

Enterprise Adoption of ICT Innovations: Multi-Disciplinary Literature Analysis and Future Research Opportunities

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Abstract

Enterprise adoption of information and communication technology innovations has been a topic of tremendous interest to both practitioners and researchers. The influence of technological, managerial, strategic, and economic factors has led the field to become a rich tapestry of theoretical and conceptual foundations. The objective of this paper is to provide a comprehensive analysis of the scholarly development of the enterprise adoption literature by examining articles over the past three decades. The study identifies nearly 400 articles and classifies them by functional discipline, publication, research methodology, and ICT type. The paper concludes with important implications for future research.

1. Introduction

Enterprise adoption of information and communication technologies (ICT) has been a topic of significant interest to practitioners and researchers over the past three decades. Previous studies have identified key drivers and inhibitors of enterprise adoption of ICT and explored the influence of important technological, organizational, strategic, economic, and managerial factors. The literature is abounding in studies that have highlighted why and how enterprises have succeeded or failed in adopting and implementing ICT. These issues have been examined for a range of different ICT, including enterprise information systems, electronic commerce, database management systems, network and telecommunications infrastructure, computer hardware, enterprise architecture components, and business productivity applications, among many others.

Because of the cross-disciplinary nature of the topic researchers have drawn on theories, frameworks and models from a variety of complementary

academic reference disciplines such as information systems, computer science, economics, organizational sciences, marketing, and strategic management. In doing so, enterprise ICT adoption research has thus become a rich tapestry of a plethora of theoretical and conceptual foundations.

Despite arguments that research within this domain is exhausted, enterprise adoption of ICT will continue to be a topic of interest to decision makers, managers, vendors, and users alike. In today's global and competitive environment, ICT can provide enterprises with means to streamline their organization, create new competitive advantages, and potentially enter new industries and markets. As new ICT emerge, there will be an increasing need to understand what value they can deliver and how the adoption will align with the overall strategy of the firm. In times of tight and often decreasing IT budgets, decision makers will continue looking for insights in how to reduce technological, organizational, environmental, managerial, and end-user risks and uncertainties associated with the adoption of potentially transformative ICT.

The objective of this paper is not to suggest new theories or propositions concerning enterprise adoption of ICT, as there is no lack of these. Given the vast nature and diversity of the enterprise adoption literature, there is also no attempt made to offer a comprehensive recitation of research findings or methodologies. The purpose is, rather, to provide a sufficient assessment of the current state of enterprise adoption research by providing a comprehensive review of the scholarly development of the literature. Based on the findings of this assessment, the paper suggests several important implications for the advancement of the enterprise adoption field.

The remainder of this paper is structured as follows. Section 2 describes the research methodology used to conduct the multi-disciplinary literature analysis. Section 3 describes the classification method

of the literature. Section 4 presents the results of the study. Research implications are discussed in Section 5. The paper concludes in Section 6.

2. Research Methodology

The study of enterprise adoption of ICT is not confined to a single discipline. As such, the identification of relevant studies becomes quite cumbersome and requires an integrative literature analysis approach. A preliminary scan of the literature reveals several complementary research streams that examine enterprise adoption of ICT. In order to simplify the classification of the relevant literature, we used a combination of previously identified supporting discipline subject areas to consolidate and group the various publication outlets into five broad research streams [150, 243].

- Category I: Information Systems and Computer Science
- Category II: Decision Sciences (Decision Theory, Productions and Operations Management, Operations Research)
- Category III: Management and Organization Sciences (Business, Strategy, Marketing, Finance, Organizational Behavior)
- Category IV: Economics
- Category V: Innovation

Given the increasingly growing base of studies across these five areas, we conducted an extensive search of the literature by searching several comprehensive online databases. These included ABI/INFORM, Academic Search Elite, ACM Digital Library, Emerald Fulltext, IEEE Xplore, Science Direct, and the Social Science Citation Index (SSCI). In those cases where online access was not available, a hardcopy of the article was obtained through the university library and interlibrary loan systems.

It should be noted that our study focused exclusively on prestigious and highly ranked journals as identified in previous studies [5, 150, 243, 278, 309]. We decided not to include conference proceedings, book chapters, and articles from the popular and trade press due to the commonly accepted belief that scholarly, peer-reviewed journals tend to be the best outlets for disseminating new knowledge [85, 278]. A complete list of journals included in our literature analysis, categorized by research stream, is shown in Table 1.

The literature search was based on a number of different descriptors adapted from the Barki keyword classification scheme, which is commonly used to

classify studies in the management information systems (MIS) and technology management literature [20]. These descriptors included: "Information Technology Adoption (EL05)", "IS Implementation (FD)", "Diffusion of Innovation (DD0502)", "IS Planning (EF)" and "Strategic Planning (AF0406)." While additional descriptors could have been used, the authors believe that these descriptors sufficiently describe and capture the breadth of topics associated with the study of enterprise adoption of ICT.

The timeframe of this review is 1974 to 2006. The starting date of 1974 was chosen based on the first occurrence of an article, to the best of the authors' knowledge, specifically addressing the issue of enterprise adoption of ICT.

The full text of each article was reviewed by the authors to eliminate those articles that did not meet the selection criteria. The selection criteria for article inclusion were as follows:

- Articles focused solely on the adoption of ICT. This eliminated those studies that considered organizational innovations, such as processes, methodologies, managerial philosophies and strategies, and administrative innovations in general
- Articles with the enterprise, organization, or firm as the unit of analysis. This eliminated a substantial body of research that focused primarily on individual (end-user) and group (team) adoption of ICT.
- Studies published in one of the six functional categories and associated leading journals, as these were considered the most likely outlets for relevant and rigorous enterprise adoption research.
- Studies based on rigorous research methods.

Based on these selection criteria, our comprehensive search yielded 390 articles from 61 journals.

3. Classification Method

The full-text of each of the 390 articles was reviewed by the authors and classified according to categories suggested by previous studies [277, 398]. The articles were classified and coded according to:

- (1) Year of publication
- (2) Functional discipline
- (3) Publication
- (4) Research methodology, and
- (5) ICT type

The classification scheme for research methodologies used in this study is based on several existing taxonomies [7, 288] and is shown in Table 2.

Articles were also classified by ICT type. The starting points for this type of classification were IDC's taxonomies of software, hardware, and network infrastructure [69, 155]. However, since these taxonomies provide a significant level of detail not applicable for the purpose of this study, the authors generated a simplified classification of the top two levels. The classification scheme for ICT type is shown in Table 3.

The coding of articles was conducted in two phases. Phase 1 included the coding of all articles by the authors and three advanced doctoral students, who have had prior experience with research methods and were conducting doctoral research in ICT, according to the two aforementioned classification schemes. Since articles could employ multiple research methods, coders were allowed to identify up to two research methodologies per article. Similarly, coders were allowed to identify up to two ICT types studied per article, if applicable. If an ICT type could not be identified in the classification scheme, coders were instructed to determine the most appropriate term and category and assign it to the article. In Phase 2, the authors and doctoral students resolved any disagreements on article classification by discussion and consensus.

Interrater reliability, defined as "agreement among coders about the categorization of content," was assessed using Krippendorff's alpha [203, 394]. This method was preferred over percentage agreement, as it corrects for chance agreement among coders. Krippendorff's alpha is a chance-corrected measure of interrater reliability that assumes multiple raters (m), n cases, and k mutually exclusive and exhaustive nominal categories [203]. Statistics were calculated in SPSS 14.0 using a macro developed by [153]. The resulting interrater reliabilities for research method and ICT type were $\alpha_{rm} = 0.8613$ and $\alpha_{ict} = 0.9072$, respectively. This is well above the recommended level of $\alpha=0.800$, thus indicating a sufficiently high intercoder agreement for article classification.

4. Results

4.1. Classification by Year of Publication

The distribution of articles published by year is shown in Figure 1. For the first two decades, we there is a constant stream of enterprise adoption studies, with less than ten articles per year. From 1994-2000, we see a constant increase in enterprise adoption

studies, ranging from 8 to 25 articles a year. A significant increase in research articles has occurred over the past six years (2001-2006), with a peak of over 50 enterprise adoption studies in 2004.

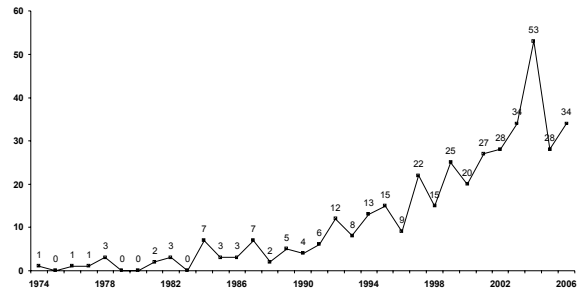


Figure 1. Distribution Trend of Publications

4.2. Classification by Functional Discipline

A classification by functional discipline reveals that studies in information systems and computer science journals (Category I) constitute an overwhelmingly large percentage (66.2%, 258 studies) of all research on enterprise adoption of ICT. Closer observation highlights that nearly half of all Category I studies have been published in the last five years. The second largest percentage of enterprise adoption research comes from journals in the decision sciences domain (Category II) with 16.7% (65 studies). Studies from Category III (Management and Organization Science) constitute 12.8% (50 studies). Studies from Category IV (Economics) and Category V (Innovation) literature comprise to 2.1% (8 studies) and 2.3% (9 studies), respectively. Despite the relatively small percentage of enterprise adoption articles, it is noteworthy that over 75% of all articles from the economics and innovation literature have been published in the last few years, supporting the authors proposition that complementary disciplines are increasingly covering a traditionally IS/CS dominated research topic.

4.3. Classification by Publication

Table 3 shows the Top 25 research outlets for enterprise ICT adoption research. Of the total of 61 journals surveyed, the top twelve journals published nearly 60 % (232 studies) of all enterprise adoption research. Information & Management published the largest numbers of studies on enterprise adoption of ICT with 47 articles (12.0%). This is a reflection of the natural fit between the research topic, the overall objective and the readership of the journal. Studies

published in Information & Management serve “managers, professionals, ... and senior executives of organizations” with aims to “collect and disseminate information on new and advanced developments in the field of applied information systems ...” and “provide guidelines and insights on how to undertake successful information technology initiatives and learn to avoid failures through the study of success and failure patterns” [96]. Indeed, journals in all disciplines with a practitioners’ oriented focus tended to have a greater number of studies related to enterprise adoption of ICT. Information systems and computer science journals with the most enterprise adoption studies include the Communications of the ACM (24 studies), European Journal of Information Systems (23 studies), and Journal of Management Information Systems (22 studies). One noteworthy observation among Category I journals is the dramatic rise of enterprise adoption studies in Electronic Markets over the past five years.

Our analysis further shows that over 70% (46 studies) of all studies in Category II have been published in three prominent journals: IEEE Transactions on Engineering Management (19 studies), Management Science (15 studies), and Decision Sciences (12 studies). Nearly half of all studies in the decision sciences (46.2% / 30 studies) have been published in the last five years

While no one journal in the management and organization science category stands out to be a major publication outlet for enterprise adoption research, several sub-disciplines (general management, strategic management, organizational science/behavior, and marketing) are represented in the top 25 journals. This indicates that while it is not a primary topic, it has received some attention from various management perspectives. The journals in the top 25 are the Strategic Management Journal (6 studies), Journal of Marketing, Organization Science, Harvard Business Review (each 5 studies), Academy of Management Journal, Academy of Management Review, and Industrial Marketing Management (each 4 studies). Two journals in economics (Categories IV) and innovation (Category V) that stand out are the RAND Journal of Economics and the Economics of Innovation & New Technologies. Both publication outlets tend to have published 50% of all research on enterprise adoption of ICT.

4.2. Classification by Research Methodology

The distribution of studies by research methodology is shown in Figure 2. The most heavily used research method is the survey method (40.5%) followed by framework and conceptual models

(19.7%), mathematical models (17.2%), and case studies (14.6%). Surprisingly few studies have utilized a field study (4.1%) or qualitative approach (4.9%). None of the studies included in this review employed an experimental approach. Table 12 shows a summary of all reviewed studies and the corresponding research methodology used.

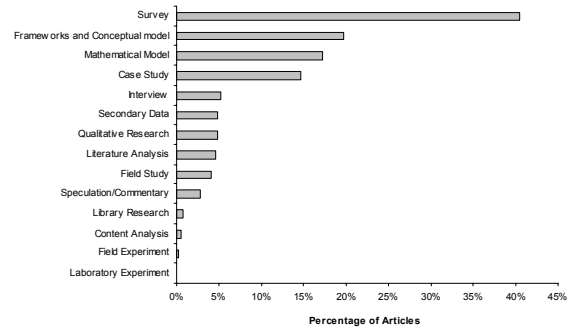


Figure 2. Distribution of Enterprise Adoption Studies by Research Methodology

4.2. Classification by ICT Type

Figure 3 shows the distribution of studies by ICT type. It clearly indicates that general IS/IT innovations (132 studies), electronic commerce and electronic business (106 studies) and enterprise information systems (70 studies) are the three most popular categories.

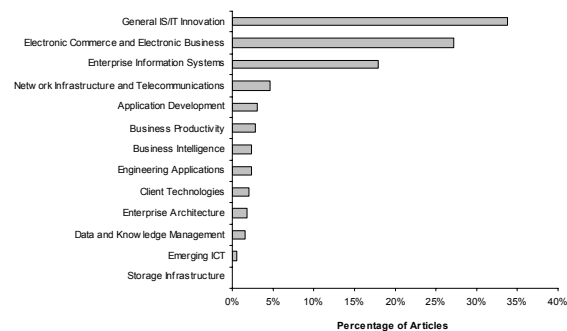


Figure 3. Distribution of Enterprise Adoption Articles by ICT Type

Some commonly investigated ICT types include enterprise resource planning (ERP) applications, electronic data interchange (EDI), supply chain management (SCM) software, the Internet, corporate websites, and inter-organizational systems. Enterprise architecture, data and knowledge management, storage infrastructure, and emerging ICT are the four least investigated categories.

5. Research Implications

The continuously growing research interest in enterprise adoption of ICT can be largely attributed to the increasing importance of ICT in enterprises. As business processes, services, operations, and people have become more dependent and intertwined with ICT and new enterprise-level ICT emerge, academic interest in enterprise adoption research has grown at a rapid rate. While some researchers have argued that the study of enterprise adoption is exhausted, the results of the literature analysis presented in this article suggest a number of interesting research implications and opportunities. These are categorized into four particular opportunity segments: (1) ICT Type, (2) Research Method, (3) Functional Discipline, and (4) Analysis Perspective. They are elaborated upon in the following sections.

5.1. Opportunity I: ICT Type

ICT capable of addressing today's and future business issues are bound to emerge. As such, enterprise adoption research has the opportunity to investigate how emerging ICT are adopted and implemented and what value and impact they may have on organizations. The results presented in this article indicate that only little attention has been given to emerging and disruptive (e/d) ICT. Most enterprise adoption studies have primarily focused their efforts on established and already well understood ICT, such as enterprise information systems (ERP, EDI, CRM), Web technologies, or the Internet. Relatively little research, however, has been conducted related to the adoption and implementation of e/d ICT, such as mobile/wireless ICT, software-as-a-service, voice over IP, RFID, storage infrastructure, healthcare ICT, and social computing networks. As new ICT emerge, the sheer amount of data and information accessed, transmitted, and exchanged within and beyond the traditional physical boundaries of an organization will grow exponentially. Threats of viruses, malware, hackers, and loss and misuse of corporate data thus requires an appropriate level of security and protection. While there is a significant amount of studies on security in general, it has been an under-investigated topic in the enterprise adoption literature.

All of this is happening in an increasingly flat world, in which ICT will play an integral role to connect, communicate and collaborate [114]. Despite the evident globalization, only few studies have focused on issues involved with global ICT adoption. Issues include, for example, standardization and integration of global enterprise information systems and deployment of global e-billing systems. As more

and more organizations outsource/offshore and compete in a global environment, the study of global ICT adoption becomes increasingly pertinent. This raises an interesting question of how the issues change when ICT is the only viable means of working together – particularly when adoption is a given. The issues that dominate are a tremendous opportunity for future research.

Emerging domains of ICT are game and entertainment technologies, which are used to simulate enterprise contexts and in some instances provide a virtual world for organizations. Second Life is a great example of these types of ICT. For a comprehensive review of organizational simulation, the readers are directed to read Rouse and Boff [326].

5.2. Opportunity II: Research Method

Enterprise adoption studies have used a variety of different research methods. Potential opportunities include the use of action research and simulation to study enterprise adoption phenomena. Similarly, researchers can use ICT to understand how enterprises adopt ICT. For example online monitoring of users' activities, inference of users' decision rules and policies, and performance assessment are now quite possible. Instead of asking them directly through empirical methods such as surveys and questionnaires, we can now look at what they are actually doing.

5.3. Opportunity III: Functional Discipline

Enterprise adoption research has and will most likely continue to be a topic of dominant interest for information systems and computer science researchers. However, the analysis presented in this article highlights the growing interest by complementary research disciplines. One particular opportunity is the investigation of enterprise adoption of ICT in the innovation domain.

An emerging discipline is services science. How is enterprise ICT adoption driven in the services context? New models and frameworks must be developed to understand how ICT's are adopted as a services. A growing area of interest is software-as-a-service, for example. The study of cross-enterprise ICT adoption raises other interesting research questions. What if enterprises are a constellation of supply chains or value networks? What happens if actors in the supply chain do not belong to the same enterprise? This leads to the opportunity to study "social" issues and network effects in the context of enterprise adoption of ICT.

5.4. Opportunity IV: Analysis Perspective

Most enterprise adoption studies take an internally-oriented organization adoption perspective. These studies investigate what factors drive and contexts facilitate the adoption and implementation of ICT. However, an equally important perspective is the vendor/service provider view. Studies could investigate how technology companies can design and market their products and service offerings in order to facilitate adoption and implementation.

6. Conclusions

Due to its inherently cross-disciplinary nature, research on enterprise adoption of ICT is difficult to confine to a single discipline. Relevant studies are scattered across various disciplines in a plethora of journals. An extensive literature search was conducted to identify enterprise adoption related articles from the leading publication outlets in five complementary research disciplines. This resulted in the identification of 390 studies from 61 journals, published between 1974 and 2006. Although the review cannot be considered exhaustive due to omission of book chapters, working papers, articles in conference proceedings, and doctoral dissertations, it does provide reasonable insights to the state-of-the-research. Results show that the topic has seen tremendous growth in the last few years and continues to receive great attention by researchers and practitioners alike. Information systems and computer science journals in particular are the primary outlets for enterprise adoption research. However, a growing interest can also be observed in the decision sciences, management and organization sciences, economics, and innovation domains. Studies across all fields have predominantly used a survey or conceptual-type of approach to understanding enterprise adoption, while general IS/IT innovations, e-business and e-commerce applications, and enterprise information systems are the most studied types of ICT. Enterprise adoption of ICT is a very important, but inherently complex issue that decision makers face today. As ICT continue to emerge, evolve and are increasingly used by organizations to create and deliver value opportunities, a solid understanding of the salient adoption and implementation criteria is of utmost significance.

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8. Appendix

Table 1. Journals Included in Assessment by Research Category

Category	Journal	Category	Journal	
I	ACM Transactions on Information Systems	III	Academy of Management Journal	
	Behavior and IT		Academy of Management Review	
	Communications of the ACM		Administrative Science Quarterly	
	Communications of the AIS		European Journal of Marketing	
	Decision Support Systems		Harvard Business Review	
	Electronic Markets		Industrial Marketing Management	
	European Journal of Information Systems		Journal of the Academy of Marketing Science	
	IEEE Computer		Journal of Business Research	
	Information and Management		Journal of Business Strategy	
	Information and Organization		Journal of General Management	
	Information Resources Management Journal		Journal of Management	
	Information Systems Frontiers		Journal of Marketing	
	Information Systems Journal		Journal of Marketing Research	
	Information Systems Management	Organization Science		
	Information Systems Research	Sloan Management Review		
	Int'l Journal of E-Commerce	Strategic Management Journal		
	Journal of Computer Information Systems	IV	American Economic Review	
	Journal of Electronic Commerce Research		Applied Economics	
	Journal of Global Information Management		Int'l Journal of the Economics of Business	
	Journal of Information Systems		Journal of Economic Dynamics & Control	
	Journal of Information Technology		Journal of Economics	
	Journal of IT Theory and Application		Journal of Industrial Economics	
	Journal of Management Information Systems		RAND Journal of Economics	
	Journal of Org. Computing & E-Commerce		Review of Industrial Organization	
	Journal of Strategic IS		Structural Change & Economic Dynamics	
	Journal of the AIS		World Economy	
	MIS Quarterly		V	Economics of Innovation & New Technology
	SIGMIS Database			European Journal of Innovation Management
	II	Decision Sciences		Int'l Journal of Innovation Mgmt
		European Journal of Operational Research		Journal of Product Innovation Management
		IEEE Transactions on Engineering Mgmt		
		Int'l Journal of Production Research		
		Interfaces		
Management Science				
OMEGA				
Production & Operations Management				

Table 2. Classification Scheme of Research Methodologies (adapted from [288])

Category	Methodology	Definition
1	Speculation/commentary	Research that derives from thinly supported arguments or opinions with little or no empirical evidence
2	Frameworks and conceptual model	Research that intends to develop a framework or a conceptual model
3	Library research	Research that is based mainly on the review of existing literature
4	Literature analysis	Research that critiques, analyzes, and extends existing literature and attempts to build new groundwork, e.g., it includes meta analysis
5	Case study	Study of a single phenomenon (e.g., an application, a technology, a decision) in an organization over a logical time frame

6	Survey	Research that uses predefined and structured questionnaires to capture data from individuals. Normally, the questionnaires are mailed (now, fax and electronic means are also used)
7	Field study	Study of single or multiple and related processes/phenomena in single or multiple organizations
8	Field experiment	Research in organizational setting that manipulates and controls the various experimental variables and subjects
9	Laboratory experiment	Research in a simulated laboratory environment that manipulates and controls the various experimental variables and subjects
10	Mathematical model	An analytical (e.g., formulaic, econometric or optimization model) or a descriptive (e.g., simulation) model is developed for the phenomenon under study
11	Qualitative research	Qualitative research methods are designed to help understand people and the social and cultural contexts within which they live. These methods include ethnography, action research, case research, interpretive studies, and examination of documents and texts
12	Interview	Research in which information is obtained by asking respondents questions directly. The questions may be loosely defined, and the responses may be open-ended
13	Secondary data	A study that utilizes existing organizational and business data, e.g., financial and accounting reports, archival data, published statistics, etc
14	Content analysis	A method of analysis in which text (notes) are systematically examined by identifying and grouping themes and coding, classifying and developing categories

Table 3. Classification Scheme of ICT Type

Category	ICT Type	Included Subtopics
A	General IS/IT Innovation	
B	Enterprise Information Systems	Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM), Sales Force Automation (SFA), Strategic Information Systems, Human Resources Information Systems, Accounting Information Systems, Electronic Data Interchange (EDI), Extranet
C	Data and Knowledge Management	File/Document Management, Databases (e.g. Relational, OO, Distributed), Database Management Systems, Distributed Databases, Data Integration, Data Warehouses, Knowledge Management, Enterprise Application Integration
D	Network Infrastructure and Telecommunications	Telephony, ISDN, Broadband Access (e.g. Cable, DSL), Local Area Networks, Wide Area Networks, Client/Server Architecture, Peer-to-Peer Architecture, Service Oriented Architecture and Web Services, Network Standards and Protocols, System and Network Management Software, Security Software (e.g. Anti-Virus, Firewall), Middleware
E	Electronic Commerce and Electronic Business	B2C/B2B E-Commerce, Electronic Payment Systems, Electronic Billing, Inter-organizational Systems (IOS), Internet / World Wide Web, Website
F	Business Productivity	Office Applications, Collaboration and Communication (Instant Messaging, E-mail, Facsimile), Intranet
G	Engineering Applications	CAD/CNC/CAM, Advanced Manufacturing Technologies, Digital Imaging Technologies
H	Application Development	CASE, Programming Languages, Content Applications (e.g. Content Management, Authoring and Publishing Software, Web Site Design/ Development Tools)
I	Business Intelligence	Data Mining, Decision Support Systems, Expert Systems, Executive Information Systems (EIS)

J	Storage Infrastructure	Storage Area Networks (SAN), Disk Storage Systems
K	Client Technologies	Personal Computers, Servers, Mainframes, Workstations
L	Enterprise Architecture	Operating Systems, Middleware, Open Source, XML, Internet/Grid Computing, Standards
M	Emerging ICT	Mobile/Wireless, RFID, Voice over IP (VoIP)

Table 4. Top 25 Journals Publishing Enterprise Adoption of ICT Research (1974-2006)

No	Publication	Category	Frequency	Percentage
1	Information and Management	I	47	12.1%
2	Communications of the ACM	I	24	6.2%
3	European Journal of Information Systems	I	23	5.9%
4	Journal of Management Information Systems	I	22	5.6%
5	IEEE Transactions on Engineering Mgmt	II	19	4.9%
t-6	Electronic Markets	I	18	4.6%
t-6	Information Systems Research	I	18	4.6%
8	Management Science	II	15	3.8%
t-9	Journal of Computer Information Systems	I	12	3.1%
t-9	MIS Quarterly	I	12	3.1%
t-9	OMEGA	II	12	3.1%
12	Journal of Strategic IS	I	10	2.6%
t-13	Decision Support Systems	I	9	2.3%
t-13	Journal of Org. Computing & E-Commerce	I	9	2.3%
t-15	Journal of Global Information Management	I	7	1.8%
t-15	Decision Sciences	II	7	1.8%
t-17	Journal of Information Technology	I	6	1.5%
t-17	Strategic Management Journal	III	6	1.5%
t-19	Information Resources Management Journal	I	5	1.3%
t-19	Information Systems Journal	I	5	1.3%
t-19	European Journal of Operational Research	II	5	1.3%
t-19	Harvard Business Review	III	5	1.3%
t-19	Journal of Marketing	III	5	1.3%
t-19	Organization Science	III	5	1.3%
t-25	Int'l Journal of E-Commerce	I	4	1.0%
t-25	Journal of Electronic Commerce Research	I	4	1.0%
t-25	SIGMIS Database	I	4	1.0%
t-25	Academy of Management Journal	III	4	1.0%
t-25	Academy of Management Review	III	4	1.0%
t-25	Industrial Marketing Management	III	4	1.0%
t-25	RAND Journal of Economics	IV	4	1.0%
t-25	Economics of Innovation & New Technology	V	4	1.0%

Table 5. Enterprise Adoption References Classified by Research Method

Research Method	References
Speculation/commentary	[14, 103, 118, 180, 189, 256, 272, 282, 285, 325]
Frameworks and conceptual model	[1, 4, 12, 16, 18, 32, 55, 57, 72, 74, 90, 98, 100, 102, 104, 108, 112, 113, 115, 125, 126, 129, 139, 141, 147, 148, 159, 160, 163, 167, 175, 178, 181, 193, 195, 198, 200, 202, 204, 209, 231, 242, 246, 247, 262, 284, 291-293, 323][329, 336, 337, 344, 358, 372, 379, 383, 392, 395, 399, 409, 411]

Library research	[266, 348]
Literature analysis	[34, 123, 137, 177, 179, 196, 197, 214, 220, 298, 304, 333, 357, 362, 376]
Case study	[21, 22, 28, 29, 31, 33, 35, 39, 42, 43, 47, 54, 64, 97, 99, 107, 138, 154, 156, 161, 173, 207, 212, 224, 228, 236, 248, 250, 255, 258, 261, 268, 276, 286, 287, 289, 312, 343, 360, 366, 375, 380, 385, 396]
Survey	[6, 9, 17, 19, 26, 27, 37, 41, 45, 46, 50, 51, 53, 60, 61, 63, 65-68, 70, 73, 75, 77, 79, 82-84, 91, 93, 95, 101, 105, 106, 109, 116, 119, 121, 122, 128, 130, 132-135][136, 144, 149, 152, 157, 158, 164, 166, 170, 174, 184, 190, 191, 199, 205, 206, 208, 210, 213, 211, 215, 217, 222, 223, 227, 229, 230, 232, 239-241, 245, 249, 253, 254, 257, 263, 265, 270, 271, 273, 280, 294, 295, 297, 299] [300, 301, 303, 306, 307, 314, 317, 316, 318, 319, 321, 322, 327, 328, 330, 331, 339, 342, 341, 345, 346, 349-352, 354, 361, 364, 365, 367-371, 373, 378, 381, 382, 386, 388, 390] [391, 397, 400-407, 410, 413]
Field study	[44, 52, 62, 76, 94, 168, 176, 302, 305, 310, 313, 315, 320]
Mathematical model	[2, 3, 8, 10, 11, 15, 23-25, 36, 48, 49, 58, 59, 80, 86, 87, 92, 110, 111, 127] [131, 140, 142, 143, 165, 169, 182, 185-188, 194, 216, 218, 219, 225, 226, 233, 235, 237, 238, 244, 251, 252, 267, 275, 279, 290, 308, 311, 332, 335, 338, 347, 359, 363, 387, 412]
Qualitative research	[145, 151, 162, 172, 264, 269, 274, 283, 296, 353, 355, 356, 374, 389, 408]
Interview	[38, 40, 56, 71, 120, 192, 201, 234, 260, 324]
Secondary data	[78, 81, 89, 88, 124, 146, 171, 183, 221, 259, 340, 384, 393]
Content analysis	[117, 281]

Table 6. Enterprise Adoption References Classified by ICT Type Category

Category	ICT Type	References
A	General IS/IT Innovation	[1-3, 9, 12, 13, 16, 32-34, 39, 40, 42, 43, 46, 48, 67, 71-75, 79-81, 83, 86, 87, 90, 98, 100, 102, 101, 106] [108, 112, 113, 115, 116, 121, 124, 123, 131, 133, 137, 138, 140, 144, 151, 157, 161, 165, 168, 169, 175, 177, 185, 189, 191, 195-197, 200] [201, 202, 214, 219, 220, 223, 231, 233, 235, 237, 238, 240, 241, 244, 252, 256, 259, 265-267, 269, 268, 270, 279, 282-284, 289, 290, 294, 297, 298, 303-305, 311, 315, 316] [136, 318, 321, 323-325, 331, 334, 337, 338, 347, 350, 355, 357, 358, 362, 363, 370-373, 375, 377, 383-385, 395, 404, 407, 412]
B	Enterprise Information Systems	[18, 22, 25, 30, 31, 41, 51, 53, 54, 61, 63, 65, 68, 70, 76, 84, 91, 97, 99, 147, 148, 152, 154, 156, 158, 171, 173, 174, 179, 182, 184, 198, 205, 206, 216, 221, 248, 254] [255, 257, 271, 274, 276, 280, 281, 286, 302, 300, 310, 313, 314, 319, 320, 330, 335, 336, 343, 345, 352, 354, 364, 366, 374, 381, 386, 387, 391, 392]
C	Data and Knowledge Management	[109, 126, 135, 170, 193, 328]
D	Network Infrastructure and Telecommunications	[58, 59, 62, 95, 134, 139, 141, 208, 210, 213, 211, 212, 215, 242, 251, 253, 287, 291]
E	Electronic Commerce and Electronic Business	[6, 15, 21, 26-28, 37, 38, 47, 77, 82, 89, 88, 92, 110, 111, 117-120, 125, 127-130, 132, 142, 143, 145, 146, 159, 162, 163, 172, 176, 178, 180] [181, 183, 186, 188, 190, 204, 209, 222, 224, 225, 227-229, 239, 245, 249, 250, 258, 260-264, 272, 273, 275, 292, 293, 295, 296, 301, 322, 329, 332, 339, 344, 348, 349, 351, 353, 361, 365, 367-369, 379, 388-390, 393] [396, 399-401, 403, 405, 406, 409-411]
F	Business Productivity	[17, 44, 93, 94, 217, 218, 230, 327, 346, 356, 380]
G	Engineering Applications	[10, 11, 23, 24, 35, 199, 232, 312, 397]
H	Application Development	[104, 105, 107, 167, 299, 308, 317, 342, 341, 402, 408, 413]
I	Business Intelligence	[4, 19, 207, 226, 285, 307, 340, 360, 382]
J	Storage Infrastructure	
K	Client Technologies	[8, 36, 49, 78, 194, 234, 306, 359]
L	Enterprise Architecture	[55-57, 122, 160, 246, 247]
M	Emerging ICT	[45, 103]