 2 provides the distribution of the articles as relative frequencies for each perspective and theme.

Table 1
Perspective Examples

Perspective	*Includes*
Organizational	Adoption and diffusion, organizational strategy and tactics, marketing uses of networks, prescriptive advice, overviews and surveys of EC
Economic	Industry structure, asset ownership, governance, adoption and distribution of IOS value, electronic market intermediaries, buyer cost of acquiring information
Technical	Architectures, technology proposals, software prototypes
Social	Social impacts of EC, national technology infrastructures
Behavioral	Consumer choice, buying decisions and perceptions, shopping behavior
Legal	Contracting, legal risks, legal advice, setting legal policy, legal views of privacy

Note. EC = electronic commerce; IOS = interorganizational systems.

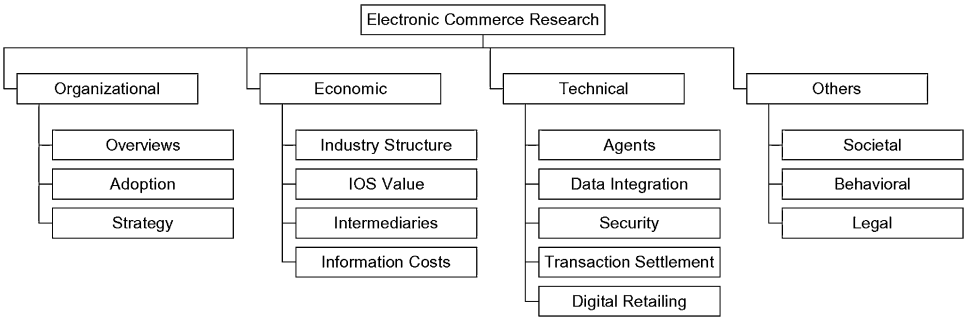

Figure 1. Taxonomy of published electronic commerce research.

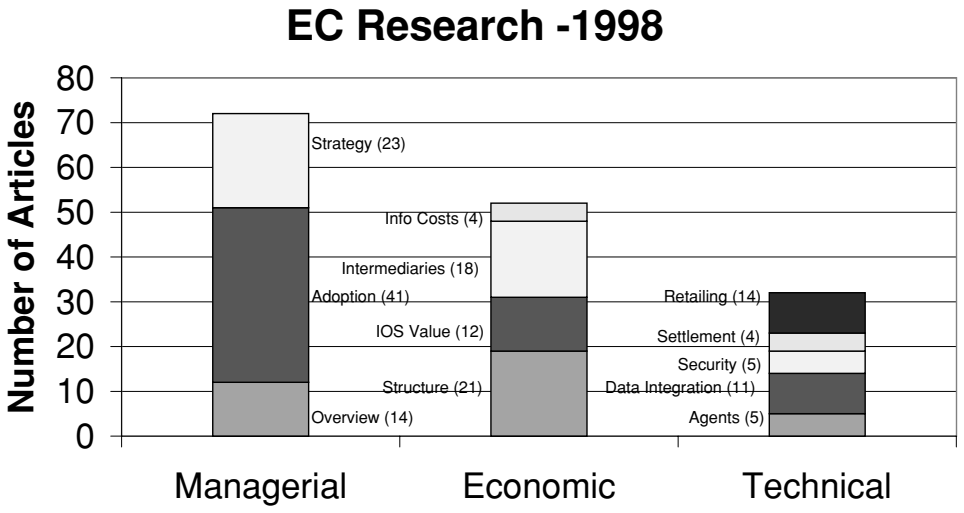

Figure 2. Major perspectives.

In the style and format of Delone and McLean [12], the following sections identify the major themes and research methods used within each perspective. Each section also contains a table that presents both a chronological and visual thematic summary of the articles.

5.1 Organizational

The organizational category is heavily populated, with approximately 72 published research articles. Three major themes emerge: EC overviews, adoption, and strategy prescriptions (Table 2). We describe each of these three themes later along with a description of the dominant research methodologies used within this category. Within each of the three themes, we also differentiate among pure EC organizational research, organizational research on EDI/IOS, and organizational research oriented more toward electronic markets.

5.1.1 EC Overviews. A number of articles within the organizational category provide overviews of and introductions to EC. These overview articles are effective in describing the relevant public policy and legal issues [3], the role of new intermediaries [9], and the new markets and value systems enabled by EC [6]. Others have proposed ways to classify Web sites. For example, Hoffman et al. [13] described the Web as a new distribution channel and medium for marketing communication, and they offer a Web site classification scheme, including online storefronts, Internet presence, content providers, malls, incentive sites, and search agents. Similarly, Spiller and Lohse [14] classified Web sites into the following categories: superstores, promotional stores, plain sales stores, one-page stores, and product listings. They concluded that most of the sites studied had limited product selection, few service features, and poor interfaces. Other EC overview articles were geared more toward the academic audience. For example, Shaw et al. [15] presented research opportunities in human–computer interaction, consumer behavioral analysis, enterprise and channel integration, and Web-based strategy development.

5.1.1.1 EDI/IOS overviews. Although these overview articles have dealt with underlying EC technologies generically for the most part, a number of overview articles addressed more specifically EDI technologies and IOS. Johnston and Vitale [16], Senn [17], and Foggett [18] presented useful frameworks for leveraging competitive advantage from IOS, such as EDI. Similarly, Johnston and Palmer [19] and Senn [20] argued for the viability of Internet-based EDI as opposed to EDI via proprietary networks. To a large extent, the work in these overview articles (both the more general articles and the EDI-specific articles) has been descriptive and is aimed at informing and guiding the practitioner and researcher alike.

5.1.1.2 EM overviews. Two of the EC overview articles dealt specifically with electronic markets. Bakos [21] argued that electronic markets provide better information on price and product, and in this sense can move us toward the ideal of a perfect market. As a result, buyers are better off and profits of sellers are reduced. However, Bakos concluded that there would be advantages for

Table 2
Management

Title	*Cite*	*Type*	*Themes*		
			Overviews	*Adoption*	*Strategy*
Airline reservations systems: Lessons from history	[40]	Conceptual, case		√	
Creating competitive advantage with interorganizational information systems	[16]	Conceptual	√		
An empirical investigation of factors influencing the success of customer-oriented strategic systems	[33]	Case		√	
A strategic analysis of electronic marketplaces	[21]	Conceptual	√		
Information systems in manufacturing coordination: Economic and social perspectives	[57]	Conceptual		√	
Electronic data interchange	[17]	Descriptive, prescriptive	√		
Interorganizational cooperation: The role of information technology an empirical comparison of U.S. and Japanese supplier relations	[98]	Survey, interview		√	
An empirically derived model for the adoption of customer-based interorganizational systems	[29]	Survey		√	
Growth patterns and regime change in nationally shared electronic banking networks: An economic analysis of CIRRUS and PLUS	[51]	Modeling		√	
The adoption of tradenet by the trading community: An empirical analysis	[41]	Survey		√	
Implementation of electronic data interchange: An innovation diffusion perspective	[30]	Survey		√	
Managing in the marketspace	[62]	Descriptive, prescriptive			√
Interdependent benefits from interorganizational systems: Opportunities for business partner-reengineering;	[105]	Case		√	
Leveraging EDIS to improve organizational and interorganizational productivity: Findings from the world's busiest port	[42]	Survey		√	
Electronic markets and virtual value chains on the information society	[63]	Descriptive			√
Configurations of interorganizational relationships: A comparison between US and Japanese automakers	[59]	Interview, survey		√	
Commercial scenarios for the web: Opportunities and challenges	[13]	Descriptive	√		
Electronic data interchange and small organizations: Adoption and impact of technology	[31]	Interviews		√	

(*continued*)

Table 2 (*Continued*)

Title	*Cite*	*Type*	*Themes*		
			Overviews	*Adoption*	*Strategy*
Innovation diffusion theory as a predictor for adoption intention for financial EDI	[23]	Survey		√	
Electronic commerce: Building blocks of new business opportunity	[4]	Descriptive, prescriptive	√		
Slaves of a new machine	[74]	Descriptive, prescriptive			√
Introducing transformational information technologies: The case of the world wide web technology	[44]	Case		√	
Business-to-business connectivity on the internet: EDI, intermediaries, and interorganizational dimensions	[19]	Conceptual, descriptive	√		
Introduction to network publishing	[75]	Descriptive, prescriptive			√
Measuring the extent of EDI usage in complex organizations: Strategies and illustrative examples	[58]	Case, interview		√	
The internet and international marketing	[69]	Descriptive, prescriptive			√
EDI success in small and medium-sized enterprises: A field study	[52]	Survey		√	
Developing mature internet strategies	[47]	Case		√	
An economic analysis of the introduction of an electronic data interchange system	[106]	Modeling		√	
Electronic commerce in decision technologies: A business cycle analysis	[76]	Descriptive, prescriptive			√
Strategic choices in the development of interorganizational information systems	[35]	Case		√	
EDI-enabled channel transformation: Extending business process redesign beyond the firm	[50]	Case, archival		√	
Viewing the web as a market place: The case of small companies	[68]	Descriptive, prescriptive			√
The architecture of transigo: Telstra's electronic business solution for Australian government and industry	[18]	Conceptual, descriptive	√		
The web's impact on selling techniques: Historical perspective and early observations	[65]	Descriptive, conceptual			√
Electronic product catalogs: What is missing?	[77]	Descriptive, prescriptive			√
Power and trust: Critical factors in the adoption and use of electronic data interchange	[80]	Conceptual			√
Experience with electronic auctions in the Dutch flower industry	[61]	Case		√	

(*continued*)

Table 2 (*Continued*)

Title	*Cite*	*Type*	*Themes*		
			Overviews	*Adoption*	*Strategy*
A new marketing paradigm for electronic commerce	[67]	Descriptive, prescriptive			√
Fact file II: The main national travel and tourism distribution system in Britain and Germany	[38]	Conceptual, case		√	
Selling in the era of the 'Net': Integration of electronic commerce in small firms	[24]	Survey		√	
The introduction of EDI systems in health-care supply chains: A framework for business transformation	[27]	Conceptual, case		√	
The link between information strategy and electronic commerce	[28]	Survey		√	
Personalize or perish	[73]	Prescriptive			√
Retailing on the WWW: The use of electronic product catalogs	[72]	Case			√
Internet-based small business communication: Seven Australian cases	[25]	Case		√	
Web assessment—A model for the evaluation and the assessment of successful electronic commerce applications	[64]	Conceptual			√
Internet based EDI strategy	[45]	Case		√	
Research opportunities in electronic commerce	[15]	Conceptual	√		
Logistics coordination in dyads: Some theoretical foundations for EDI-induced redesign	[55]	Modeling		√	
A classification of Internet retail stores	[14]	Case, archival	√		
Characteristics of electronic markets	[22]	Descriptive, prescriptive	√		
Marketplace strategy and the European information society	[79]	Descriptive, prescriptive			√
A contingency model of Internet adoption	[26]	Survey		√	
Electronic cash in Hong Kong	[39]	Descriptive, case		√	
Electronic commerce: Definition, theory, and context	[9]	Descriptive, conceptual	√		
Certification authority guidelines in Japan	[43]	Descriptive, case		√	
Information technology infrastructure for textile and apparel industry in Hong Kong	[78]	Prescriptive			√
Catching the wave: Alertness, responsiveness, and the market Influence in global electronic networks	[56]	Archival, case		√	
Purchasing on the Net—The new opportunities for electronic commerce	[66]	Descriptive, prescriptive			√

(*continued*)

Table 2 (*Continued*)

Title	*Cite*	*Type*	*Themes*		
			Overviews	*Adoption*	*Strategy*
Designing trustworthy interorganizational trade procedures for open electronic commerce	[81]	Conceptual			√
Success and failure factors for implementing effective electronic markets	[83]	Prescriptive			√
Marketing information on the information I-way	[71]	Descriptive, prescriptive			√
The merchant of Prato—revisited: Toward a third rationality of information systems	[53]	Case		√	
Reducing the barriers to interorganization electronic data interchange	[46]	Prescriptive		√	
A combined-method study of small business internet commerce	[49]	Survey, case		√	
Expanding the reach of electronic commerce: the Internet EDI alternative	[20]	Conceptual, prescriptive	√		
Factors influencing the adoption of the Internet	[34]	Survey		√	
Business use of the Internet: An analytical framework and exploratory case study	[48]	Conceptual		√	
Attractors: Building mountains in the flat landscape of the World Wide Web	[70]	Descriptive, prescriptive			√

Note. The checkmarks give a clear signal regarding the number of electronic commerce articles within each theme.

firms that move first into electronic marketplaces. Similarly, Strader and Shaw [22] argued that there are significant cost-based differences between traditional and electronic markets for buyers and sellers. Further, electronic markets were argued to change industry structure and future sources of organizational revenue.

5.1.2 Adoption. A large number of articles within the organizational category reported on studies of adoption, implementation, diffusion, and use of network-era computing technologies within and among organizations. The adoption theme addresses how and why firms adopt EC technologies. It investigates the factors related to EC adoption, successful implementation, and use. This is the area within the organizational category where the reader finds the greatest preponderance of data-based, empirical research.

5.1.2.1 EC adoption. A number of studies were aimed at the adoption of EC-related technologies. From this research we can summarize several factors that appear to drive adoption. Present adoption intention depends on complexity, operational risk, and strategic risk, whereas future adoption intention depends on

complexity, observability, and strategic risk [23]. Perceived benefits and organizational readiness influence adoption of EC [24, 25]. Organizational and technological factors, rather than environmental factors, drive EC adoption [26]. Alternatively, rather than studying EC adoption directly, Klein and Schad [27] proposed a framework for business transformation that integrates various organizational redesign approaches into a comprehensive analysis and change process. They contend that EC-related adoption is not just about organizational adaptation, but also involves issues in innovation and redesign.

Alternatively, Lederer et al. [28] sought to understand the relationship between business strategy and the types of EC benefits that would drive EC adoptions. They found that when the business strategy is focused on differentiation and focus, the EC benefit of competitiveness would be important. When the business strategy is cost leadership, the EC benefit of cost savings would be important. In their study, the business strategy of differentiation and focus were more common than the cost–leadership strategy.

5.1.2.2 EDI/IOS adoption. A number of these adoption-related articles were specific to IOS and EDI-related systems. Several studies focused on the antecedents to EDI-related adoption, which include proactive technology orientation and internal push for the system [29], relative advantage, costs, and technology compatibility [30], external pressure from trading partners [31], strategic necessity [32], successful information systems implementation, competitive environment, adoption of other IS innovations, and successful product marketing [33]. Those factors that appear to inhibit EDI-related adoption appear to be poor support for sales force, poor quality pilot tests, and situations where the champion loses control [33]. Those factors that appear to lead to successful adoption include organizational readiness and awareness of benefits.

Tan and Teo [34] found that among the benefits attracting organizations to EDI-based approaches were global reach and access to customers and information. Choudhury [35] found that demand uncertainty and market variability drove the choice of interorganizational information system type. In observing the buyer–-supplier relationship, Riggins et al. [36] found that buyers benefited when suppliers adopted optional buyer-initiated modifications to IOS. However, it was not clear how suppliers benefited, so there was little incentive for them to make the modification, buyers with leverage could require suppliers to adopt. Similarly, Barua et al. [37] argued that EDI solutions are generally good for large suppliers but not for small suppliers.

5.1.2.3 EC implementation. A number of studies presented descriptive accounts of EC-related implementations, including travel registration systems in Britain and Hong Kong [38], an electronic-cash initiative in Hong Kong [39], a historical account of airline reservation systems [40], TradeNet [41], Portnet [42], and a Japanese test-bed EC project [43]. Some of the lessons learned from these case studies are that having large, installed processing capacity give economies of scope and scale, participants in EC need established technological competence in order to gain competitive advantage, consistent exploitation of opportunities leads to sustainable competitive advantage, trialability and experimentation were

useful, adopters with strong need for information and strong executive leadership benefited greatly in organizational and interorganizational productivity, and initiators tended to realize greater benefits than did reactors. In addition, Jarvenpaa and Ives [44] described the Web as a transformational information technology, one that can potentially dramatically change the organization. As such, they argued that it is generally not well managed by information technology (IT) groups alone; rather, they found that ad hoc, interdisciplinary teams appeared to best drive Web-site implementations.

5.1.2.4 EDI/IOS implementation. A number of these implementation-oriented articles dealt specifically with IOS and EDI-related systems. Choudhury [35] found that the strategic significance of the interorganizational information system, size, and bargaining power drive the choice of development approach for the system. Factors, which appear to influence successful implementation, include organizational compatibility and costs [30]. Segev et al. [45] went one step further, suggesting that a traditional systems development approach was better for implementing stable, long-term EDI in a predictable environment, whereas a prototyping approach was better for short-term, temporary EDI relationships in uncertain, unpredictable environments. Finally, Lind [46] proposed a process for creating an EDI for motor carriers to interact with federal and state regulatory agencies.

5.1.3 EC diffusion and use. A number of studies were aimed at the diffusion and use of EC-related technologies. One descriptive study [47] reported that large banks, reacting to competition, focused their Internet strategy on building large but relatively simple Web sites. Few offered Net-based transactions. Other studies sought to uncover the factors that determine the successful use of EC-related systems. Vadapalli and Ramamurthy [48] proposed that innovation characteristics and characteristics of the organization, such as organizational boundaries, transaction costs, an organizational cognition, will determine long-term business use of the Internet. Similarly, Poon and Swatman [49] found that management involvement and enthusiasm, and entrepreneurship, were important to implementation success and ongoing usage.

5.1.3.1 EDI/IOS diffusion and use. A sizeable number of these diffusion and use-related studies dealt specifically with IOS and EDI-related systems. Some studies were focused on how to best leverage EDI-related implementations. Clark and Lee [50] found that a combination of EDI and process reengineering was better than EDI alone. Kauffman and Wang [51] concluded that the implementers of the CIRRUS and PLUS networks shared assets but kept their corporate identities separate to great advantage. Raymond and Bergeron [52] found that the quality of organizational support, implementation process, and control procedures influence the level and nature of benefits derived from EDI in small and medium-sized firms. In addition, the quality of the organizational context for EDI was better when EDI implementation was voluntary than when EDI was forced. In studying the failure of SPINTEL, an interorganizational information system in Prato, Italy, Kumar et al. [53] concluded that the techno-economic and

the sociopolitical perspectives were not sufficient to understand the failure. They proposed that a third perspective—the collaborative/cooperative approach—helps us to better understand the failure, focusing on issues of trust, social capital, and collaborative relationships. Other studies were aimed at understanding the consequences of the use of IOS. For example, Clemons and Kleindorfer [54], and Sheombar [55], found that EDI use can be a means to support and intensify interorganizational coordination. Similarly, Zaheer and Zaheer [56] observed over 4000 bank exchanges on Reuters dealing system and concluded that banks that are alert and responsive tend to exercise greater market influence within their industry.

In addition to the research summarized earlier, three articles in particular provide useful guidance for research on IOS and EDI-related systems. Kling et al. [57] showed how transaction cost economics, agency theory, resource dependence theory, and institutional theory can be used to understand organizational integration via information technologies such as EDI. Massetti and Zmud [58] observed EDI usage and identified the EDI measurement constructs of volume, diversity, breadth, and depth of transactions. Finally, Bensaou and Venkatraman [59] surveyed EDI participants and identified five naturally occurring interorganizational relationships: remote relationship, electronic control, electronic interdependence, structural relationship, and mutual adjustment.

5.1.3.2 EM diffusion and use. Finally, a relatively small number of articles were aimed at the diffusion and use of electronic market systems. Lee and Clark [60] found that the benefits to an electronic market were that they reduce transaction costs and increase market efficiency. Barriers found included transaction risks and resistance to organizational reengineering. Heck and Ribbers [61] found that electronic auctions lead to increased efficiency and separation of informational and physical trading processes. In addition, Heck concluded that if the perceived and actual quality of product, logistical performance, and IT performance were all high, then there was high trust and success of an electronic auction system. If any stakeholder became worse off, then the electronic auction system wouldn't succeed. New entrants could build competitive advantage with an innovative electronic auction system even in the face of dominant players in their industry.

Although a variety of methods have been used for this research on EC-related adoption, implementation, diffusion, and use, the more common methods appear to be case study, survey, and interview. Of the three themes of research within the organizational category, the most rigorous research has been done within the stream on adoption, implementation, diffusion, and use. Indeed, this research makes the organizational category one of the two more rigorous categories (together with economics) that we studied and present in this article.

5.1.4 EC Strategy Prescriptions. These articles were generally prescriptive in nature, offering strategic and tactical advice at the business unit, organizational, and industry level. A number of articles offered general advice for the move to EC. For example, Rayport and Svikola [62] argued that information-defined transactions and "marketspaces" will dominate and change the value proposition and

management of business organizations. They described how the content, context, and infrastructure will and should be different for organizations with the move toward EC. Similarly, Benjamin and Wigand [63] argued that the move to EC would give consumers increased access to goods but would cause restructuring and redistribution of profits among stakeholders in the value chain. They proposed that with the evolution to electronic markets, there would be lower coordination costs and disintermediation. Finally, Selz and Schubert [64] offered a model for assessing Web-based EC investments.

5.1.4.1 Marketing prescriptions. A significant proportion of articles in the strategy theme prescribed advice for marketing in an EC era. In several articles, it was generally argued that the move to EC fundamentally changes the way marketing should be thought of and conducted (e.g., [65–68]). Other articles prescribed more specific advice within the marketing realm. Quelsh and Klein [69] described how to use international marketing to achieve global reach. Watson et al. [70] described how to use the Web to increase communication to and from customers and other stakeholders. Kannan et al. [71] described how to use electronic communities for generating marketing information. Palmer [72] described the role of marketing to affect Web-site design. Finally, Ludi [73] described how to use the Web to provide a personally relevant context for, and how to build one-to-one relationships with customers.

5.1.4.2 Management of technology prescriptions. Another thread of articles prescribed advice regarding specific EC-related technologies and contexts, including online publishing [74, 75], decision-making technologies [76], electronic product catalogues [74, 77], IT infrastructure for the Hong Kong apparel industry [78], European telecommunications deregulation [79], IOS and EDI [80, 81], and electronic markets [82].

In general, the articles within this strategy theme were conceptual and prescriptive. Although they lack the relatively rigorous research methods of articles within the adoption theme, the articles within the strategy theme are useful in that they comment on real world phenomena and provide opportunities for further empirical study.

In summary, there is already a great deal of diverse EC research within the organizational perspective. Overview articles present useful frameworks and descriptions of EC, disintermediation, new intermediaries, new markets, EDI, electronic markets, and other EC-related topics. Articles within the adoption theme present the beginnings of an empirical literature on the antecedents and consequences of EC-related adoption, implementation, diffusion, and use. Finally, a number of articles offer useful advice on the strategy and tactics for conducting a variety of forms of EC. Although all are useful in some way, the most rigorous in terms of research methods and cumulative contributions has been research within the adoption subcategory. This research relied primarily on case, survey, and interview methodologies.

5.1.5 Summary and future directions. There were many useful articles within the organizational perspective that provided introductions to and overviews

of EC, EDI, IOS, and electronic markets (EM). These articles are useful not only as general primers on these areas, but also because they provide practical information, such as ways to classify Web sites. Similarly, the articles that provided strategic prescriptions are useful guides to EC-related research and practice. They describe a world where information-defined transactions and marketspaces will dominate and change the way that business is conducted. For example, they offer advice for marketing in this new environment, such as creating and harnessing electronic communities for generating useful marketing information.

There was, perhaps, even greater value in the large number of articles within the organizational perspective that reported on studies of adoption, implementation, diffusion, and use of EC, EDI, IOS, and EM. This research suggests a number of factors that lead to successful EC-related adoption, including perceived benefits, organizational readiness to adopt EC, proactive technology orientation, internal push for the system, technology compatibility, external pressure from trading partners, strategic necessity, and successful information systems implementation. Factors such as management involvement, management enthusiasm, and entrepreneurship were found to be important to successful implementation and ongoing usage. Among the consequences of EC implementations were economies of scope and scale, and competitive advantage.

Although a great deal of research has already been conducted within the organizational perspective, there remains an ample opportunity for additional research. For example, there is a need for a more precise theoretical integration of the adoption research across EDI/IOS, EM, and EC areas. The described research has provided theoretical basess from which to further this research, including transaction cost economics, agency theory, innovation and diffusion theory, resource dependence theory, and institutional theory. A second useful avenue of study would be to test some of the forward-looking propositions within the articles that proffer strategic advice. For example, does the move to EC fundamentally change the nature of marketing, promotion, and pricing? If so, how? Alternatively, what specific reasons favor Internet-based EDI over proprietary networks?

5.2 Economic

Economics has intuitive appeal as a theory base for EC research, especially in the area of business-to-business transactions. The majority of the articles from the economics perspective have focused on IOS, including the use of EDI. Four economic themes of industry structure, value of IOS adoption, roles in electronic markets, and the buyer's costs of acquiring information, are addressed in Table 3.

5.2.1 Industry Structure, Asset Ownership, and Governance

5.2.1.1 Electronic markets hypothesis. The effects of EC on industry structure, asset ownership, and governance has been one theme of this research. Malone and colleagues [82, 84; see also 85] proposed in the electronic markets hypothesis (EMH)—that electronic computer networks would cause greater reliance on markets rather than vertical integration (hierarchies) for organizing economic activity within an industry. Reduced coordination costs of EC were

Table 3
Economics

Title	*Cite*	*Type*	*Themes*			
			Industry Structure	*IOS Value*	*Intermediaries*	*Information Costs*
Modeling coordination in organizations and markets	[85]	Conceptual	√			
Electronic markets and electronic hierarchies	[82]	Conceptual	√		√	
The logic of electronic markets	[84]	Descriptive	√			
Electronic integration and strategic advantage: A quasi-experimental study in the insurance industry	[95]	Cases	√	√		
A strategic analysis of electronic marketplaces	[21]	Conceptual			√	
Information links and electronic marketplaces: The role of interorganizational information systems in vertical markets	[101]	Conceptual	√			
A model of competing interorganizational systems and its application to airline reservation systems	[114]	Modeling			√	
An economic analysis of interorganizational information technology	[54]	Modeling		√		
Information technology and industrial cooperation: The role of changing transaction costs	[90]	Conceptual	√			
Information technology, incentives, and the optimal number of suppliers.	[91]	Conceptual	√			
Interorganizational cooperation: The role of information technology an empirical comparison of U.S. and Japanese supplier relations	[98]	Cases	√			
The impact of information technology on the organization of the economic activity: The "Move to the Middle" hypothesis	[89]	Conceptual	√			
Some propositions regarding the role of information technology in the organization of economic activity	[88]	Conceptual	√			

(*continued*)

Table 3 (*Continued*)

Title	*Cite*	*Type*	*Themes*			
			Industry Structure	*IOS Value*	*Intermediaries*	*Information Costs*
Limits to interfirm coordination through information technology: Results of a field study in consumer packaged goods distribution	[104]	Case		√		
EUROSELECT: The strategic rationale of an EDI network and its cooperative arrangements in the grocery wholesale industry	[97]	Case	√			
Information assets, technology, and organization	[92]	Conceptual	√			
Does information technology lead to smaller firms?	[86]	Compustat data	√			
Computerized loan origination systems: an industry case study of the electronic markets	[102]	Cases	√			
Interdependent benefits from interorganizational systems: Opportunities for business partner–reengineering;	[105]	Cases		√	√	
The growth of interorganizational systems in the presence of network externalities	[36]	Modeling		√		
Impact of electronic data interchange technology on JIT shipments	[103]	Case, modeling		√		
Determinants of electronic integration in the insurance industry: An empirical test	[96]	Theoretical, survey	√			
Optimal policies for subsidizing supplier interorganizational system adoption;	[107]	Conceptual, modeling		√		
Electronic data interchange: Competitive externalities and strategic implementation policy	[93]	Modeling	√	√		
The emergence of electronic market intermediaries	[116]	Conceptual			√	
Interorganizational business process redesign: Merging technological and process innovation	[109]	Cases	√			
Market-enabling Internet agents	[124]	Conceptual				√
A method to assess expected net benefits of EDI investments	[108]	Case		√		

(*continued*)

Table 3 (*Continued*)

Title	*Cite*	*Type*	*Themes*			
			Industry Structure	*IOS Value*	*Intermediaries*	*Information Costs*
Market process reengineering through electronic market systems: Opportunities and challenges	[60]	Conceptual			√	
Impacts of the electronic marketplace on transaction cost and market structure	[112]	Conceptual			√	
Strategies for smart shopping in cyberspace	[125]	Conceptual				√
An exploratory study of the emerging role of electronic intermediaries	[117]	Cases			√	
Reducing buyer search costs: Implications for electronic marketplaces.	[122]	Conceptual				√
Ownership and investment in electronic networks	[111]	Conceptual, modeling			√	
An economic analysis of the introduction of an electronic data interchange system	[106]	Modeling		√		
Efficient selection of suppliers over the Internet	[32]	Conceptual, modeling				√
Electronic commerce in decision technologies: A business cycle analysis	[76]	Cases			√	
EDI-enabled channel transformation: Extending business process redesign beyond the firm	[50]	Case		√		
Agency relationships and monitoring in electronic commerce	[100]	Conceptual	√			
Designing a market for quantitative knowledge	[113]	Conceptual			√	
Mixed mode network structures: The strategic use of electronic communication by organizations	[99]	Cases	√			
AUCNET: Electronic intermediary for used car transactions	[120]	Case			√	
Do electronic marketplaces lower the price of goods?	[119]	Case			√	
Trading-process characteristics for electronic auctions	[121]	Conceptual			√	

(*continued*)

Table 3 (*Continued*)

			Themes			
Title	*Cite*	*Type*	*Industry Structure*	*IOS Value*	*Intermediaries*	*Information Costs*
Building and sustaining interorganizational information sharing relationships: The competitive impact of interfacing supply chain operations with marketing strategy	[110]	Conceptual, modeling		√		
Intermediation, contracts, and micropayments in electronic commerce	[118]	Conceptual			√	
Creating a custom mass-production channel on the internet	[115]	Conceptual			√	
Exchange costs as determinants of electronic market bearings	[123]	Conceptual			√	

Note. The checkmarks give a clear signal regarding the number of electronic commerce articles within each theme.

expected to increase the efficiency of both hierarchies and markets, but holding all things equal, Malone predicted there would be an increase in the proportion of economic activity coordinated by markets. The theorized lower coordination, search, and switching costs within electronic markets were consequently expected to increase the number of suppliers used by buyers.

In a 15-year (1974–1989) assessment of IT investments and size of the firm, Brynjolfsson et al. [86] claimed their results are "fully consistent with a relative increase in the reliance on markets for coordination following IT investments" (p. 1642). Hess and Kemerer [87], however, explicitly tested the EMH using five case studies of computerized loan origination systems 10 years after their introduction. In contrast to EMH, they found greater use of electronic links to strengthen hierarchical relationships rather than to create electronic markets.

5.2.1.2 Move-to-the-middle hypothesis. Clemons and colleagues [88–90] refined the EMH with their "move to the middle hypothesis." They argued that the lower coordination costs of EC, along with no increase in transaction risk, would lead to a greater outsourcing of production, but this outsourcing would be to a reduced set of selected suppliers. Similarly, Bakos and Brynjolfsson [91] and Brynjolfsson [92] explained that the observed reduction in the number of suppliers in some industries was due to the notion of incomplete contracts, or "noncontractables." Buyers could maximize their own profits by actually limiting their supplier search to a few chosen suppliers. Such limits would motivate suppliers to invest in critical noncontractables such as innovation, responsiveness, and information sharing that would not be supported in pure price markets. Further, the investment costs of an IOS may actually increase the total costs of coordination,

which would also effectively reduce the number of suppliers. Wang and Seidmann [93] provided further economic modeling support for buyers choosing few suppliers.

5.2.1.3 Hybrid forms of ownership and governance. Other researchers have documented how these EC-enabled changes in buyer–supplier relationships have given rise to hybrid forms of industry structure, asset ownership, and governance other than pure market or hierarchy. Citing Konsynski [94] and Venkatraman and Zaheer [95], Zaheer and Venkatraman [96] introduced the term of *electronic integration* as a specific form of vertical, quasi-integration achieved through the deployment of dedicated IS among relevant actors in adjacent stages of the value chain. Klein and Kronen [97] documented how EC enabled a "horizontal virtual organization" to simultaneously leverage the advantages of both markets and hierarchies in the European grocery industry. Bensaou [98] found the presence of IT-enabled hybrid structures in both the U.S. and Japanese auto industries, but the countries differed markedly in their use of these hybrid structures for cooperation to control uncertainty, use of IT, and industry-certified IOS standards. Holland and Lockett [99] described a continuum of industry structures. They examined five European industries and found that IOS supported hybrid structures in three of them (fashion retailing, IT suppliers, and cash management). Croson and Jacobides [100] drew on agency theory to address the need for monitoring of resources committed to hybrid forms of industry organization when incentives are aligned or misaligned among participants.

Thus, early support for both the move to the middle hypothesis and the rise of hybrid structures refine and expand the initial EMH. Such findings, however, may only be evidence of a transitory evolution of business-to-business EC. Both Malone et al. [84] and Bakos [101] anticipated a sequenced transition from the electronic links of hierarchies to unbiased electronic marketplaces. Kemerer and Hess [102], Venkatraman and Zaheer [95], and Brynjolfsson et al. [86] all cautioned that a few years may be an insufficient gestation period for the organizational change and industry transformation necessary to utilize electronic markets and hybrid structures.

5.2.2 Adoption and distribution of IOS value. A second theme of economics-based EC research is the adoption and distribution of IOS value. Although an earlier section of this article reported on the adoption of EC from the management perspective (i.e., characteristics of the organization, characteristics of the innovation, intent to adopt, etc.), economics has been used to address the specific incentives, subsidies, and distribution of IOS value.

5.2.2.1 Creating and appropriating surplus value. Several field case studies have documented that IOS create new (surplus) value among trading partners. The value can take the form of reduced shipping errors, reduced cycle time, timely access to strategic information, or new business [36, 95, 103]. One consistent finding across both case studies and economic models is that surplus IOS benefits are interdependent and unequal between buyers and sellers. Clemons and Kleindorfer [54] formally modeled how bargaining power, as a function of

transaction specificity, uncertainty, and switching costs, affected the distribution of IOS value. Clemons and Row [104] advocated the use of game theory to determine optimal distribution. Thus, research has appropriately segmented the analyses of IOS value into the differing perspectives of buyers and suppliers.

5.2.2.2 Buyer-advocated adoption. Because buyers are the presumed, though not universal, beneficiary of IOS, their rational objective would be to increase supplier adoption of IOS when suppliers may be less than eager to incur adoption costs. Riggins and colleagues [36, 105] argued for buyer subsidies to increase supplier IOS adoption. The subsidization approach has been further refined to consider effects of both incentives and penalties [106] and differing subsidies at differing stages of IOS development [107]. Wang and Seidmann [93] argued that a partial adoption by the supplier base may actually be optimal for the buyer.

5.2.2.3 Supplier adoption. When faced with a buyer-initiated IOS, suppliers face negative externalities in their adoption decision (i.e., declining value of IOS investment as more suppliers adopt). Hoogeweegen and Wagenaar [108] created a decision support system to quantify a supplier's or an industry intermediary's adoption decision. A decision not to adopt may mean a substantial loss of business, whereas adoption may at best incur high costs with little value or may further erode suppliers' bargaining position. Riggins and Mukhopadhyay [105], Clark and Stoddard [109], and Clark and Lee [50] all concured that suppliers must engage in internal process reengineering including integration with internal systems to capture some of the surplus value created by an IOS. Seidmann and Sundararajan [110] advocated that electronic integration should focus on the sharing of strategic data rather than just transactional data. Suppliers should then seek long-term contracts as insurance against buyer abuse of the information asymmetry created by IOS.

5.2.3 Electronic Market Intermediaries

5.2.3.1 Market makers. The third economics-based theme is the creation of and roles for electronic market intermediaries. Malone [85] and Bakos [21] speculated regarding which industry participants would be the electronic market makers. Riggins and Mukhopadhyay [105] observed that market makers—usually buyers—and early adopters often captured a larger share of the value from IOS. Bakos and Nault [111] used economic modeling to argue that optimal ownership of electronic market assets and essential skills varies by industry characteristics. Industries having positive, marginal, and investment network externalities are best served by a single industry system with joint ownership. Lee and Clark [112] further segmented electronic markets into electronic brokerages and auctions, with each form having differing abilities to serve the search, price discovery, and settlement of transactions. Unique characteristics of some products or industries will, however, require very specialized technologies and procedures for creating EM. For example, EM designs for quantitative knowledge from heterogeneous data sources and specific decision support tools are proposed by Geyer et al. [113] and Bhargava et al. [76].

Some vast markets, such as airline travel, may have multiple market makers where both buyers and sellers can chose among intermediaries while bargaining for length of contract and fees or commissions. Chismar and Meier [114] modeled the role of switching costs, benefits, and competitive position using the experiences of airline computerized reservation systems vendors and travel agents. Their model identified options for competitive responses to switching opportunities.

Elofson and Robinson [115] propose that electronic markets can support custom mass-production where an intermediary helps buyers aggregate their product preferences and then negotiates with producers via an electronic auction. Their model shifts mass customization from being supplier driven to being buyer driven.

5.2.3.2 Market roles. Because electronic markets often have many buyers and sellers, there are specific roles required for effective commerce. These roles include facilitation of communication, aggregation and matching of offers, sharing of interorganizational marketing data, developing trust, and guaranteeing quality [116–118]. Lee [119, 120] documented how AUCNet, a successful Japanese used car intermediary, has enacted these roles. Reck [121] outlined how market makers can adapt the trading structures from four different types of auctions to create rules for electronic markets.

5.2.4 Cost of acquiring information. Finally, the fourth economic theme has focused explicitly on the buyer's cost of acquiring information. Bakos [122] explicitly described how electronic markets reduce buyers' acquisition costs. Barua et al. [32] proposed a search process for locating suppliers via complementary evaluation strategies using sequential evaluation and bidding. They advocate the use of buyer announcements of minimum purchase attributes to reduce the supplier set and associated search costs. Perales [123] argued that buyers can reduce their total exchange costs through increasing buyer–seller trust via intermediaries. Other researchers have considered the roles of electronic agents for information acquisition and filtering [124, 125].

5.2.5 Summary and future directions. In summary, much of the economics-based EC research to date has focused on a set of relatively well-defined dependent variables: industry structure, appropriation of IOS value, incentives for IOS adoption, value of intermediaries, and transaction costs. Many of the economics articles have been well linked to prior EC research and have made progress in establishing a cumulative tradition. The dominant methods have been modeling and case studies.

Although the electronic markets hypothesis provides theoretical direction for EC research, it remains absent of empirical support over 10 years after its introduction. Preliminary support for its variant, the move to the middle hypothesis, has been established in multiple industries and through multiple methods. Continued research in multiple industries is needed as longer gestation periods may be needed for the requisite evolutions in IT infrastructure and business practices.

Preliminary research, primarily through case studies, has documented the emergence of hybrid forms of industry structure, asset ownership, and governance. The specifics of these hybrid forms and their causes are not yet well understood. Likewise, there is little insight regarding if these forms are enduring or are only transitory steps en route to the purer forms of markets and hierarchies. Such questions can only be addressed through longitudinal research with temporal points of comparison within specific industries.

Research to date has produced substantial insight regarding the adoption of IOS and appropriation of the economic surpluses created by these systems. In most industries, buyers have initiated the IOS and have captured the larger share of the surplus. Buyer-paid incentives for supplier adoption should optimally vary with the stage of system rollout. Future research may address how electronic supplier coalitions form to balance industry power and ownership of IOS assets. Alternatively, greater cooperation in the form of hybrid ownership and governance may shift the appropriation of IOS value.

Conceptual articles have outlined the roles for new intermediaries, or *infomediaries,* and some case studies have documented their effectiveness in certain industries. Much research is needed to understand the industry and technology factors that lead to infomediary success. The rise of online consumer shopping will provide especially rich opportunities for researching how infomediaries fill needed roles and create value.

There is little doubt that the costs of information acquisition for buyers will fall in the network era of computing. The research challenge, however, is to determine what information should be shared, how it should be structured, to what extent sellers should make it available, and how buyers should digest and act on it.

5.3 Technical

The technical perspective was defined by 39 articles that discuss ways of automating EC or otherwise adding increased value to EC activities. Five themes emerged within this perspective: software agents, data integration from heterogeneous sources, security, transaction settlement, and digital retailing technologies (Table 4). Each is reviewed in turn later.

5.3.1 Agents. Much technical research looks at ways that agents, automated programs with some knowledge of the consumer's wants and needs, can increase the effectiveness of EC. King and Jones [126] looked at example of the NewsAlert service mediated by computer robots. Oliver [127] examined how agents could participate in business negotiations. This work was expanded on by Bichler et al. [128] and Guttman et al. [129]. Keller and Genesereth [130] also looked at virtual catalogs, a catalog that is comprised of information directly from manufacturers' smart catalogs. This allows the manufacturers to keep their individuality, but consumers the ability to "find the market" all in one place. Paper-based examples of such catalogs are like SkyMall catalogs, found on many U.S.-based airlines, and corporate in-house procurement guides.

Table 4
Architecture & Infrastructure

			Themes				
Title	*Cite*	*Type*	*Agents*	*Data Integration*	*Security*	*Transaction Settlement*	*Digital Retailing*
Inter-organization information sharing systems	[137]	Descriptive		√			
Intershop: A distributed architecture for electronic shopping	[151]	Conceptual					√
InterShop: Enhancing the vendor/customer dialectics in electronic shopping	[152]	Conceptual					√
Competitive intelligence, software robots, and the internet: The NewsAlert prototype	[126]	Descriptive	√				
Integrating information from global systems: Dealing with the "On-and off-ramps: Of the information superhighway	[131]	Conceptual		√			
Securing the commercial Internet	[138]	Descriptive			√		
Perils and pitfalls of practical cybercommerce	[140]	Case				√	
Is electronic commerce ready for the Internet?	[141]	Case			√		
Multi-vendor catalogs: Smart catalogs and virtual catalogs	[130]	Conceptual	√				
Money in electronic commerce: Digital cash, electronic fund transfer, and ecash	[144]	Descriptive				√	
Watermarking cyberspace	[143]	Conceptual			√		
The development of FEDI in Switzerland: A life-cycle approach	[146]	Descriptive					√
Platform to publish and retrieve multilingual information on the WWW	[136]	Descriptive		√			
On designing a language for electronic commerce	[133]	Conceptual		√			
Security Issues on the Internet	[139]	Prescriptive			√		

(*continued*)

Table 4 (*Continued*)

Title	*Cite*	*Type*	*Themes*				
			Agents	*Data Integration*	*Security*	*Transaction Settlement*	*Digital Retailing*
Using infomaster to create a housewares virtual catalog	[148]	Descriptive					√
Designing a market for quantitative knowledge	[113]	Conceptual					√
AUCNET: Electronic intermediary for used car transactions	[120]	Descriptive				√	
The past and future history of the Internet	[142]	Conceptual			√		
EFT in electronic commerce in the USA	[145]	Descriptive				√	
Gulliver: Distributing Irish tourism electronically	[149]	Case					√
Artificial agents learn policies for multi-issue negotiation	[127]	Conceptual	√				
Requirements for electronic markets architecture	[132]	Conceptual		√			
The concept of mediating electronic product catalogues	[135]	Conceptual		√			
eCo System: CommerceNet's architectural framework for internet commerce	[150]	Descriptive					√
Design criteria for electronic market servers	[153]	Conceptual					√
Information technology infrastructure for textile and apparel industry in Hong Kong	[78]	Descriptive		√			
The Electronic Mall Bodensee (EMB): An introduction to the EMB and its architectural concepts	[147]	Descriptive					√
Services of a broker in electronic commerce transactions	[128]	Conceptual	√				
Agents as mediators in electronic commerce	[129]	Conceptual	√				
Expanding the reach of electronic commerce: The Internet EDI alternative	[20]	Conceptual		√			
Introducing XML/EDI frameworks	[134]	Conceptual		√			

Note. The checkmarks give a clear signal regarding the number of electronic commerce articles within each theme.

5.3.2 Data integration. Much work has been done with the goal of facilitating heterogeneous systems in potentially many countries. Madnick [131] proposed the problem of integrating data from disparate sources so that the agents mentioned earlier will be able to compare goods in a meaningful format, such as making sure prices are uniformly reported in Euros or dollars, and Schmid [132] continued with that theme. Covington [133] set forth an important concept by proposing a formal language for business communications and the language for electronic commerce as a standard for computers to speak with each other when performing EC. EDI had ANSI X.12 standards for completing transactions, and there is a possibility that traditional EDI will somehow migrate over onto the Internet. Webber [134] proposed an XML/EDI framework as another standard for completing transactions, and Senn [20] also explored EDIs migration into the Internet. Schmid et al. [135] took a slightly different approach to the problem, but also developed a standard for creating electronic catalogs in an agent-friendly format. Native language of the supplier and consumer is also an important consideration, and Cha [136] presented a platform to mitigate parts of this problem.

5.3.3 Security. As we move from conducting transactions from private to public networks, data security takes on a new importance. This was not a big concern in Barrett and Konsynski's [137] article describing IOS as a means to strategic advantage through technology. However, the ability to electronically eavesdrop on an electronic transaction has both merchants and consumers looking for ways to protect the integrity of the transaction as well as the participants. Bhimani [138] and Garfield and McKeown [139] gave good overviews of planning for EC security and steps businesses can take to increase the confidence in the integrity of transactions. Borenstein et al. [140] and Cooper and Duncan [141] gave cases where security was a definite issue and list steps actual businesses took to overcome those problems. Leiner et al. [142], in their futuristic essay, also described potential means used to secure transactions in the future. Authenticity of documents sent over the Internet is also a requirement, and Berghel [143] described an algorithm and method for digitally "watermarking" documents to prevent alteration of the document en route from sender to receiver.

5.3.4 Transaction settlement. Many researchers are also investigating ways that transactions can be settled electronically. For years, banks have been able to wire money from one place to another, but this concept is not available to the average consumer to purchase goods on a whim.[2] Credit cards are most commonly used today in the settlement of retail transactions on the Web, but even this requires expense to merchants and time before their accounts is credited and the consumer is debited for the purchase amount. Panurach [144] looked at electronic funds transfer (EFT) a newer complement to wiring money, as well as new

[2]Of course, the extent to which people have capabilities with electronic cash varies internationally. Although the average consumer in the United States does not have this capability, consumers in other countries, such as Finland, do.

concepts like digital cash and e-cash as ways of settling transactions. Lieberman [145] further looked at the proliferation of EFT in the United States. Borenstein et al. [140] also described the electronic payment system used by First Virtual Holding.

5.3.5 Digital retailing technologies. A number of articles within the technical perspective presented case studies of actual technology implementations at either the organizational, industrial, or country level. For example, Cathomen and Klein [146] described the creation and use of a financial EDI system in Switzerland, and Zimmerman [147] talked about creating the technical infrastructure to support an electronic shopping mall in the Bodensee area of western Europe. Similarly, Genesereth and Keller [148] described the use of an electronic catalog to market and sell housewares. Gulliver, the Irish tourism board's electronic system, is detailed by O'Connor and Rafferty [149]. Yen and Su [78] described the infrastructure used by the apparel and textile industries in Hong Kong for communication and commerce, whereas Tenebaum [150] described the architecture used by CommerceNet in the creation of EcoSystem. Baty and Lee [151, 152] described a potential electronic shopping system, and Wrigley [153] further described the architecture that could be used the design of servers to support these markets, but for the most part these case studies present real systems that are in use as opposed to proof-of-concept prototypes.

5.3.6 Summary and future directions. Obviously, EC will not be possible without the technical underpinnings and architecture to support it. Agents are perhaps the wave of the future, as they learn buyers' and sellers' wants and needs and are able to make decisions without direct human intervention. For these agents to conduct secure transactions, research needs to continue on authentication and encryption to build the confidence of both buyers and sellers in EC. Participants can learn from each other by studying the models implemented and proposed by others for building EC sites. Finally, we need to continue to explore ways to create standards that will make electronic communications for business easier, such as through the creation of a common language for business.

Kimbrough and Lee [154] enumerated three communication-oriented topics, with a technical focus, for EC researchers to pursue:

1. Development of a formalized language for business communication that overcomes the many limitations of EDI standards. Speech acts theory would be the logical basis for its design. It would be the essential language of intelligent agents and would include logical, modal, deontic, and defeasibility operators capable of both informative and performative communication acts.
2. Development of formal electronic trading procedures to support ad hoc, open electronic transactions where the level of trust, coordination, and duration of the trading relationship are all low or brief. These procedures will be necessary for agent-based negotiation and formal audit controls.
3. Development of optimized interfaces for EC-oriented managerial decision support, online shopping, and multilingual documents.

If technical research were to continue down the lines proposed by Kimbrough and Lee, it would go a long way toward answering many important EC questions. Although we are not necessarily looking in EC research for direct ways to optimize communications networks, as we might expect of electrical engineers and computer scientists, we do need the technical understanding to support the business processes. The research that can be done here will greatly aid the underpinnings of EC.

5.4 Other Perspectives

Although the bulk of the published research on EC research can be found in the organizational, economic, and technical themes, there has also been some useful EC research that cannot be classified neatly within these three areas. In Table 5, we briefly summarize this additional research under three categories: social, behavioral, and legal.

5.4.1 Social. Eighteen research articles on EC dealt with issues at the social level. Within this area we saw two major recurring themes emerging: international development and the role of government. We describe each in turn later.

5.4.1.1 International development. There were a number of articles within the social category in which the authors focused on a particular country and described EC developments there. Among the countries included in these types of articles were Australia [155], Korea [156], India [157], Philippines [158], Singapore [159], and China [160]. Aside from providing useful descriptions of EC infrastructure and use around the globe, these articles also provide useful ideas for practitioners and researchers. For example, Dutta [161] described the telecommunication infrastructures within developed versus developing countries and discussed the role this plays in EC development globally. In addition, Vogel and Gricar [162] described a use of a group support system to enable policymakers and business leaders in Slovenia to focus on EC.

5.4.1.2 Role of government. A few articles dealt directly with the role of government in EC. For example, Von Alstyne and Brynjolfsson [163] argued for a potential "balkanization" of communities as a result of increased use of the Internet and described how this can be avoided with smart policy choices. West [164] described the role of government in EC and argued that governments need to become more entrepreneurial or risk having some of their services become privatized. Wang et al. [165] described customer privacy concerns about Internet marketing and discussed how these can be best managed at the organizational and societal level.

Although there are not a lot of articles in the social category, the research methods employed in this area are diverse. Within this relatively small batch of articles, we saw uses of mathematical modeling, archival data analysis, participant longitudinal study, case study, survey research, and a number of conceptual articles.

Table 5
Other Perspectives

Title	*Cite*	*Type*	*Themes*		
			Social	*Behavioral*	*Legal*
The adoption of Tradenet by the trading community: An empirical analysis	[41]	Case		√	
InterShop: Enhancing the vendor/customer dialectic in electronic shopping	[152]	Case		√	
Electronic communities: Global villages or cyberbalkanization?	[163]	Conceptual	√		
Potential of electronic markets in the Philippines	[158]	Conceptual	√		
The design and development of Internet- and intranet-based collaboratories	[37]	Conceptual		√	
Electronic commerce in India: The untapped potential	[157]	Conceptual	√		
The physical infrastructure for electronic commerce in developing nations: Historical trends and the impact of privatization	[161]	Conceptual	√		
Consumer reactions to electronic shopping on the World Wide Web	[169]	Survey		√	
Obeying the laws of cyberspace	[172]	Conceptual			√
The government's role in diffusion of EC in Korea	[156]	Conceptual	√		
Formal aspects of electronic commerce: Research issues and challenges	[154]	Conceptual		√	
The past and future history of the Internet	[142]	Conceptual	√		
China's information super highway: Its goal, architecture and problems	[160]	Conceptual	√		
Assessment of electronic commerce developments in Singapore	[159]	Conceptual	√		
Marketplace strategy and the European information society	[79]	Conceptual	√		
Electronic cash in Hong Kong	[39]	Conceptual		√	
Toward virtual communities in rural Australia	[155]	Case	√	√	
Web-based sales: Defining the cognitive buyer	[166]	Conceptual		√	
Consumer behaviors and unresolved regulatory issues in electronic marketing	[168]	Conceptual		√	
Adding value in the information age: Uses and gratifications of sites on the World Wide Web	[167]	Conceptual		√	
Internet commerce basics	[5]	Conceptual	√		
Marketing information on the information I-way	[71]	Conceptual	√		
Web-based customer decision support systems	[170]	Conceptual		√	

(*continued*)

Table 5 (*Continued*)

Title	*Cite*	*Type*	*Themes*		
			Social	*Behavioral*	*Legal*
The need for supporting electronic commerce systems with electronic contracting systems	[173]	Conceptual			√
Using electronic commerce to focus a country: The case of Slovenia	[162]	Case	√		
Customer privacy concerns about Internet marketing	[165]	Conceptual	√		
Electronic markets and electronic governments	[164]	Conceptual	√		

Note. The checkmarks give a clear signal regarding the number of electronic commerce articles within each theme.

5.4.2 Behavioral. Thirteen articles dealt with issues at the behavioral level, and for the most part these dealt with consumer behavior.

5.4.2.1 Consumer behavior. Consumer behavior appeared to be the theme running through nearly every one of the handful of articles within this category. Several discussed consumer perceptions, behaviors, and uses of EC [166–168]. For example, Jarvenpaa and Todd [169] reported the results of a survey that suggests that shoppers on the Web liked the breadth of stores but not the depth within. Shoppers also perceived that shopping via the Web saved them time and effort, but they were not happy with service and perceived shopping via the Web to be somewhat risky. Two other articles took a slightly more technical approach within this category. For example, O'Keefe and McEachern [170] described a decision support system to support consumer decisions via the Web. Similarly, Westland et al. [39] described consumers' transition from cash to smart cards in Hong Kong.

There are no dominant research methods within this category, given the relatively small number of articles. The articles included used survey methods, observation, case study, and conceptual essay.

5.4.3 Legal. Three articles that were captured in our search dealt with legal issues and are summarized next.

Cavazos [171] described a sampling of the potential legal problems for the entrepreneur doing business on the Internet, including privacy and liabilities, common law privacy torts, copyright, and defamation. Kiely [172] advised that, given the legal implications of EC, organizations move into EC incrementally, managers develop EC legal knowledge and skills, and that managers attempt to get involved and influence EC policy within their countries. Finally, Runge [173] described the process and implications of electronic contracting.

The articles within this category were each conceptual with a combination of descriptive and prescriptive intent, perhaps necessarily so given the nature of the category.

Table 6
Research Framework

	Electronic	*Commerce*
	Creation and adoption of online enabling technologies	Changes in the conduct of business, or "value exchange"
Business-to-business	Creation of IOS (EDI)	Value system rationalization
	Adoption of IOS	Redistribution of IOS value
	National infrastructures	Changes in industry structure, ownership, governance (e.g., infomediaries)
		Changes in business strategy
Business-to-consumer	Peer-to-peer supply chain software	Channel conflict
		Marketing uses of networks
	Shopping agents	Mass customization
	National infrastructures	New infomediaries
		Reduced costs of buyers acquiring info
Consumer-to-consumer	National infrastructures	Electronic markets
	Peer-to-peer software	

Note. IOS = interorganizational systems; EDI = electronic data interchanges.

5.5 Framework for EC Research

The organizational, economic, and technical perspectives provide a useful analysis of the theoretical bases for EC research. They do not, however, organize research areas that may span perspectives and focus on one segment of EC. In Table 6, we categorize the themes across the research perspectives to recognize both the online and value exchange components of EC and segment by the scope of value exchange: business-to-business, business-to-consumer, and consumer-to-consumer.

The Electronic column addresses research and development opportunities focused on the creation of online EC infrastructures. Examples include the establishment of technical standards or new technologies for delegation of shopping and are often targeted to one scope of interaction. This also includes organizational adoption of online technologies, as this is an antecedent to their effect on commerce. The Commerce column addresses research targeted at understanding the impacts of online EC technologies on the value exchange process. Examples include changes in industry structure, mass customization of products, and consumer-to-consumer electronic markets. Each of these is of interest to IS researchers, with the consumer-to-consumer area being the least researched component to date.

6 EC RESEARCH AND THE IS DISCIPLINE

Having synthesized EC research to date and proposed some next steps, we now ask what role will the field of IS play in advancing EC research? Given the relative newness of the IS discipline, particularly when compared to the relatively older disciplines of economics and management, and given the inherently interdisciplinary nature of the IS discipline, it is important to think about the role that IS can, should, and will play in research on EC.

Because EC is important and popular, and interdisciplinary by its very nature, one can reasonably expect a continued flurry of research papers from those disciplines that contribute to and are affected by EC (e.g., marketing, economics, computer science, information sciences, and business information systems). Fortunately, the IS discipline is itself interdisciplinary and thus far has played a unique role as the nexus of EC research. By this we mean that not only have IS journals been the most common outlet for EC research, but, more important, the IS discipline lies at the heart of EC research, bridging the gap among the organizational, economic, and technical aspects of EC research. Indeed, one could argue that IS researchers are perhaps the best equipped to understand and study this phenomenon, given that they are uniquely trained to understand the interactions of people, technology, commerce, and organizations. Disciplines such as accounting, management, marketing, and economics, with long-established traditions and well-entrenched dependent variables, have not been required to be interdisciplinary in order to succeed, as is common among IS researchers. In this vein, the IS discipline has an opportunity to continue to be a primary generator of and repository for EC research.

If, however, IS researchers are to lead EC research, we contend that they must address two key issues if EC research is to produce valuable and timely knowledge. The first issue is the systematic development of coherent streams of EC research focused on specific, micro-level questions, whereas the second addresses requirements for establishing a cumulative EC research tradition at a macro level.

6.1 Developing Coherent Streams of EC Research

6.1.1 Reference disciplines and theory. Keen [174, p. 13] argued that researchers in a given area should build on each other's work and invoke shared definitions and concepts. This advice is prudent for EC research as a whole, but it fits better for the specific themes of EC research that can potentially emerge as coherent research *streams.* The diverse nature of EC research and the initial development of EC research streams as described earlier (i.e., themes within the organizational, economic, and technical perspectives) suggest that this area of research will evolve as multiple, and perhaps relatively independent, streams of research. For example, one can scarcely imagine a single research article effectively addressing intention to adopt (organizational), electronic agent behavior and motivation (economic), and blackboard architectures (technical). Similarly, EC researchers studying how and why business marketing changes for the better when firms move to the Web will likely find little value in research that mathematically models electronic market behavior.[3] Streams of research deal with collections of related questions and are roughly represented by the themes identified in the literature review (e.g., EDI adoption, appropriation of IOS value, and agents). As a stream of

[3]We recognize that there will be instances where an EC research study in one EC research stream will benefit from research conducted in another stream, but we believe that such instances will be the exception rather than the rule.

research is originated and developed, it will identify and draw on its own reference disciplines, theories, common methods, and dependent variables.

Keen [174] also argued that reference disciplines should serve to inform rather than to constrain applied research fields such as IS. In particular, reference disciplines can provide necessary methodological guidance, an informed base of theories, and a reference point for quality control on which EC research can be built. Researchers err when viewing EC as a new, technology-driven phenomenon and fail to recognize it in the context of existing theories. For example, studies of EC adoption, diffusion, and use will benefit from the extensive body of management (e.g., Van de Ven et al. [175]) and IS literature [176, 177] on these topics. Linking specific EC constructs with precision to existing theories and then building strongly on those theories will be more valuable than passing citations of Rogers' [178] work on diffusion. We contend that research within each of these EC streams ought to be coherent in and of itself and with the relevant body of research that precedes it, but that it is not necessary or feasible for EC research in its entirety across all streams to be strictly coherent.

6.1.2 Dependent variables. Each stream of EC research will benefit from selection of relevant and measurable dependent variables. Keen [174] warned how improper surrogates of the relevant dependent variables can mislead well-intended research efforts. Dependent variables in IS research have measured system quality, information quality, use, user satisfaction, and organizational impact [12]. Each of these is directly applicable to EC research and may be more or less important to a particular stream. Information quality, for example, is directly applicable to economics, whereas system quality is of interest to transaction settlement as a technical research stream.

EC researchers may frame their choice of dependent variables in two ways. The first calls for alignment with a reference discipline. For example, the perceived success of the implementation may be of particular interest to the adoption and diffusion literature. The second alternative for framing the dependent variable, however, aligns more closely with our definition of EC as the *online exchange of value.* Because EC research is relatively applied, we argue that the dependent variable must be closely linked to the creation of business value. For example, it would be possible for the implementation of an EC system to be perceived as highly successful by employees and managers and yet fail to create any business value. Although we do not minimize the serious challenges of measuring and assessing business value, we do argue that reasonable steps toward such measures are possible. Quantitative data regarding access to new markets, reduction in transaction costs, and measured improvements in cycle time are all indicators of business value. Refinement of these dependent measures over time will improve the coherence of an EC research stream.

Both the organizational and economic perspectives provided themes that are developing as coherent streams of EC research. The economic stream regarding the effects of EC on industry structure provides an example of research that is grounded in a reference discipline, advanced specific research hypotheses, has identified meaningful groups of dependent variables, and is self-referencing among articles. In contrast, new EC articles that fail to link to either an existing

stream or to carefully launch a new stream of EC research are unlikely to add value. This brings us to the second key issue: establishing a cumulative EC research tradition at a more macro level.

6.1.3 Establishing a cumulative EC research tradition. Although this establishing reference disciplines and dependent measures for micro-level EC research streams is essential, alone it will be insufficient to produce a cumulative EC research tradition, at a macro level. Keen argued [174] that in a cumulative tradition, researchers not only build on each other's work and invoke shared definitions and concepts, but also have specialized journals where each has a clear focus and there is some "definition of orthodoxy, while unorthodoxy is not discouraged" [p. 13].

EC research shows some progress in this area, though much work remains. As is self-evident from Tables 2 through 5, EC research has appeared in a variety of publication outlets making it more difficult to establish a cumulative tradition. The major literature review within this article is one step toward integrating this burgeoning, disparate literature. In addition, the emergence of EC-oriented journals (e.g., *Journal of Organizational Computing and Electronic Commerce, The International Journal of Electronic Commerce,* and *The International Journal of Electronic Markets*) is another positive development. We need to think more, however, about where good EC research ought to be published. Although specialty EC research journals are useful, as argued by Keen [174], they present interesting potential problems as well. For example, a disproportionately low number of EC research articles (only 43 of the 202 articles in Tables 2–5) appeared in the top three IS journals as identified by Hardgrave and Walstrom [179] (*Communications of the ACM* (*CACM*), *Information Systems Research*, and *MIS Quarterly*) with a relatively high number of those (19) appearing in *Communications of the ACM*.

We argue that although the specialty journals play a useful role, good EC research needs also to be published within the mainstream IS journals. This will help to further inculcate within this research area the rigor of our mainstream research journals,[4] and it will help to promote the acceptance and spread of EC research within the IS discipline. There are several ways that this can be achieved. For example, the mainstream IS research journals can have special issues devoted to relevant, rigorous EC research. This will help to further legitimate EC research within IS and draw the interest of IS researchers and doctoral students to this area, which in the long term is ultimately beneficial to the IS mainstream research journals, the EC specialty journals, indeed, to the IS discipline as a whole.

Regardless of whether good EC research is published within the IS mainstream research journals or within EC specialty journals, if we do not promote the conduct and publication of good EC research within the IS discipline, then it will be conducted and published elsewhere, such as in management, economics, and marketing. One can see the beginnings of this trend happening already. Further, academic departments within these areas work feverishly to offer EC-related courses, and at a recent national marketing academic association annual meeting, the hiring demand for people in marketing with IS experience and training was

[4]This is not to say that the EC research published in EC specialty journals is not or will not be of good quality.

evident. One could argue that it is natural and necessary that EC research shift more to the reference disciplines, but we argue that IS researchers by training are better able to address the interdisciplinary EC issues. Further, for a variety of reasons, it would be beneficial to the IS discipline to lead in understanding EC phenomena.

Finally, issues of research quality must not become lost in the excess publishing capacity available. Both editors and reviewers for all journals must insist on the use of emerging concepts and shared definitions as they become accepted. Although EC research as a whole must be open to all types of research methods that contribute to knowledge creation, enforcement of rigor within the selected methodology is essential for the production of credible knowledge. Robey [180] called this the Triad for the Justification of Research, stating that the research aim should drive the theoretical foundations and research methodologies. Although he does not want to classify great blocks of methods and theories as unworthy of publication in IS journals, he demands that rigor be applied to advance the field. At this stage in EC research, additional atheoretical research involving descriptive cases, surveys, and opportunity samples are unlikely to significantly advance EC research.

7. CONCLUSION

EC is a multifaceted and emerging interdisciplinary research effort that has been largely unaware of itself. Perhaps this is because of the unparalleled growth in EC research. With only 15 articles predating 1993 and 86 published in 1997 alone, the growth of interest in EC is self-evident. Ten or 20 years hence, perhaps even sooner, conversations of commerce are likely to presume electronic commerce. This literature review documents that several streams of research have emerged within the organizational, economic, and technical perspectives described here. This article provides a road map to existing EC research and the themes evident in these articles. It recommends next steps for future research efforts and provides advice to help this young research area develop a cumulative tradition. The intentional development of coherent EC research streams is absolutely necessary if EC researchers, and the IS area in particular, are to make useful contributions to this fast-moving phenomenon. The network era of computing is rapidly unfolding, with little understanding of its far-reaching effects on commerce. In the absence of coherent and value-adding research on this topic, IS area itself risks disintermediation.

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