Key data management issues in a global executive information system

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Abstract:
Information technology plays a significant role in a global organization. Senior executives of these organizations need constant and timely access to global information for making decisions. This information originates in different places worldwide for a global organization and needs to be organized before it can be used for decision-making. The organization and management of global corporate data presents unique challenges. This paper discusses the data organization and management related issues for developing a global executive information systems (EIS) for senior executives of global companies. The objective of a global EIS is to provide executives with a consistent, integrated and summarized view of operational data from subsidiaries worldwide. The global EIS also provides access to external data that is captured from different sources. The system facilitates integrating the internal and external data for effective decision-making.
Keywords: Information systems, Database management, Globalization

Article:
1. Introduction
The increased globalization of businesses places a tremendous demand for information that is needed for executive decision-making. In the early 1980s we saw the emergence of executive information systems to support executive decision-making. These systems provided executives with the necessary information in a timely fashion to support their decision-making. The use of these systems has increased over the years and they have become a "must have" for major corporations in the US. One limitation of these systems is the fact that they focus more on the domestic environment rather than the international dimension. In present times it is important that information that is presented by these systems includes data from worldwide operations of a global corporation and external sources to facilitate decision-making in global corporations. Companies need to assess potential threats and competitors worldwide. This creates a need for a system that provides information to executives from worldwide operations. We call such a system a global executive information system (EIS) and define it as:

- a computer-based information system;

- that provides easy access to domestic;

- and international information;

- for senior executives working at headquarters and in subsidiaries worldwide of a global organization;

- to support their analysis and decision-making functions.

The system uses databases (internal and external) to provide access to timely information. The global EIS is very user-friendly and access is provided via icons, a mouse and/or a touch screen. The user is not expected to have much IT or keyboarding skills. The information that is presented to

the executives is supported by customized presentation formats (color and graphics) and provides exception reporting and drill-down capabilities. The system is linked to electronic mail and other online information services. Such a system would allow executives in global organizations to access data on markets worldwide.

At the heart of a global EIS is the data, which needs to be collected so that it can be processed, managed and presented to executive users for decision-making. This data is both internal and external to a global organization. The internal data that needs to be collected and processed is captured by the transaction processing systems. These systems collect the operational data from worldwide subsidiaries of an organization. The external data includes competitor and industry data, and data about the political, social, economic, and legal environment of countries where a company has operations or might be planning to begin operations. The sources for this external data need to be identified and used for presenting information to the executives. When internal and external data are combined and processed using a global EIS, executives should be able to make better decisions. This paper addresses the issues relating to the collection, management, and processing of internal/external data by global organizations. The specific research questions are:

- What should be the scope of data that is included in a global EIS?

- What are the issues for the collection and processing of internal data from worldwide subsidiaries for a global EIS?

- What are the external sources of data available for a global EIS?

In the next section, we discuss the research foundations for a global EIS. The third section includes the research framework that was used to address research questions and propositions in the study. Section 4 presents the research methodology used for the study. Results are presented and discussed in section 5. Finally, in section six we discuss the implications for future research.

2. Research foundations

Data plays a vital role in organizations, and in recent years companies have recognized the significance of corporate data as an organizational asset. An overview of studies conducted by scholars (Brancheau et. al., 1996; Niederman et. al., 1991; Brancheau and Wetherbe, 1987, Dickson et. al., 1984; Ball and Harris, 1982; Martin, 1982) reveals that data as a corporate resource has been consistently ranked as a top priority for IS executives. Consequently, a company needs to address the issue of collecting, managing and presenting its corporate data in the form of useful information for effective decision-making. Executive information systems (Watson et. al., 1991; Leidner and Elam, 1993- 94; Leidner and Elam, 1994; Matthews and Shoebridge, 1992; Meall, 1990; Millet and Mawhinney, 1992; Rockart and DeLong, 1988) developed during the early 1980s fulfilled the information needs of senior executives in corporate America. These systems generally did not incorporate international data as a component of an EIS.

A few studies have examined the role of data as an organizational resource. Deans et. al. (1991) identified a comprehensive list of international IS issues and data utilization was ranked as a top priority in this study. More recently, Palvia, Kumar, Kumar and Hendon (1996) raised the issue that executive information systems used by executives in global organizations need to be global in scope. They call a system developed specifically for this purpose a global EIS. In their paper, they conducted an exploratory study to identify in macro categories, the types of information required by executives in a global EIS, the current level of use of such information, and the sources of such information.

Eom (1994) discussed the emergence of "transnational management support systems" (TMSS) for organizations operating in the changing global environment. He highlighted the significance of the EIS component in TMSS, by stating that one of the functional requirements for such a system would be global data access. Min and Eom (1994) talked about developing an integrated decision support system (IDSS) for handling the complexities and the uncertainties of global logistics operations. They defined such a system as:

A world-wide network of multi-user decision support systems that integrates the MNF's (multinational firm) various logistics operations and standardizes databases across national, cultural and market boundaries... (p. 31)

Violano (1988) described Citicorp's Global Report System as one that provides executives with real time information on international banking. The system filters, integrates and organizes financial information (e.g. international currency trading, foreign exchange, geographic countries and regions) for senior executives. Not only does the system provide information for executives, it also allows the user to search desired topics. This puts the "world at your hands" according to Violano (1988).

Iyer and Schkade (1987) discussed different characteristics of multinational management support systems. They point out that managers of multinational corporations are often "inundated with unsolicited information from several sources." It becomes important not only to retain such information, but also to organize it for future use. They proposed the use of an ESS, which will not only allows executives to scan the information, but also performs ad-hoc analysis for evaluating decision tasks.

3. Research framework: objectives and hypotheses
A research framework allows researchers to conduct systematic research leading to the development of a cumulative body of knowledge. In this paper, we address research questions based on the global EIS data framework (Figure 1). The framework is organized as follows.

There are two main components of data in a global EIS: internal and external data. Internal data originates in worldwide subsidiaries (S1, S2, S3 ...) and global headquarters of a company. This data resides in the operational databases that an organization and its subsidiaries maintain. The data that resides in these databases becomes the basis for answering questions/ queries that are of a specific nature and relate primarily to organizational performance. For example: What were the corporate sales for the last quarter of 1998? How much profit did we make in subsidiary S2? How does the performance of subsidiary S1 compare to S3 in region X (e.g. Asia or Africa)?

The external data in a global EIS helps answer questions about the business environment and are generally broader in scope. For example: What is the level of IT infrastructure in a specific part of the world? What is the status of e-commerce in Australia? What is the extent of telecommunications infrastructure in a subsidiary? Answers to these questions cannot be retrieved from internal databases that companies maintain. A global company needs to scan and collect such data from sources that are external to the organization. These sources need to be identified so that whenever there is a need for such data it is readily available for executive decision-making.

Research questions (Q1-Q4) and propositions (P1-P6) that address the issues of collecting, organizing, and processing of internal and external data are shown in the framework. It must be pointed out that a more comprehensive list of questions and propositions was developed after the first phase of this study. During the second phase, these questions and propositions were validated and finalized for the main study. In the following sections, different components of the framework are discussed.
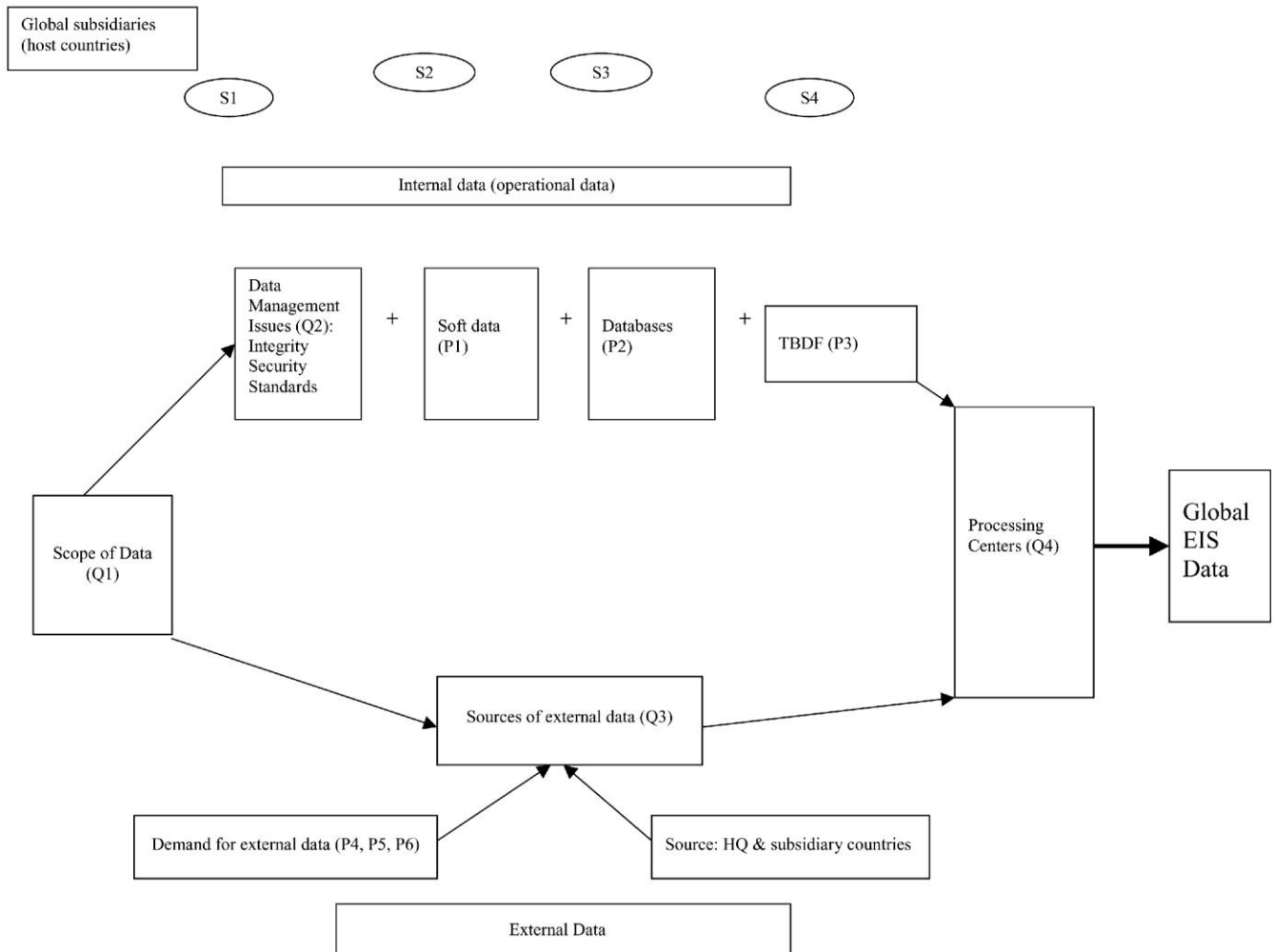
3.1 Scope of data for a global EIS
The literature (Houdeshel and Watson, 1987; Rockart and DeLong, 1988; Watson et. al., 1991) points out that data is an important part of an EIS, as it forms the basis of the information that is provided to the executives by the system. Much of the data is internal to the organization and is extracted from databases that exist in the organization, e.g. transaction processing systems and functional areas (Watson et. al., 1991). Developing a global EIS necessitates determining at the outset the scope of the data that is to be included in the system. This will have an impact on the collection and management of the data. It also helps in assigning responsibilities for data collection and management. Further the data that forms a part of the global EIS will have an impact on the usage of the system by executives worldwide. Questions such as whether the global EIS include data from

worldwide subsidiaries or should the data be confined to major regions (e.g. Europe, Asia etc.) and/or subsidiaries (countries) only. Summarily, the question that needs to be addressed is the following:

Q1: What is the scope of the data that is to be included in a global EIS?

Figure 1
Global EIS data framework

3.2 Internal data

Data in the global EIS comes from internal and external sources. The internal sources include data at headquarters and subsidiaries worldwide. This data is extracted from transaction processing systems in different functional areas of the business (Watson et. al., 1991) from subsidiaries worldwide. Internal data originating in worldwide subsidiaries needs to be collected from different and disparate operational sources in each subsidiary. For example, subsidiaries located in countries like India or Russia can be prone to data problems that originate due to cultural or political disparities (Chepaitis, 1994; Palvia and Palvia, 1992). Furthermore, the definition of "customer" and the code used to represent it may vary in different operational locations. This can lead to data reliability and consistency problems. Thus there is a need to ensure that standard definitions are provided for data items in different parts of the world for each subsidiary. Further, this data is a corporate resource and security of the data should be ensured. In summary, the question that needs to be addressed is:

Q2: What are the potential problems in a global EIS with respect to data management?

Mintzberg (1975) and Zmud (1986) point out the significance of internal data that is captured from human sources and that it is very important to understand complex problems. Watson et. al. (1991) define this as "soft-data" and include news, rumors, opinions, ideas, predictions, explanations, and plans in this category of data. In

their opinion capturing this data as a part of an EIS can be a difficult process. They however point out that this data will add to the "richness" of the information that is provided by an EIS. It would be interesting to see if including soft data in a global EIS would improve the quality of the system. We propose that:

P1: Inclusion of soft data in the global EIS will improve the quality of the global EIS (Mintzberg, 1975; Watson et. al., 1991; Zmud, 1986).

Several possibilities exist with respect to the structure and organization of the internal databases used for a global EIS. These databases are owned and managed by subsidiaries in different parts of the world. Subsidiaries can use databases that are centralized, decentralized, or distributed within each subsidiary. The objective is to ensure that data in these databases is reliable, consistent and accurate and executives (local and corporate) have timely access to this data. While there may be a strong need to keep data at the local level for better management of operations, there is also the requirement of executives being able to access the data from anywhere. Therefore, we propose that:

P2:   Standardized distributed databases are more appropriate for a global EIS.

Transmitting data from where it originates to the place where it is required for processing and decision-making is very important for controlling and coordinating the operations of a global organization. Carlyle (1988) points out that "on the congested data highways of multinational corporations, the problems of getting the right data in the right amount to the right people at the right time are multiplying daily as global markets emerge" (p. 54). Data that originates from worldwide subsidiaries needs to be transmitted from different places to global corporate headquarters. The establishment of communications networks worldwide ensures that data transmission problems are reduced to the greatest extent possible. However, regulations imposed by nations that restrict the movement of data across borders are a major hurdle in the effective use of such networks. This would have an impact on the extent of usage/diffusion of systems that are developed by global corporations. Based on this fact we propose that:

P3:   The greater the extent of regulations (restrictions) imposed on transborder data flows, acquisition of hardware and software, and the usage of certain telecommunications equipment by nations, the less effective will be the diffusion/usage of information technologies (i.e. global EIS) in a global organization operating in these nations. (Buss, 1982; Deans et. al., 1991).

3.3 External data
External data has the potential of making a significant contribution to the global EIS' effectiveness. This data, in many cases, is collected from sources existent in the home country (corporate headquarters) of the global corporation. These data items help senior management at corporate headquarters to answer questions that relate to different national environments. For example: Do we enter a new market? What is the IT infrastructure in a country where a new technology is planned to be implemented? Is there adequate educated manpower available to implement technology solutions? Organizations need to decide on data sources that are available for external data. Furthermore, they may have to identify secondary sources when primary sources are not available, are very expensive, or not so critically needed. Sometimes, redundant data sources may be needed to increase confidence and reliability. In any case, considerable time and effort need to be spent. The question that we address is:

Q3: What are the different external sources of information that can be used for a global executive information system?

The external data required and collected from different sources is affected by three factors

1. the intensity of the global competition faced by an organization,

2. the restrictions imposed on the collection of this data, and

3. the uncertainty of the environment in which a global company operates.

These factors influence the extent and nature of data that needs to be collected for a global EIS. We propose that:

P4: The greater the intensity of the global competition that an organization faces, in its national environment (home country), the greater will be the demand for external sources of information for a global EIS.

P5: The greater the level of uncertainty in the national environment of an organization, the greater will be the demand for external information for a global EIS.

P6: The greater the governmental constraints imposed on the acquisition of information by organizations (in home country), the less likely it is that the quality of information in a global EIS would be effective/good.

3.4 Data processing centers
Data that is collected and managed by subsidiaries is initially isolated in databases around the world and needs to be integrated at the headquarters. This is important especially for internal data as the data originates in different subsidiaries worldwide. For example, subsidiaries may have collected data in different currencies and/or used different measurement units. Before this data can be used for analysis and decision-making by executives at the headquarters all discrepancies need to be resolved and "clean data" needs to be provided for a global EIS. The internal data also needs to be integrated with external data for providing a context in which it can be used. For example, if sales in a particular subsidiary are poor, the internal performance data from that subsidiary can be compared to performances of local competitors in that country. This requires linking to sources that provide additional data about the national environment of that subsidiary. The main challenge for a global company is to create a common logical vision of corporate data so that executives can look at the "big picture". A key macro decision in this regard is the number and location of the processing centers. The research question can be stated as:

Q4: Where should the processing center(s) for a global EIS be located?

Indeed there will be other questions on processing (e.g., processing modes, operational and programming details, etc.), but they tend to be detail-oriented and relate to the specific situation of the company. These issues are outside the scope of our inquiry.

4. Research methodology
This study was conducted in three phases:

1 phase I: literature review and analysis;

2 phase II: pilot case studies; and

3 phase III: a final mail survey.

4.1 Phase I (literature review and analysis) Phase I was an extensive literature review of the following streams of research:

- globalization and the role of information technology in global organizations;

- executive information systems; and

- global executive information systems.

The objective of the literature review was to propose a research framework (Figure 1) for the study of data related issues for developing a global EIS. As a starting point, the key international IS issues study (Deans et. al., 1991) was used to extract a list of important issues for the study of information systems in global organizations. This study was then combined with the results of the Watson et. al. (1991) study to identify issues for global executive information systems. This list of issues was then supplemented by other research studies in the international IS and executive information systems research streams (Carlyle, 1988; Deans and Kane, 1992; Eom, 1994; Freedman, 1985; Huff, 1991; Ives and Jarvenpaa, 1991; Ives et. al., 1993; Leidner and Elam, 1993-94; Leidner and Elam, 1994; Matthews and Shoebridge, 1992; Meall, 1990; Millet and Mawhinney, 1992; Palvia et. al., 1992; Passino and Severance, 1990; Roche, 1992; Watson, 1995). The near-exhaustive list was analyzed to develop the research framework shown in Figure 1. The framework provided the basis for a detailed questionnaire.

4.2 Phase II (pilot case studies)
Phase II used the case study approach to refine and extend the issues from the literature review. The objective was to use the case studies to formulate specific research propositions and questions. There are two main reasons for using case studies for this phase. First, case studies are likely be the most appropriate way for initial investigation of issues in a relatively new area. This investigation will eventually form the foundation for further research in global EIS. Second, as per Gummesson (1991), case study research provides the advantage of presenting a holistic view of a process. The in-depth investigation allows the study of different aspects of a research topic and their relationship with one another. In essence, it enables researchers to view the total environment of the process under study. It should be noted that the use of case studies is on the rise in management research (Gummesson, 1991; Bonoma May, 1985; Bonoma, 1985).

Yin (1984) distinguishes between three types of case study research: exploratory, descriptive, and explanatory. In the current research, the case studies were primarily exploratory. These studies were used for formulating specific propositions and questions. The data from the cases was analyzed using content analysis. Inferences were made based on responses of information systems executives. Underlying themes (Berelson, 1952) were the major unit of analysis. The results of this phase, along with the analysis of the literature, were used to develop research propositions and questions for the final phase.

The case studies were conducted in five different companies based in Memphis, New York, and Los Angeles. Of the five companies, four are US-based global organizations and one is a Japanese company. These companies represent a variety of industries:
- banking;

- entertainment;

- automobile;

- transportation; and

- paper.

Furthermore, companies were from both the service and manufacturing industry. The selection of companies was based on our ability to gain access to senior IS executives in the company.

Every company in the pilot study has operations in at least two countries, i.e., home country and outside. Senior IS executives (e.g. CIO, VP-Information systems etc.) were interviewed to elicit information for the case studies. Care was taken to ensure that the executives interviewed were involved with international IS projects

and executive information systems projects in their respective companies. Open-ended questionnaires were used for the case studies.

4.3 Phase III (mail survey)

The third phase used a mail survey to get responses on a variety of questions. The objective was to address the questions and hypotheses developed in the previous phases. A multi-part questionnaire was mailed to a large random sample of senior IS executives in 503 companies. These were geographically dispersed global firms in the US. The questionnaire provided a definition of global EIS in the beginning to ensure that respondents had a common understanding of the term.

The questionnaire was pretested by initially mailing it to 20 companies. Changes were incorporated and the questionnaires were then mailed to the remaining companies. The survey population for the questionnaire was chosen from the Information Week list of the 500 biggest and best corporate users of information technology. This list was matched with databases like the World Directory of Multinational Enterprises and the Fortune Industrial and Service 500's to develop a list of global organizations. We believed that being the leaders in the usage of IT, these companies would be potential candidates for having a global EIS or EIS. Once the data was collected, statistical methods were used to analyze the data and report the results.

5. Results and discussions

Initially we present demographic information about our sample, followed by results for the research questions and propositions listed earlier. The respondents included global companies headquartered in different parts of the US and the world. Of the total usable responses ($N = 48$, approximately 9 per cent), 86 per cent of the companies had their headquarters in the USA and 14 per cent had headquarters in other countries. While a higher response rate is desirable, it is adequate given the exploratory nature of the study. The lower response is attributable to a relatively lower fraction of global companies using EIS. We expect this situation to change over time. Moreover, Alreck and Settle (1985, p. 45) point out that "response rates are often only about five or 10 per cent."

Companies in this sample are geographically dispersed in the USA and are from different industries. Furthermore, all respondents had substantial IS work experience, adding credibility to the quality of data. The number of manufacturing sector companies was 23 (48 per cent) and the number of service sector companies was 25 (52 per cent). In the manufacturing sector, respondents included chemicals, health care, industrial, commercial electronics, computers, and consumer goods. The service sector category included companies from transportation, finance, software development and consulting, telecommunications, media, retail, pest control, and entertainment. Fifty per cent of the companies had assets over $10 billion. Forty per cent had revenues over $10 billion. The IS budgets for these companies were between $100 million and $5 billion, and the average foreign involvement was about 38 per cent (foreign involvement is measured as a ratio of international revenues to total revenue).

Table I
Number of employees working for responding companies ($N = 43$)

Number of employees	Per cent
100–25,000	46
25,001–50,000	19
50,001–100,000	19
100,001–150,000	9
150,000 and above	7

Table II
Number of IS employees working for responding companies ($N = 26$)

Number of IS employees	Per cent
1–500	27
501–1,000	30
1,001–2,000	12
2,001–3,000	12
3,001 and above	19

The total number of employees in the companies that provided this data ($N = 43$) are shown in Table I and the number of IS employees $N = 26$) are shown in Table II.

Majority of the respondents were Vice Presidents and/or Directors (47 per cent) of IS, followed by IS managers/staff (18 percent), CIOs (13 per cent), project leaders (11 per cent) and consultants, etc. (11 per cent).

The average total work experience of the respondents is 23 years, and the average IS experience is 18 years ($N = 43$).

Fifty-six per cent of the companies had an EIS in use. Twenty-seven per cent had a global EIS. Of course, the "global EIS" companies are a subset of the "EIS" companies. Companies, which did not have an EIS or a global EIS, were asked to project their answers in terms of a global EIS.

5.1 Scope of data for a global EIS

Determining the scope of data for a global EIS helps in managing data and assigning responsibilities for it. It also tells us about the range of decisions that can be supported by an EIS. Table III presents the results for the scope of data that should be included in a global EIS.

As the table indicates, the majority of the respondents (91.6 per cent) recommended that the scope of the data that should be the global organization. Even among respondents that do not use an EIS or a global EIS, a significant percent (81 per cent) perceive that the scope of the data should be global. Nevertheless, integrating global corporate data poses major challenges for an organization. For example, the data is stored in different parts of the world, which implies that chances are high that different database management systems are used. Differences in standards and business definitions of data can further complicate the issue.

Table III
Scope of data for a global EIS ($N = 48$)

Scope of data for a global EIS	All companies ($N = 48$)	Companies without EIS or global EIS ($N = 21$)	Companies with EIS ($N = 27$)	
			Global EIS ($N = 13$)	EIS ($N = 14$)
Global data (entire enterprise)	44 (91.6%)	17 (81%)	13 (100%)	14 (100%)
Country (subsidiary) data only	1 (2.1%)	1 (4.8%)	–	–
Regional data only (e.g. Europe, Asia)	3 (6.3%)	3 (14.2%)	–	–

The implication of this finding is that global companies need to create a global data architecture, the goal of which is to provide consistent, reliable, and extractable global corporate data for executive decision-making. The architecture would enable global corporations to provide a strategy for managing vast volumes of global corporate data. This is to ensure that the data resource of an organization is utilized to the fullest extent possible. This is a difficult task given the fact that data originates in different parts of the world.

To facilitate the collection and management of global organizational data and to implement a strategy consistent with the global data architecture, we recommend that the company hire a person who understands the company's business and its data. This person may be referred to as the global data administrator. This person should be able to understand and balance the data needs of the local (subsidiary) and corporate (headquarters) executives. He or she should ensure that data definitions are consistent and standardized across the global organization. Furthermore, the data in the global EIS should be continuously maintained and periodically refreshed. Changes in subsidiaries are constant and unpredictable. Senior executives need to be aware of these changes for effective decision-making. The global data administrator should be responsible for ensuring that important changes affecting the organization are captured by the global EIS and presented to the users in a timely manner.

5.2 Internal data issues

When asked about potential problems related to managing corporate data in worldwide subsidiaries, all respondents agree that data integrity, data standards, and data security are important issues for the management of data in a global EIS. Inconsistencies in data among subsidiaries are common and need to be resolved. Business and IT staff in subsidiaries need to agree on common definitions of data entities and attributes. Standards should be adopted by each subsidiary to ensure that common definitions of data exist and are used at each subsidiary. This is a key requirement for making subsidiary data part of the global corporate resource. In

addition, data security must be ensured at every subsidiary. This can be a problem in subsidiaries that do not have specific laws governing data access. Subsidiaries must be "educated" on maintaining data as a corporate resource. Recommendations for preventing corporate data from getting lost or accessed by unauthorized users should be provided. The issue of "customer privacy" must also be addressed as a good practice. The global data administrator can play a key role in ensuring that data integrity, standards, and security issues are adequately addressed. Once again, the global data architecture can be the driving force for addressing these vital issues, and to make sure that the global EIS is reliable, consistent and secure.

A vast majority of respondents (73.0 per cent) agree that it is important to include soft data in a global EIS and that the inclusion of such data would lead to a higher quality system. Once again, the global data administrator can play a crucial role in ensuring that soft data is included in a global EIS. He or she can be instrumental in educating executives on the importance of sharing this data on a worldwide basis to improve the quality and usefulness of the system. The administrator may have to give assurances (and back them up) regarding the confidentiality of the sources of data and access rights. This would only increase the likelihood of people willing to share soft data on a worldwide basis.

When asked about the technological architecture of the underlying database, majority of the respondents (60.4 per cent) agree that a distributed database structure is more appropriate for a global EIS. Only 4.2 per cent disagreed. The remaining neither agreed nor disagreed. A preference for distributed databases (as opposed to centralized databases) indicates the presence of subsidiary level local requirements and the need for local control. The distributed architecture allows meeting global needs while also ensuring that local needs are also met along with better performance and response times. Furthermore, the local operations remain responsible for the reliability and accuracy of data. In this manner, reliable and accurate data is made available to corporate headquarters and other subsidiaries.

As expected, many respondents (47.9 per cent) agree that the regulations imposed on transborder data flows (TBDFs), acquisition of hardware and software, and usage of telecommunications equipment will hamper the usage/diffusion of a global EIS in a global company. Only 29.2 per cent of the respondents thought that such regulations will not have an impact on the usage/ diffusion of a global EIS. The response distribution for TBDF impacts is similar among companies with or without EIS, thus adding credibility to our results. In summary, respondents perceive TBDFs regulations to have a moderate impact on the usage/diffusion of a global EIS. With more and more nations removing restrictions on TBDFs and the acquisition of technology, the impact of political/legal restrictions will continue to be less important in the future. The only places where political influences may still be an important issue will be in subsidiaries located in underdeveloped countries (Palvia, Palvia and Roche, 1996, p. 21), and in unstable political environments.

5.3 External data issues
Based on the literature and case study results, nine types of data sources were identified as potentially relevant for obtaining international business data within the national environment (global corporate headquarters) of a company. As data can be obtained from multiple sources, respondents were allowed to check multiple sources. The number of respondents choosing different external sources is shown in Table IV.

The highest recommended source of external information is online databases. Other sources considered important are suppliers/customers/trade associations, published (trade/general/government publications), academic institutions/private research labs., and information brokers/ consultants. It is clear that most of the widely preferred sources of external data are hard sources. This result is in contrast from an earlier study (Palvia, Kumar, Kumar and Hendon, 1996), which identified non-computer-based resources as the most-cited sources of international business information. A likely explanation for the popularity and preference for on-line databases is the explosive growth of the Internet and the easy availability of data on the net in recent years. Not only is the data more readily available, it is also easy to access and is becoming increasingly accurate and reliable (especially when obtained from multiple sources).

Sources of external data not used as frequently as in the past include: chambers of commerce, conferences/trade shows, business travels, and personal contacts. A possible reason for the low use of chambers of commerce and conferences/trade shows is the fact that these sources are confined to the gathering and collecting data pertaining to the local environment rather than international data. While personal contacts and travels do provide invaluable insights, a high reliance on these sources is not warranted any more as is borne out by the results. These results imply that easy and free access to data on the net is welcome by organizations as a source of external data.

Table IV
Sources of external data for a global EIS

Source of information	All companies (overall respondents) (N = 48)	Companies that do not have an EIS/global EIS (N = 21)	Companies with EIS (N = 27)	
			Global EIS (N = 13)	EIS (N = 14)
Online databases	40	17	11	12
Suppliers/customers/trade associations	32	13	8	11
Published (trade/general/government publications)	31	12	9	10
Academic institutions/private research labs.	28	11	11	6
Information brokers/consultants	26	10	7	9
Chambers of commerce	17	7	6	4
Conferences/trade shows	17	7	6	4
Business travels	15	5	5	5
Personal contacts	15	7	3	5

The demand for international data required in a global EIS varies with the level of global competition that an organization faces in its home country. The survey findings reveal that 72.9 per cent of the respondents believe that the intensity of the global competition that an organization faces directly impacts the demand for external sources of data. It should be noted that respondents who do not use an EIS or global EIS perceived more strongly (about 80 per cent of them) than respondents using such systems (66 per cent of them) that the level of global competition impacts the need for greater sources for external data. It makes sense that companies that face global competition and do not have computerized systems to access external data (i.e. on their competitors, industry, government, etc.) would perceive a greater need for EIS type systems.

Another factor that impacts the demand for international data for a global EIS is the level of uncertainty in the environment. Three-fourths (75.1 per cent) of the respondents agreed that greater the level of uncertainty in the national environment, greater will be the demand for external data in a global EIS. Most of the global corporations in the US operate in a very dynamic environment. In recent times, we have seen a series of acquisitions and mergers that change the structure and playing field of the companies in an industry (e.g. the mergers of Chrysler and Mercedez-Benz, and Citibank and Travelers Insurance). Consequently, there is greater uncertainty for organizations competing in the international environment. The increased uncertainty leads to greater demand for external data and is reflected in the results.

The quality of data in a global EIS should be negatively affected by the constraints imposed by the government on the acquisition of such data. However, results show that only 58.3 per cent of the respondents believed that government constraints on the acquisition of data impacts the quality of data in the global EIS. The US is a country where there are very few constraints on acquisition and use of data by companies. Data is generally freely available to anyone who wishes to access it, especially with the growth of the Internet. The relatively cheap and easy access to data worldwide may be a possible explanation for the somewhat contradictory response.

5.4 Data processing centers
Respondents were asked about the location of the processing center(s) for a global EIS. They were provided three choices: headquarters only, regional (e.g. European) processing centers, and/or country (subsidiaries) processing centers. Table V presents these results.

The most preferred data processing center for a global EIS by respondents was the company headquarters. Respondents prefer data to be collected from different subsidiaries and then processed at headquarters. A possible explanation can be that this way companies would be able to maintain better control, and would be able to better aggregate and analyze the data from a corporate perspective. Note this recommendation in no way contradicts the earlier recommendation about a distributed data architecture; there may be distributed data processing for operational activities, yet the final processed data would be made available at the headquarters for EIS processing. The global data administrator would be able to ensure that problems relating to data integrity, unclean data, common data definitions, conversion of currencies and measurement units, etc. are resolved before the data is included in the EIS.

Table V
Data processing centers for a global EIS (N = 48)

Scope of data for a global EIS	All companies (N = 48)	Companies without EIS/ global EIS (N = 21)	Companies with EIS (N = 27) Global EIS (N = 13)	EIS (N = 14)
Headquarters only	25	9	8	8
Regional centers	21	12	6	3
Country processing centers	11	8	2	1

A close second alternative is regional processing centers. This option is in the middle of the two extremes of a global processing center and country processing centers. A global processing center may be overwhelming and complex to manage. Many companies adopt a "regional" approach in the management of their operations, e.g. Citibank in India (Palvia, Palvia and Roche, 1996). The least preferred approach is country processing centers. The rationale behind this approach is that IS management might lack the experience and expertise needed to deal with problems associated with global data collection and processing.

6. Conclusion

This article reports findings from 48 global companies about the issues involved in collecting, managing and processing internal and external data for a global EIS. We have argued in this paper that multinational companies need to have a global data architecture for utilizing the vast data resources at hand and in developing a global EIS. The important role a global data administrator can play in implementing the global data architecture has been proposed. The study also presents and discusses useful findings relating to managing and using internal and external data for developing a global EIS. Potential external sources of information are identified. The findings of the study suggest that data availability may not be the real problem. Rather the need to organize the data in a system where it can be used for decision-making is the challenge facing global organizations.

We need to emphasize that the results of this study are exploratory. Paucity of previous research and the complexity of the subject necessitated that our study identify the data issues involved in developing a global EIS. We recommend that future studies pursue an examination of these issues in greater depth. Detailed studies on specific data management issues for developing a global EIS, the use of current technologies (the Internet, data warehousing and data marts) for developing a global EIS and the use of Intranets for sharing data in a global organization are some of the questions that demand researchers' attention.

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