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MODERN MANAGEMENT IN THE DEVELOPING WORLD: THE SUCCESS OF EIS IN MEXICAN ORGANIZATIONS

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Abstract

Executive Information Systems are being used in organizations around the world to assist with the increased managerial information needs related to the opening of markets and the globalization of enterprise. This study adapts a model of IS success to the context of EIS in order to examine the potential success of EIS use by Mexican managers to help them cope with their highly competitive environment. Using data gathered from 89 Mexican senior and middle managers, the study examines some antecedents of EIS use, types of EIS use, individual impacts of EIS use, and organizational impacts of EIS use. The study suggests that Mexican managers use EIS to monitor internal and external information which enables them to make decisions faster, to have a better understanding of their environment, and to engage in more thorough decision analysis. These individual benefits of EIS use then lead to certain organizational benefits, including a shared vision of organizational goals and performance, improved communication in the organization, improved competitive response, and improved organizational decision making effectiveness.

1. INTRODUCTION

The 1990s has witnessed the rapid and unexpected opening of markets around the world. A prime example is that of the Mexican market which had enjoyed lucrative stability and security courtesy of tight government control over competition and trade. For the past several years, Mexican organizations, both because of the increasing competition and political vicissitudes related to the opening of the market, have been faced with fast and unpredictable change. Any sudden and massive change in an organization's environment demands requisite shifts in an organization; the adaption can be structural, technological, and/or cultural (Leavitt 1964). Information Technology (IT) is one form of technological response. IT becomes increasingly important in competitive environments because organizational decision makers have a greater need for timely, accurate information on which to base organizational decisions (Huber 1990). One system that is experiencing widespread adoption in Mexico is Executive Information Systems (EIS), necessitated by the need to maintain better control over performance.

This study looks specifically at the individual and organizational impacts of EIS in Mexican organizations. Based on an adaptation of the DeLone and McLean (1992) model of IS success to the context of EIS, the study examines some antecedents of EIS use, types of EIS use, individual impacts of EIS use, and organizational impacts of EIS use. The overall research question is: are EIS, systems which some claim may be ill-suited to polychronic, high-context cultures such as Mexico (Raman and Watson 1994; Rainer and Watson 1995), successful in Mexico? What are the impacts of EIS use on Mexican managers and organizations?

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2. THE MODEL AND HYPOTHESES

The model of EIS success used for the current study, depicted in Figure 1, draws upon the DeLone and McLean model of IS success and adapts the model to an EIS context. The DeLone and McLean model of IS success suggests that system quality and information quality lead to use and user satisfaction, which lead to individual impacts which then lead to organizational impacts. We are not going to examine system quality because the evidence suggests that systems that are of low quality are discontinued shortly after their inception leading to a somewhat high failure rate among EIS (Millet and Mawhinney 1992).

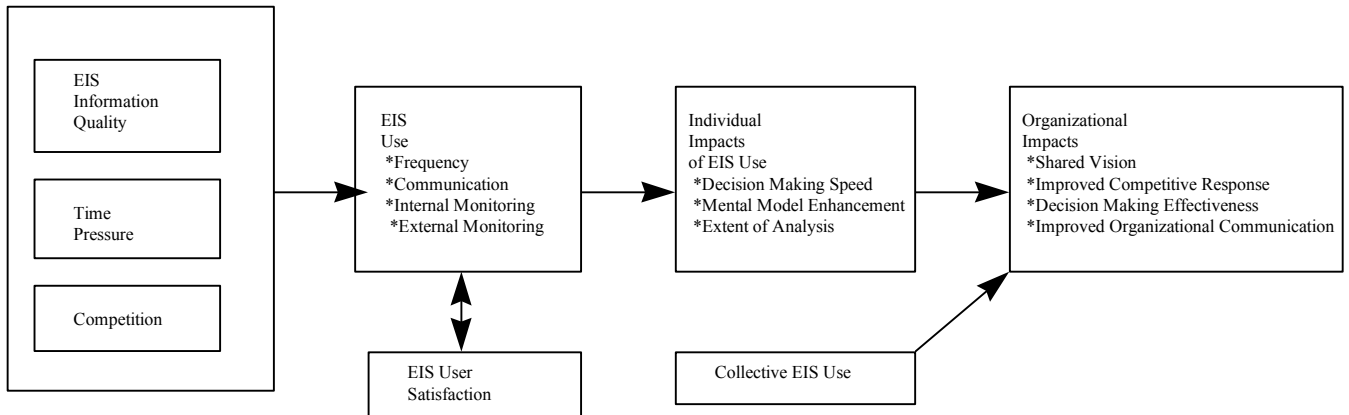


Figure 1: Model of EIS Success

The model of EIS success does include three variables not included in the DeLone and McLean model, namely perceived competition, perceived time pressure, and collective use of the system. McLean and DeLone suggest that the exact choice of variables depends on the objective of the study, the organizational context, and the aspects of the IS addressed by the study, among other things. Given the great competition facing Mexican organizations, it is felt that this variable should be included as a motivator of IS use. In addition, Mexican organizations are expected to be under far greater time pressure than previously. Finally, we feel that the organizational impacts of EIS will emerge only after a large base of users spanning organizational boundaries exists; hence, we include a variable labeled collective use. The variables comprising the model of EIS success are further described below.

2.1 Competition

Competition is defined as the rate and predictability of change in an organization’s environment. A competitive environment may influence the deployment and use of IT for managers charged with decision making in this competitive environment (Johnston and Carrico 1988). Watson, Rainer, and Koh (1991) suggest that an industry’s competitiveness and information intensity are important aspects of the environment to consider when examining EIS; competitiveness was a key factor leading to EIS development in their study. Emery (1991) also found that the need for senior management to be responsive to environmental changes was a primary factor used to justify EIS projects. If EIS are built to respond to competition in the organization’s environment, it is reasonable to presume EIS use will likewise be related to competition. It is thus hypothesized that

Hypothesis 1: EIS use will be positively related to the competitiveness of the organization’s environment.

2.2 Perceived Time Pressure

Perceived time pressure in decision making is the perceived need to make decisions quickly. Rockart and DeLong (1988) found that one of the most prevalent reasons contributing to EIS development included personal time pressure leading to the use of information technology to increase efficiency and to exercise control. Managers react to time pressure by using less information and fewer communication channels than they would under nonthreatening conditions (Gladstein and Reilly 1985; Molloy and Schwenk 1995; Gosler, Green, and Hughes 1986). Executives feeling such pressure would desire a few fast and reliable sources of information. In such a case, an EIS may be a preferred source of information in that it has the capability to bring together information from multiple sources thereby enabling a manager to readily obtain the necessary real-time information under time pressure from the EIS. Thus, it is hypothesized that

Hypothesis 2: EIS use will be positively related to the time pressure facing the manager.

2.3 Quality of EIS Information

The presence of and access to timely, relevant, and accurate information, defined as information quality, is crucial to the effective performance of managers. Studies suggest a direct relationship between perceived quality of information and its use in decision making and a direct relationship between good information and good decision making (Szewczak 1988). In addition, higher quality information is used more frequently as is information that is easier to access (O'Reilly 1982). Watson, Rainer and Koh (1991) found that the need for rapid status updates was the most important internal pressure leading to the development of EIS. Bergeron, Buteau and Raymond (1991) identified that, for successful EIS, executives identified quality of information provided by the system as one of the most important characteristics. The quality of EIS may be particularly relevant to Mexican managers, who are often unable to get reliable information about performance indicators from human sources because of a cultural tendency to avoid giving unfavorable information (Stephens and Greer 1995). It is thus hypothesized that

Hypothesis 3: EIS use will be positively related to the quality of information provided by the EIS.

2.4 EIS Use and EIS User Satisfaction

Consistent with the DeLone and McLean model, we posit that EIS use and EIS user satisfaction will be positively related in a circular relationship so that the greater the use of the EIS, the more satisfied the user and the more satisfied the user, the greater the use. However, in terms of the impact of EIS on individual users and the organization, we will argue that it is the use of EIS, rather than the satisfaction of the user with the EIS, that contributes to individual and organizational impacts. It is thus hypothesized that

Hypothesis 4: EIS use and EIS user satisfaction will be positively related.

2.5 Individual Impacts of EIS Use

As individual level decision making impacts of EIS use, this study will use the following variables described and tested in Leidner and Elam (1995): decision making speed, extent of analysis in decision making, and individual mental model enhancement. In their sample of US executives, Leidner and Elam found that the frequency and length of EIS use was positively related to decision making speed, mental model enhancement, and the extent of analysis in decision making. Because we are interested in the organizational impact of EIS, which according to DeLone and McLean may be related to the extent to which individual impacts occur, we will retest these hypotheses on the current sample. Consistent with the findings of the US sample, we hypothesize that

Hypothesis 5: Decision making speed will be positively related to EIS use.

Hypothesis 6: Mental model enhancement will be positively related to EIS use.

Hypothesis 7: The extent of analysis in decision making will be positively related to EIS use.

2.6 Organizational Impact

As organizational level impacts of EIS use, this study will derive variables alluded to in prior research. For the most part, the organizational level of impacts has not been addressed directly in prior research. Some of the early EIS were used only by a few members of the top management team, making claims about organization-wide implications tenuous. However, with the dispersion of EIS to other levels of the organization, it is feasible to anticipate some benefits of EIS on the organization as a whole.

2.7 Organizational Vision

Case studies of EIS suggest that EIS use among top managers may result in a shared perspective of what is important for managers at all levels to focus their attention on. In short, if top managers are examining specific performance measures on a regular basis, subordinates are forced to assign priorities in such a manner as to maximize performance on the factors regularly examined by top management. One result of such a visible symbol of top management priority may be to inculcate a shared vision of the organization's performance as well as a shared vision of organizational objectives (Rockart and DeLong 1988). Much as the development of shared analogies in organizations help frame strategic decisions (Sapienza 1983), a shared vision may help frame organizational decisions by giving a consistent interpretation to current and desired performance. The greater the level of EIS use by managers at all levels and the greater the impact that EIS has on the individuals using it, the greater the extent the vision is shared. We thus hypothesize that

Hypothesis 8: Shared organizational vision will be positively related to the individual impacts of EIS use and the collective use of EIS.

2.8 Organizational Communication

There are two reasons to expect that EIS use might improve organizational communication. One reason is that many, if not most, current EIS are equipped with electronic mail capabilities. Initial email research has suggested that email increases overall communication by increasing the frequency of communication among existing communication partners and by encouraging the development of new contacts (Trevino and Webster 1992; Sproull and Kiesler 1986). A second reason EIS might lead to improved organizational communication is that organizational members have consistent information. Communication may be more efficient in that it can be devoted to discussions about the implication of the information rather than resolving discrepancies in the information content. EIS use may improve both the decision maker's understanding of problems and the decision maker's ability to communicate effectively with others (Molloy and Schwenk 1995). The greater the level of EIS use by managers at all levels and the greater the impact that EIS has on the individuals using it, the greater the improvement to organizational communication. We thus hypothesize that

Hypothesis 9: Improved organizational communication will be positively related to the individual impacts of EIS use and the collective use of EIS.

2.9 Organizational Competitive Response

A primary objective of many EIS is the provision of external information to improve the ability of managers to scan the environment and keep abreast of competition. While initial studies of EIS revealed markedly little incorporation of external information, more recent research indicates that external information in the form of access to stock market information, to external databases, and to customer information is becoming common in EIS. For example, IBM's executive decisions software package has integrated Desktop Data's NewsEdge product into their EIS which monitors live news from nearly a dozen different sources and provides this to the user based on a match with the user's interest profile (Frolick and Ramarapy 1993). One example of an EIS providing external information enabling the organization to respond effectively to competition is Hertz, which pulls information about prices in each market and then adjusts their own prices as appropriate to undercut the competition. External information can also assist organizations in responding to their external environment. As reported in Rainer and Watson, an energy company has weather maps in their EIS so that if a major storm enters the Gulf, they can track

the storm and see if they have to evacuate their offshore drilling rigs. The greater the level of EIS use by managers at all levels and the greater the impact that EIS has on the individuals using it, the greater the competitive response of the organization. We thus hypothesize that

Hypothesis 10: Improved competitive response will be positively related to the individual impacts of EIS use and the collective use of EIS.

2.10 Organizational Decision Making Effectiveness

In some of the early work on MIS, King and Rodriguez (1978) suggested that the primary assessment of the value of an MIS if it is intended to support managerial decision making is improved decision making. Although improved decision making is not the single purported end of EIS, it can be considered an important goal for many EIS. Huber suggested that higher quality and more timely information provided by advanced IT would lead to higher quality decisions. Molloy and Schwenk found that the use of IT was considered critical for both the identification activity of the final decision outcome for over half of the decisions examined. Studies have found that data availability and the amount of information accessed can influence the effectiveness of decisions (Gosler, Green and Hughes 1986). Because EIS are built with the intent of providing relevant information in an easily accessible format, they should contribute to improvements in the effectiveness of decision making. The greater the level of EIS use by managers at all levels and the greater the impact that EIS has on the individuals using it, the greater the decision making effectiveness of the organization. We thus hypothesize that

Hypothesis 11: Decision making effectiveness will be positively related to the individual impacts of EIS use and the collective use of EIS.

3. METHODOLOGY

A survey instrument was used to gather data to test the relationships expressed in the hypotheses. The research was conducted in Mexico; the survey was originally written in English by the author and then translated into Spanish. Many of the items on the survey had been previously used in a study of EIS users in the United States (Leidner and Elam 1995). The Mexican translator had been born to Mexican parents in a US border town and had been reared and educated in the US although Spanish was the language of his household. Two other bilingual individuals reviewed the translation. Following translation, the survey was pretested on three Mexican executives to ensure that the questions were clear. These individuals were all executives in a financial institution. The individuals provided feedback on any wording they found ambiguous and their suggestions were incorporated into the final survey. Few changes were in fact necessary, reflecting the fact that the majority of the questions had been pretested in the United States and that the questions had been translated very accurately.

3.1 Selection of Respondents

The researcher obtained a list of all medium and large Mexican organizations. The list was organized alphabetically within major cities in Mexico. The sample for the study was drawn from the Monterrey region. It was desirable to draw the sample from the Monterrey area because the author would be able to personally visit all of the organizations in Monterrey¹ and it was felt that the response rate would be very low if the author did not personally visit the organizations. The Mexican culture values face-to-face communication substantially more than the US culture (Condon 1985; Kras 1995; Moran and Abbott 1994) and the author anticipated lack of commitment to the study on the part of participants if she did not make the effort to personally meet individuals in the organizations identified to have EIS. The IS director of every tenth organization on the

¹The author had accepted a summer teaching position in Monterrey. The schedule permitted the author to visit organizations during the day and teach in the evening. Visiting organizations outside of the Monterrey vicinity, however, was not feasible.

list was called. The IS directors were asked whether the organization had an EIS and, if so, they were asked to describe the system. If the IS director replied in the positive, an arrangement was then made for an on-site, face-to-face interview. It was felt that the face-to-face interview was important to enable greater clarity (because of the language difference) as well as to establish commitment to the project. Interviewing the IS director was also a means of ensuring that each of the companies participating in the study did in fact have an EIS as traditionally defined.

During the on-site interview, the IS director was given a set of ten surveys to distribute to a sample of EIS users. If there were more than ten EIS users, we requested that the contact person randomly distribute the surveys to users in proportion to their management level (i.e., if 30% of the total EIS users were top managers and 70% middle managers, then 30% of the respondents were upper managers and 70% were middle managers). Although executive policy makers were originally intended to be the users of EIS, these systems are now frequently used at lower management levels (Watson, Rainer, and Koh 1991). Leidner and Elam found no difference in the outcome of EIS use for senior and middle managers, suggesting that EIS is relevant to both levels of management. We will therefore not distinguish in this study between senior and middle managers, but refer to the EIS users as “managers.”

3.2 Measurements

Where possible, items were derived from previously verified sources; in some cases, the items used to measure the variables of interest were created specifically for this study.

3.2.1 Perceived Competition

Items measuring perceived competition were borrowed from an instrument developed by Doty, Glick, Sutcliffe, Miller, and Huber (1988). The three items ask about the extent to which other organizations in the industry attempt to capture the organization’s customers/clients, face a prosperous environment, and have easy access to resources for growth and expansion. The survey also asks the extent to which the manager’s own organization operates in a competitive environment, has easy access to resources for growth and expansion (negative scale), and seeks to increase market share. The respondents answered each question on a five point Likert scale ranging from “to no extent” (1) to “to a great extent” (5). This same five-point scale was used for most of the items. Exceptions will be noted.

3.2.2 Perceived Time Pressure

Because no previous items measuring perceived time pressure were available, the items were developed by the author. The survey asks the extent to which it is critical to the organization’s performance to immediately identify problems, find a workable solution to a problem very quickly, and quickly make decisions. The survey also asks the extent to which it is critical to the individual’s personal performance to: immediately identify problems, find a workable solution to a problem very quickly, and quickly make decisions.

3.2.3 EIS Information Quality

Rockart and DeLong equated EIS data quality with timeliness, accessibility, accuracy, and completeness. This is similar to Bergeron and Raymond (1992), who associate quality with information that is flexible, timely, relevant, complete, and validated. The survey asks the extent to which the EIS provides availability of information that was previously unavailable, timely information, a single delivery source of important information, control over the content of the information, consistency of the information with that received by other managers, and accurate information.

3.2.4 EIS Use

Frequency of EIS use was measured on a five-point scale consisting of infrequently, monthly, one to four times per week, daily, and several times per day. For the collective EIS use measure, respondents were asked to rate the extent to which their peers, their subordinates, and their superiors used the EIS on the same five-point scale consisting of infrequently, monthly, one to four times per week, daily, and several times per day.

One way to measure EIS use is thus the frequency of use as described above. However, as stated by Bergeron, Rivard, and Gara (1995), EIS use per se is not necessarily successful use. Vlahos and Ferratt (1995) concur that the effectiveness of EIS depends heavily upon their use, and specifically how they are used. We will thus also define EIS use in terms of the type of EIS use which will be categorized according to monitoring internal data, monitoring external data, and communicating with others in the organization. A major departure of this study from past EIS research is the attempt to examine more closely how the EIS is used rather than only how frequently it is used. To measure the use of EIS for communication, the survey asks the extent to which the individual uses the EIS to communicate with peers, to communicate with subordinates, and to communicate with superiors. To measure the use of EIS for internal monitoring, the survey asks the extent to which the individual uses EIS to monitor daily operations, to analyze operational data, and to monitor the consequences of previous decisions. To measure the extent to which EIS is used to monitor external information, the survey asks the extent to which the individual uses EIS to analyze external data, to monitor information about competitors, and to monitor national and international news.

3.2.5 EIS User Satisfaction

Items measuring EIS user satisfaction are adopted from Sanders and Courtney (1985) who examined user satisfaction with DSS. DSS in their instrument was changed to EIS. The survey asks the extent to which the individual has become dependent on EIS in fulfilling work responsibilities, the extent to which the use of EIS has made the individual more valuable to the organization, the extent to which the individual personally benefits from the existence of EIS, and the extent to which the individual relies on EIS in performing his/her job. The Sanders and Courtney measure was chosen for its succinctness. Because user satisfaction was not the primary interest of this study, it was desired to have a terse yet previously validated measure for satisfaction. In addition, Sanders and Courtney were examining user satisfaction with a particular subclass of IS, namely decision support systems. Likewise, the current study was not interested in user satisfaction with IS in general, but rather user satisfaction with a subclass of systems, namely executive information systems. The Sanders and Courtney measure therefore adapted nicely to the purposes of this study.

3.2.6 Individual Impacts

The items measuring Mental Model Enhancement, Decision Making Speed, and the Extent of Analysis in Decision Making were taken from Leidner and Elam. To measure mental model enhancement, the survey asks the extent to which the EIS has had the following benefits: given the individual a clearer sense of where things are going, a sharper vision and increased understanding of the business, a better understanding of important trends, and better insights into the problems and opportunities facing the organization. To measure decision making speed, the survey asks the extent to which the EIS helps the individual make decisions quicker, shorten the time frame for making decisions, and spend less time in decision-related meetings. This survey also added two additional questions, one concerning the speed with which the manager is able to conduct decision analysis and one concerning the speed with which the manager is able to implement decisions. To measure the extent of analysis, the survey asks the extent to which the EIS has helped the individual spend significantly more time analyzing data before making a decision, examine more alternatives in decision making, use more sources of information in decision making, and engage in more in-depth analysis.

3.2.7 Organizational Impacts

The organizational impact variables are being created specifically for this study. IS studies have been plagued with difficulty in isolating the effects attributable to the IS (DeLone and McLean 1992). IS are usually implemented as part of other organizational change. EIS, for example, are many times built as a means of coping with reductions with middle management prompted by competitive pressures. It is therefore difficult to isolate whether organizational impacts following the development of the EIS are attributable to the use of the EIS or are really a result of the streamlining of organizational processes mandated by organizational changes. In addition, one would expect a time lag between when a system is built and when organizational impacts are experienced (Jarvenpaa and Ives 1990). During the lag between implementation and outcome, there are other organizational processes taking place that might obscure any direct effect of the IS. Thus, because there do not exist at this point valid methods for distinguishing EIS organizational impacts, this study will rely on perceptual measures of organizational impact.

Three items to measure each of the organizational impact constructs were developed. The survey asks the extent to which EIS use has improved communication with subordinates, with superiors, and with peers (the “improved communication” impact); the survey asks the extent to which EIS use has increased the overall effectiveness of the firm, increased the effectiveness of decision making in the firm, and increased the speed with which the organization is able to implement decisions (the “decision making effectiveness” impact); the survey asks the extent to which the firm is better able to make important strategic decisions, to respond to competitive pressures, and to notice changes in the environment (the “competitive response” impact); and the survey asks the extent to which the EIS has led to a giving managers a shared understanding among managers of the firm’s competitive environment, a shared understanding of the firm’s performance, and a shared understanding of important trends (the “shared vision” impact).

4. ANALYSIS AND RESULTS

In total, the author had telephone interviews with 24 Mexican IS directors that stated that their organizations had EIS.² On-site interviews were conducted in each of the organizations. Among the original 24 organizations that agreed to participate, it was determined during the on-site interviews that seven did not have working EIS but were in the stages of planning or developing an EIS. They were therefore disqualified from further participating in the study. In total, 170 surveys were sent by the IS directors to managers in the seventeen remaining organizations. Of these, 89 were returned for a response rate of 62%. The industries represented in the sample include construction, manufacturing, financial services, food products, consumer products, and professional services. All of the participating companies were Mexican owned and operated and all of the respondents were natives of Mexico. Roughly half of the respondents were senior managers and half were middle managers.

4.1 Construct Validity and Reliability

Content validity — the representativeness of the measures (Straub 1989) — was assessed by subjecting the survey to pilot testing. The pilot testing suggested that the questions and instructions were clear. Construct validity — the meaningfulness of the measures — was assessed by common factor analysis (Kerlinger 1986). 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. In general the items loaded strongly on the proper construct and the alpha’s, except for competition, all exceed .7. Table 1 presents the results of the factor loadings and reliability scores. Table 2 presents the descriptive statistics for each variable.

²The author was planning to spend approximately five weeks in Mexico gathering data and wished to arrange one interview per working day. After 24 companies with EIS were identified, the telephone calls to identify companies with EIS were stopped.

Table 1: Factor and Reliability Analysis

Construct	Factor Loading	Cronbach's Alpha	Construct	Factor Loading	Cronbach's Alpha
Factor: Perceived Time Pressure		0.89	Factor: Speed of Decision Making		0.85
Critical to effective organization performance to:			Make decisions quicker	0.79	
Immediately identify problems	0.75		Speed of decision analysis has increased	0.8	
Find a workable solution to a problem very quickly	0.81		Able to implement decisions faster	0.88	
Quickly make decisions			Shorter time frame for making decisions	0.86	
Critical to effective personal performance to:	0.8		Spend less time in decision related meetings	0.72	
Immediately identify problems	0.81		Factor: Mental Model Enhancement		0.79
Find a workable solution to a problem very quickly	0.84		Clearer sense of where things are going	0.85	
Factor: Perceived Competition		0.59	Sharper vision and increased comprehension of the business	0.75	
Other organizations in the industry:			Better understanding of important trends	0.77	
attempt to capture our customers/clients	0.55		Factor: Extent of Analysis		
face a prosperous environment	0.82		Using the EIS has allowed me to engage in more in-depth analysis	0.77	
have easy access to resources for growth	0.64		I spend more time analyzing data before making a decision	0.8	
Our organization:			Factor: Organizational Competitive Response		0.94
operates in a competitive environment	0.57		Organization better responds to competitive pressure	0.79	
Factor: EIS Information Quality		0.81	Organization better makes important strategic decisions	0.76	
Accuracy of information	0.72		Factor: Organizational Communication		0.89
Consistent and dependable information	0.68		Improved communication with superiors	0.89	
Correct information	0.88		Improved communication with peers	0.87	
Availability of timely information	0.86		Factor: Organizational Shared Vision		0.73
Factor: EIS Use for Communication		0.86	Shared understanding of the firm's performance	0.86	
Use EIS to communicate with others in the organization	0.88		Shared understanding of important trends	0.77	
Use EIS to communicate with superiors	0.91		Factor: Organizational Decision Making Effectiveness		0.82
Factor: EIS Use for Monitoring Internal Information		0.74	Increased Organizational Effectiveness	0.75	
Use EIS to monitor daily operations	0.81		Improved Quality of Decision Making	0.68	
Use EIS to monitor operational data	0.85		Organization can implement decisions faster	0.82	
Factor: EIS Use for Monitoring External Information		0.75			
Use EIS to analyze external data	0.74				
Use EIS to monitor information about competitors	0.69				
Use EIS to monitor national and international news	0.79				
Factor: EIS User Satisfaction		0.77			
Dependent on EIS	0.72				
More valuable in the organization	0.74				
Personally benefit from EIS	0.63				
Rely on EIS in performing job	0.86				

A MANOVA was run to test for an overall organizational effect (Table 3). The test was marginally significant ($F=1.88$, $p>.041$) although only one of the variables showed a significant difference across organizations. This variable was perceived competition ($F=6.37$, $p>.014$). Because only a single variable showed a systematic difference across organizations, we will treat the individual responses within organizations as individual responses rather than collapsing all of the responses in an organization into a single response.

Table 2: Descriptive Statistics

Variable	Mean	St Dev	Max	Min	N
Perceived Time Pressures	4.58	0.51	5	2.6	89
Competition	3.72	0.59	5	2.25	88
Perceived EIS Information Quality	4.15	0.79	5	1	84
Frequency EIS Use	3.6	1.2	5	1	89
EIS Use — Communication	2.69	1.31	5	1	85
EIS Use — Internal	0.079	1.12	5	1	85
EIS Use — External	2.87	1.15	5	1	82
Satisfaction	3.22	0.78	5	1	82
Decision Making Speed	3.67	0.8	5	1	88
Mental Model Enhancement	3.57	0.82	5	1	88
Extent of Analysis	3.79	0.95	5	1	87
Organizational Shared Vision	3.85	0.94	5	1	86
Organizational Decision Making Effectiveness	3.79	0.86	5	1	86
Organizational Communication	3.29	1.05	5	1	86
Organizational Competitive Response	3.36	1.19	5	1	85

Table 3: MANOVA for Organization Effect

Variable	F	p>
Perceived Time Pressures	2.79	0.099
Competition	6.37	0.014
Perceived EIS Information Quality	1.68	0.199
Frequency EIS Use	3.478	0.67
EIS Use — Communication	0.047	0.827
EIS Use — Internal	0.174	0.678
EIS Use — External	0.697	0.407
Satisfaction	0.3511	0.555
Decision Making Speed	0.0147	0.839
Mental Model Enhancement	0.542	0.464
Extent of Analysis	0.847	0.361
Organizational Shared Vision	0.313	0.578
Organizational Decision Making Effectiveness	0.213	0.645
Organizational Communication	0.396	0.531
Organizational Competitive Response	0.9544	0.332

In order to test the hypotheses, MANOVAs were run. Table 4 shows the results of the MANOVA using the antecedents of EIS (perceived time pressure, perceived competition, perceived information quality in the EIS) as the independent variables and the types of EIS use as the dependent variables. This MANOVA is significant ($F=3.199, p>.002$).

Table 4: MANOVA of EIS Antecedents on EIS Use

	MANOVA		Regression			
	F(df)	p>	Adj. R2	Coeff.	t	p>
	3.199 (12)	0.002				
Frequency of EIS Use			0.090			
Perceived Time Pressure				-0.137	-1.182	0.241
Perceived Communication				-0.035	-0.321	0.749
Perceived EIS Information Quality				0.381	3.280	0.002
EIS Use — Communication			0.067			
Perceived Time Pressure				-0.326	-2.783	0.007
Perceived Competition				0.086	0.784	0.435
Perceived EIS Information Quality				0.035	0.302	0.764
EIS Use: Internal			0.159			
Perceived Time Pressure				0.160	1.440	0.154
Perceived Competition				-0.170	-1.627	0.108
Perceived EIS Information Quality				0.339	3.031	0.003
EIS Use: External			0.65			
Perceived Time Pressure				0.172	1.472	0.145
Perceived Competition				-0.278	-2.520	0.014
Perceived EIS Information Quality				0.027	0.228	0.820

Table 5 shows the results of the MANOVA using the types of EIS use as independent variables and the individual impacts as dependent variables. The MANOVA is significant ($F=5.23; p>.000$).

Table 6 presents the results of a MANOVA using the individual impacts and collective EIS use as independent variables and the perceived organizational impact variables as the dependent variables. The MANOVA is significant ($F=11.23, p>.000$).

4.3 Hypothesis Testing

Hypothesis 1 predicted that EIS use would be positively related to perceived competition. This hypothesis is rejected. None of the types of EIS use is predicted by perceived competition. Contrary to the hypothesis, the use of EIS to examine external information is negatively related to perceived competition ($t=-2.52, p>.014$).

Hypothesis 2 predicted that EIS use would be positively related to perceived time pressure. This is not supported for any of the types of EIS use. The use of EIS to communicate, however, is negatively related to perceived time pressure ($t=-2.78, p>.007$).

Hypothesis 3 predicted that EIS use would be positively related to the quality of information in the EIS. This hypothesis is supported for the use of EIS to monitor internal information ($t=3.031, p>.003$) and the overall frequency of EIS use ($t=3.28, p>.002$).

Table 5: MANOVA of Individual Impacts by EIS Use

	MANOVA		Regression			
	F(df)	p>	Adj. R2	Coeff.	t	p>
	5.23 (12)	0.000				
Decision Making Speed			0.318			
EIS Use: Communication				0.029	0.306	0.761
EIS Use: Internal				0.343	2.613	0.011
EIS Use: External				0.238	2.064	0.042
EIS Use: Frequency				0.124	1.035	0.304
Mental Model Enhancement			0.404			
EIS Use: Communication				0.042	0.457	0.649
EIS Use: Internal				0.380	3.094	0.003
EIS Use: External				0.282	2.610	0.011
EIS Use: Frequency				0.113	1.037	0.303
Extent of Analysis			0.386			
EIS Use: Communication				-0.107	-1.152	0.253
EIS Use: Internal				0.360	2.890	0.005
EIS Use: External				0.248	2.720	0.026
EIS Use: Frequency				0.155	1.410	0.163

Hypothesis 4 predicted that EIS Use and EIS Satisfaction would be positively related. This hypothesis is supported for the use of EIS to examine internal ($r=.389, p>.000$) and external ($r=.278, p>.007$) information but not for the overall frequency of EIS use ($r=.15, p>.07$) nor the use of EIS to communicate ($r=.079, p>.242$).

Hypothesis 5 predicted that decision making speed would be positively related to EIS use. This hypothesis was supported. Specifically, the use of EIS to monitor internal information and the use of EIS to monitor external information were positive and significant predictors of individual decision making speed ($t=2.613, p>.011$ and $t=2.604, p>.042$, respectively). Thirty-one percent of the variance in decision making speed was explained by the EIS use variables.

Hypothesis 6 predicted that mental model enhancement would be positively related to EIS use. This hypothesis was supported. Specifically, the use of EIS to monitor internal information ($t=3.094, p>.003$) and the use of EIS to monitor external information ($t=2.610, p>.011$) were significant positive predictors of mental model enhancement. Forty percent of the variance in mental model enhancement was explained by the EIS use variables.

Hypothesis 7 predicted that the extent of analysis in decision making would be positively related to EIS use. This hypothesis was supported. Specifically, the use of EIS to monitor internal information ($t=2.89, p>.005$) and the use of EIS to monitor external information ($t=2.72, p>.026$) were significant positive predictors of the extent of analysis in decision making. Thirty-eight percent of the variance in the extent of analysis in decision making was explained by the EIS use variables.

Table 6: MANOVA of Organizational Impacts by Individual Impacts

	MANOVA		Regression			
	F(df)	p>	Adj. R2	Coeff.	t	p>
	11.23 (12)	0.000				
Organizational Shared Vision			0.483			
Individual Speed				0.159	0.795	0.429
Individual Analysis				0.417	2.336	0.022
Individual Mental Model				0.149	0.975	0.333
Collective EIS Use				0.042	0.457	0.649
Organizational Communication			0.197			
Individual Speed				0.627	2.512	0.014
Individual Analysis				-0.330	-1.483	0.142
Individual Mental Model				-0.141	-0.743	0.460
Collective EIS Use				0.351	3.007	0.004
Organizational Response to Competition			0.525			
Individual Speed				0.191	0.997	0.322
Individual Analysis				0.106	0.624	0.534
Individual Mental Model				0.459	3.135	0.002
Collective EIS Use				0.039	0.438	0.663
Organizational Decision Making Effectiveness			0.630			
Individual Speed				0.685	4.042	0.000
Individual Analysis				-0.001	-0.009	0.993
Individual Mental Model				0.099	0.773	0.442
Collective EIS Use				0.077	0.992	0.360

Hypothesis 8 predicted that shared organizational vision would be positively related to individual impacts and collective EIS use. This hypothesis is supported. However, it is only the individual impact that EIS use has on the extent of analysis that significantly and positively contributes to shared vision ($t=2.356$; $p>.02$). Forty-eight percent of the variance in shared vision is explained by the individual impacts and collective use variables.

Hypothesis 9 predicted that improved communication in the organization would be positively related to individual impacts and collective EIS use. This hypothesis is supported. Collective EIS use ($t=3$; $p>.004$) and individual decision making speed ($t=2.5$; $p>.000$) are significant positive predictors of improved organizational communication. Nineteen percent of the variance in organizational communication is explained by the individual impacts and collective use variables.

Hypothesis 10 predicted that improved competitive response in the organization would be positively related to individual impacts and collective EIS use. This hypothesis is supported. Mental model enhancement ($t=3.7$, $p>.002$) is a significant and positive predictor of organizational competitive response. Fifty-two percent of the variance in organizational competitive response is explained by the individual impacts and collective use variables.

Hypothesis 11 predicted that organizational decision making effectiveness would be positively related to individual impacts and collective EIS use. This hypothesis is supported. It is the individual speed related to EIS use that enables effective organizational decision making ($t=4.04$, $p>.000$) according to the data. Sixty-three percent of the variance in organizational decision making effectiveness is explained by the individual impacts and collective use variables.

Figure 2 summarizes the findings of the hypothesis testing. Arrows indicate significant positive relationships unless there is a negative sign to indicate that the relationship is significant but negative. Although from a theoretical and intuitive viewpoint, the direction of the relationships can be argued, the research method does not allow for causality to be ascertained. The arrows must therefore be interpreted as indicating relationships but not necessarily causality.

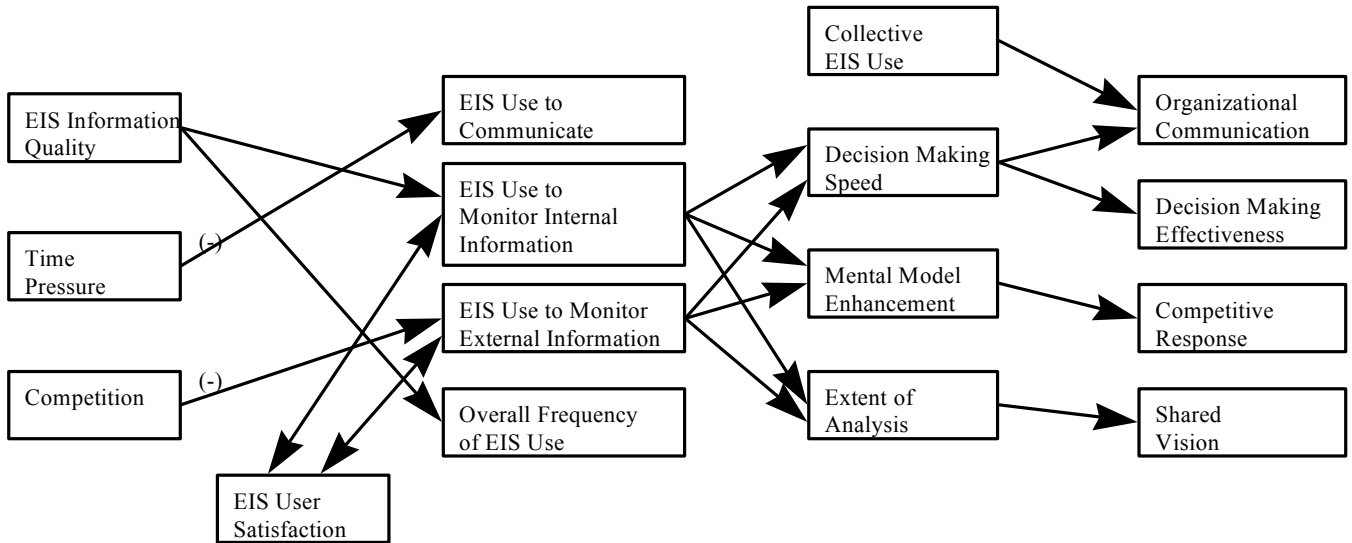


Figure 2: Summary of Hypothesis Testing Results

5. DISCUSSION, LIMITATIONS, AND CONCLUSIONS

The present study adapted the DeLone and McLean model of IS success to the context of EIS success. The results proffer insights into some antecedents as well as some consequences of EIS use. The overall frequency of EIS use was best explained by the quality of information in the EIS. Prior research has shown that competition in the organization’s environment as well as time pressure facing managers are important reasons behind the development of EIS (Watson, Rainer, and Koh 1991; Rockart and DeLong 1988); however, neither competition nor perceived time pressure were significant predictors of EIS use. Hence, EIS tend to be used for different reasons than they are built. Using EIS to communicate with others in the organization was negatively related to perceived time pressure. It may be that the lack of immediate feedback hinders the use of electronic communication when there is a sense of urgency. It may also be that Mexican managers, who have been noted to communicate face-to-face more than their North-American counterparts (Stephens and Greer 1995), use email to supplement rather than replace face-to-face communication so that when time pressure exists, it is the supplementary communication form that is abandoned.. This study also favors the finding of Molloy and Schwenk that managers decrease reliance on IS when faced with time pressure. Perceived time pressure was, in fact, negatively related to each type of use, except for external monitoring, although the relationships were not all significant. Perceived competition was negatively related to the use of EIS to examine external information. It is possible that given such a turbulent environment as is facing Mexico, information about the external environment is not trusted, and hence not examined, because it is felt that it will change so quickly. Very little of the variance in the EIS use variables was explained by the antecedents of EIS use, pointing to the need to reconsider the antecedent variables.

This study, as have past EIS studies (Leidner and Elam 1995; Rainer and Watson 1995), indicates that managers perceive personal benefits from using EIS. This study also suggests that certain types of EIS use have a greater influence on outcomes than others. Of the three types of use examined in this study — the use to communicate, the use to monitor internal information, and the use to monitor external information — it is the internal and external monitoring that demonstrate significant positive influences on the individual impact variables. Using EIS to communicate was not positively related to any

of the individual impacts. This does not suggest that the communication function is not valuable, but rather that, in comparison with the internal and external information provided by EIS, it is not as significant, particularly as pertains to the decision making variables examined as individual impact variables. Each of the three individual impacts of EIS use — decision making speed, mental model enhancement, and the extent of analysis in decision making — was significantly related to the use of EIS to examine internal information and the use of EIS to examine external information. One EIS study found that improved mental model was not considered an important benefit of EIS use (Rainer and Watson 1995); this study, however, confirms the finding in Leidner and Elam that EIS helps refine a manager's understanding of the business. The overall frequency of EIS use is not an important predictor of EIS benefits when the types of EIS use are taken into account.

The organizational impacts were examined from the perspective of individual managers. Consistent with the DeLone and McLean model, we examined the relationship between individual impacts and organizational impacts. We also considered the impact of collective EIS use on organizational impacts. The findings suggest that improvements in decision making effectiveness were best explained by improvements in the decision speed of individual managers, improvements in organizational communication were associated with collective EIS use and decision making speed, improvements in competitive response were related to the enhanced mental models of managers, and shared vision was explained by the extent of analysis of the information. These results suggest that the individual impacts of EIS use are associated with various perceived organizational benefits. Although the organizational measures are perceptual, they do offer a rough indication that EIS can have organizational outcomes in addition to the more commonly examined individual outcomes.

In terms of the model of EIS success, the antecedents of EIS use need to be more clearly explored. It may be that the explanation for use is quite simple: that managers anticipate benefits from using EIS and hence they use EIS. Of equal interest would be undertaking a study of why some managers do not use EIS even though a quality EIS is available. The individual impacts of EIS seem to be well explained by EIS use and the organizational impacts are well explained by the individual impacts and collective use. Thus, the DeLone and McLean model of IS success, when adapted to an EIS context, appears to be useful in understanding the impact of EIS on managers and organizations.

5.1 Limitations

There are several limitations to the study that warrant mention. First, the study addressed only users of EIS at the point in time the survey was administered. Users who had discontinued use of the system were not included in the sample. Thus, the results cannot be used to deduce requirements for EIS success but only to suggest that EIS can be successfully used. Second, the study was conducted in a particular context: that of a developing nation with a recently opened market. One must take caution in generalizing the results to other contexts. Third, it is inappropriate to make causal deductions. Although from a theoretical and intuitive standpoint, the direction of the hypotheses were argued, the research method did not test for directionality. Therefore, the results must be interpreted in terms of association rather than causality. Last, the organizational measures were individual's perceptions of organizational impacts. More powerful measures of organization impact would examine financial measures of organizational performance.

5.2 Conclusion

This study purported to examine the impact of EIS on Mexican managers and Mexican organizations. In particular, are EIS successful in Mexico? Raman and Watson state that "for managers in a high context society, EIS is a poor substitute for the meaning that comes from high context communication." This study contradicts the viewpoint that systems such as EIS will not be successful in high-context societies: EIS is not a substitute for other sources of communication or information, but rather a complement. The results suggest that Mexican managers use EIS in such a manner as to experience faster decision making, improved understanding of the business, and increased decision making analysis which then help create a shared organizational vision, improved organizational communication, improved organizational competitive response, and improved organizational decision making effectiveness. EIS can thus be successful in a high context society in the sense that managers using EIS perceive benefits from their use. On a broader level, EIS appear to be helping Mexican managers cope with the increased need for both more internal and external information resulting from their new business environment. This is not to suggest that

organizations in developing nations must embrace the management technology and practices of their counterparts in industrialized nations in order to succeed, but rather that management technology from the industrialized organization can be used successfully, though perhaps differently, in organizations in developing nations to help the organizations in developing nations respond to the challenge of competition from their industrialized rivals.

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