A MULTICULTURAL PERSPECTIVE OF THE IMPACT OF EIS ON ORGANIZATIONAL INTELLIGENCE, DECISION MAKING AND STRUCTURE

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Abstract: Although information technologies in business organizations around the world may be very similar, the meanings conveyed through the technologies may be dependent on managerial values and national culture. Cultural differences need to be understood before information technology developed for an organization in one country can be effectively implemented in an organization in another country. Drawing on responses from multiple users of EIS across many organizations in Mexico and Sweden, and comparing these to multiple users from a previous study in the United States, the current study examined whether cultural differences influence the relationship between Executive Information Systems' use and various outcomes related to organizational intelligence, decision making, and structure. The study found significant differences, predictable by cultural factors, in the impact of EIS use. The findings confirm the notion that IT is used by executives to reinforce behaviors valued in their culture rather than that IT will reshape behaviors and values.

1. Introduction

As the world increasingly moves toward more open, global markets, the need for timely, reliable, easily accessible information will be a key to effective decision making. Executive Information Systems (EIS) can be one means of providing this important information. Several benefits of EIS use have been suggested in the literature. Studies have suggested that EIS enable executives to focus more on analysis rather than the collection of data, to conduct more in-depth analysis, and to take action faster [Rockart and DeLong, 1988; Watson, Rainer, Koh, 1991], as well as to improve decision making and increase productivity [Belcher and Watson, 1993]. Although originally seen in large US organizations, the use of EIS as important management tools has also been reported in Australia [Pervan and Rhua, 1996; Pervan and McNeely, 1995; Hassan & Gould, 1994], Canada [Bergeron et al., 1995], and the United Kingdom [McBride, 1995; Holtham & Murphy, 1994].

Yet, even as information technology in business organizations around the world converges, the meanings conveyed through them as well as the outcomes of their use may remain culture specific [Limaye and Victor 1991]. For example, one study found that culture plays a role in the predisposition toward and selection of electronic communication media [Straub, 1994]. This can be attributed to the fact that any information system is developed with a set of assumptions concerning how it should be used and what types of impacts should be anticipated; indeed, even designer values vary across cultures [Kumar and Bjorn-Andersen, 1990; Raman and Watson, 1994]. Incongruence between the values embedded in technology use and the values in a culture that uses the technology will lead to problems [Baligh, 1994]. In cases where the use of the IT requires adaptation of behavior to achieve benefits, adaptations which are legitimized by and consistent with core values in a culture will be more effective than adaptations incongruent with core cultural values [Lachman, Nedd and Hinings, 1994]. Evidence of incongruence was revealed in a study that found that GDSS was not as well received in Singapore as in the United States and even led to negative consequences because of different attitudes toward the appropriateness of the expression of conflict [Ho et al, 1989].

EIS may be particularly culture specific in terms of the perceived outcomes of use in that these systems are developed with individuals in mind, exhibit a clear preference for quantifiable information, and focus on timeliness--such characteristics are highly valued in the culture of the United States but may not be as valued in other cultures. Such systems may meet with

resistance when being implemented in cultures with different perspectives of time, individuality, and the importance and trustworthiness of quantifiable information. Even if successfully implemented, such systems may not yield the same benefits as they do in the culture from which the systems originally emerged. Much as universal statements about the effects of organizational structures on individuals cannot be made on account of national cultural differences [Lincoln et al, 1981], generalizations about the outcomes of using an information system on individuals cannot be made across cultures until research offers evidence of similar effects of IS use across cultures.

The current study examines how cultural differences influence perceptions of the outcomes of EIS use. Whereas much prior empirical research has focused primarily on EIS from the IS perspective, this study reports the findings of 184 EIS users from Mexico and Sweden and compares the current findings to the findings reported in Leidner and Elam [1995] of 91 EIS users from the United States in order to examine the following research question: are there differences in the perceived outcomes of EIS use across cultures?

The paper is organized as follows: the next section summarizes an existing theory of the impact of EIS on decision making based on a study of US executives and presents the expected role of culture in explaining different outcomes of the theory in other cultures, the third section presents the methodology, the fourth section presents the analysis and hypothesis testing, and the fifth section presents the discussion of the findings, the limitations, and the conclusion.

2. Theoretical Foundations and Hypotheses

2.1 Executive Information Systems

An EIS is a computer-based information system designed to provide senior, and in many cases middle and lower level, managers access to information relevant to their management activities. An EIS draws data from different sources, puts together the data and presents the data for specific users' needs. In a recent empirical analysis of 91 EIS users in the United States, Leidner and Elam [1995] examined the relationship between EIS use (measured as frequency of use as well as length of use) and outcomes related to organizational intelligence, decision making, and structure. Their findings, summarized in Figure 1, suggested that EIS use (either frequency of EIS use, length of EIS use, or both) was positively related to increased information availability, enhanced mental models, greater analysis, and faster decision making. No relationship was found between EIS use and involvement of subordinates in decision

making.

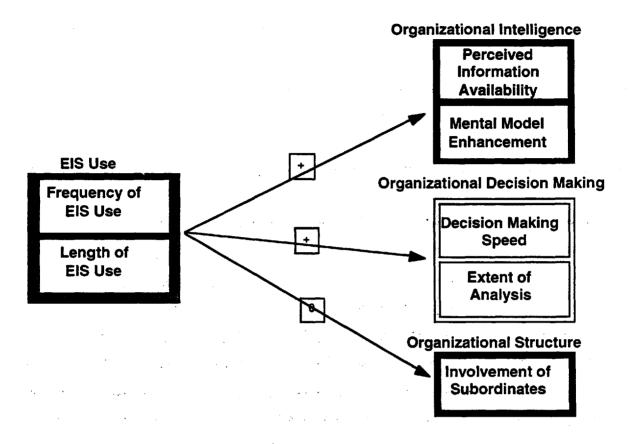


Figure 1: Outcomes of EIS Use for US Managers

Their research was based on a theory developed and tested on managers in the United States. It thus ignores the role that culture-based value systems play in influencing how IS use will influence decision making behaviors. What is and is not perceived to be a desirable result of EIS use depends upon what is of value to the individual. What is of value to individuals is to a certain extent determined by their culture. For instance, the fact that faster decision making is considered a desirable result may be culturally determined. The use of a system may not increase the speed of decision making in a culture that does not place an intrinsic value on fast decision making. Volonino et al [1995] suggest that for EIS to be used, it should be seen as not only having the potential of producing results, but results valued by managers. The most important predictor of EIS use in one study was the anticipated consequences of using the EIS [Bergeron et al, 1995]. We would suggest that anticipated and desired outcomes will vary across cultures because managerial values vary across cultures [Peterson, 1993a; Boyacigiller and Adler, 1991].

While EIS research outside the US has been undertaken as previously mentioned [Pervan and Rhua, 1996; Pervan and McNeely, 1995; Bergeron et al., 1995; McBride, 1995], there is not yet cross-cultural EIS research. Ronen and Shenkar [1985] and Pugh [1993] have both conducted cluster analyses of countries and found the following cultural clusters: Anglo, Latin European, Latin American, Germanic, Nordic, Near Eastern, Far Eastern, and Arab. These are also similar to Hofstede's [1980] original clustering of cultures. The past EIS research has predominantly been from countries in the Anglo cluster, which includes the UK, the US, Canada, Australia, Ireland, South Africa, and New Zealand. There is no theoretical reason to believe that EIS outcomes will vary by nation within the same national cultural cluster. For example, Watson et al. [1992, p.36] found little difference in EIS in the U.K. and the U.S.--these countries both fall in the cultural cluster labeled "Anglo" and indeed the similarities were striking. However, there is reason to believe that EIS outcomes may vary across cultures. Indeed, there is growing evidence that cross-cultural differences do exist concerning executive and management characteristics and behavior [Peterson, 1993a; Boyacigiller and Adler, 1991]. Hence, it seems logical that national culture would influence EIS use and the perceived outcomes of EIS use.

The current study extends research examining the outcomes of EIS to a multicultural context. Specifically, the research examines whether the same relationships between EIS use and five variables related to organizational intelligence, decision making, and structure identified in the aforementioned US study will be found in cultures that are markedly different from the US or whether these outcomes of EIS use are culturally independent. In the next section, we present the theoretical dimensions of culture. Based on this theory and characteristics of the working environments in Mexico and Sweden, we will develop hypothesize of the outcomes of EIS use in the Sweden and Mexico.

2.2 National Culture

Hofstede [1991] defined culture as "the collective programming of the mind that distinguishes the members of one category of people from those of another." He identified four widely used constructs delineating cultural differences: power distance, uncertainty avoidance, individualism, and masculinity [Hofstede, 1980 and 1985] Hall [1976] identified two constructs: time orientation and communication context. Hofstede and Bond [1988] later identified another cultural dimension, Confucian Dynamism, which was intended to distinguish among Asian cultures. As the coutries involved in our study are Western, we will not consider

this dimension.

Power Distance is the extent to which members of a society accept that power in institutions and organizations is unequally distributed [Hofstede, 1980]. Countries in which power distance is high are characterized by a low trust in others, by autocratic decision making, by less formal planning, and by resistance to change. A very low power distance culture suggests consensual decision making and trust in others. Mexico ranks very high on the power distance scale, the US ranks in the middle, and Sweden ranks very low [Hofstede, 1980].

Uncertainty avoidance is the degree to which members in society feel uncomfortable with uncertainty and ambiguity which leads them to support beliefs promising certainty and to maintain institutions protecting conformity [Hofstede, 1980]. Countries high on the uncertainty avoidance scale tend to exhibit a short-term focus, an eye on details, and less strategic planning. Countries lower on the uncertainty avoidance scale tend to exhibit more careful and thorough planning and a longer-term perspective. Mexico is very high on the uncertainty avoidance scale, the US is roughly in the middle, and Sweden ranks low [Hofstede, 1980].

Masculinity is the extent to which society is achievement oriented, assertive, and competitive as opposed to femininity which is the extent to which a society values relationships, quality of life, and caring for others. The Mexican culture ranks very high on the masculinity dimension, the US ranks slightly higher than average, and Sweden ranks extremely low (i.e. ranks high in terms of femininity) [Hofstede, 1980].

Individualism is the preference for a loosely knit social framework in society in which individuals are supposed to take care of themselves and their immediate family as opposed to collectivism in which there is a larger in-group to which is given unquestioning loyalty [Hofstede, 1980]. Mexico ranks low in terms of individualism (i.e. high in terms of collectivism), the US ranks very high in terms of individualism, and Sweden ranks in the middle.

Time perspective as defined by Hall [1976] is characterized by monochronic and polychronic perspectives as the two extremes. A monochronic time orientation defines time as linear and characterizes people whith a preference for sequencing tasks and working without interruption. A polychronic time orientation defines time as circular and is characterized by the simultaneous occurrence of many things, a great involvement of many people, and a tendency to view problems as a web of interrelated issues that must be addressed simultaneously. The Mexican culture is characterized as polychronic; the Swedish and US cultures are characterized

as monochronic.

Communication context [Hall, 1976] describes the preference for information to be stated directly (low-context) as opposed to the preference to draw inferences from non-explicit or implicit information (high-context). Low-context communicators exhibit a preference for detail and especially hard quantifiable detail stated verbally or in written reports. High context communicators rely less on explicitly stated facts and more on intuition and feelings stemming from personal observations. The Mexican culture is considered a high-context culture whereas the US and Sweden are both considered low-context.

Table 1 summarizes the differences in the cultural dimensions for the United States, Sweden, and Mexico.

	The United States	Sweden	Mexico	Mean Score
Power Distance	Medium	Low	High	
score* (rank out of 53 countries	40 (38)	31 (47)	81 (5)	57
Uncertainty Avoidance	Medium	Low	High	
score* (rank out of 53 countries	46 (43)	29 (49)	82 (18)	65
Masculinity	High	Low	High	
score* (rank out of 53 countries	62 (15)	5 (53)	69 (6)	49
Individuality	High	High	Low	
score* (rank out of 53 countries	91 (1)	71 (10)	30 (32)	43
Communication Context	Low	Low	High	
Time Orientation	Monochronic	Monochronic	Polychronic	

^{*:} A score ranges from 1 to 100

Table 1: Summary of Theoretical Cultural Differences

2.3 Impact of the Cultural Dimensions on Variables of Interest in the Study:

This section will discuss how the above described culture dimensions, in concert with other characteristics of the environments facing Swedish and Mexican managers, may affect the relationship of EIS use to perceived information availability, mental model enhancement, extent of analysis, decision making speed, and involvement of subordinates.

2.3.1 Information Availability

Information availability is the presence and accessibility of information relevant to managers. US management research has consistently made the point that upper level managers rely more on informal soft information for decision making than formal computer-based information [Mintzberg, 1973; Jones and McLeod, 1986]. However, these tendencies were observed before the existence of systems capable of providing daily information specifically requested by senior managers. The existence of EIS attests to a need to have computer-based information available to senior managers. Prior research of US executives has found positive and significant relationships between the frequency of EIS use and perceived information availability [Leidner and Elam, 1995]. Since the purpose of EIS--to provide access to information--is not expected to vary systematically across cultures, EIS use is hypothesized to be perceived as making information available that was previously unavailable or difficult to obtain.

Both Sweden and Mexico were experiencing changes in the early 1990s creating the need for more information. In the case of Sweden, the Swedish environment was experiencing economic challenges as a result of the incipient European Community which was introducing increased competition. During the time of the study, companies were preparing to cope with increased competition stemming from the European Union. Similarly, Mexican managers were dealing with the opening of the Mexican market which greatly increased their need for organizational and external information. As early as 1988, Mexico had started to open its markets, privatize, lower import duties, and lessen government control of business. The passage of NAFTA in the early 1990s served to solidify these trends. In order for Mexican businesses to survive in this new environment, inefficiencies had to be eliminated and the mind-set of managers had to be changed as the Mexican businesses struggled to implement a market-oriented strategy [Nichols, 1993]. One response to increased competition may be the introduction of systems, such as EIS, to provide ready access to important internal and external information. Thus, we anticipate that EIS will be perceived as increasing information availability in both Sweden and Mexico. Formally stated:

Hypothesis 1a: Swedish executives will perceive that EIS use leads to an increase in information availability.

Hypothesis 1b: Mexican executives will perceive that EIS use leads to an increase in information availability.

2.3.2 Mental Model Enhancement

However, while there are not anticipated differences in the perceived information availability provided by the EIS, in some cultures the use of the information made available by the EIS may have different consequences than in others. Vandenbosch and Higgins' [1996] study suggests that EIS use can have a positive impact on mental model maintenance as well as on mental model building. They defined mental model maintenance as the confirmation of existing knowledge in one's mental model. They defined mental model building as the development of a new representative of knowledge. We define mental model enhancement as the addition of new knowledge to an existing mental model. This lies somewhere between mental model maintenance and mental model building.

It has been suggested that the increased availability of information provided by EIS may enable executives to better understand their business environment [Rockart and Delong, 1989]. Leidner and Elam [1995] found that US executives associated frequency and length of EIS use with mental model enhancement. For EIS to be useful in enhancing a manager's mental model, however, the type of information most readily available in EIS--daily financial performance figures--must be of particular value to the managers. In cultures that value soft information coming from multiple organizational informants, such as the high context Mexican managers, or that do not place a premium on daily as opposed to weekly or monthly information, the use of the EIS and the increased information provided therewith may not lead to an increased understanding of the business.

We suggest that the degree to which EIS use is related to mental model enhancement may depend on whether the EIS user is from a high or low context culture. Hall [1976] suggests that for top executives in a low-context office such as is typical in Sweden or the US, most of the information that is relevant to the job originates from the few people the executive sees in a day. Advisors and support personnel control the content and flow of organizational information. Information is highly focused, compartmentalized, and controlled, and therefore not apt to flow freely. By contrast, executives in a polychronic culture such as Mexico have a preference for a multitude of informants at many levels. Hall [1976] suggests that in a high-context office, information flows freely from all sides and the entire form and function of the organization is centered on gathering, processing, and disseminating information. He further suggests that channels are seldom overloaded because people stay in constant contact. Thus, in a high-context culture such as Mexico, the additional information provided by an EIS is not

likely to be as significant in enhancing one's mental model of the business as in the low-context cultures such as Sweden or the US because executives in high context cultures are accustomed to already receiving a wide variety of information from a multitude of sources. We therefore suggest that the low-context, monochronic Swedish managers will experience a greater perceived enhancement of their mental model from EIS use than will the Mexican managers. Formally stated:

Hypothesis 2a: Swedish executives will perceive that EIS use leads to an enhancement of their mental model.

Hypothesis 2b: Mexican executives will not perceive that EIS use leads to an enhancement of their mental model.

2.3.3 Extent of Analysis:

The extent of analysis in decision making is the "reflective thought and deliberation given to a problem and the array of proposed responses" [Miller and Friesen, 1980]. Time spent on inter-relating symptoms to get at the root cause of problems and the effort spent to generate solutions are examples of analytic processes [Miller and Friesen, 1980]. Leidner and Elam [1995] found that for US executives, the frequency and length of EIS use were positively related to the extent of analysis in decision making. However, this relationship may not hold in other cultures.

The amount of analysis conducted during decision making is likely to be most related to uncertainty avoidance among the cultural dimensions. Countries with very low uncertainty avoidance typically do not encounter anxiety relating to an inability to accurately forecast all future factors that might be relevant to a decision whereas countries characterized by high uncertainty tend to ignore factors that seem unpredictable. This helps explain why low uncertainty countries engage in long-term planning compared to high uncertainty avoidance cultures—the anxiety associated with an inability to predict important future factors inhibits the planning process in higher uncertainty avoidance cultures [Hofstede, 1985]. Cultures high on uncertainty avoidance tend to use rather formalized and rigid short-term planning systems; data and information not coming from very trusted sources in a high uncertainty avoidance environment would be viewed with great skepticism. In practical terms, this suggests that high uncertainty avoidance cultures would not engage in as extensive of analysis of data before making decisions because the data may not be trusted or the data may not be viewed as

predicting the future. One study found that the uncertainty avoiding French were significantly less likely to engage in strategic planning than the uncertainty accepting Germans and English [Horovitz, 1980].

Moran and Abbott [1994] confirm that in Mexico, a very high uncertainty avoidance culture, proyectismo--making decisions without critical analysis and assuming in time that all will be accomplished--is a common approach to decision making. Kras [1995] asserts that decision making and planning in Mexico has always been difficult because of the extreme fluctuations in the economic and political climate. Such fluctuations have led to a short-term focus and a lack of attention to detailed analysis. The short-term focus of Mexicans appears to be endemic to their political, economic, and cultural context (Ramos, 1962; Derossi, 1971). Derossi (1971) suggests that the historical instability in government and economics limits the range of forecasting and encourages private industry to behave negatively--a "predatory" attitude develops where immediate profit is sought because present favorable conditions are not expected to last. In addition to the political and economic situation which interacts with uncertainty avoidance to produce short-term planning, the educational system in Mexico encourages deductive reasoning and the pursuit of abstract concepts (Kras, 1995). Kras suggests that this results in managers with little inclination to carry out extensive analysis of detailed information. Condon (1985) echoes this view when he observes that Mexican managers prefer to entertain outlines of general principals supported by credible personal experience rather than getting mired in details.

Thus, analysis in support of decision making in Mexico and other high uncertainty avoidance cultures tends to involve an intellectual pursuit of abstract concepts as opposed to an analysis of detailed data [Kras, 1995] whereas in lower uncertainty avoidance cultures the decision making and planning approach is largely empirical, making the analysis of operational and financial data, such as that readily provided by an EIS, valuable. In the case of our study, the low uncertainty avoidant Swedish executives are expected to value extensive analysis prior to decision making whereas the Mexican executives are not expected to value in-depth analysis of data contained in an EIS and are therefore not expected to experience an increase in the extent of analysis before decision making related to EIS use. Formally stated, we hypothesize that:

Hypothesis 3a: Swedish executives will perceive that EIS use leads to an increase in their extent of analysis in decision making.

Hypothesis 3b: Mexican executives will not perceive that EIS use leads to an increase in

their extent of analysis in decision making.

2.3.4 Decision Making Speed

The speed of decision making is defined as the time when a decision maker recognizes the need to make some decision, to the point in time when he/she renders judgment [Stephensen, 1986]. Eisenhardt [1989] posits that one means of coping with the need to make fast decisions is the relying on a few trusted sources of information rather than attempting to gather a multitude of information from manifold sources. The EIS can be this trusted source of information in cultures where the speed of decision making is regarded as important. Leidner and Elam [1995] found support for the hypothesis that the frequency and length of EIS use would be related to the speed of decision making in their sample of US executives. However, the perceived need to make decisions fast might vary with cultures; some cultures might not place a value on being fast to act.

Of the cultural dimensions previously discussed, Hofstede's uncertainty avoidance and masculinity/femininity dimension may have implications for the extent to which managers within a culture value speed in decision making. Countries with high uncertainty avoidance may be expected to value fast decisions out of a concern that volatility in the environment might render decisions ineffective if they are not made immediately. Two decision making patterns could result from high uncertainty avoidance--one, no decisions being made out of a concern that the decision would likely not fit the context once implemented or two, continual rapid adjustments to the environment resulting in rapid successive decisions being made. We anticipate that in the business context facing Mexico in the 1990s, with the privatization of industries and the opening of the market, a pattern of making rapid decisions to ensure survival would be more likely than a pattern of continued waiting for more favorable circumstances.

The masculinity cultural dimension may also shed light on attitudes toward the importance of speed in decisions making. Hofstede [1985] suggests that masculine cultures are more assertive, aggressive and decisive than are feminine cultures. Assertiveness and decisiveness may reveal themselves in a tendency to make decisions quickly (although this says nothing about the time of implementing the decision). Hofstede's [1985] finding of a strong correlation between masculinity and the average speed limit in countries suggests a sense of urgency in masculine societies. The Mexican culture is a masculine culture whereas the Swedish culture is a feminine culture. The US stereotype of the Mexican culture often portrays

Mexicans as embracing a "manana" or procrastination philosophy--the antithesis of making decisions quickly. However, this stereotype might apply more to the implementation of decisions than to the speed of making decisions themselves. As Kras [1995] suggests, implementation of decisions may be slow in Mexico because pedagogy in Mexico and in most high uncertainty avoidant countries is based on deductive reasoning--moving from the abstract to the concrete--but the next step of learning how to apply ideas in practical situations is hardly ever taken. This might result in Mexicans taking longer to implement decisions so that even if the decisions are made quickly, the entire process appears slow. Stephens and Greer [1985] confirm having found no evidence of the "manana syndrome" in well-managed Mexican companies among middle and upper hierarchical levels. In summary, Sweden, ranking very low on masculinity and uncertainty avoidance, would not be predicted to value speed in decision making whereas Mexico, being very high on masculinity and uncertainty avoidance, would. Stated formally,

Hypothesis 4a: Swedish executives will not perceive that EIS use leads to an increase in their decision making speed.

Hypothesis 4b: Mexican executives will perceive that EIS use leads to an increase in their decision making speed.

2.3.5 Involvement of Subordinates in Decision Making

Involvement of subordinates in decision making is the relying on subordinates to bring to their superiors attention potential problems requiring action and the relying on subordinates to analyze problems and alternatives. Leidner and Elam [1995] did not find a relationship between the frequency and/or length of EIS use with a change in the involvement of subordinates in decision making among US executives. This may be because involving subordinates carries neither a consistent positive nor consistent negative connotation in the US. Whether or not a positive or negative connotation is attached to involving subordinates in decision making may be culturally determined and is likely related to the power distance dimension.

The power distance dimension suggests the extent to which power is centralized or decentralized in organizations with higher power distance cultures centralizing power and engaging in autocratic decision making and with lower power distance cultures decentralizing power and engaging in consensual decision making. The US, being in the middle of the power distance dimension, favors neither participatory nor autocratic decision making. On the other hand, a very low power distance culture such as Sweden would value consensual decision making and trust in others. The Skandinavian model of decision making is one of participation. Systems that enable delegation of responsibility may therefore be more readily embraced in cultures lower in power distance such as Sweden than in high power distance cultures such as Mexico. In Mexico, subordinates expect and desire autocratic superiors so that non-involvement of subordinates in decision making is common and respected; the use of EIS is likely not to affect this autocratic style [Kras, 1995]. Kras states that in Mexico, there is no tradition of delegation of authority and subordinates are expected to accept unconditionally what their bosses say. We would therefore expect Swedish executives to involve subordinates more in decision making as a result of using EIS but for Mexican executives to involve subordinates less in decision making as a result of using EIS. Stated formally, we hypothesize that:

Hypothesis 5a: Swedish executives will perceive that EIS use leads to an increase in their involvement of subordinates in decision making.

Hypothesis 5b: Mexican executives will perceive that EIS use leads to a decrease in their involvement of subordinates in decision making.

2.4 Summary

This section has presented hypotheses predicting that EIS users from Sweden and from Mexico will respond systematically differently to the variables tested in the Leidner and Elam study of US executives. Figure 2 summarizes the hypotheses.

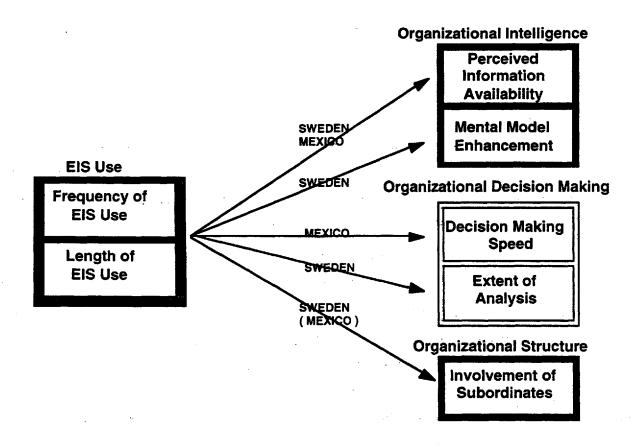


Figure 2: Summary of Hypotheses

3. Methodology

A survey instrument was used to gather data to test the relationships expressed in the hypotheses. The survey collected information on personal decision making styles, the use of an EIS, and the user's perceptions of the consequences of using an EIS. The same survey used in Leidner and Elam [1995] was employed after having been translated into Spanish and Swedish. A central concern of every translation is to produce the cultural equivalent of an instrument—i.e., one that has equivalent meaning [Graham et al, 1994]. A native Swede translated the survey into Swedish and a native Mexican translated the survey into Spanish. Both translators had resided and worked in the United States. Following Tse et al [1988], after the questionnaire had been translated, it was reviewed by individuals whose native tongue was Swedish for the Swedish version or Spanish for the Spanish version.

The items used to measure the five outcome variables are given in the Appendix. These were all measured on a five-point scale with 1 representing "to no extent" and 5 representing "to a great extent." The operalization of the variables has previously been described in Leidner and

Elam [1995] and will therefore not be repeated here. EIS Use was measured in terms of frequency (on a five-point scale ranging from monthly to usage several times per day) and length (number of months) of use.

3.1 Data Collection

Data collection in Sweden took place in 1992 and 1993. Through an extensive review of business, trade, and academic journals, and through contacting the major suppliers of EIS development shells and consultants for EIS development, the researchers identified companies in Sweden with EIS. Data collection in Mexico took place in 1994 and 1995. There were no references found in business, trade, or academic journals to Mexican organizations with EIS; nor were the authors able to glean information from US-based suppliers or consultants. Instead, a database containing the names of the top managers and company addresses for all medium and large sized organizations in Mexico was obtained. The IS director in a random sample of the organizations was called and asked if the organization had an EIS.

A contact person was identified in each company and interviewed over the phone. The contact person was typically from the information systems department and had an important role in designing, developing, and/or maintaining the EIS. The contacts were asked about the major system features, the spread of the system in the organization, and their perceptions of the EIS's benefits. Interviewing the contact person was a means of ensuring that each of the companies participating in the study did in fact have an EIS as traditionally defined.

In addition, the authors visited several of the organizations participating in both countries and were given demonstrations of the EIS. While the authors did not personally use the EIS, the demonstrations they witnessed revealed no obvious differences in system features. The features of the EIS (drill-down analysis, status updates of information, graphical interface, access to an electronic news provider, etc.) appeared standard. Since EIS have not yet been categorized into meaningful types, no attempt was made to control for a particular type of EIS. In general, the systems from the Swedish sample were built in 1991-1992 and the systems from the Mexican sample in 1990-1991; by way of comparison, the systems from the Leidner and Elam [1995] US study were built in 1989-1990. Considering that there is likely a lag in the time technology is developed in the US to the time it emerges in foreign countries, the slight difference in time periods of EIS development may result in a more equivalent sample across the countries. No attempt was made to control for regional representation of the samples within the countries. We are interested in overall country differences which should reveal themselves

regardless of whether a preponderance of responses from one country were located in a particular region of that country or were spread evenly across the country.

The contact person was given a set of surveys to distribute to EIS users. If the number of users was less than ten, we requested that all EIS users be given a survey. If there were more than ten EIS users, we requested that the contact person randomly distribute the surveys to EIS users. Care was taken in the handling of surveys to guarantee confidentiality for all respondents involved and thereby reduce the possible threat of respondents failing to respond at all or failing to respond honestly. Respondents were provided with private envelopes to seal and return to the researchers or to seal and return to the individual contact in the organization who would then return the envelopes to the researchers. There was no code on the surveys to trace them to individuals. A cover letter to the participants explained the project, the voluntary nature of their participation, and the policies the researchers would employ to ensure their confidentiality.

Although senior executives were originally intended to be the users of EIS, these systems are now frequently used at lower management levels [Watson et al., 1991]. Senior management can be considered as the president and one level below the president, while middle management is two levels below the president [Zaki and Hoffman, 1988]. In the case of the previously reported study of US EIS users, roughly half were senior and half middle managers following the definition of Zaki and Hoffman [1988]. However, Leidner and Elam [1995] found no difference in the outcome of EIS use for senior and middle managers, suggesting that the outcomes of EIS use are similar at both levels of management.

Using the Zaki and Hoffman classification, all of the Swedish respondents in the current study classify as senior managers whereas half of the Mexican respondents were senior and half middle managers. We suggest that the samples are in fact comparable because Swedish organizations are much flatter than Mexican organizations; hence it is likely that many "senior" managers in Swedish organizations would be positioned at more than one level below the President (and hence defined as "middle" managers) were they in organizations as hierarchical as those in Mexico. We will therefore not distinguish in this study between senior and middle managers, but refer to the EIS users as "managers." It might be pointed out that the word "manager" itself is problematic since it does not exist in some cultures and has a different meaning in different cultures [Peterson, 1993b]. In our study, all of the individuals were in middle to high level positions involving administrative responsibilities in their organizations,

including supervising subordinates and planning, rather than in clerical, operational, or technical (such as engineering or computer science) positions.

4. Analysis and Results

In total, 22 Swedish contacts and 24 Mexican contacts agreed during phone conversations to distribute surveys. Responses were returned from all 22 Swedish and 17 Mexican organizations. Among the original 24 organizations in Mexico that agreed to participate, it was determined during follow-up interviews that 7 did not have working EIS but were in the stages of planning or developing an EIS. They were therefore disqualified from participating in the study. In total, 317 surveys were sent to the 39 organizations. Of these, 198 were returned for a response rate of 62% for total surveys sent. Of the 198 returned, 184 were usuable: 95 from Sweden and 89 from Mexico. The industries represented by the Swedish organizations included construction, consumer products, transportation, manufacturing, petroleum, pharmaceutical, and telecommunications. The industries represented by the Mexican organizations included construction, consumer products, manufacturing, financial services, food products, and professional services.

4.1 Construct validity & reliability

Construct validity addresses the question of whether the constructs are real, as measured, or merely artifacts of the methodology [Straub, 1989]. Eigenvalues greater than 1 and scree plots were used in determining the number of factors. For an item to be considered in the composition of a variable, it had to have a loading of at least .5 on the factor, with no loading exceeding .3 on another factor, had to conform to a priori assignments, and had to add to the variable's reliability.

The mean of the items in each scale was used to combine the items into a variable score. Cronbach's alpha was used to assess the inter-item reliability of the final, multi-item scales. While a reliability score of .6 is usually considered acceptable [Nunally, 1967], all of the variables' reliability scores exceed .8 except for one. The exception was the involvement of subordinates in decision making with a reliability of .71. The factor loadings and the reliability scores for each variable are provided in Table 2. Table 3 presents the descriptive statistics for each variable by country.

	Cronbach's Alpha	Factor
Factor 1: Perceived Information Availability	0.000	Loading
A vailabilies of information that was married by	0.856	0.72
Availability of information that was previously unavailable except as a special request		0.72
Information available in a more timely manner		0.92
A single delivery source of important, frequently used		0.92
information	•	
Factor 2: Mental Model Enhancement	0.902	
Clearer sense of where things are going		0.72
Sharper vision and increased compehension of the business		0.83
Better understanding of important trends		0.84
Better insights into the problems and opportunities facing us	• •	0.85
Factor 3: Extent of Analysis in Decision Making	0.896	
Spend significantly more time analyzing data before making a decision		0:82
Examine more alternatives in decision making		0.84
Use more sources of information in decision making		0.82
Factor 4: Decision Making Speed	0.88	
Make decisions quicker		0.6
Shortened the time frame for making decisions	•	0.67
Factor 5: Involvement of Subordinates in Decision	Making 0.712	
Many problems requiring organizational action are		0.519
brought to my attention by subordinates		0.55
frequently involve subordinates in decision processes		0.70

Table 2: Factor Analysis and Reliability

	Descriptive Statistics:			Mexico	
	Mean	St Dev	Min	Max	N
Frequency of Use	3.6	1.2	1	5	89
Length of Use (Years)	3.37	1.38	1	5	82
Perceived Information Availability	4.22	0.81	1	5	87
Mental Model Enhancement	3.53	0.78	1	5	88
Extent of Analysis	3.76	0.97	1	5	87
Decision Making Speed	3.63	0.81	1	5	88
Involvement of Subordinates	3.82	0.49	2.6	4.8	88

	Descriptive Statistics:		Sweden		
	Mean	St Dev	Min	Max	N
Frequency of Use	3.62	0.81	1	5	95
Length of Use (Years)	2.59	0.96	1	5	95
Perceived Information Availability	3.81	0.61	1	5	95
Mental Model Enhancement	3.16	0.64	1	5	95
Extent of Analysis	3.13	0.66	1	4.33	95
Decision Making Speed	2.71	0.77	1	4.5	94
Involvement of Subordinates	3.81	0.61	1	5	95

Table 3: Descriptive Statistics

4.2 Statistical analysis performed

MANOVA was run to test for an overall country effect on all the variables combined. The country effect is signficant (F=4.56, df=6; p=.000). MANOVA was run to test if there was an overall organizational effect. There was no significant organization effect (F=1.47, df=6; p=.159); hence, the country differences overshadowed any organizational differences.

In order to test the hypotheses, the sample was divided by country and MANOVAs were run using frequency and length of EIS use as the independent variables and information availability, mental model enhancement, extent of analysis, decision making speed, and involvement of subordinates as the dependent variables. Because we are interested in the impact of EIS use on several outcome variables, conducting t-tests of differences in the outcome variables across the cultures would not provide insight into how varied levels of use in a country was related to various outcomes. We are therefore not testing whether results of EIS use will be greater/less in one country compared to another, rather we are testing whether EIS use will or will not be perceived as affecting the various outcome variables as predicted by general cultural proclivities. Therefore, we will conduct our analysis by examining, within each culture, whether frequency or length of use have perceived impacts on the individual managers.

The results of the MANOVAs for each country are given in Tables 4 and 5. For Swedish managers, the frequency of EIS use was significantly and positively related to mental model enhancement and the extent of analysis in decision making; it was significantly and negatively related to the involvement of subordinates in decision making. For Swedish managers, the length of EIS use was significantly and positively related to perceived information availability, mental model enhancement, and decision making speed. For Swedish managers, frequency of use was not significantly correlated with length of use (r=.13, p<.09); the Swedish managers tended to use the EIS at a fairly frequent level independent of the length of time they had had the EIS. For Mexican managers, the frequency of EIS use was positively and significantly related to perceived information availability, the extent of analysis in decision making, and decision making speed. The length of EIS use was not significantly related to any of the dependent variables. For Mexican managers, the frequency of use has a slight though weak positive correlation with length (r=.19, p<.03).

	DF]	F P>F	Regression		
	10	1.835	0.039	Coeff.	T	P>T
Information Availability						
EIS Use: Frequency	•			0.193	3.007	0.004
EIS Use: Length				-0.096	-1.866	0.066
Mental Model						
EIS Use: Frequency	,			0.132	1.858	0.067
EIS Use: Length				0.033	0.584	0.561
Extent of Analysis	•					• .:
EIS Use: Frequency				0.215	2.273	0.026
EIS Use: Length			,.	-0.036	-0.480	0.633
Decision Making Speed						
EIS Use: Frequency				0.188	2.598	0.011
EIS Use: Length				-0.036	-0.615	0.540
Involvement of Subordin	ates					
EIS Use: Frequency	*	•		0.072	1.243	0.218
EIS Use: Length				0.022	0.468	0.641

Table 4: MANOVA for Mexican Sample

	DF	F	P>F	Regressio		n
•	10	3.72	Ö	Coeff.	T	P>T
Information Availability	٠.		· . ·		100	
EIS Use: Frequency		•		0.006	0.082	0.935
EIS Use: Length	•		• •	0.129	2.279	0.025
Mental Model			•. •:			
EIS Use: Frequency				0.295	4.411	0.000
EIS Use: Length		* .		0.175	3.204	0.002
Extent of Analysis				•	· - ·	
EIS Use: Frequency				1.680	1.958	0.054
EIS Use: Length				0.105	1.494	0.139
Decision Making Speed		•	•			-
EIS Use: Frequency				0.171	1.739	0.086
EIS Use: Length				0.216	2.686	0.009
Involvement of Subordin	ates	,				
EIS Use: Frequency				-0.177	-2.700	0.008
EIS Use: Length		•		0.053	0.979	0.330

Table 5: MANOVA for Swedish Sample

4.2 Hypothesis Testing:

Hypothesis 1 predicted that Swedish and Mexican managers would perceive information availability with frequent and long term use of EIS. This hypothesis is partially supported for both countries. The Swedish managers perceived increased information availability the longer

they had used the EIS whereas the Mexican managers perceived increased information availability the more frequent they used the EIS. Swedish managers did not perceive increased information availability with frequent EIS use and Mexican managers did not perceive increased information availability with length of time of EIS use.

Hypothesis 2 predicted that that Swedish managers would experience an enhanced mental model from using EIS but that Mexican managers would not experience an enhanced mental model. This hypothesis was supported. Swedish managers who used EIS frequently or over time perceived an enhanced mental model. Mexican managers neither associated an enhanced mental model with frequent EIS use nor with long-term EIS use.

Hypothesis 3 predicted that Swedish managers would experience more extensive analysis resulting from EIS use but that Mexican managers would not experience an increase in their extent of analysis from EIS use. This was partially supported. The more frequent the use of EIS by Swedish managers, the greater the extent of analysis in decision making; however, the relationship did not hold for the length of time of EIS use. A small but significant positive relationship was found between the frequency of EIS use and the extent of analysis in decision making for the Mexican managers, but not with the length of time of EIS use.

Hypothesis 4 predicted that Swedish managers would not experience increased decision making speed from EIS use but that Mexican managers would experience an increase in their decision making speed related to EIS use. This hypothesis is also partially supported. Swedish managers did not perceive an increase in their decision making speed associated with the frequent use of EIS; however, they did perceive an increase in decision making speed associated with the length of time of EIS use. Mexican managers associated decision making speed with the frequent use of EIS but not with the length of time of EIS use.

Hypothesis 5 predicted that Swedish managers would associate an increase in their involvement of subordinates in decision making related to EIS use but that Mexican managers would associate a decrease in their reliance on subordinates in decision making related to EIS use. This hypothesis is not supported. In fact, Swedish managers had a significant negative relationship between the frequent use of EIS and the involvement of subordinates in decision making. There was neither a positive nor a negative relationship between the frequency of EIS use or the length of EIS use with the involvement of subordinates in decision making for the Mexican managers.

Figures 3 and 4 summarize the hypothesis testing results, including the US results from

Leidner and Elam [1995] for comparison. Table 6 presents the results as a comparison against the prior study of US executives. Table 6 words the results in terms of the hypotheses used in Leidner and Elam [1995].

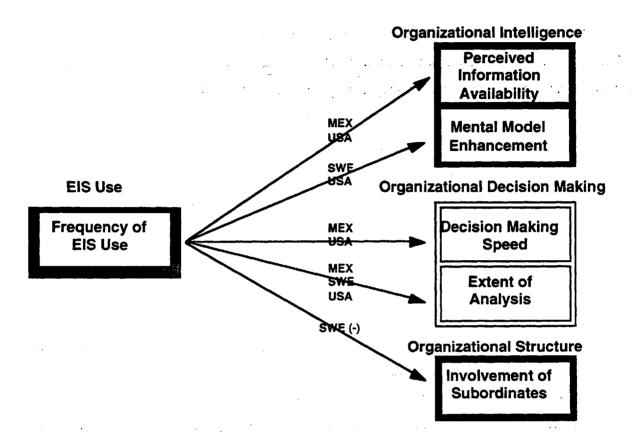


Figure 3: Hypothesis Testing Results Using Frequency of EIS Use

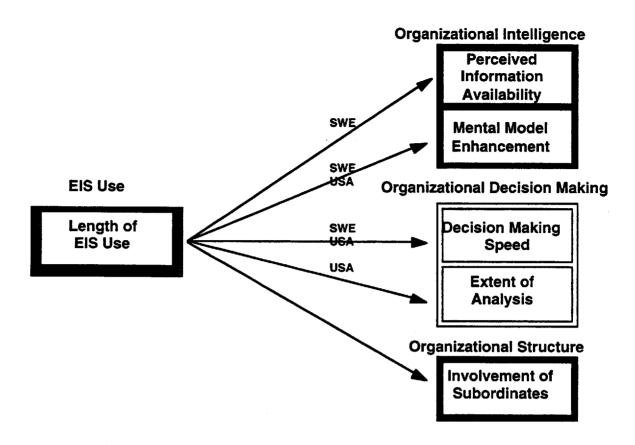


Figure 4: Hypothesis Testing Results Using Length of EIS Use

		USA	SWE
MEX			
The more frequent the manager's use of EIS,		•	
the greater the perceived information availability.	YES	NO	YES
the greater the enhancement to his/her mental model.	YES	YES	NO
the greater the extent of analysis.	YES	YES	YES
the faster the decision making speed.	YES	NO	YES
the less the involvement of subordinates in organizational	NO	YES	NO
intelligence and decision making.			
The longer the manager's use of EIS,			
greater the perceived information availability.	NO	YES	NO
the greater the enhancement to his/her mental model	YES	YES	NO
the greater the extent of analysis	YES	NO	NO
the faster the decision making speed.	YES	YES	NO
the less the involvement of subordinates in organizational	NO	NO	NO
intelligence and decision making.			

Table 6: Comparison of Results Against US Sample

5. Discussion, Limitations, and Conclusion

The findings suggest that culture does play a role in the outcome of use of an information system. In ten hypotheses comparing three cultures, agreement across all three cultures is found in only two of the ten hypotheses (see Table 6). Moreover, there was no significant relationships between length of use of EIS in Mexico and any of the outcome variables. Thus, in countries of high uncertainty and high context such as Mexico, the data in the EIS, though real-time, may still not be trusted, or may not be trusted to be indicative of future performance. EIS seem particularly well suited for cultures moderate or low in both uncertainty avoidance and power distance such as Sweden and the United States. However, the fact that the Mexican executives continued using the EIS over time despite not reporting significant relationships between length of EIS use and any of the variables reported in this study suggests that they were perceiving benefits not addressed in this study, such as benefits in the area of communication or creating a shared vision of the organization. Such factors merit future research.

Several points of interest were raised by the findings. Like US managers, managers in both Sweden and Mexico perceived higher information availability when they used the EIS either frequently or over time. However, in terms of achieving increased understanding of their organization from using EIS, Swedish managers, like US managers, reported enhanced mental models from frequent and long-term use of the EIS whereas Mexican managers did not. This provides some evidence that certain types of information are more valuable in some cultures than others. The features and types of information in the EIS were very similar in each country, as revealed during interviews. However, the value of the information in the EIS toward helping managers understand their business was greater in Sweden and the US than in Mexico. This suggests that the Mexicans might have more use of soft information in the EIS than the other two cultures (the other cultures may have a need for soft information as well, but the need may be even greater in Mexico). Adler [1983] suggests that the effective transfer of process and person embodied technology requires that members of a culture have the ability to absorb and utilize context-free information. This tendency is difficult to develop in cultures that function primarily by emphasizing context-dependent sources of information such as in Mexico.

In the case of decision making speed, Mexican managers, as did US managers, associated decision making speed with frequency of use of the EIS. Contrary to the hypotheses, speed also seemed to be an important aspect of EIS in Sweden. Swedish managers, as did US managers, associated decision making speed with the length of use of the

EIS. This might tentatively suggest that over time, the system influenced the Swedish managers to adopt a decision making style--in this case fast decision making--that ran contrary to the dominate cultural pattern.

Managers from both Sweden and Mexico perceived more extensive analysis from using EIS frequently, but not from long-term use of the EIS. The Mexican managers were not expected to use EIS to increase their analysis. Indeed, it is interesting that while the Mexicans reported greater analysis, they did not reported an improved mental model. This may tentatively suggest that the systems encouraged a decision making behavior--extensive analysis--that itself did not alter the thinking of the managers.

Finally, contrary to the hypotheses, Swedish managers reported a decrease in their reliance on subordinates with frequent use of the EIS. The unexpected result may be related to the economic difficulties Sweden has been experiencing during the past several years, following a deregulation and demonopolization trend which has led organizations to pursue cutbacks. Thus, perhaps cultural proclivities must be altered during urgent economic times. Another explanation might be that organizational power in Sweden is more equally distributed than in the U.S. or Mexico, and hence problems can be handled at a lower level in the organization; therefore less interaction between upper level managers and subordinates is needed. Hence, the EIS is used to distribute decision making downward rather than involving lower levels in upper level decision making. Also running contrary to hypotheses was the finding that Mexicans did not report a decrease in their reliance on subordinates in decision making. One explanation is that the Mexican organizations had already downsized substantially and the EIS was used to cope with the downsizing, but not to further decrease reliance on the middle management that remained. Another explanation is that there may be a slow trend in Mexico toward greater participation. Kras [1995] suggests that there is a new generation of managers in Mexico which because of university training strongly support the delegation of responsibility together with the accompanying authority and accountability. Perhaps the results of this study suggest that they are in fact moving in this direction.

Several limitations of the study need to be mentioned. The first deals with a caution against misinterpretation: just because one culture perceives their behavior to have been altered by a system, another culture observing the behavior may not notice a change. Another limitation is true of any multi-cultural research involving the replication of a study first carried out in one nation: the questions on the survey were originally intended for US managers and were

intended to reflect activities of importance to US executives. It is possible that some questions may have been irrelevant to the Swedish and Mexican managers but they answered them anyway. The correlary is also true: it is possible that some issues important to Swedish or Mexican managers may not have been included in the survey as they were not originally considered important to the US managers. Hofstede and Bond [1988] suggest that a limitation of cross-cultural replication research is that such instruments cover only issues considered relevant in the society in which they were developed, but exclude questions unrecognized by the designer because they do not occur in his/her society. However, this does not mean that cross-cultural replication research should not be undertaken, but rather that follow up research is necessary to uncover variables not included in the original study. Another limitation concerns the sample: we neither controlled for geographical area within each country nor controlled for system characteristics. Although the systems appeared to be quite similar across the countries, we can not offer definitive proof of their similarity. Lastly, we used country as a surrogate of culture as is frequently done [Kim, Park, and Sadiki, 1990]; had we taken a direct measure of culture, this would have proven a stronger indication of cultural differences across the nations in our sample, but would have likely led to a lower response rate in that the survey would have been substantially longer.

Despite the aforementioned limitations, this study makes a contribution to the growing knowledge of EIS as well as to the rudimentary field of cross-cultural IS studies. EIS are rapidly being adopted and used by organizations throughout the world. This study examined whether cultural differences influenced the relationship between EIS use and several aspects of decision making behaviors and processes. In particular, we examined how executives in Sweden and Mexico perceived the outcomes of their EIS use and compared their perceptions with those of US executives. We found that EIS have greater long-term relevance in low-context cultures such as Sweden and the United States. We also found that greater information availability does not necessarily improve general understanding of the business, as indicated by the Mexican sample of managers.

Kelley et al [1987] suggest that one perspective on culture and organizational adaptation is that "individuals irrespective of culture are forced to adopt industrial attitudes and behaviors such as rationalism, secularism, and mechanical time concerns in order to comply with the imperative of industrialization." This perspective ignores the longevity of basic cultural values and their influence on individual behavior. While managers may be forced to adopt modern

management technologies to survive in the global business environment, they are able to adapt the technology to their own cultural values rather than conforming their values to the assumptions of the technology. The adoption of management technologies designed to enhance individual performance, such as EIS, are context dependent and culture is an important contextual factor to consider in anticipating potential benefits of information technology.