

Information Systems Tools, Data Security, And On-Line Database Usage Among Multinational Enterprises

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Abstract

Multinational enterprises (MNEs) are increasingly important to business activity in the United States and abroad. Developing technologies in e-business, information security, and electronic financial reporting are causing major changes in the accounting information systems of companies based in the U.S. and around the globe. The ability to communicate and process data efficiently and effectively is essential to the continued success of these firms. MNEs operate in diverse cultural environments. Research has demonstrated that culture affects the use of information technology, including how firms collect, sort, process, and distribute accounting information and other types of information. The efficiency and effectiveness of information systems depends on the appropriate use of information systems tools and techniques. This study examines the use of systems development tools and techniques, data security devices, and on-line databases among multinational firms.

Introduction

International companies have become increasingly important to the economic stability of the United States. Currently, of the International Fortune 500 companies, many are headquartered within the United States. Of the companies whose headquarters are not physically located in the United States, many have branch offices in the United States or its territories. Additionally, the products produced or generated by these 500 firms are utilized throughout the world, including the United States. A global market is therefore no longer an emerging reality, it has become an actuality.

A key element in the development of multinational enterprises (MNEs), according to various academic and trade journals (cf., Arm-

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strong, 1998; Liberatore and Stylianou, 1994; Reck, 1989; Rugman, 1986; Smith and Salter, 1992; Smith and Smith, 1998), is the ability to communicate and process data efficiently and effectively throughout the firm. The use of information technology is often affected by the various cultures in which MNEs operate (Eining and Lee, 1997). Technological advances have altered the methods by which MNEs conduct both their domestic and international operations. Advances such as e-business, information security, and electronic financial reporting are among the most significant technological changes facing accountants. Advice to accountants regarding these technology challenges from the most widely distributed professional accounting journal was: "Confront and resolve them, or they'll overwhelm you and your business" (Tie, 2000, p. 20). The purpose of this paper is to examine the use of information systems tools and techniques, data security devices,

and on-line databases among multinational business firms. Additionally, a comparative analysis is provided of the use of these items based on the firm's size, nature of data processing, and reporting hierarchy.

Impact of Information Systems on Multinational Business

Multimedia, electronic interchange, portable computers, and multi-currency software have altered the day-to-day operations of multinational business firms. The development and refinement of information systems have also altered the manner in which accounting information is derived and disseminated throughout these global organizations. As nations become increasingly interdependent, the multinational enterprise will increase its contribution to a smoothly functioning world economy. The ability of an international business firm to collect, sort, process, and distribute information, particularly financial information, influences both directly and indirectly other business firms around the globe (cf., Adams, 1993; Dunning, 1980; and Smith and Salter, 1992).

The influence of advanced technology is felt at both the firm-wide and the individual level, throughout the world. The ability to generate accurate, up-to-date financial information will allow the multinational enterprise to more effectively respond to the needs of financial statement users (e.g. creditors, suppliers, customers, and stockholders) in a constantly changing marketplace. Within the firm, information pertinent to production, distribution, marketing, and other departments can now be distributed in a few seconds to remote branch locations of a corporation, via international communications networks (Smith and Salter, 1992).

Utilizing communication networks can improve internal communications, expedite ordering, decrease labor costs, and enhance overall data availability. The ability of a commercial over-night delivery service to track, via bar code, the location and status of virtually every package in its possession, is an example of the impact of today's information technology. Data entry cen-

ters are operating in firms throughout the world, including the "less developed" areas such as Mexico, Korea, China, and the Philippines (Smith and Salter, 1992).

The globalization of business has affected all areas of accounting. For example, for accounting and auditing, both international and domestic standards have evolved to meet the reporting demands of international transactions. Other areas which are directly or indirectly related to accounting, such as operating systems and communications, have also been affected (cf., Pantages, 1989; Reck, 1989; Nadel, 1992; and Morris, 1994). Accounting's role in the organization is evolving to meet the needs of the international business environment.

The accounting profession, by necessity, has responded to changes in the global marketplace. Accountants must have familiarity with information system technologies, the changes these technologies have undergone, and their proper usage at the international business level. Continuing advances in the area of information systems have exerted significant influences on the manner in which accounting information is collected, processed, and transmitted. The widespread use of the facsimile machine is one example of the rapid changes experienced in the last decade. The use of facsimile machines in the U.S. has grown from about 300,000 in the early 1980s to millions in the 1990s (Morris, 1993).

Literature Review

The effects of cultural and national status upon organizational structure and individual relationships have been examined by Hall (1977), Redding and Martyn-Johns (1979), and Hofstede (1989). Nobes (1987) and Gray (1988) contend that national differences in financial reporting systems are the result of cultural, legal, and various other social and economic differences within individual countries.

The idea that international companies develop strategies and corporate advantages from components native to the nation-state from which these companies originate was explored by Dun-

ning (1977), Rugman (1986), and Kogut and Singh (1988). Gonzales and Zimbaro (1985) indicated that the performance of the corporations themselves becomes somewhat contingent upon national culture. Gleeson (1994) examined business growth and accounting procedures in international markets and indicated that technological innovations are increasing productivity and accuracy in the machine tool industry in Australia. The use of group decision-making technology to improve communication within firms has been examined in a number of studies (cf. Johnson, 1994; Gallupe, DeSanctis, and Dickson, 1988).

Factors Affecting Information Systems

Organization and reporting structure can affect the operations of the information system department. A key question related to organization structure of the information systems department is whether information processing should be centralized or decentralized within the firms. The literature suggests there may not be one optimum organization structure for all firms, but rather the optimum structure is unique for each firm (cf., Marais, 1995 and Wilkinson, 1986, 757-58).

Assessing risk and uncertainty in new technology investments is a complex process (Accola, 1994). Information systems are crucial elements to corporate strategies, relations, communications, and control. The need to organize and automate is essential for the modern firm to be competitive in a world economy. There are a variety of systems development tools available to help in this area. Bryce (1983) listed eight types of tools. Carey and McLeod (1988) evaluated the use of 11 specific system development methodologies and tools.

Data security has always been a major concern to firms. Security issues have become more complex due to the advent of modern computers. Magnetic tape, floppy disks, and hard disks have provided the ability to store vast amounts of data on relatively cheap materials. These items are uniquely vulnerable to destruction by moisture, heat, and general exposure (Jacobson, 1985, 71-72). The loss of data because of natural disaster or sabotage could totally disrupt a

firm's operations. Data security techniques are designed to prevent such losses. Security techniques include: making back-up copies of data files, restricting logical and physical access to files, limiting distribution of output, use of antiviral software, and encrypting data for transmission purposes.

Hypotheses and Research Methodology

This study examines three items pertaining to information systems: tools and techniques, data security devices, and use of public on-line databases. Three hypotheses were developed as follows (stated in alternate form):

H1: The use of information system tools and techniques, data security devices, and public on-line databases will be more extensive at larger firms. This is anticipated because as organizations increase in size, they often become more complex. The aforementioned information system items may be employed to help manage this complexity (cf., Maccoby, 1994; Roche and Porter, 1995; Swenson, 1993).

H2: The use of information system tools and techniques, data security devices, and public on-line databases will be greater for firms that are centralized in organizational structure. This is anticipated because as management control is increased, the information systems department will respond by increasing use of system tools and techniques, data security devices, and public on-line databases (cf., Dumaine, 1991; Liberatore and Stylianou, 1994; Marais, 1995).

H3: The use of information system tools and techniques, data security devices, and public on-line databases will be greater for firms whose reporting hierarchy is at a lower level of management. This is expected due to the increased accountability (more immediate and direct supervision) that is associated with a lower reporting level (cf., Feld, 1990 and Liberatore and Stylianou, 1994).

A survey concerning information systems was mailed to 750 business firms selected from the Fortune Global 500 and the U.S. Fortune

500 which were involved in international trade; usable responses were received from 77 firms. The low response rate (10.3%) precludes generalization of the findings to all firms; although, a wave analysis indicated that respondents were not significantly different ($t=1.38$, not significant) from non-respondents (Oppenheim, 1966). In a wave analysis, early respondents are compared to late respondents, and late respondents are considered representative of non-respondents. Table 1 provides a breakdown of firms by the organization structure and nature of data processing; form

of organization; geographic areas of operation; and total revenue.

The firms utilize a number of on-line computer databases, including LEXIS, NEXIS, Business Software, Accountants, and Financial World. All together, over 4,000 on-line computer databases are available (Miller, Smith and Strawser, 1990). Many of these are accessible via the Internet.

Restrictions on data flow were ranked from most to least restrictive. The most restrictive barrier to information flow was tariffs on leased lines or data transmission services. The second-most restrictive barrier was incompatible communication protocols between countries. Third-most restrictive was incompatible equipment standards between countries. Fourth-most restrictive was foreign local regulations and fifth was conflict with U.S. regulations.

A total of 68 percent of the respondents indicated that the information system department is on the same level as major departments such as production and marketing. Among the firms, the information system department manager reports to various supervisory positions. A total of 16.0 percent report to the president or CEO of the firm; 54.7 percent report to the CFO or a corporate vice-president; 9.3 percent report to the Board of Directors; and 20.0 percent report to another person. In 31.5 percent of the firms, the data processing operations are centralized, 20.5 percent are decentralized, and 48.0 percent have characteristics of both centralized and decentralized.

Systems development tools and techniques used by information system departments are shown in Table 2. The most often used tool or technique was identified as system flowcharts, which was followed by program flowcharts. The least used was Nassi-Schneiderman diagrams. A good overview of systems development tools and techniques is presented in the study by Carey and McLeod (1988). Frequency of use is indicated on a scale of 1=daily and 5=never.

Data security devices used by firms are shown in Table 3. File backup procedures were

	Percent
Structure:	
Major Department	68.0 %
Non-Major Department	32.0 %
Data Processing Nature:	
Centralized	31.5 %
Decentralized	20.5 %
Both	48.0 %
Form of Organization:	
Public Corporation	86.30 %
Private Corporation	12.32 %
Government Owned	1.36 %
Geographic Area of Operation:	
U.S.	85.33 %
Europe	69.33 %
Japan/Pacific Rim	62.66 %
Canada	60.00 %
Mexico/Latin Am.	56.00 %
Middle East	46.66 %
Other	29.33 %
Total Revenue:	
Less Than \$500 Million	14.90 %
500 Mill - 1 Bill	1.49 %
1 Bill - 5 Bill	40.29 %
5 Bill - 10 Bill	25.37 %
More Than \$10 Billion	17.91 %

the most often used data security device (89.3 percent of firms). In second place was password procedures (86.6 percent of firms).

Table 2
Use of Systems Development Tools
And Techniques

Tool/Technique	Average Use
System Flowcharts	1.70
Program Flowcharts	1.94
Document Flowcharts	1.96
Data Flow Diagrams	1.98
Prototyping	2.39
Case Tools	2.46
Entity Relationship Modeling	2.60
Decision Tables	2.62
Top-Down Analysis	2.62
Object-Oriented Analysis	2.72
Struc. Walkthroughs	2.85
Structured English	3.10
Hipo Charts	3.48
Warnier-Orr Diagrams	4.00
Nassi-Schn. Diagrams	4.21

Note: 1=Daily and 5=Never

Analysis and Results

The information obtained from the survey was analyzed to determine differences in the use of information systems tools and techniques,

Table 3
Use Of Data Security Devices

Data Security Device	Percent
File Backup Procedures	89.33 %
Passwords	86.66 %
Files At Two+ Locations	80.00 %
Anti-Viral Software	80.00 %
Limited Physical Access	76.00 %
Limiting Output Reports	65.33 %
Accounting Control/Monitoring Software	53.33 %
Physical Security Devices	50.66 %
Encryption Software	41.33 %

Note: Sums to more than 100 % due to use of more than one device by a firm.

tween large and small firms. The relatively larger firms tend to use security devices to a greater extent. The statistical analysis indicates that the first hypothesis (that larger firms make greater use) can be accepted for five items, those having a significant difference, as shown in Table 4.

Firms were categorized according to the nature of data processing: centralized, decentralized, or having both centralized and decentralized aspects. As shown in Table 5, firms that have decentralized data processing generally make somewhat less use of systems development tools and techniques than firms which are centralized or have aspects of both centralized and decentralized, although the differences are mostly insignificant. Information systems departments that are centralized in processing may take a more structured approach to the use of system development tools and techniques, and this may account for their more extensive use in such departments. Decentralized firms generally make less use of data security devices and make less use of public databases. One of the disadvantages associated with decentralization is less control of data and processing; consequently, the lower use of security devices may aggravate problems associated with reduced control. The statistical analysis indicates that the second hypothesis (that firms with a more centralized structure make greater use) can be accepted for seven items, those having a significant difference, as shown in Table 5.

Firms were classified according to the information system department's reporting hierarchy: (1) reporting to the home office in the firm's home country, (2) reporting to the regional headquarters, (3) reporting to foreign office or (4) other (e.g. reporting only to the local office). As shown in Table 6, firms in which the information systems department reports to the firm's home office, as opposed to firms in which reporting is done at lower levels, generally make less frequent use of systems development tools and techniques, less frequent use of data security devices, and less frequent use of public data bases. The lower reporting level of the information systems department may be associated with increased accountability and greater technological sophistication within the department; consequently, greater use

Table 4
Use Of Information Systems Items According To Firm Revenue

System Development Tools and Techniques	\$ 0-1 BILLION		> \$1BILLION	
	Rank	Score	Rank	Score
System Flowcharts	1	2.14	1	1.63
Data Flow Diagrams	2	2.16	4	1.95
Program Flowcharts	2	2.16	3	1.91
Document Flowcharts	4	2.33	2	1.90
Prototyping	4	2.33	5	2.40
Entity Relationship Modeling	6	2.60	9	2.59
Case Tools	6	2.60	6	2.44
Object-Oriented Analysis	8	3.00	10	2.69
Structured English	8	3.00	12	3.11
Structured Walkthroughs	10	3.40	11	2.78
Top-Down Analysis	10	3.40	8	2.52
Decision Tables	12	3.60	7	2.50*
Hipo Charts	13	4.00	13	3.40
Warnier-Orr Diagrams	14	4.40	14	3.93
Nassi-Schn. Diagrams	15	4.60	15	4.14

Note: Scores of 1=Daily and 5=Never

	% Using	% Using
<u>Data Security Devices</u>		
File Backup Procedures	100.00 %	93.33 %
Passwords	90.91 %	91.67 %
Anti-Viral Software	81.82 %	86.67 %
Storage Two Locations	63.64 %	88.33 %*
Limiting Output Reports	63.64 %	70.00 %
Limited Physical Access	63.64 %	53.33 %
Physical Security Devices	54.55 %	83.33 %
Accounting Control/Monitoring	18.18 %	63.33 %*
Encryption Software	18.18 %	50.00 %*
<u>Public Databases</u>		
Lexis	27.27 %	40.00 %
Nexis	18.18 %	33.33 %
Business Software	9.09 %	25.00 %
Financial World	9.09 %	15.00 %*
Accountants	9.09 %	11.67 %
Foster Natl Gas	0 %	6.67 %

*Statistically Significant Difference at .05

of tools and techniques, as well as data security devices would be expected. The statistical analysis indicates that the third hypothesis (that firms with a lower reporting level) can be accepted for 12 items, those having a significant difference, as shown in Table 6.

tions software, systems development tools, and security devices. Accountants can play a key role in addressing these important technologies and their impact on the firm's accounting information system.

Conclusions

This study has examined the use of information system tools and techniques, data security devices, and public on-line databases among multinational enterprises. Differences in use of these items were observed among firms depending on firm size, nature of data processing, and reporting hierarchy. In general, more extensive use, although not always significant, of information system tools and techniques, data security devices, and public on-line databases was associated with larger firms, more centralized organizational structure, and where reporting level was at a lower level (e.g. regional office versus home office). Information systems represent an area of potential competitive advantage which may be utilized by a firm's management. MNEs must continually evaluate changes in their information systems, including communica-

Table 5
Use Of Information Systems Items According To Nature Of Data Processing

Systems Development Tools and Techniques	Centralized		Decentralized		Both	
	Rank	Score	Rank	Score	Rank	Score
System Flowcharts	1	1.60	1	1.72	1	1.74
Program Flowcharts	2	1.85	2	2.00	4	1.96
Document Flowcharts	3	2.00	2	2.00	3	1.92
Data Flow Diagrams	4	2.08	4	2.09	2	1.84
Prototyping	5	2.51	5	2.22	6	2.36
Entity Relationship	6	2.58	10	3.33	7	2.38
Case Tools	7	2.69	5	2.22	7	2.38
Decision Tables	8	2.86	8	2.77	9	2.40
Top-Down Analysis	9	2.94	9	2.83	5	2.34
Struc. Walkthroughs	10	3.07	10	3.33	11	2.54
Structured English	11	3.11	12	3.14	13	3.04
Object-Oriented Analy	12	3.25	7	2.37	10	2.48
Warnier-Orr Diagrams	13	4.11	14	4.00	14	3.82
Hipo Charts	14	4.27	12	3.14	12	2.95*
Nassi-Schn. Diagrams	15	4.43	15	4.14	15	3.94

Note: Scores of 1=Daily and 5=Never

	<u>% Using</u>	<u>% Using</u>	<u>% Using</u>
<u>Data Security Devices</u>			
File Backup Procedures	100.00 %	70 %	93.93 %*
Passwords	90.90 %	70 %	93.93 %
Anti-Viral Software	81.81 %	70 %	87.87 %*
Storage Two Locations	72.72 %	65 %	93.93 %*
Limited Physical Access	72.72 %	60 %	87.87 %*
Limiting Output Reports	59.09 %	55 %	75.75 %
Physical Security Devices	45.45 %	40 %	60.60 %
Acctg Control/Monitoring	36.36 %	50 %	66.66 %*
Encryption Software	31.81 %	30 %	57.57 %

	<u>% Using</u>	<u>% Using</u>	<u>% Using</u>
<u>Public Databases</u>			
Lexis	22.72 %	40 %	42.42 %
Business Software	22.72 %	10 %	27.27 %
Nexis	18.18 %	25 %	39.39 %
Accountants	13.60 %	5 %	12.12 %
Financial World	9.09 %	5 %	21.21 %*
Foster Natl Gas	4.50 %	5 %	6.06 %

* Statistically Significant Difference at .05

Limitations and Future Research

This study was limited by the firms that responded to the survey. The sample certainly represents the views of many MNEs; however, the sample results cannot be generalizable to all MNEs. There are a number of possibilities for

further research regarding use of information technology by MNEs. Future research might examine specific cultural factors (e.g. power distance, uncertainty avoidance, masculinity, etc.) regarding use of information technology by MNEs. Future research might explore the potential impact of information technologies on profit-


Table 6
Use of Information Systems Items According to Reporting Hierarchy

Systems Development Tools and Techniques	Home Office		Regional Office	
	Rank	Score	Rank	Score
System Flowcharts	1	2.10	1	1.28
Document Flowcharts	2	2.36	3	1.33*
Data Flow Diagrams	3	2.44	6	1.85
Program Flowcharts	4	2.59	1	1.28*
Object-Oriented Analysis	5	2.68	14	3.00
Top-Down Analysis	6	2.86	4	1.60*
Entity Relationship Modeling	7	3.06	7	2.00
Case Tools	8	3.26	7	2.00
Structured Walkthroughs	9	3.28	12	2.28
Decision Tables	10	3.31	7	2.00*
Structured English	11	3.43	11	2.20
Prototyping	11	3.43	5	1.66*
Hipo Charts	13	3.60	13	2.60
Warnier-Orr Diagrams	14	3.77	7	2.00*
Nassi-Schn. Diagrams	15	4.20	15	3.50*

Systems Development Tools and Techniques	Foreign Office		Other	
	Rank	Score	Rank	Score
System Flowcharts	1	1.47	1	1.55
Document Flowcharts	2	1.61	6	2.12*
Data Flow Diagrams	4	1.66	2	1.87
Program Flowcharts	2	1.61	4	1.88*
Object-Oriented Analysis	11	2.78	7	2.14
Top-Down Analysis	9	2.44	10	3.00*
Entity Relationship Modeling	8	2.31	8	2.40
Case Tools	7	2.23	2	1.87
Structured Walkthroughs	10	2.66	9	2.85
Decision Tables	6	2.05	10	3.00*
Structured English	12	3.00	10	3.00
Prototyping	5	1.90	5	2.10*
Hipo Charts	13	3.57	13	3.50
Warnier-Orr Diagrams	15	4.15	14	5.00*
Nassi-Schn. Diagrams	14	4.00	14	5.00*

Note: Scores of 1 = Daily and 5 = Never

*Statistically Significant Difference at .05.

ability. In addition, future research might examine differences between firms operating in various geographic regions. 

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Table 6 Continued

	Home Office	Regional Office	Foreign Office	Other
	% Using	% Using	% Using	% Using
<u>Data Security Devices</u>				
File Backup Procedures	87.50 %	100.00 %	96.15 %	93.33 %
Anti-Viral Software	87.50 %	85.71 %	84.61 %	86.66 %
Passwords	87.50 %	100.00 %	92.30 %	93.33 %
Storage Two Locations	75.00 %	100.00 %	88.46 %	80.00 %*
Limiting Output Reports	68.75 %	85.71 %	76.92 %	53.33 %*
Limited Physical Access	62.50 %	100.00 %	88.46 %	80.00 %*
Physical Security Device	43.75 %	57.14 %	61.53 %	46.66 %
Accounting Control	43.75 %	71.42 %	50.00 %	66.67 %
Encryption Software	31.25 %	85.71 %	53.84 %	53.33 %*
<u>Public Databases</u>				
Lexis	25.00 %	42.85 %	38.46 %	40.00 %
Business Software	18.75 %	42.85 %	30.76 %	6.66 %
Financial World	18.75 %	14.28 %	15.38 %	6.66 %
Nexis	12.50 %	42.85 %	38.46 %	26.66 %
Accountants	6.25 %	14.28 %	15.38 %	6.66 %
Foster Natl Gas	0 %	0 %	3.80 %	13.33 %*

*Statistically Significant Difference at .05.

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