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# The Intellectual Core Of Electronic Commerce Research From 2006 To 2010

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# THE INTELLECTUAL CORE OF ELECTRONIC COMMERCE RESEARCH FROM 2006 TO 2010

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## Abstract

*The purpose of this paper is to explore the intellectual core of electronic commerce (e-commerce) research. Data was collected from the top six e-commerce journals (Lowry, Romans, & Curtis, 2004), the International Journal of Electronic Commerce, MIS Quarterly, Electronic Market, Journal of MIS, Information Systems Research, Management Sciences from 2006-2010. A total of 1056 electronic commerce related articles and 33036 references were identified. There were 47 high value research articles identified using a citation and co-citation analysis. Using factor analysis we identified five research areas: trust, technology acceptance and technology application, e-commerce task-related application, e-markets, and information systems success. The findings of this study provide core knowledge and directions for researchers and practitioners interested in the electronic commerce field.*

*Keywords: Citation analysis, Classification, Electronic commerce, Co-citation.*

# 1 INTRODUCTION

During the last decade, a rapid change in electronic commerce (EC) has occurred due to globalization and advances in internet technology (Ngai & Wat, 2002; Zwass, 2003). The continuing improvements in e-commerce have led to many new and fascinating applications in business processes. To make business organizations grow in this rapidly changing environment, transferring findings from e-commerce studies into practice may be the critical contribution. Therefore, the rapidly growing number of internet users and global electronic commerce has led researchers to study the topic of electronic commerce (D. Gefen, E. Karahanna, & D. W. Straub, 2003; Heinze & Hu, 2006). With numerous electronic commerce journal articles, increasingly more scholars and practitioners would like to identify and understand the core knowledge of e-commerce. Thus, the intellectual core of this field has recently become an important research issue (Bardhan, Demirkan, Kannan, & Kauffman, 2010; Wade & Nevo, 2006; Yu & Liu, 2010).

The purpose of this study is to explore the intellectual core of electronic commerce research. The core knowledge of a field is not easily identified. In the past, to explore the core issues of e-commerce, researchers always needed to examine a large number of articles (Kauffman & Walden, 2001; Ngai & Wat, 2002), and to spend a considerable amount of manpower and energy, but the research results were argued with subjective decisions. To overcome these shortcomings, this study collected research articles from top six e-commerce journals (Lowry, et al., 2004), the International Journal of Electronic Commerce, MIS Quarterly, Electronic Market, Journal of MIS, Information Systems Research, Management Sciences from 2006-2010. Citation and co-citation analysis approaches are used to analyze e-commerce articles. We can identify highly valued articles. Hence, factor analysis is used to identify the core knowledge of e-commerce.

## 2 LITERATURE REVIEW

### 2.1 Electronic Commerce

E-commerce, which originated in 1993, conveys information more effectively, improves organizational efficiency and indirect activities of an organization's agenda (Zwass, 2003). As the internet developed, electronic commerce grew rapidly. The number of studies of electronic commerce also increased. E-commerce knowledge is often narrowly defined in Internet-related business activities and services. To better understand the nature and scope of e-commerce, a number of studies reviewed the literature, proposed a framework, or classified electronic commerce articles. For example, Zwass (1996) proposed a framework for e-commerce integration. The framework has three meta-levels, Infrastructure, Services, Products, and Structures. Ngai and Wat (2002) reviewed and classified the appropriate electronic commerce (EC) studies between 1993-1999. Their results reveal four main categories: application areas, technological issues, support and implementation, and others. Recently, Zwass (2010) performed an extensive literature review and developed a comprehensible taxonomic framework of factors in co-creation including co-creators, task characteristics, process, and co-created value in electronic commerce.

### 2.2 Co-Citation

Co-citations analysis in the units of measurement shows that the relationships between reference documents can be measured (Small, 1973). We focus on co-citations and try to identify the subfields and core research areas of e-commerce. The co-citation indirect reference is a more objective quantitative analysis to shows a trend of evolution, not a few personal views. On the other hand, it's breaking the limit on the number of artificial classification. The parameters that possibly affect the result of co-citation analysis include key words, specific journal, literature, author, journal, multi-period, and single period. Many studies use the co-citation method to explore important issues. We

reviewed the previous researches (Casey & McMillan, 2008; Culnan, 1987; Hsiao & Yang, 2011; Lin, Wang, & Tsai, 2010; Pilkington & Meredith, 2009; Schildt, Zahra, & Sillanpaa, 2006; Sircar, Nerur, & Mahapatra, 2001; Tight, 2008) and summarize the co-citation usage in Table 1.

Author(Year)	Research methods	Research issue	Data reference		Analysis of the object			Period	
			K	SJ	L	A	J	M	S
Culnan (1987)	Co-citation	MIS Key Issue		•		•			•
Sircar et al.(2001)	Co-citation	System Development		•		•			•
Schildt et al.(2006)	Co-citation	Entrepreneurship Research	•	•	•				•
Tight (2008)	Co-citation	Education Research		•		•			•
Casey and McMillan (2008)	Co-citation	Industrial & Labor Relations		•		•	•	•	

Table 1. Co-citation literature review. Note: K(Key Word), SJ(Specific Journal), L(Literature), A(Author), J(Journal), M(Multi-period), S(Single period)

### 3 METHODOLOGY

In this section, we introduce procedures to discover the intellectual core of electronic commerce research. First, the data source is selected to identify the electronic commerce related articles. All articles in the study are published in the top electronic commerce journals, which are high quality papers, resulting in an increase in the reliability of the data sources and results (Ramos-Rodriguez & Ruiz-Navarro, 2004). Second, citation analysis is used to rank and find highly valued electronic commerce articles. Third, the co-citation method is used to obtain the raw matrix that can be analyzed by factor analysis to extract the intellectual core of electronic commerce research.

#### 3.1 Selection of data source

Lowry et al. (2004) performed the largest global, scientometric survey of information system (IS) journal rankings, allowing the subjects to freely rank the top four of the core journals, creating a majority decision rather than one by a few specific scholars. Their results show that the top six e-commerce journals for IS researchers are IJEC, MISQ, EM, JMIS, ISR, MS. The IJEC and EM journals are solely e-commerce research journals. MISQ, JMIS, ISR, and MS are top IS journals and the most popular venues for publishing EC studies(Bharati & Tarasewich, 2002; S. M. Lee, Hwang, & Kim, 2007). These top six e-commerce journals are our target journals. A total of 1662 research articles are identified. Due to the rapid growth of electronic commerce recently, we focus on the articles published in the past five years (from 2006 to 2010). The authors collected keywords from a top electronic commerce journal, the IJEC, from 1996 to 2009. There are 1470 keywords and repeat ones are removed. A total of 1118 keywords are left and distributed into Zwass's seven layer hierarchical structure for e-commerce: (1) Electronic marketplaces and Electronic Hierarchies; (2) Products and systems; (3) Enabling services; (4) Secure messaging; (5) Hypermedia/multimedia object management (6) Public and private communication utilities; (7) and Wide-area telecommunications infrastructure (Zwass, 1996). We also invited two experts to assess the keywords that represent e-commerce. There are 106 valid e-commerce keywords. The 106 valid e-commerce keywords are used to verify electronic commerce related articles in their abstract and keywords of the MISQ, JMIS, ISR, and MS published papers during the 2006 to 2010 period, there are 778 EC related articles in major IS journals. And 278 EC articles published in EC specialty journals. A total of 1056 electronic commerce related articles and 33036 references are identified.(Note: The source data of electronic commerce related articles do not include JMIS, Vol. 27 Issue 3 - Winter2010 because EBSCO database was not included on Feb. 1st 2011.)

### 3.2 Citation Analysis

Citation analysis is used to process a large amount of information. Researchers use citation analysis to evaluate the literatures to understand the trends in periodicals, the reference rate, and the research units in the same research issues or for a particular journal (Chang & Hung, 2004; Hung, Hung, Kang, & Tang, 2009), and in accordance with the articles specified in the literature, an analysis of issues such as statistics of citation rankings (Claver, Gonzalez, & Llopis, 2000; Yang & Wu, 2007). In this research, the authors use citation analysis to identify highly cited articles. In general a highly cited research article always represents a highly valued article.

### 3.3 Co-citation Method

Co-citation analysis is a well-known structuring method in bibliometrics (Borgman, 1989) and is based on a frequency count of two documents that are cited in pairs in the same study (Small, 1973). Therefore, through a number of highly relevant cluster, we can observe the structure of scientific knowledge in the field and define a research front (Price, 1965). To produce an original citation matrix two components of the conditions of their results need to be met: (1) a set of highly cited source documents that represent the core studies in an area of research, and (2) a set of citing documents that cite those core documents (Hsiao & Yang, 2011). After creating a co-citation matrix, data conversion is necessary to achieve standardization. In this study, the Squared Euclidean distance is selected to convert the matrix and the diagonal of the matrix data is replaced by the maximum value citation of the literature item (H. White, 2003). The standardized citation matrix of co-citation can be analyzed by factor analysis (Small & Griffith, 1974).

#### 3.3.1 Factor Analysis

Factor analysis is a kind of interdependence technique that analyzes interrelationships (correlations) among a large number of variables, and performs data summarization and reduction. It's commonly used in co-citation analysis (Culnan, 1987; Leydesdorff & Vaughan, 2006; H. D. White & McCain, 1998) to analyze the relationship between each variable and define the underlying structure among the variables in the analysis, known as factors. The important research articles are always co-cited by other studies within a specialized area (McCain, 1990). Those research articles are prone to load the same factor, which represents a subfield/factor. Every subfield corresponding to the analyzed factor describes an intellectual core defined by articles it loads highly in that subfield/factor (Hsiao & Yang, 2011).

## 4 RESULT

### 4.1 Citation Analysis

This study counted literature citation frequency from the core of the top six e-commerce journals from 2006 to 2010. Each highly valued literature was cited more than 16 times. In total, 47 articles comprised the set of the source document. Thus, these articles formed a  $47 \times 47$  square co-citation matrix. Table 2 shows the highly cited documents (The document code in the first column facilitates the two-dimensional graph representation). We show these highly values studies yearly in Table 2.

No	Author(Year)	Journal	No	Author(Year)	Journal
1	Davis (1989)	MIS Quarterly	25	Pavlou (2003)	International Journal of Electronic Commerce
2	Venkatesh, et al.(2003)	MIS Quarterly	26	Bhattacharjee (2001)	MIS Quarterly
3	Gefen et al.(2003)	MIS Quarterly	27	McKnight et al.(1998)	Academy of Management Review

4	McKnight et al.(2002)	Information Systems Research	28	Agarwal and Karahanna (2000)	MIS Quarterly
5	Davis et al.(1989)	Management Science	29	Benbasat and Zmud (2003)	MIS Quarterly
6	Podsakoff et al.(2003)	Journal of Applied Psychology	30	Karahanna et al. (1999)	MIS Quarterly
7	Fornell and Larcker (1981)	Journal of Marketing Research	31	Doney and Cannon (1997)	Journal of Marketing
8	Ba and Pavlou (2002)	MIS Quarterly	32	Katz and Srapiro (1985)	American Economic Review
9	Pavlou and Gefen (2004)	Information Systems Research	33	Armstrong and Overton (1977)	Journal of marketing research
10	Hevner et al. (2004)	MIS Quarterly	34	Jarvenpaa et al.(2000)	Information technology and management
11	DeLone and McLean(1992)	Information Systems Research	35	Bharadwaj (2000)	MIS Quarterly
12	Bakos (1997)	Management Science	36	Klein and Myers (1999)	MIS Quarterly
13	Chin et al. (2003)	Information Systems Research	37	Venkatesh and Morris (2000)	MIS Quarterly
14	Jarvis et al.(2003)	Journal of Consumer Research	38	Carte and Russell (2003)	MIS Quarterly
15	Malone et al.(1987)	Communications of the ACM	39	Diamantopoulos and Winklhofer (2001)	Journal of marketing research
16	Mayer et al.(1995)	Academy of Management Review	40	Orlikowski and Lacono (2001)	Information Systems Research
17	Brynjolfsson and Smith (2000)	Management Science	41	Pavlou and Gefen (2005)	Information Systems Research
18	Venkatesh and Davis (2000)	Management Science	42	Wixom and Todd (2005)	Information Systems Research
19	Podsakoff and Organ (1986)	Journal of Management	43	Bhattacharjee (2002)	Journal of management information systems
20	Moore and Benbasat (1991)	Information Systems Research	44	Lee and Turban (2001)	International Journal of Electronic Commerce
21	Delone and McLean (2003)	Journal of Management Information Systems	45	McKinney and Yoon (2002)	Information Systems Research
22	Taylor and Todd (1995)	Information Systems Research	46	Choudhury and Sabherwal (2003)	Information Systems Research
23	Sambamurthy et al.(2003)	MIS Quarterly	47	Bakos (1991)	MIS Quarterly
24	Koufaris (2002)	Information Systems Research			

Table 2. High cited articles

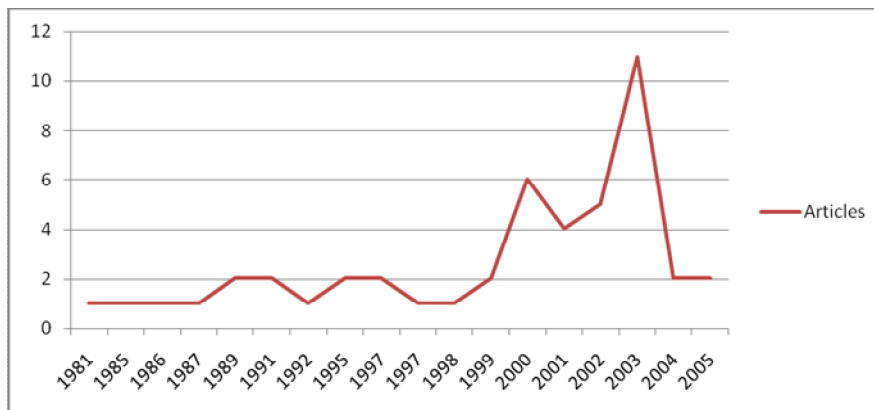


Table 3. Highly cited articles yearly

Table 3 shows that there were few core studies in e-commerce before 1999. From the year of 2000, the core literature of e-commerce clearly began to grow with more highly valued research articles appearing in 2003.

#### 4.2 Factor Analysis

Factor analysis is used to do define the underlying structure among the variables in co-citation analysis (Culnan, 1987; Leydesdorff & Vaughan, 2006; H. D. White & McCain, 1998). The results of factory analysis reveal 5 subfields/factors. After studying the concept of mining the structure for its components, the 5 subfields/factors were named trust, technology acceptance and application, E-commerce task-related review, E-markets, and information systems success.

### 5 DISCUSSION

Five main subfields/factors of e-commerce were obtained from this study and were discussed as follows. The first emerging core knowledge in e-commerce is trust. Because the innovative e-commerce services in the information processes are more dependent on electronic data transmission network (M. Lee & Turban, 2001). Users are concerned with the confidentiality of electronic data exchange impacting their identity. Enhancing the user's trust in e-commerce applications is still a focus of scholars (Ba & Pavlou, 2002; M. Lee & Turban, 2001). Therefore, trust is still the most important factor in the context of e-commerce because it is the key to making transaction in many relationships (Morgan & Hunt, 1994).

The second subfield of e-commerce is the acceptance and application of technology. With the advance of Internet technology, and the rapid application of information technology services, making the technology acceptable to the users has become a high priority issue in e-commerce. For example, the technology acceptance model (TAM) is widely used in different tasks (Taylor & Todd, 1995; Venkatesh, et al., 2003), and the application of technology is investigated at different levels (Jasperson, Carter, & Zmud, 2005).

The third important factor of e-commerce is task-related, including different research methods and the review of aspects of the wide application of e-commerce (Jarvis, et al., 2003; P. Podsakoff, et al., 2003). A number of studies review different tasks such as the management of information systems, market structure development model, and self-reports in organizational research.

The fourth intellectual core of e-commerce is the electronic market. Effectively understanding the characteristics of e-market development has become a subject of e-commerce (J.Y. Bakos, 1991), which also includes the electronic hierarchies of electronic markets (Malone, et al., 1987), consumer search costs of e-markets, and comprises differences between traditional markets and electronic markets (J. Yannis Bakos, 1997; Brynjolfsson & Smith, 2000).

Finally, the fifth core knowledge is information systems success. Due to the long term benefits of e-commerce, information systems success has become an important indicator for e-commerce firms (Delone & Mclean, 1992, 2003). Realizing the core property of information system is also important (Benbasat & Zmud, 2003). The more knowledge of an information system a manager has, the more successful an information system will be.

In the co-citation analysis, a subfield/factor is constituted by many research articles. A valuable research article perceived to be useful may involve with more than one factor in more than one specialty (H. D. White, 1990). For example, a high-cited article, Benbasat and Zmud (2003), which performed factor analysis loaded both on factor 2 (acceptance and application of information technology) and factor 4 (IS success), with factor loadings of 0.56 and 0.58, respectively. Thus, some electronic commerce articles are not solely in one subfield, but includes more, such as accepting an application of information technology and an IS success.

## 6 CONCLUSIONS

The purpose of this study is to explore the intellectual core of e-commerce. Citation and co-citation, and subsequent quantitative methods are used to discover the underlying core structure of e-commerce. Researchers may extend this line of research in the near future because the core knowledge in every field is not easily identified. For practitioners, the intellectual core of e-commerce may be the basis for a manager of an e-commerce firm who should pay attention to the e-commerce task and application, and may provide better information for users to accept the e-commerce technology, offer transparent transaction procedures, guarantee information to establish users' trust, and confirm and maintain continual IS success in the competitive e-market. Recently cloud computing, electronic business operations of enterprises, and group buying behavior of consumers grows quickly. We expect that future researches stream of e-commerce will focus on cloud computing, business operations of enterprises, and consumer behavior patterns, especially in the value co-creation of consumers.

## 7 LIMITATIONS AND FUTURE STUDY

The results of this study have two limitations that should be addressed. First, the source data does not include all the research articles of the top six e-commerce journals. We focus on the source data published recently (from 2006 to 2010), which already includes a total of 1056 electronic commerce related articles and 33036 references. Future studies may collect all the articles of the top six e-commerce journal to perform a trend analysis and explore the evolution of electronic commerce. Second, some of the major e-commerce journals are not included, such as: *Electronic Commerce Research*, *Journal of Electronic Commerce Research*, *Journal of Organizational Computing and Electronic Commerce*, *International Journal of Electronic Business*, and *Quarterly Journal of Electronic Commerce*. Future studies may consider exploring the core knowledge of these other e-commerce journals.

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