An Exploratory Study of Organizational Information Systems Usage and Effectiveness

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ABSTRACT

In the 21st century, there is no doubt that organizations are using information technologies (IT) to become more effective and efficient, consequently gaining competitive advantages. There are extensive researches on the organizational effectiveness of IT. However, there is lack of empirical study in how organizations are using IT. In this study, using exploratory study methodology, we investigate the usage and effectiveness of a variety of IT in organizations in different industries. Specifically, we focus on the extent of use and the effectiveness of traditional Information Systems (TIS), and two newly-recognized types of IS, E-Commerce (E-C) and Customer Relationship Management systems (CRM). We also examine the impact of industry types on the extensiveness and effectiveness of using specific IT.

INTRODUCTION

When discussing about the business environment, especially in the U.S., it is very common to find that the marketplace has become more diverse in terms of geographic availability, products sophistication, as well as services quality (Harris, 2004, Atkins, 2004). This phenomenon is

largely the result of severe competition, and merging of big corporations. The customers' products and services demands have also becoming more and more mature and specific. There is no doubt that IT can provide a cure to a lot of business problems. However, without proper design and maintenance, IT can become a quandary to the companies instead of cure to problems (Caldwell, 1996). Yuthas and Eining (1995) suggested that there are three commonly used factors to measure the information systems effectiveness: decision performance, usage, and satisfaction. Their experimental study showed that decision performance, the system's ability to support managerial decision making, is the most significant factor that affects IS effectiveness. To synthesizes and validates the construct of IT success within organizations, Mahmood, Hall and Swanberg (2001) has done a meta-analysis about the factors affecting IT usage. Meta-analysis analyst the empirical results of various studies over a period of time. They concluded that users' perception of ease of use and their perceived usefulness of an IT system are the two most important factors determining the degree of the IT usage. Organizational support, users' educational level, training level, and professional level were also found to be important factors, although not as significant. Intuitively, it is expected that there are also industry different in the IT usage and effectiveness. For example, service industry will use more customer relationship management systems and E-commerce. Manufacturing industry will value TIS more. Government industry may be lower in IT requirement compare to private organizations. For the purpose of this study, we have divided the information systems into 3 different groups. They are traditional IS (TIS), Customer Relationship Management System (CRMS), and Electronic Commerce (E-Commerce).

TIS include human resource systems, payroll systems, accounting systems, purchasing systems, and database management systems and some other systems that support basic business functions.

As noted by Robinson (2000), there has been a great deal of recent interest in CRM. Included under the CRM rubric, for Robinson, are a wide range of applications, including those for gathering data about customers to ones used by customers, such as self-service Web sites where customers can get information on or purchase products. Many CRM applications are oriented toward gaining a competitive advantage by moving the customer more quickly through the system. Time-savings potentially represent an improvement from the standpoint of both the organization and its customers (Burgum, 2000).

The American Institute of Certified Public Accountants (2000) defines E-Commerce as, "Current and evolving technological processes that allow the accessing, updating, and communicating of information in a purely digital format, which can be used more efficiently and effectively, thereby creating a competitive advantage." The Federal Electronic Commerce Acquisition Program Management Office (ECAPMO, 1994) defines E-Commerce as, "The paperless exchange of business information using electronic data interchange (EDI), e-mail, electronic bulletin boards, electronic funds transfer (EFT), and similar technologies."

Research Questions

To establish the research platform, there are two major research questions that are used to bring out the essence of the IT usage and effectiveness. These questions are as follows.

Research Question 1: There is no difference in the extensiveness and effectiveness of traditional Information Systems (TIS), E-Commerce (E-C) and Customer Relationship Management systems (CRM).

Research Question 2: There is no difference in Manufacturing, Service, and Government organizations in terms of the extensiveness and effectiveness of traditional Information Systems (TIS), E-Commerce (E-C) and Customer Relationship Management systems (CRM).

METHODOLOGY

Subjects

Subjects in the sample were approximately 475 managers from a variety of organizations. The managers were roughly 35% female, and the age range was from the late 20's to late 60's, with an average age of approximately 39. Their average working experience was 17 years and they had an average of 9 years of management experience. The types of organizations include 7% in Manufacturing, 83% in Service, as well as 10% in Government. The managers were attending graduate level management training emphasizing Quality Management at two universities in a large Southern city and all indicated that their organizations had at least a moderate interest in the quality movement.

Data

Consistent with our previous discussion and earlier research (Fok et al, 2000, 2001), we measured the IT use and effectiveness in three areas: CRM, E-C, and TIS. Respondents were asked to evaluate a series of IS/IT programs in terms of *extent of use* (0 to 5 scale for no use to high level of use) and *effectiveness* (1 to 5 scale for low to high level of effectiveness). In the area of CRM, measures were developed to examine *how extensively* three primary categories of CRM systems were used in the organization. They include web sites handling customers' transactions, IS gathering information about customer preferences, and IS supporting the work of customer service employees. The second one asked how *effectively* the CRM systems were used.

Similarly, in the area of E-C, six types of E-C systems were examined which include Intranet, Extranet, Web sites providing specific product/service information, Electronic Data Interchange, Enterprise Resource Planning, and Electronic Funds Transfer System.
TIS area includes eight traditional IS/IT programs, such as computer-based systems in human resources, payroll, accounting, order processing, purchasing, database management, decision support, and expert systems.

RESULTS

Research Question 1 examines if there is differences in the extensiveness and effectiveness of various technologies. Table 1 is the summary of the descriptive statistics of the use of the 18 IT. The top five technologies being used by different organizations are computer-based payroll system (4.09), computer-based accounting systems (3.95), Intranet (3.67), Database Management Systems (3.52) and Web sites providing specific product/service information. The systems that

reported very little use are Expert Systems (1.27), Enterprise Resource Planning Systems (1.68), and Electronic Procurement Systems (1.71). We ran paired-T tests on the average usage of TIS, CRM, and EC technologies. All three pairs are statistically significant with EC reported highest average use (3.10) which is significantly higher than average use of TIS (2.58) which in turn is higher than the average use of CRM technologies (2.21).

Of the companies reported use of a certain technology, the reported effectiveness of different technologies are very similar to each other ranging from 3.03 (average effectiveness of IS gathering information about customer preferences) to 4.46 (effectiveness of payroll systems) (see Table 2). The average effectiveness of all TIS, EC, and CRM technologies were 3.86, 3.81, and 3.39 respectively. The findings support the general notion that if an organization has adopted a technology, they are invested financially as well as emotionally and therefore they all viewed the technology to be moderately effective.

Research Question 2 examines if there is differences in the extensiveness and effectiveness of various technologies among three industries: manufacturing, service, and government. Table 3 summarizes the ANOVA results of comparing usage of various technologies among different industries. The two technologies that reported significant different use among industries are ERP systems and IS gathering customer preferences. Multiple comparisons results indicate that Manufacturing has significant higher level of use of ERP than Service industry and Service industry has significant higher level of use of IS gathering customer preferences than Government.

Among those companies that reported use and effectiveness of a certain technology, significant industry differences were found in three technologies (Table 4). For Decision Support Systems, Service organizations report higher effectiveness than Government organizations. For IS gathering customer preferences, Service organizations report higher effectiveness than Manufacturing and Government organizations. For systems that support customer service employees, Manufacturing organizations report higher effectiveness than Government type organizations.

Table 1:

Descriptive Statistics of the Use of Various Technologies[a]

	N	Minimum	Maximum	Mean	Std. Deviation
Computer-based Human Resource Systems	478	0	5	3.18	1.82
Computer-based Payroll Systems	478	0	5	4.09	1.54
Computer-based Accounting Systems	478	0	5	3.95	1.61
Computer-based Purchasing Systems	478	0	5	2.80	1.93
Database Management	478	0	5	3.52	1.69
Decision Support Systems	478	0	5	1.83	1.86
Expert Systems	478	0	5	1.27	1.78
Intranet	478	0	5	3.67	1.72
Extranet	478	0	5	2.63	2.07
Electronic Data Interchange Systems	478	0	5	2.35	1.96
Enterprise Resource Planning (ERP) Systems	478	0	5	1.68	1.98
Web sites providing specific product/service information	478	0	5	3.48	1.62
Web sites handling at least part of customers transactions	478	0	5	2.28	1.95
IS gathering information about customer preferences	478	0	5	1.98	1.88
IS supporting the work of customer service employees	478	0	5	2.37	2.00
Electronic Funds Transfer Systems	478	0	5	2.94	2.00
Electronic Procurement Systems	478	0	5	1.71	1.91
Valid N (listwise)	478				

a. COUNTRY = 2

Descriptive Statistics [a]

	N	Minimum	Maximum	Mean	Std. Deviation
Average TIS Use	478	.00	5.00	2.9486	1.0501
Average EC Technologies Use	478	.00	5.00	2.5865	1.1497
Average CRM Technologies Use	478	.00	5.00	2.2078	1.5817
Valid N (listwise)	478				

a. COUNTRY = 2

Table 2:

Descriptive Statistics of the Effectiveness of Various Technologies[a]

	N	Minimum	Maximum	Mean	Std. Deviation
Computer-based Human Resource Systems	394	1	5	3.74	1.05
Computer-based Payroll Systems	432	1	5	4.37	.83
Computer-based Accounting Systems	426	1	5	4.11	.94
Computer-based Purchasing Systems	355	1	5	3.64	1.10
Database Management	414	1	5	3.86	1.08
Decision Support Systems	264	1	5	3.31	1.16
Expert Systems	186	1	5	3.32	1.16
Intranet	410	1	5	4.10	1.03
Extranet	324	1	5	3.97	1.06
Electronic Data Interchange Systems	312	1	5	3.67	1.12
Enterprise Resource Planning (ERP) Systems	220	1	5	3.48	1.17
Web sites providing specific product/service information	427	1	5	3.80	1.16
Web sites handling at least part of customers transactions	316	1	5	3.62	1.21
IS gathering information about customer preferences	292	1	5	3.36	1.25
IS supporting the work of customer service employees	307	1	5	3.65	1.07
Electronic Funds Transfer Systems	355	1	5	4.09	1.06
Electronic Procurement Systems	240	1	5	3.54	1.15
Valid N (listwise)	60				

a. COUNTRY = 2

Table 3:

ANOVA of the Use of Various Technologies

		Sum of Squares	df	Mean Square	F	Sig.
Computer-based Human Resource Systems	Between Groups	2.990	2	1.495	.447	.640
	Within Groups	1577.439	472	3.342		
	Total	1580.429	474			
Computer-based Payroll Systems	Between Groups	4.952	2	2.476	1.059	.347
	Within Groups	1102.994	472	2.337		
	Total	1107.945	474			
Computer-based Accounting Systems	Between Groups	5.782	2	2.891	1.117	.328
	Within Groups	1221.376	472	2.588		
	Total	1227.158	474			
Computer-based Purchasing Systems	Between Groups	3.909	2	1.954	.520	.595
	Within Groups	1773.872	472	3.758		
	Total	1777.781	474			
Database Management	Between Groups	1.733	2	.867	.302	.739
	Within Groups	1352.898	472	2.866		
	Total	1354.632	474			
Decision Support Systems	Between Groups	13.356	2	6.678	1.945	.144
	Within Groups	1620.484	472	3.433		
	Total	1633.840	474			
Expert Systems	Between Groups	2.146	2	1.073	.335	.716
	Within Groups	1513.614	472	3.207		
	Total	1515.760	474			
Intranet	Between Groups	12.488	2	6.244	2.164	.116
	Within Groups	1361.773	472	2.885		
	Total	1374.261	474			
Extranet	Between Groups	4.880	2	2.440	.569	.566
	Within Groups	2022.417	472	4.285		
	Total	2027.297	474			
Electronic Data Interchange Systems	Between Groups	8.998	2	4.499	1.174	.310
	Within Groups	1809.289	472	3.833		
	Total	1818.286	474			
Enterprise Resource Planning (ERP) Systems	Between Groups	27.485	2	13.742	3.561	.029
	Within Groups	1821.265	472	3.859		
	Total	1848.749	474			
Web sites providing specific product/service information	Between Groups	3.413	2	1.707	.649	.523
	Within Groups	1241.058	472	2.629		
	Total	1244.472	474			
Web sites handling at least part of customers transactions	Between Groups	19.099	2	9.550	2.537	.080
	Within Groups	1776.387	472	3.764		
	Total	1795.486	474			
IS gathering information about customer preferences	Between Groups	21.370	2	10.685	3.077	.047
	Within Groups	1639.274	472	3.473		
	Total	1660.644	474			
IS supporting the work of customer service employees	Between Groups	11.691	2	5.845	1.470	.231
	Within Groups	1876.574	472	3.976		
	Total	1888.265	474			
Electronic Funds Transfer Systems	Between Groups	4.268	2	2.134	.530	.589
	Within Groups	1900.962	472	4.027		
	Total	1905.229	474			
Electronic Procurement Systems	Between Groups	6.921	2	3.461	.944	.390
	Within Groups	1730.986	472	3.667		
	Total	1737.907	474			

Table 4:

ANOVA of the Effectiveness of Various Technologies

		Sum of Squares	df	Mean Square	F	Sig.
Computer-based Human Resource Systems	Between Groups	.469	2	.235	.212	.809
	Within Groups	428.968	388	1.106		
	Total	429.437	390			
Computer-based Payroll Systems	Between Groups	1.423	2	.712	1.019	.362
	Within Groups	298.254	427	.698		
	Total	299.677	429			
Computer-based Accounting Systems	Between Groups	2.371	2	1.185	1.345	.262
	Within Groups	370.183	420	.881		
	Total	372.553	422			
Computer-based Purchasing Systems	Between Groups	.161	2	8.040E-02	.066	.936
	Within Groups	422.737	349	1.211		
	Total	422.898	351			
Database Management	Between Groups	.846	2	.423	.365	.695
	Within Groups	473.100	408	1.160		
	Total	473.946	410			
Decision Support Systems	Between Groups	9.650	2	4.825	3.690	.026
	Within Groups	341.255	261	1.307		
	Total	350.905	263			
Expert Systems	Between Groups	.872	2	.436	.318	.728
	Within Groups	249.312	182	1.370		
	Total	250.184	184			
Intranet	Between Groups	7.061	2	3.531	3.350	.036
	Within Groups	427.829	406	1.054		
	Total	434.890	408			
Extranet	Between Groups	4.614	2	2.307	2.079	.127
	Within Groups	352.937	318	1.110		
	Total	357.551	320			
Electronic Data Interchange Systems	Between Groups	.311	2	.155	.125	.883
	Within Groups	383.535	308	1.245		
	Total	383.846	310			
Enterprise Resource Planning (ERP) Systems	Between Groups	1.615	2	.807	.590	.555
	Within Groups	292.625	214	1.367		
	Total	294.240	216			
Web sites providing specific product/service information	Between Groups	7.450	2	3.725	2.811	.061
	Within Groups	557.909	421	1.325		
	Total	565.358	423			
Web sites handling at least part of customers transactions	Between Groups	8.961	2	4.480	3.087	.047
	Within Groups	452.836	312	1.451		
	Total	461.797	314			
IS gathering information about customer preferences	Between Groups	17.369	2	8.684	5.725	.004
	Within Groups	435.335	287	1.517		
	Total	452.703	289			
IS supporting the work of customer service employees	Between Groups	7.335	2	3.668	3.254	.040
	Within Groups	342.671	304	1.127		
	Total	350.007	306			
Electronic Funds Transfer Systems	Between Groups	1.582	2	.791	.713	.491
	Within Groups	387.134	349	1.109		
	Total	388.716	351			
Electronic Procurement Systems	Between Groups	1.734	2	.867	.654	.521
	Within Groups	311.346	235	1.325		
	Total	313.080	237			

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