End-User Computing Success Factors: Further Evidence from a Developing Nation

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The rapid growth of end-user computing (EUC) has dramatically affected the nature of information systems in many organizations and many countries. EUC proliferation is more evident in organizations in developing countries because of steady improvement in the performance/price ratio of EUC computing technology. As organizations become increasingly dependent on EUC to fulfill their information requirements, the management of EUC resources demands a better understanding of the factors that affect EUC success. This paper attempts to measure and validate some individual and organizational factors hypothesized to affect the success of EUC in a developing country, namely Saudi Arabia. One hundred and fifty-eight end users in forty-five small organizations were surveyed. The study findings indicate that EUC success is closely associated with organization size, EUC training, source of computer application, computer literacy, top management involvement, number of system analysts, and availability of native language software. The need for a process oriented model to study organizational variables is addressed because of the importance of the time frame of the EUC adoption process.

Despite the relative novelty of end-user computing (EUC), signs of its increasing proliferation are abundant. Rockart and Flannery (1983) have reported 50 to 90% annual growth of EUC in several companies. It has been estimated the EUC will absorb 75% of computer resources by 1990 (Benjamin, 1982). In a more recent study, Ein-dor and Segev (1988) found that almost 40% of the work force of the surveyed organizations were end users.

It seems that the shift in emphasis from traditional computing practices toward EUC is not limited to the highly advanced nations. Actually, the trend may be more evident in developing nations, where the majority of organizations are relatively small. Small organizations cannot afford the high cost of expensive hardware and supportive technical staff such as system analysts and programmers. Professionals and managers are forced to rely on themselves to satisfy...
their computational needs on relatively inexpensive hardware.

Several studies in the Middle and Far East have described the advent of EUC in these developing regions (Abdul Ghani & Al-Sakran, 1988; Abdul Ghani & Al-Meer, 1989; Ibrahim, 1985; Tsai & Wei, 1987). In a study of the data processing environments of 200 Saudi organizations, Abdul Ghani and Al-Sakran (1988) note a growing reliance on EUC. A large percentage of the organizations using computers (66%) do not have formal electronic data processing (EDP) departments. Instead, these organizations depend on end-use computing, and more specifically on microcomputer based application packages. Tsai and Wei (1987) report a similar pattern in Taiwan. More than 61% of the companies use microcomputers rather than minicomputers or a mainframe. In a study of computing usage in Kuwait, another developing nation, Ibrahim (1985) points to the similarities of computing practices between developed nations and developing countries.

The studies of computing practices in developing nations have been primarily descriptive in nature. Relatively little attention has been paid to the assessment of the variables that affect EUC. This study investigates a number of individual and organizational variables that have been identified in the literature as determinants of EUC success or failure. The study is a pioneering attempt to measure the success level of EUC and the factors that influence EUC in the context of a developing country, namely Saudi Arabia.

The importance of EUC management to developing nations stems from the central role of information resources in modern economic development. It is widely accepted that computerization is critical to economic growth (Abdul-Gader, 1988; Bogod, 1979). Evidence also, however, suggests that developing countries striving towards computerization are constrained in their efforts by a lack of technical infrastructure and a scarcity of competent manpower (Abdul-Gader, 1988; Matta & Boutros, 1989). To establish the needed technical infrastructure and to adjust for the lack of skilled human resources, Saudi Arabia relies heavily on imported technology and foreign manpower. Unlike many developing countries, Saudi Arabia can be characterized by its favorable financial position. As a major crude oil exporter, Saudi Arabia is able to finance large annual computer imports. The Saudi microcomputer and minicomputer market, for example, exhibits growth rates similar to the trends in the American market (U.S. Department of Commerce, 1985).

It is of paramount importance to a developing country’s managers to identify and study the variables that may promote or hinder attaining the full potential of these considerable investments. This study examines a number of variables that have been identified in the literature as determinants of EUC success. The objective is to assess the relevance and applicability of these variables in a culture fundamentally different from those of developed countries (e.g., United States). This study would also benefit the increasing number of multinational corporations involved in business arrangements in Saudi Arabia. There are almost 300 joint projects between Saudi Arabia and the United States (Saudi Arabia Chamber of Commerce, 1988).

Previous EUC research is presented in the next session. Based on this background, hypotheses are developed and dependent and independent variables are defined. This section is followed by a discussion of the methodology used in this study. Next, the data are analyzed, and conclusions are presented.

**Background**

End-user computing is defined as the ability of the ultimate users (professional staff and managers) to directly fulfill their computational needs (Rockart & Flannery, 1983). It is difficult to develop an objective and meaningful measure of EUC success. A review of the Management Information Systems literature
suggests several surrogate measures of this construct. Among the proposed measures are user information satisfaction, the impact of information systems on organizational performance, and system utilization (Cerullo, 1980; Cheney, Mann, Amoroso, 1986; Ein-dor & Segev, 1978; Delone, 1988; Hamilton & Chervany, 1981; Lucas, 1978; Montazemi, 1988; Raymond, 1987a, Welke & Konsynski, 1980).

The most frequently used measure of EUC success is user information satisfaction (Cheney et al., 1986; Montazemi, 1988; Raymond, 1987a; Raymond, 1987b). User information satisfaction is conceptualized as the end user’s attitude toward the computer applications he uses. The measurement of user information satisfaction has produced relatively rich measurement construction and validation studies (Bailey & Pearson, 1983; Baroudi & Orlikowski, 1988; Ives, Olson, Baroudi, 1983). Specific scales have also been developed for small organizations (Doll & Torkzadeh, 1988; Montazemi, 1988; Raymond, 1987b).

To measure EUC success, the user information satisfaction scale developed by Doll and Torkzadeh (1988) was chosen for this study. This scale is a modified version of the widely used instrument for measuring user information satisfaction by Ives et al. (Barki & Huff, 1985; Ives et al., 1983; Mahmood & Becker, 1985-86; Raymond, 1985). Based on a survey of 618 end users, Doll and Torkzadeh developed a Likert-type 12-item scale to measure user information satisfaction. The items correspond to five underlying dimensions of satisfaction including content, accuracy, format, ease of use, and timeliness. Statements of specific relevance to EUC are used in the scale. High reliability and validity indicators have been reported for this scale (Doll & Torkzadeh, 1988).

An understanding of the factors that are associated with EUC success is essential to the management of this significant information resource. Ein-Dor and Segev (1978) proposed a conceptual scheme for identifying organizational variables that directly or indirectly affect the success of EUC. Based on this scheme, Cheney et al. (1986) have postulated 12 propositions relating organizational factors to EUC success. The factors are grouped into three categories: uncontrollable, partially controllable, and fully controllable. Factors that are beyond the control of management include task technology variables and organizational time frame. Partially controllable factors include psychological climate and systems development backlog. The controllable factors are EUC training, rank of EUC executive, and EUC policies.

This conceptual scheme has formed the skeleton of most empirical studies of EUC success factors. Based on a survey of 21 organizations, Ein-Dor and Segev (1988) asserted that the extent of EUC is closely related to top management use, end users’ perceived needs, organization size, and EUC budget.

In the context of small business organizations, Raymond (1985) reported that the success of EUC was associated with six variables: in-house application development, in-house application use, number of administrative applications, type of applications, rank of computer-based information system function, and geographical location of EUC. Delone (1988) related nine variables to EUC success: use of external programming support, level of computer-based information systems planning, top management computer knowledge, top management involvement in computerization of applications, employees’ acceptance of computers, sophistication of computer control, age of computer operations in the organization, level of computer training, and type of computer use (on-site computer use vs. use of computer service). However, only three variables were found significant to determining the degree of success of EUC: top management computer knowledge, top management involvement in computerization, and use of on-site computers.

In a study of small Canadian organizations, end users reported that EUC success is
closely associated with the number of system analysts in the organization, the intensity of information requirement analysis, the degree of end-user involvement, the level of end-user computer literacy, and the degree of centralization in the firm (Montazemi, 1988).

Based on these studies, nine success predictors were chosen for this study:

1. organization size (Ein-Dor & Segev, 1988; Raymond, 1987a),
2. degree of centralization (Delone, 1988; Montazemi, 1988),
3. end-user training (Cheney et al., 1986; Delone, 1988),
4. availability of EUC planning and policies (Alavi, Nelson, Weiss, 1988; Cheney et al., 1986; Delone, 1988; Porter & Gogan, 1988),
5. applications development source (in-house vs. external) (Delone, 1988; Montazemi, 1988; Raymond, 1985),
6. end-user computer literacy (Montazemi, 1988),
7. top management computer literacy (Delone, 1988; Montazemi, 1988),
8. top management involvement in computerization (Delone, 1988; Ein-Dor & Segev, 1988), and
9. number of system analysts (Montazemi, 1988).

The operationalization of these factors is shown in Table 1. In the results and discussion section, justifications for the choice of these factors will be presented.

A hypothesis was formulated for each success factor chosen for this study. Among Saudi organizations, the success of EUC was hypothesized to be:

H1: positively associated with the size of the organization

Table 1: Operationalization of the Independent Variables (Success Factors)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>QUESTIONNAIRE ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization size</td>
<td>Number of employees</td>
</tr>
<tr>
<td>Centralization</td>
<td>Number of managers</td>
</tr>
<tr>
<td>End-user training</td>
<td>Overall level of computer training for employees 1=low; 2=medium; 3=high</td>
</tr>
<tr>
<td>EUC planning</td>
<td>Availability of formal EUC plans and policy manuals; 1= no formal plans or policies; 2=low quality plans and policies; 3=medium quality plans and policies; 4=high quality plans and policies</td>
</tr>
<tr>
<td>Application Development</td>
<td>Percentage of applications developed in-house 1=100% (total internal development); 2=Between 50% and 99%; 3= Between 1% and 50%; 4=0 (totally external development)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>QUESTIONNAIRE ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>End user's literacy</td>
<td>Level of end user computer literacy 1=intermediate; 2=nonprogramming end user; 3=command-level end user; 4=programming end user</td>
</tr>
<tr>
<td>Top management literacy</td>
<td>Level of top management computer literacy 1= intermediate; 2= nonprogramming; 3=command-level; 4=programming</td>
</tr>
<tr>
<td>Top management involvement</td>
<td>Degree of top management involvement in computerization (i.e., interaction with DP manager) 1=None; 2=occasional; 3=highly involved</td>
</tr>
<tr>
<td>Number of system analysts</td>
<td>Number of system analysts in the organization</td>
</tr>
<tr>
<td>Arabic applications</td>
<td>Percentage of Arabic computer applications 1=0% (no Arabic application); 2=Between 1% and 33%; 3=Between 34% and 66%; 4=Between 67% and 99%; 5=100% (no non-Arabic applications)</td>
</tr>
</tbody>
</table>
H2: negatively associated with the degree of centralization in the organization

H3: positively associated with the degree of end-user training programs

H4: positively associated with the degree of EUC planning and policies

H5: positively associated with the proportion of externally developed applications

H6: positively associated with the degree of end-user computer literacy

H7: positively associated with the degree of top management computer literacy

H8: positively associated with the degree of top management involvement in computerization

H9: positively associated with the number of system analysts in the organization

Because the native language in Saudi Arabia is Arabic, the availability of Arabic software and Arabic applications was also hypothesized to affect the success of EUC. Thus, a tenth success predictor was added to the above list of independent variables and the following hypothesis was postulated:

H10: The likelihood of a successful EUC is greater with the higher proportion of Arabic software and applications acquired by the organization.

Methodology

The study was conducted in the Eastern Province of Saudi Arabia in the Fall of 1988. A purposeful sample of the organizations in the directory of the Chamber of Commerce in the province was contacted by telephone. Out of seventy-four organizations contacted, forty-five had EUC activities and agreed to participate in the study. Data were collected in two phases. First a semi-structured personal interview was conducted with one of the top managers in each organization. The interview gathered information about the organizational factors identified as influencing EUC success and other organizational characteristics. After the interview, the respondent was asked to complete a questionnaire and to help distribute it to end users in his organization. End users’ responses constituted the second stage of data collection.

Doll and Torkzadeh’s (1988) user information satisfaction scale was also included in the questionnaire. Questions were written in both English and Arabic languages on the same form. The inclusion of the English language along with the Arabic was necessary because of the large number of non-Arab personnel working in Saudi organizations. There is ample evidence from cross-cultural studies that when the cultural differences are not accounted for, the research instrument loses its psychometric rigor (Parameswaran & Yaprak, 1987). Thus, the back translation method suggested by Brislin (1986) was used to translate user information satisfaction scale from English into Arabic. The scale was translated back and forth between English and Arabic by several bilingual persons. The process was repeated until both versions converged.

A total of 158 end users responded. The mean number of respondents per organization was 3.51. Table 2 depicts the characteristics of the surveyed organizations. Generally the sample consisted of small organizations. Two-third of the organizations employed less than 100 employees and the biggest organizations employed just 250 employees. The three major economic sectors of manufacturing, service, and trading were represented in the sample. Classified by their computing environment type, most of these organizations did not have formal data processing departments. Actually, only ten establishments reported having a separate department responsible for data processing. On
Variables with standardized scores of more than +3 or less than -3 are classified as outliers (Tabachnick & Fidell, 1983). None of the research variables were classified as outliers when tested individually. For the composite variables, such as user information satisfaction, inspection of Mahalanobis distance showed no multivariate outliers (Tabachnick & Fidell, 1983).

Normality, homoscedasticity, and linearity assumptions are of major importance for statistical analysis. Variables with severe skewness may distort hypothesis testing since they are not normally distributed. However, with a sufficiently large sample size, normality and homoscedasticity are usually assumed (Kerlinger, 1973). Linearity, however, must be analyzed because correlation coefficients between variables are only responsible to their linear relationship. A rigorous test of the nature of the associations between the variables was performed. Examination of the bivariate scattergrams (user satisfaction composite score against every success factor) revealed predominantly linear relationships.

Reliability and Validity of Scale

To test the internal homogeneity of Doll and Torkzadeh’s user satisfaction scale, two measures of reliability were used: item to total correlation and Cronbach’s alpha (Nunnally & Durham, 1975). Obviously, these two measures are not independent. The objective of calculating item to total correlations is to gain insight into which items have low and insignificant contributions to the measurement of EUC success. The item to total correlations were positive, ranging from +0.29 to +0.85. All of these items’ correlation coefficients were significant at 0.001 level.

The alpha coefficient, or Cronbach’s reliability index, was also calculated to measure the internal consistency of the user information satisfaction scale. This calculation was per-

<table>
<thead>
<tr>
<th>Table 2: Sample Characteristics</th>
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</thead>
<tbody>
<tr>
<td><strong>Number of employees</strong></td>
</tr>
<tr>
<td>0-100</td>
</tr>
<tr>
<td>101-200</td>
</tr>
<tr>
<td>201-250</td>
</tr>
<tr>
<td><strong>Number of end users</strong></td>
</tr>
<tr>
<td>0-5</td>
</tr>
<tr>
<td>6-20</td>
</tr>
<tr>
<td>Over 20</td>
</tr>
<tr>
<td><strong>Economic sector</strong></td>
</tr>
<tr>
<td>Manufacturing</td>
</tr>
<tr>
<td>Services</td>
</tr>
<tr>
<td>Trading</td>
</tr>
<tr>
<td><strong>Computing Environment</strong></td>
</tr>
<tr>
<td>Organizations without form</td>
</tr>
<tr>
<td>data processing department</td>
</tr>
<tr>
<td>Organizations with formal</td>
</tr>
<tr>
<td>data processing department</td>
</tr>
<tr>
<td><strong>Average number of personal computers</strong></td>
</tr>
<tr>
<td><strong>Average number of terminals</strong></td>
</tr>
</tbody>
</table>

the average, each organization had eight personal computers and/or two computer terminals.

Analysis

Tabachnick and Fidell (1983) caution that premature analysis of data without checking for data abnormalities may hinder an honest analysis. Missing data, outliers (extreme cases), and violations of statistical assumptions need to be investigated and corrected before applying statistical procedures.

Missing data can be a serious problem for any research. A corrective treatment should be adopted if a large percentage of cases are missing, or if the missing points exhibit a nonrandom pattern (Tabachnick & Fidell, 1983). Because data were partially collected through interviews, only a few missing units resulted. Thus, no deletion of cases or estimation of missing values was necessary.

Outliers are another source of concern for any statistical manipulation. Outliers are cases with extreme values on one variable (univariate outliers) or a combination of variables (multivariate outliers). Outlying cases introduce undue influence on statistical parameters (correlation coefficients, mean, and variance).
formed for the twelve statements that constitute the scale. The alpha coefficient was 0.90, which is slightly lower than what Doll and Torkzadeh have reported. Ninety percent, however, is a sufficiently high level to warrant credibility for the user information satisfaction scale (Nunnally & Durham, 1975). The twelve statements shared a common factor (measurement of user information satisfaction) that has explained 90% of the variance of their weighted linear composite.

The construct validity of the scale was also assessed. This type of validity is concerned with how two or more theoretically related measures are empirically associated (Zeller & Carmines, 1980). An important component of construct validity is convergent validity, which refers to “the extent to which [the measure] correlates highly with other methods designed to measure the same construct” (Churchill, 1979, p. 70). Closely related to satisfaction is the alienation construct (Lefkowitz, 1980). Computer alienation and its scale (Abdul-Gader, 1988; Minch & Ray, 1986) could be used to show convergent validity. If user information satisfaction scores are found to correlate negatively with computer alienation scores, then the scale manifests convergent validity. The Pearson correlation coefficient between computer alienation and user information satisfaction was -0.48. This negative relationship was statistically significant at the 0.01 level.

<table>
<thead>
<tr>
<th>Success Factors</th>
<th>Hypothesis</th>
<th>EUC success*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization Size</td>
<td>H1</td>
<td>0.21 (45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.041)**</td>
</tr>
<tr>
<td>Centralization</td>
<td>H2</td>
<td>0.13 (45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.613)</td>
</tr>
<tr>
<td>End-User training</td>
<td>H3</td>
<td>0.52 (45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.003)***</td>
</tr>
<tr>
<td>EUC Planning</td>
<td>H4</td>
<td>0.06 (45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.032)**</td>
</tr>
<tr>
<td>Applications Development</td>
<td>H5</td>
<td>0.45 (45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.032)**</td>
</tr>
<tr>
<td>End-Users' Literacy</td>
<td>H6</td>
<td>0.37 (158)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.007***</td>
</tr>
<tr>
<td>Top Management Literacy</td>
<td>H7</td>
<td>0.56 (63)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.003***</td>
</tr>
<tr>
<td>Top Management Involvement</td>
<td>H8</td>
<td>0.23(63)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.041**</td>
</tr>
<tr>
<td>Number of System Analysts</td>
<td>H9</td>
<td>0.230 (45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.027**</td>
</tr>
<tr>
<td>Arabic Applications</td>
<td>H10</td>
<td>0.321 (45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.003***</td>
</tr>
</tbody>
</table>

* Correlation coefficient, (number of observations), and significant tests)  ** Significant at 0.05  *** Significant at 0.01
Results and Discussion

Organization size and EUC success

The first variable which was hypothesized to be a determinant of EUC success is the size of the organization. Many researchers have postulated that smaller organizations are less likely to have successful EUC experience (Ein-dor & Segev, 1988; Raymond, 1987a). This is attributed to the smaller organizations’ inability to create a favorable atmosphere for EUC because of their tendency toward centralization and their lack of adequate resources.

The number of employees was used as an indicator of size. As can be seen from Table 3, the Pearson correlation coefficient between user information satisfaction and the number of employees was significant. Therefore, EUC success seems to be related to organization size, but the association is not strong. Raymond (1987a) and Ein-Dor and Segev (1988) reported similar results.

Degree of centralization and EUC success

Following Montazemi (1988) and others (Miller, 1983), the number of managers in the organization was used as a measure of the degree of centralization of the decision making. End users have been found to be more satisfied in less centralized organizations (Montazemi, 1988). Justification for this finding is based on the need of less centralized organizations for integration. An effective use of computer-based information systems is perceived as a strategic tool for accomplishing this integration, leading the way to a more supportive organizational climate.

Contrary to Montazemi’s finding, this factor failed to be of any significance in relating to EUC success in the study sample. It is clear from Table 3 that the correlation coefficient between centralization and user information satisfaction was low and statistically insignificant. A possible explanation of this discrepancy is the multi-faceted centralization’s effect on EUC. In his classic Diffusion of Innovations book, Rogers (1983) argued that the effect of organizational structure variables (i.e., centralization) on innovations is contingent on the stage of the innovation process. As an innovation, EUC progresses through two main stages in organizations: (1) initiation including information gathering, conceptualization, and planning for EUC adoption, and (2) implementation including organizational actions to put EUC into use. Although low centralization facilitates the initiation of EUC it makes it more difficult to ensure successful implementation at the later stage (Rogers, 1983; Sapolsky, 1967). Low centralization correlates positively with EUC success at the beginning but ends with a negative impact on EUC. Based on Roger’s research approach, the effect of centralization and other organizational structure variables on EUC should be investigated after careful consideration of the stage of EUC in the organization.

End-user training and EUC success

Training refers to a wide rage of computer oriented educational techniques that could be adopted by the organization to educate its employees. Professional development programs, tutorials, computer-assisted instruction, and resident experts are examples of these techniques. Because of the wide recognition of the importance of education in the MIS literature, Cheney et al. (1986) proposed that “[t]he availability of end-user training is positively related to the success of EUC [facilities].”

Based on the intensity of their education programs, the study sample was segmented into three groups. Organizations with a high level of educational policy were projected to have more successful EUC. On the other end, if no formal training programs were implemented, EUC success likelihood would be lower. Table 3 depicts a significant positive association between end-user training and EUC success. In contrast, Delone (1988) found no association between level of training and EUC success.
Formal planning and EUC success

The fourth variable that was hypothesized to relate to the level of EUC success is formal planning. The availability of high quality formal plans to guide the creation and operation of EUC facilities should help in integrating these facilities with the organization’s basic goals. Similarly, appropriate EUC policies should be needed to provide a control mechanism for the development, maintenance, and use of EUC (Alavi et al., 1988; Cheney et al., 1986 Porter & Gogan, 1988).

According to the data collected by De lone (1988), EUC success had no significant association with the level of planning. The present study, too, failed to show a significant correlation. Out of the forty-five organizations surveyed, only two reported using formal EUC plans and policies. The other organizations were simply ignorant in this regard, following a laissez-faire strategy. These organizations lack policies for EUC technology assimilation. Functional departments use their budgets to finance EUC investments without an organizational application selection guidelines. It is not surprising to see this kind of pattern in small businesses, especially in a developing country.

Application development source and EUC success

It was hypothesized that EUC success is positively related to the proportion of external support for application development. Computer literacy among small business personnel is typically limited (Delone, 1988). Moreover, developing nations lack specialized knowledge and technical know how. In Saudi Arabia, for example, Abdul Ghani and Al-Sakran (1988) have noted such limited computer literacy that almost 85% of Saudi companies using microcomputers purchase ready-made software or subcontract software houses. The heavy reliance on dedicated packages in the sample was expected to compensate for the lack of computer expertise. To this end, an interesting research question emerges: does acquiring dedicated packages have a positive impact on the level of user information satisfaction and hence EUC success?

Table 3 shows reassuring results. The correlation coefficient between EUC success and the proportion of external support for application development was +0.45. It is significantly different from zero. Delone (1988) and Montazemi (1988) reported no association between these two variables, whereas Raymond (1985) reported a negative association.

Computer literacy and EUC success

Two hypotheses were formulated to investigate the relation between EUC success and computer literacy. Both the end-users’ computer literacy (Hypothesis 6) and top management’s computer literacy (Hypothesis 7) were projected to positively influence EUC success. The data collected confirmed these two hypotheses (Table 3). Higher levels of computer knowledge and experience increase the likelihood of EUC success. This finding is congruent with those of previous studies (Delone, 1988; Montazemi, 1988).

Management involvement and EUC success

Top management involvement with computerization is often identified as one of the critical success factors of data processing departments (Rockart, 1979). In the EUC context, EUC success is also expected to be higher in organizations with higher top management involvement. This involvement has been operationalized as the amount of interaction between top management and the data processing manager. In organizations with no formal data processing (DP) departments (77.7%), the levels of top management participation in application development and utilization have been used
as measures of involvement.

Delone (1988) and Ein-dor and Segev (1988) reported a significant positive association between EUC success and top management involvement. As can be seen in Table 3, this study also found a positive relation between these two variables.

**Number of analysts and EUC success**

In traditional information system development, system analysts play a significant role in defining information needs and proper technologies to realize them. In a survey of personal computer usage, Lee (1986) pointed out that personal computer users viewed their information system staff as the best source of information. The presence of system analysts in the firm offers an internal consulting mechanism to help end users in acquiring or developing applications.

As shown in Table 3, there was a positive association between the number of system analysts and user information satisfaction. This finding reflects those of another study (Montazemi, 1988).

**Native language applications and EUC success**

In general, non-English-speaking developing nations lack native computer applications developers. English-based development tools are available which, in many occasions, force local organizations to use English to build computer applications rather than their own language. It was hypothesized that high proportions of Arabic software and applications increase user information satisfaction.

As expected, the number of English computer applications surpassed the number of Arabic applications. Only twelve organizations (26.7% of the sample) reported using Arabic applications as compared with 73.3% using English applications only. As shown in Table 4, the difference between the mean satisfaction scores of the end users in these two groups was significantly different. The users of Arabic applications had a higher mean than the users of English applications.

Furthermore, the correlation between EUC success and the percentage of Arabic computer applications was +0.32 and significantly different from zero (Table 3). Thus, hypothesis 10 is confirmed.

**Conclusions**

An understanding of the factors which are associated with EUC success is essential to managing this significant information resource. Individual and organizational variables that may hinder full EUC technology assimilation should be analyzed in an effort to enhance the chances of EUC success. EUC and other information resources assimilation is the catalyst to successful economic development in developing countries. Unfortunately, the literature on EUC success factors has focused exclusively on organizations in developed countries (Cheney et al., 1986; Delone, 1988; Ein-dor & Segev, 1988; Montazemi, 1988; Raymond, 1987a). Simi-

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**Table 4: End User Information Satisfaction Mean Scores**

<table>
<thead>
<tr>
<th>Arabic/English Applications Users</th>
<th>Mean</th>
<th>One-tail T-test</th>
<th>p-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35.0</td>
<td>-2.65</td>
<td>0.004</td>
<td>Significant at 0.01</td>
</tr>
<tr>
<td>Just English Applications Users</td>
<td>24.0</td>
<td></td>
<td></td>
<td></td>
</tr>
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larly, the literature on computing practices in developing nations has been primarily descriptive in nature (Abdul Ghani & Al-Sakran, 1988; Ibrahim, 1985; Tsai & Wei, 1987). Most of the studies focus on surveying data processing environments. Certainly there is a need for studying EUC issues such as validating psychometric scales and testing hypotheses that pertain to developing countries.

This type of research is important, not only for developing countries, but also for the increasing number of American multinational corporations that operate in these developing countries. Drucker (1986) has stressed the significance of understanding local values, attitudes, and management practices to the effectiveness of multinational corporations.

In this study, the level of EUC success has been measured by user information satisfaction. Ten success factors were hypothesized to affect user information satisfaction. Based on the data collected from 158 end users working in 45 Saudi organizations, several interesting findings emerged. EUC success is more likely to occur in larger organizations which have top management active in the development of computer applications. Other factors that favorably affect EUC success are a higher degree of end-user training programs, the use of externally developed applications, the employment of a larger number of system analysts, and the adoption of a larger proportion of native language computer applications. Computer literacy among end users and top managers also exhibits a significant positive effect on EUC success. Degree of centralization and level of EUC planning fail to demonstrate significant associations with EUC success.

This study points to the need for a comprehensive model in studying centralization and other organizational structure variables. Of particular importance to structural variables is the time frame of EUC. Structural variables exhibit different effects on EUC at different periods of the EUC adoption process. Centralization, organizational size, and formalization (of EUC plans or training) may encourage EUC acceptance in one organization and help in creating a supportive organizational climate for EUC success; but these same variables may display the opposite outcomes in another organization if the two organizations are in different stages of the EUC adoption process. On a larger scale, developing countries should be compared with developed countries after accounting for differences in the EUC adoption process.

Further research is also needed to incorporate other EUC success factors such as end users’ needs, managerial style, and job related variables (satisfaction, motivation, job description, etc.).

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