AN EMPIRICAL EXAMINATION OF
INFORMATION SYSTEMS SUCCESS IN RELATION WITH
INFORMATION SYSTEMS DEVELOPMENT PHENOMENA

by
ANDREAS I. NICOLAOU
Bachelor of Science
The Athens School of Economic and Business Sciences

Master of Accountancy
Southern Illinois University at Carbondale

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I hereby recommend that the dissertation prepared under my supervision by Andreas I. Nicolaou

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Michael Marcel
In Charge of Dissertation

Wallace W. Davidson
Head of Department

Recommendation concurred in

1. Michael Marcel
2. Richard Reyes
3. Marvin W. Crandall
4. John D. Willey
5. Dale Brown

Committee for the Final Examination
AN ABSTRACT OF THE DISSERTATION OF

Andreas Iacovou Nicolaou, for the Doctor of Business Administration degree in Accountancy, presented on April 7, 1993, at Southern Illinois University at Carbondale.

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MAJOR PROFESSOR: Michael M. Masoner

Research in information systems has been concerned with the assurance of system success, as perceived by the users of a system, without adequately defining the construct or examining its validity. The construct of success is useful in evaluating the effectiveness of managerial interventions in system development.

This dissertation develops a theory to guide the selection of a criterion measure that should be functionally related to information systems success. This criterion is a decision maker's intention to further develop the existing information system within his or her organization. The generalized (non-quantitative) form of the cost/benefit principle is employed to advance hypotheses that examine the predictive validity of alternative indicators of information systems success.

Data were gathered through a cross-sectional mail survey of 1,000 decision makers in systems development. Two success concepts were measured: (a) the quality of output information as perceived by the users of the system's output and (b) the usefulness of a system as perceived by its users. The perceived cost of the intended change in an
existing information system was also measured. Tests for construct validity, including confirmatory factor analysis, provided supportive results. The measures were found to exhibit high reliability and were able to discriminate their theoretical variables. Tests of the hypothesized effects indicated that system usefulness, along with cost, had a significant effect on future development intentions. Information quality was not found to have a strong effect on development intentions.

These results suggest that system usefulness can be validly utilized to evaluate the effectiveness of managerial interventions in system development. The use of information quality in evaluating such policies was not supported by the results. Further research is needed to ascertain the nature of information quality and to determine its relationship with both situational and other controllable variables that operate during the process of system development.
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CHAPTER 1
INTRODUCTION

This research concerns the topic of success in information systems (IS hereafter). Success is an elusive concept which is often conceptualized from a wide perspective but operationalized with narrow measures. A problem encountered when success has a wide perspective, is that many unsubstantiated assumptions must be made in order to use it in an empirical study. In the literature on income determination in financial accounting, for example, should a business be assumed to be liquidated at the end of each period of time? Alternatively, should the business be assumed to have an infinite existence or a finite existence? Research in organizational effectiveness [e.g., Quinn and Rohrbaugh 1983] poses a similar issue. One set of effectiveness criteria may emphasize the permanence of the niche established, while an alternative set may incorporate objective achievement of the organization, such as profitability, efficiency and productivity.

In both cases, the model used critically depends upon the assumption made. The problem is that no one can be sure of which narrowly defined measures to include for analysis, given the wide perspective of the success measure. The solution is contingent upon the types of phenomena that are of interest to an investigator. The trade-off, however, lies in the limited ability to generalize beyond the narrow scope adopted.
The IS literature has typically reported using narrow measures of success which necessitate narrow definitions of success. Examples of such definitions are as follows:

"User satisfaction is defined as the extent to which users believe the information system available to them meets their information requirements" [Ives et al. 1983, 785].

Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" [Davis 1989, 320].

The measures of success associated with these definitions may not translate into increased use of the system, another measure of success found in the IS literature. To attempt a greater generalization, the effect of increased system use may have an indeterminate effect on the establishment of a niche for the organization.

The IS literature can be characterized as possessing many narrow concepts of success. One possible taxonomy of those concepts would begin by separating actual measures of success from perceived measures. The most important example of an actual measure is utilization statistics of an IS. However, such a measure ignores the integrated context in which work is actually accomplished and the extent to which information obtained from the system is actually used [Melone 1990]. Two important examples of perceived measures are the quality of information derived by the system and the usefulness of the IS in helping an employee perform his or her job better. There are other examples, such as (a) user decision-making performance and time, and (b) acceptance of and confidence in the system. Most of these perceived
measures are not completely distinct from or unrelated to one another. Many of them share a common characteristic, however, in that they are based on the notion of a user providing some form of evaluative response [cf. Melone 1990].

Brief Review of the Use of IS Success in Past IS Research

Almost all statistical relationships in past IS research have utilized a measure of success as the dependent variable of the relationship. A justification is naturally needed for a given concept to be viewed as a measure of success. Validity is the more technical term used in research for the justification of a measure. Nunnally [1978, 87] states that there are three major functions of measures and these correspond to three types of validity. They are: (a) the measurement of traits or dimensions (construct validity), (b) the representation of a specified universe of content (content validity) and (c) the establishment of a theoretically justified statistical relationship with a particular variable (predictive validity). The predictive or criterion validity will be the central theme of the present study.

The statistical relationships examined in past IS research which have a measure of success as the dependent variable can be characterized as follows:

\[ \text{Success} = f_1(\text{Controllable Policy Variables}) \]  

where: Success is one alternative measure of IS success, either perceived or actual.
Examples of controllable policy variables would include (a) the technical design characteristics of a system [Benbasat and Dexter 1985; Jarvenpaa 1989; Montazemi 1988; Raymond 1985]; (b) direct participation of users in the process of system development versus an indirect, representative-type participation; symbolic user influence on development decisions, with the system analyst making all significant decisions, versus strong control of users over decisions [e.g., Alavi and Henderson 1981; Edstrom 1977; Franz and Robey 1986; Ginzberg 1981; Ives and Olson 1984; Montazemi 1988; Robey and Farrow 1982; Robey et al. 1989]; (c) the type of system development process used, for example, traditional system development life cycle versus a prototyping approach [Alavi 1984; King and Rodriguez 1981]; and (d) the conduct of the implementation process, for example, number of system analysts present in a firm [Montazemi 1988], realism of user pre-implementation expectations [Ginzberg 1981].

As suggested by equation (1), the general approach taken in the literature was to identify and measure a set of causal factors or policy variables that could operate during the process of developing an IS and associate those factors with a measure indicating the success of the system. The statistical relationship was established for the purpose of identifying a success factor. In other words, a given policy was either successful or unsuccessful. The degree of success of the policy variable was not known a priori,
however. Therefore, the statistical relationship was used to establish the predictive validity of the policy variable and was not concerned with the predictive validity of the success measure.

The research orientation described above has been characterized by Doll and Torkzateh [1991] as "upstream" research and was clearly distinguished from a "downstream" research orientation, where a given success measure would be used as an independent variable in predicting phenomena or events related to the processes of IS development and use. Although most of the prior IS literature has emphasized the upstream perspective, the design of those studies does not permit them to answer the question as to whether a specific measure of IS success is a valid criterion against which the effectiveness of system development efforts can be compared or, what types of concepts can be best employed to measure IS success. In order to answer these questions, a downstream research perspective must be adopted.

Success itself should produce further reactions toward the IS. The downstream perspective is an examination of just those reactions. Success needs to be the independent variable and the action toward the IS, the reaction to success, becomes the dependent variable.

Past downstream research has mainly focused on the reaction occurring in system utilization [Baroudi et al. 1986; Fuerst and Cheney 1982; Lucas 1978; O'Reilly 1982; Robey 1979; Schewe 1976; Srinivasan 1985]:
System Utilization = f\(_2\)(IS Success) \hspace{1cm} (2)

It should be noted that system utilization, itself, has been used as a measure of success in many studies [e.g., Markus 1984]. More recently, the trend in IS research has been toward identification of intermediate steps in a cycle of success with adoption, acceptance, satisfaction, utilization and performance [e.g., Lucas et al. 1990]. In this view, utilization still remains as a downstream reaction.

These equation (2) studies have resulted in inconclusive research findings [Kim 1989]. The relationship is particularly problematic when system usage is mandatory [cf. Lucas 1978; Lucas et al. 1990, Study 1]. A more critical problem, however, is the lack of a theoretical basis for predicting outcomes [Melone 1990] or reactions to IS success. This dissertation adds to the body of literature in downstream research. It differs from previous studies in that it develops a theory to guide the selection of a criterion measure that should be functionally related to IS success. This criterion variable is a decision maker's intention to further develop the IS currently existing in his or her organization.

Purpose of the Study

The purpose of this study is to provide evidence on the predictive validity of IS success in explaining system development intentions. The generalized cost/benefit framework is used to identify measures of IS success. This
framework is selected because it offers a basis for theory development that is commonly used in many diverse fields of study, as in organizational psychology [e.g., Beach and Mitchell 1978; Vroom 1964], social psychology [e.g., Fishbein and Ajzen 1975] and accounting [e.g., Larcker 1981]. It is also selected because it provides both positive and negative indicators that are commonly used by managers in evaluating IS success [cf. Newman 1989].

The Research Model

A decision maker is an organizational member with authority over system development decisions (for example, an organization’s financial controller). As the theoretical development at the end of the next chapter will show, a decision maker’s intention to develop is closely related to concepts developed in change theories. However, it is more similar to theories which utilize concepts of a probabilistic nature (e.g., Fishbein and Ajzen [1975]; Vroom [1964]), rather than to theories which utilize discrete concepts (e.g., Cooper and Zmud [1990]; Mintzberg et al. [1976]; Rogers [1983]). The first relationship that can be developed here is as follows:

\[ \text{Intent} = f_3(\text{Generalized Cost/Benefit Measure}) \]  (3)

where: Intent is the intention to further develop the existing IS.

Generalized Cost/Benefit Measure (GC/BM) is a measure of cost/benefit that recognizes the inability to quantify benefits in economic terms.

The relationship between the GC/BM and Intent finds
theoretical justification upon the cost/benefit principle. Decisions about capital budgeting projects, which share characteristics with system development decisions, are frequently evaluated on cost/benefit criteria [cf. Horngren 1982; Larcker 1981]. Therefore, similar criteria should be useful in explaining intentions about system development. Due to the inability to quantify IS benefits in any objective way and, also, due to the difficulty of isolating system impacts upon an organization or users, it is necessary to use the generalized (non-quantitative) form of the principle. The application of the generalized form of the principle in many diverse domains is reviewed in the next chapter. The application of the principle in the research model of the present study seeks supporting evidence from those related domains.

In equation (3), generalized benefit is measured by a change in the success of the existing IS that is due to the intended development. In order to apply this incremental approach, IS success will be measured through a comparison between judgments on the existing system and judgments on the new system, that is, the one that would result from a future development of the existing system. Similarly, generalized cost is measured by the expected incremental cost that is necessary to introduce the intended IS project. Hence, equation (3) can be restated as:

\[ \text{Intent} = f_4(\Delta\text{Success}, \Delta\text{Cost}) \]
where:  \( \Delta \text{Success} \) is the perceived success of the intended change in relation to the existing IS.

\( \Delta \text{Cost} \) is the expected incremental cost of the intended change.

In the IS literature, two approaches are used most frequently to measure perceived IS success. The first approach focuses upon the perceived usefulness of an IS or perceived system usefulness (SU) [Davis 1989; Robey 1979; Schultz and Slevin 1975], while the second focuses upon the perceived quality of the information generated by an IS or perceived information quality (IQ) [Bailey and Pearson 1983; Doll and Torkzateh 1988; Ives et al. 1983; O'Reilly 1982; Zmud 1978]. Each approach can offer a set of items that are part of the domain of perceived IS success. The present study utilizes the concepts of SU and IQ in measuring perceived IS success. Therefore, the basic relationship considered in this work becomes:

\[
\text{Intent} = f_{\text{ Intent}}(\Delta \text{SU}, \Delta \text{IQ}, \Delta \text{Cost})
\]

where:  \( \Delta \text{SU} \) is a measure of the perceived usefulness of the change in the IS relative to the existing IS.

\( \Delta \text{IQ} \) is a measure of the perceived information quality of the change in the IS relative to the existing IS.

This study will test the ability of the two IS success concepts in predicting intentions to further develop an existing IS. The research hypotheses to be examined in this study can be stated as follows:

A decision maker's intention to develop will be:

H1: positively associated with his or her incremental information quality beliefs;
H2: positively associated with his or her incremental system usefulness beliefs; and

H3: negatively associated with incremental cost beliefs.

The positive association hypothesized in H1 and H2 between intention to develop and the two perceived IS success concepts (IQ and SU) is predicated upon the cost/benefit principle. Higher expected benefits from a future state than the benefits obtained from an existing state, would indicate a propensity to modify an existing IS. The negative association between the perceived cost and intention to develop, is also based upon the cost/benefit principle. The higher the incremental cost necessary to move to a desired future state, the lower the probability of moving to that state.

Outline of the Study

The next chapter presents a review of research that is related to the research questions of the present study. Chapter 3 presents the method employed for instrument development, data collection and measurement of the research variables. Chapter 4 presents the data analysis and results in examining the construct validity of the scales included in the research instrument. Chapter 5 examines the three research hypotheses of the study and presents the findings from the empirical analysis. Finally, the last chapter discusses the findings, suggests areas where those findings could have a useful contribution, identifies limitations in the study and presents suggestions for future research.
CHAPTER 2
REVIEW OF RELATED RESEARCH

This chapter reviews significant lines of research that are related to the research questions of this study. Research on the measurement of IS success is reviewed first, followed by a review of research in other disciplines that relates to the concepts examined in the present study. Basic research that developed a set of theories explaining change phenomena is reviewed also. Research that provides theoretical and empirical support for the research model of this study is reviewed in the last section.

Alternative Measures of IS Success

In the early IS literature, two concepts were thought to provide alternative measurements for IS success. Those relate to system utilization and user information satisfaction [cf. Ginzberg 1979]. User information satisfaction (UIS) has received the greater attention and serves as the primary construct by which information systems are evaluated and behavioral issues examined [Ives et al. 1983].

System utilization studies assume that the acceptance of a system by its users in an organization could be a measure of its success [Markus 1984]. The extent to which a system is utilized by users was furthermore assumed to be one indicator of their acceptance of the system [e.g., Lucas 1975, 1981; Swanson 1974]. In general, there is a
preference in the literature for perceived rather than objectively-measured use [cf. Robey 1979]. The difficulty with using system utilization as a measure of IS success is that it should be measured only when there is a choice between alternative systems [Lucas 1978]. In most cases, system utilization is not voluntary, since no other system is available for use [Lucas et al. 1990]. For this reason, the use of system utilization as a measure of IS success is not considered further.

Research on the Measurement of User Information Satisfaction (UIS)

User information satisfaction (UIS) is assumed to reflect the satisfaction of users with their information system. Bailey and Pearson [1983] represented the first comprehensive effort to provide a valid measure of the concept. They defined UIS as the sum of a system user’s beliefs or attitudes toward a variety of items [p. 531], that is, the individual’s reaction to an item relative to his perceived information requirements [p. 533]. The items included in the instrument related to both the system product (characteristics or attributes of the output information, e.g., output accuracy, reliability, timeliness, relevancy) and to the support provided during development (e.g., time required for new developments, processing of change requests, flexibility and integration of the system, degree of training, top management involvement). The instrument employs 39 items, with each being evaluated on
four adjective pairs on a semantic differential scale. The term "user information satisfaction" may not encompass support provided during development. A more informative label would have been "user information and system satisfaction." For consistency with past studies, however, the use of the original label will be continued.

One criticism of the instrument is that its mere length presents practical problems for its effective administration in applied settings. Another criticism relates to the inclusion of items that could be antecedents to UIS, e.g., situational factors related to the development environment, with items that could indicate UIS. This criticism was first made by Treacy [1985] and later by Doll and Torkzateh [1988], Kim [1989] and Galletta and Lederer [1989]. The validity of that argument, however, depends upon the boundary assumptions that are made about the concept of UIS. Bailey and Pearson attempted to measure a wide range of phenomena that would generalize to the broad content of systems development. They contributed an instrument that has been widely used in IS research. As the field matures, the definition and measurement of concepts should be better refined.

Ives, Olson and Baroudi [1983] further validated the Bailey and Pearson [1983] instrument. In their study, three factors emerged from the original set of 39 items (the instrument was further reduced into a short form of 13 items): (a) EDP services and staff (items relating to the IS
function/support); (b) information product (items relating to the quality of output information); and (c) knowledge or involvement (items relating to user training and participation in development).

Baroudi and Orlikowski [1988] also reported a similar factor structure in an evaluation of the short-form 13-item instrument. The instrument had also been used in other studies and similar conclusions were reached about its factor structure [Miller and Doyle 1987; Montazemi 1988; Raymond 1985].

Treacy [1985] has criticized the Bailey and Pearson [1983] instrument mainly because of the heterogeneity of items included in it. Including in the instrument items relating to situational factors or antecedent variables to UIS (for example, extent of involvement in development and management support), violates the assumption of item homogeneity. In Treacy's [1985] psychometric validation of the Bailey and Pearson [1983] instrument, the "information product" or "quality of information output" factor attained the most satisfactory results. Individual measures which comprised that factor displayed close semantic congruence, high reliability (Cronbach α=0.943) and were able to discriminate the theoretical variable.

Using the Bailey and Pearson [1983] instrument as a basis, Doll and Torkzateh [1988] developed a new instrument that attempted to measure "end-user computing satisfaction." Their instrument was exclusively concerned with the
"information quality" items of the Bailey and Pearson instrument, with the other set of items in the original instrument being excluded on the grounds earlier presented by Treacy.

Areas of Information Quality

A description of detailed information quality concepts that were examined in the past IS literature is provided in Appendices A and B. Definitions that were advanced in those studies are also presented in the Appendices. To gain a better understanding of those detailed concepts, a summary or categorization of them is necessary. Three categories of information quality can be arrived at [cf. Ahituv and Neumann 1982]: (a) information content, (b) information timeliness and (c) information format or accessibility.

Ahituv and Neumann [1982] define information content to refer to such information attributes as accuracy, precision, reliability, relevance and completeness. Completeness relates to the comprehensiveness, sufficiency, or adequacy of the output contents. Relevance relates to the usefulness, significance, or need for a particular piece of information in performing a function or making a decision. The attributes of accuracy, precision and reliability can be all defined in the same manner, as they all indicate that information does not vary from what it purports to measure.

Information timeliness refers to the timely presentation of a report and to the currency (i.e., age) of the output information. In an early analysis of the concept
of timeliness of managerial accounting information, Feltham [1968] indicated that timeliness refers to a reporting interval (i.e., frequency of reporting) and a reporting delay (i.e., time interval between occurrence of an event and reporting its impact). The current conceptualization of timeliness in the IS literature is very close to Feltham's [1968] original proposal.

In terms of information format, the traditional concern has been with the layout and readability of information on a report. The concept of information format, however, is semantically close to the concept of "accessibility" which has been studied in the disciplines of information science [e.g., Culnan 1984, 1985] and interpersonal communications [e.g., O'Reilly 1982; Zmud et al. 1990]. An extensive survey of indicators for the concept of accessibility that were used in both the IS and related bodies of literature is presented in Appendix B. Culnan [1984, 1985] has concluded that accessibility is a multidimensional concept and encompasses dimensions relating to the physical access to the system, to the ability to form a query once access to the system has been gained and to the ability to retrieve potentially relevant information. The last dimension (termed "information accessibility") is most closely related to information format, although in the case of information contained in a report the major accessibility issues would relate to clear and orderly displays or layouts, its readability, organization, use of concise language and ease
of interpretation.

Past IS literature has in general been in consensus about the information attributes described above. The IS literature, however, has not considered additional types of information attributes that were developed in managerial and financial accounting. For example, the Statement of Financial Accounting Concepts No. 2 [FASB 1980] describes the qualitative characteristics of accounting information and defines additional information attributes such as those relating to the level of aggregation of information (also, Chenhall and Morris [1986]), its comparability, feedback value and predictive value. Several studies on the design of management accounting systems [e.g., Chenhall and Morris 1986; Dermer 1973; Gordon and Miller 1976; Gordon and Narayanan 1984; Larcker 1981] have also examined such information attributes as those relating to the focus of information (internal or external), its quantification (financial or nonfinancial) and its time horizon (ex post or ex ante). Swanson [1987] presents an additional information attribute that relates to its "motivating" aspect and that could be associated with the use of budget-based information for subordinate motivation [cf. Hayes and Millar 1990]. All of these information attributes, along with those that were examined in the IS literature, are summarized in Table 1. In examining Table 1, two sets of information attributes can be identified: a smaller set found in the IS literature and a more complete set found in the accounting literature.
Categories of Information Quality with Specific Attributes Examined in the IS Literature

Information Content
  Accuracy Components:
    Accurate, correct, reliable, precise, consistent, or objective (no surprises).
  Relevance:
    Relevant, useful, helpful, or congruent with its intended use.
  Completeness:
    Complete, sufficient, comprehensive, or adequate.

Information Timeliness
  Timely, up-to-date, or current.

Information Format or Accessibility
  Useable or readily accessible for use, i.e., can be easily interpreted, report format is clear and understandable, output contents are orderly arranged and readable.

Additional Categories of Information Quality with Specific Attributes Examined in the Accounting Literature.

Aggregation:
  Level of aggregation is presented at the desired unit(s) of analysis -- functional areas, time periods.

Comparability:
  Information is comparable with output information reported in prior periods, for other divisions, product lines.

Feedback Value:
  Information that assists in confirming or adjusting prior expectations, information to monitor prior decisions.

Predictive Value:
  Information that helps in forecasting the outcome of past or present events.

Focus:
  Internal or external.

Quantification:
  Financial or nonfinancial.

Time horizon:
  Ex post (historical) or ex ante (future-oriented).
Enhanced content validity would be among the benefits of using the set of information attributes developed in accounting.

Research on Perceived System Usefulness

Alternative conceptualizations of system success were presented by several other IS studies that used concepts not directly related to the information output of the information system. Those concepts were mostly based upon expectancy theory [cf. Vroom 1964]. For example, Schultz and Slevin [1975], Robey [1979] and Schewe [1976], each measured the "perceived worth" or "value" of an information system. Davis [1989] developed an instrument that measured "perceived system usefulness," a concept which was a direct extension of those earlier studies. Perceived system usefulness was defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [Davis 1989, 320]. Three different dimensions of system usefulness were identified. They were related to contributions or impacts of the system upon (a) job effectiveness, (b) user productivity and time savings and (c) the importance of the system to one's job. Lucas et al. [1990] also developed the concept of a user's "personal stake," which is semantically very similar to the concept of system usefulness. Appendix C presents the detailed concepts that were used in prior IS studies to measure system usefulness.

Table 2 categorizes the detailed concepts presented in
Appendix C and presents examples to support the resulting classifications. Studies which examined the need for different types of systems to address different information processing needs [cf. Alloway and Quillard 1983; Johnson 1984; Kaplan 1988, 1990; Money et al. 1988; Zmud 1983] can suggest areas on which each system type can have an impact. The usefulness of a system could therefore be assessed by considering its potential contribution to the attainment of objectives in those areas where it has an impact. A number of examples illustrating this process could be constructed using the categories presented in Table 2. To provide one example, enhanced operational efficiency could be an indicator of the usefulness of a transaction processing system which has a primary impact upon the operational level of an organization.

Integration of the Concepts of IS Success

In a review of the concept of user satisfaction in the IS literature, Kim [1989] has concluded that it has been studied from three different perspectives: (a) user satisfaction in terms of attitudes toward the IS (US-A), (b) user satisfaction in terms of information quality (US-IQ) and (c) user satisfaction in terms of IS effectiveness (US-E). Kim's three perspectives can be contrasted with the alternative approaches to IS success, as identified previously. US-A appears to be best represented by Bailey and Pearson's [1983] approach, US-IQ by Doll and Torkzateh's [1988] approach, and US-E by Davis' [1989] approach. Table
### TABLE 2

**UNIFYING CONCEPTS OF INFORMATION SYSTEM USEFULNESS**

<table>
<thead>
<tr>
<th>Transaction Processing</th>
<th>Management Support</th>
<th>Strategic Analysis and Decision Support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational or</strong> Administrative Efficiency</td>
<td>Operating Process (Short-Term) Efficiency, e.g., -Cost control -Organizational Productivity Enhance Profitability Supply Products/ Services on Time Enhance Employee Satisfaction</td>
<td>Improve Service Quality Gain Competitive Advantage Improve Product or Output Quality Enhance Individual: - Job Performance - Productivity - Decision Effectiveness</td>
</tr>
</tbody>
</table>

**System Type Labels**

- **Kaplan [1990]:**
  - Financial Reporting: Operational Control
  - Alloway and Quillard [1983]:
- **Zmud [1983]:**
  - Transaction Analysis: Information Reporting Decision Support Systems
- **Raymond [1985]:**
  - Transactional Applications: Administrative Applications

**System Type Examples**

- **General Ledger:** Exception Reporting Decision Modeling
- **Inventory Control:** Budget Variances Sensitivity Analysis
- **Payable/Receivable:** Sales Analysis Product Pricing, Mix, Costing
- **Order Entry/Billing:** Fin. Projections

**Areas of Impact**

- **Operational Level:** Management Planning Organizational and Control Posture Performance Individual Manager’s Evaluation Effectiveness Subordinate Motivation Intraorganizational Communication
3 presents and contrasts the three instruments developed in each of those approaches. The instruments are contrasted on the basis of their domain of application, purpose and dimensionality.

In his review, Kim criticized the perspective of user satisfaction in terms of attitudes toward the IS (US-A) and, particularly, Bailey and Pearson's instrument, as lacking content validity for being an adequate indicator of IS effectiveness. If one excludes the situational factors from the Bailey and Pearson instrument, however, the items remaining in it are similar to the ones studied under the perspective of user satisfaction in terms of information quality (US-IQ). As a result, in this research, no distinction is made between the US-A and US-IQ perspectives, but a single US-IQ perspective is followed, along with the US-E perspective. Kim's development of these two perspectives has had a strong influence upon the concepts selected to be examined in the present research.

As mentioned in many previous studies, the effectiveness or success of an IS can be evaluated by the extent to which the IS enhances user effectiveness and contributes to the accomplishment of organizational objectives such as productivity, profitability, flexibility and competitiveness [cf. Hamilton and Chervany 1981; Newman 1989; Nolan and Seward 1974; Schultz and Slevin 1975]. Studies that examined the "value" of introducing an IS into an organization [cf. Alavi 1982; Keen 1981; Money et al.
TABLE 3

ILLUSTRATIONS OF KIM’S [1989] THREE PERSPECTIVES ON USER SATISFACTION WITH AN INFORMATION SYSTEM


Domain of Application:
User: Primary IS users (no direct interaction with the IS itself).
System: Whole IS environment (not application-specific).

Purpose:
To measure a user’s satisfaction with the information product and the IS support provided in the firm. This measure has two objectives: (a) to help improve the productivity of an IS, i.e., improve efficiency in the supply and effectiveness in the utilization of ISs and (b) to predict system success, as measured by the utilization of system outputs.

Principal Dimensions:
a) Satisfaction with the organizational support for developing and maintaining the system, for example, satisfaction with EDP services and staff, user knowledge/training, user involvement in development.
b) Satisfaction with the information product (i.e., system output). Mainly relating to information content (relevance, accuracy, precision, timeliness) and information presentation (format, mode).

Items in Short-Form Instrument (as reported by Ives et al. [1983]):
Information Product:
- Reliability of output.
- Relevancy of output.
- Accuracy of output.
- Precision of output.
- Completeness of output.
EDP Staff and Services:
- Relationship of users with EDP staff.
- Processing of requests for changes.
- Attitude of EDP staff.
- Communication with EDP staff.
- Time required for new system development.
Knowledge and Involvement:
- Degree of EDP training provided to users.
- Users’ understanding of the system.
- Users’ sense of participation in development.
TABLE 3 (continued)

US-IQ: Doll and Torkzateh [1988]

Domain of Application:
User: End users/DP amateurs (both use and develop personal applications).
System: Specific end-user computing applications.

Purpose:
To measure "end-user computing satisfaction," a surrogate for utility in decision making. An end-user application's utility is enhanced when outputs meet the user's information requirements (information product factor as in the Bailey and Pearson instrument) and the application is easy to use. The objective is to evaluate specific end-user applications in order to help build better applications and realize social and economic benefits from IT investments.

Principal Dimensions:
a) Satisfaction with information product (system output).
b) Satisfaction with an application's ease of use.

Items:
Content:
Does the system provide precise information?
Does the information content meet your needs?
Does the system provide reports that seem just about exactly what you need?
Does the system provide sufficient information?
Accuracy:
Is the system accurate?
Are you satisfied with the system's accuracy?
Format:
Is the output presented in a useful format?
Is the information clear?
Ease of Use:
Is the system user friendly?
Is the system easy to use?
Information Timeliness:
Do you get the information you need in time?
Does the system provide up-to-date information?
TABLE 3 (continued)

US-E: Davis [1989]

Domain of Application:
User: End users.
System: Specific end-user applications.

Purpose:
To measure an end user’s perception of usefulness associated with a specific system. Perceived system usefulness is the degree to which a person believes that using a particular system would enhance his or her job performance. The objective is to predict whether a particular application will be accepted (used) by prospective end users.

Principal Dimension:
Perceived information system usefulness.
Clusters of system usefulness:
1. Job effectiveness.
2. Productivity/time savings.
3. Importance of system to one’s job.

Items:
Quick accomplishment of tasks.
Improved job performance.
Increased (user) productivity.
Enhanced job effectiveness.
Easier to do one’s job.
Overall Usefulness.
1988; Smith 1983; Thierauf 1982; Wagner 1981] have emphasized the importance of intangible benefits in evaluating the effectiveness of that system. Appendix D presents a summary of the intangible benefits examined in these studies and it also categorizes benefits according to areas (operational, managerial, personal) with which they primarily relate.

The perceived quality of the output information derived by the IS, which is equivalent to Kim's US-IQ perspective, could be the best indicator of UIS. Ives et al. [1983, 785] define UIS as "the extent to which users believe the information system available to them meets their information requirements." As presented previously, three basic categories of information quality have been examined in past IS research. They represent characteristics of output information that can support the information requirements or decision making needs of IS users. The concept of perceived information quality is one measure that can indicate the success of the system in meeting user information requirements. This concept is used in the present research as one principal measure of IS success.

The concept of system usefulness, as defined and operationalized by Davis [1989], is equivalent to Kim's [1989] perspective on user satisfaction in terms of IS effectiveness (US-E). The concept of IS effectiveness has been used in the prior literature (as in those studies reviewed in Appendix C) to refer to the perceived
contribution of the IS in attaining personal and organizational objectives. That is, perceived IS effectiveness or perceived system usefulness refers to a set of beliefs about the potential outcomes of using an IS or of introducing a new system into an organization. The concept of perceived system usefulness is another measure that can indicate the success of the system in enhancing user effectiveness and in contributing to the attainment of objectives. This concept is used in the present research as one principal measure of IS success, along with the concept of perceived information quality.

In conclusion, the literature reviewed in this section emphasizes two concepts of IS success, perceived information quality (IQ) and perceived system usefulness (SU). The present study will adopt these two concepts. The next section looks at research from other disciplines that could have an impact upon the two concepts of IS success.

Research in Related Disciplines

Both analytical and empirical research in other disciplines have studied concepts that are related to the concepts selected in this study in the following ways: (a) to the issue of identifying a comparative basis against which IS success is measured; (b) to the use of information quality as a variable that could explain variations in system design choices; and, (c) to the conceptual distinction between the two concepts of IS success, that is, perceived information quality (IQ) and perceived system
usefulness (SU).

Comparative Referent

The choice of a numeraire or standard measure of comparison is an important aspect of the process by which an enterprise’s success is measured in financial accounting. For example, standard measures of value or measures of a numeraire of a system that were developed in economics, such as the consumer price index (CPI) or general purchasing power of money, were adopted in financial accounting and used in price-level financial reporting [FASB 1974, 1979]. Measures of an enterprise’s success could be different according to the numeraire used; for example, success relative to the activity of holding a given amount of wealth in a market basket of goods (as indicated by the CPI) over time, success relative to holding money over time (the traditional financial accounting numeraire), or success relative to holding gold over time (a numeraire used early in the century) [cf. Masoner 1980]. The particular numeraire adopted, therefore, is important in determining success. As a result, the concern with a numeraire or comparative referent is central to financial accounting.

More recently, Cameron [1986] and Cameron and Whetten [1983b] introduced a very similar issue in the organizational effectiveness literature. Cameron developed a set of questions which can be used to bound the scope of research. One question which is most relevant for the present study inquires about the referent against which
effectiveness or success is judged. Such a judgment could be: (a) comparative, e.g., success of one system against another; (b) normative, e.g., success relative to an ideal standard or objective; (c) goal-centered, e.g., comparison of success indicators against a set of goals; (d) improvement, e.g., comparison of present success against past performance on the same indicators; and (e) trait, e.g., success relative to whether the system possesses certain desirable traits or static characteristics.

Prior IS studies that dealt with the measurement of success did not consider the issue of specifying the referent against which success is judged. Table 4 illustrates how the items from the Bailey and Pearson [1983] and Davis [1989] instruments could be modified to explicitly specify the comparative referent. As Table 4 illustrates, items in the perceived usefulness scale developed by Davis [1989] imply an improvement over some implicit alternative. In contrast, the items in the Bailey and Pearson [1983] instrument imply an absolute assessment of information quality.

Contrary to past studies, the specification of the numeraire is made explicit in this study. As explained in the presentation of the research model, the numeraire for the concepts measured in the present study is the IS currently existing in an organization. Judgments concerning IQ and SU beliefs will refer to a new IS or to a change in the existing IS and will be made using the existing IS.
(i.e., the numeraire) as the comparative basis. Specifically, this study’s respondents will respond to each item using two scales: one for the future system that would result from a specified IS project and, as a referent, one scale for the IS currently existing in their organizations. A detailed discussion of the research method adopted in this study is presented in the next chapter.

**Importance of Information Characteristics in Management Accounting Systems Research**

As previously noted (and as illustrated in Table 1), the information characteristics investigated in studies on management accounting systems design [Chenhall and Morris 1986; Gordon and Miller 1976; Gordon and Narayanan 1984; Larcker 1981] formed a more complete set of attributes than

<table>
<thead>
<tr>
<th>TABLE 4</th>
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<tbody>
<tr>
<td><strong>COMPARATIVE REFERENT IN IS SUCCESS INSTRUMENTS</strong></td>
</tr>
</tbody>
</table>

**Bailey and Pearson [1983]: Example of an Original Item**
Relevancy of output information (to intended function).

**Bailey and Pearson [1983]: Modified Item to Explicitly Specify the Comparative Referent**
Relevancy of output information (to intended function) provided by the IS existing in my organization, as compared to the relevancy of output information provided by other IS’s I have used in the past.

**Davis [1989]: Example of an Original Item**
Using the system in my job would enable me to accomplish tasks more quickly.

**Davis [1989]: Modified Item to Explicitly Specify the Comparative Referent**
Using the system currently existing in my organization would enable me to accomplish tasks as quickly as would be possible with the best system I would like to use in the future.
those examined in the IS literature. Examples of information characteristics examined in these studies include: information focus, quantification, time horizon, timeliness, comparability, aggregation and integration of information about the activities of interrelated subunits.

The studies cited above, as well as case studies performed in a pricing decision context [cf. Breath and Ives 1986], contribute to the recognition of perceived information quality as a significant component of IS success. The early Gorry and Scott Morton [1971] framework also makes a similar contribution in addressing the issue of how well a set of information characteristics can support different levels of managerial activity (for example, the time horizon of information is ex post in operational control but ex ante in strategic planning).

It is worthwhile to note that in Chenhall and Morris [1986], the two concepts of perceived information quality and perceived system usefulness were merged together. The authors identified perceived system usefulness as the concept of interest in their study and measured the concept using perceived information quality, that is, items relating to perceived information characteristics. As a result, the measurement scales were designed to capture the "usefulness" of each information characteristic in carrying out the overall tasks in a respondent's organizational unit. The merging of the two concepts, however, is an assumption that was made by those investigators.
Conceptual Distinction Between the Two Concepts of IS Success

In the field of organizational analysis, researchers have been long concerned with the measurement of the effectiveness of organizations [e.g., Georgopoulos and Tannenbaum 1957]. This body of research did not draw upon the earlier research on the same subject in accounting. IS research has also not drawn upon either body of literature (with the single exception of Melone [1990]). Research in OE has finally reached a consensus that effectiveness or success is a construct that is subject to examination from multiple perspectives [e.g., Lewin and Minton 1986; Quinn and Rohrbaugh 1981, 1983].

Cameron and Whetten [1983a] suggest that, in order to understand the construct of OE, the various models of OE must be clarified. Models of OE are direct products of multiple, arbitrary models of organizations (e.g., the rational, natural system and open system models discussed in Scott [1987]). Each model of organizations focuses on different phenomena and uses different criteria to judge effectiveness. Each model captures a different and independent aspect of organizational strength. From this observation, it follows that a single model of OE does not encompass the total meaning of effectiveness; each model maps part of the construct space of effectiveness. In addition, there is not sufficient evidence suggesting that one model (and the phenomenon it represents) is more important than any other model. As a result, the different
models of OE should not be viewed as competing alternatives.

The OE literature seems to agree on four different models. The rational system model emphasizes goal attainment (where goals are defined as desired end states [Etzioni 1964]), such as output quantity, quality, productivity and efficiency [cf. Campbell 1977; Georgopoulos and Tannenbaum 1957; Friedlander and Pickle 1968; Gouldner 1959; Molnar and Rogers 1976; Scott 1977, 1987; Steers 1975]. The open system model emphasizes interactions with the environment, such as effectiveness of resource acquisition and utilization [Katz and Kahn 1978; Molnar and Rogers 1976; Seashore and Yuchtman 1967; Yuchtman and Seashore 1967]. The natural system model emphasizes a set of support (self-maintenance) goals, such as participant satisfaction and morale, in addition to the set of output goals that are emphasized by the rational system model [cf. Campbell 1977; Gouldner 1959; Scott 1977, 1987]. The decision process model emphasizes the effectiveness of the processes of information acquisition and utilization in problem solving activity [Quinn and Rohrbaugh 1983; Seashore 1983].

Campbell [1977], in his integration of the OE literature, collected a list of the criteria he had found in the prior literature to "have been proposed seriously as indices of organizational effectiveness" [1977, 36]. These criteria are summarized in Table 5. As Campbell [1977, 39] states, "There are simply a lot of them and there have been
precious few attempts to weed out the overlap and get down to the core variables."

Quinn and Rohrbaugh [1981, 1983] empirically analyzed the criteria identified by Campbell [1977]. Using multidimensional scaling, they integrated the criteria of Table 5 into the form found in Figure 1. Their analysis resulted in three perceptual dimensions of effectiveness, including: (a) an internal, person-oriented emphasis, versus an external, organization-oriented emphasis, (b) a contrast in organizational preferences between stability or control and flexibility or change and (c) a means-ends continuum or the degree of closeness of each criterion to desired organizational outcomes. The four models of organizations that were reviewed above produced the many criteria of Table 5 which in turn were integrated into the three dimensions of Figure 1. Quinn and Rohrbaugh's [1981, 1983] findings were useful in defining the construct of effectiveness in a more precise manner, as compared to the use of an unwieldy number of effectiveness criteria.

Table 5 and its reorganization in Figure 1 provide a broader perspective of success than any other body of literature reviewed here. From this broader perspective, the perceived quality of information (IQ) derived from the system could be equivalent to the emphasis of the natural system model on support goals, while the user perceived usefulness of the system (SU) in contributing to the attainment of valued outcomes could be equivalent to the
<table>
<thead>
<tr>
<th>1. Overall effectiveness</th>
<th>2. Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Efficiency</td>
<td>4. Profit</td>
</tr>
<tr>
<td>5. Quality of output</td>
<td>6. Accidents</td>
</tr>
<tr>
<td>7. Growth</td>
<td>8. Absenteeism</td>
</tr>
<tr>
<td>11. Motivation</td>
<td>12. Morale</td>
</tr>
<tr>
<td>15. Flexibility/adaptation</td>
<td>16. Planning and goal setting</td>
</tr>
<tr>
<td>17. Goal consensus</td>
<td>18. Internalization of organizational goals</td>
</tr>
<tr>
<td>19. Role and norm congruence</td>
<td>20. Managerial interpersonal skills</td>
</tr>
<tr>
<td>21. Managerial task skills</td>
<td>22. Information management and communication</td>
</tr>
<tr>
<td>23. Readiness</td>
<td>24. Utilization of environment</td>
</tr>
<tr>
<td>25. Evaluations by external entities</td>
<td>26. Stability</td>
</tr>
<tr>
<td>27. Value of human resources</td>
<td>28. Participation and shared influence</td>
</tr>
<tr>
<td>29. Training and development emphasis</td>
<td>30. Achievement emphasis</td>
</tr>
</tbody>
</table>

Source: Campbell [1977, 36-9].
emphasis of the rational system model on output goals.

The present research does not aspire to conceptualize and measure IS success along the whole range of effectiveness dimensions. As Melone suggests, the multiplicity of perspectives in OE explicitly indicates that "Separate measures of the various components of IS effectiveness are likely to be a far more useful managerial tool than is any scalar summary measure of effectiveness" [1990, 78]. This study provides an initial attempt to adopt multiple measures. At the same time, the completeness of the measures used (content validity) becomes a distant ideal as a result of the insights gained from the OE literature.

Figure 1. Models of Organizational Effectiveness

<table>
<thead>
<tr>
<th>Natural System or Human Relations Model</th>
<th>Open System Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Means: Coherence; Morale</td>
<td>Means: Flexibility; Readiness</td>
</tr>
<tr>
<td>Ends: Human resource development</td>
<td>Ends: Growth; Resource acquisition</td>
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<td></td>
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<tr>
<td>Output</td>
<td>Flexible Internal --------------------- External</td>
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<tr>
<td>Quality</td>
<td></td>
</tr>
<tr>
<td>Means: Information management; communication</td>
<td>Means: Planning; Goal setting</td>
</tr>
<tr>
<td>Ends: Stability; control</td>
<td>Ends: Productivity; Efficiency</td>
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<td></td>
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<tr>
<td>Control</td>
<td>Rational Goal Model</td>
</tr>
</tbody>
</table>

Source: Quinn and Rohrbaugh [1983, 369].
Review of Basic Research on Change Theories

Information systems development can be thought of as a process of change. The study of phenomena related to IS development presents the need to examine whether these phenomena can be explained by a theory that deals with change. A number of approaches toward such a theory are summarized in Table 6. The different approaches in Table 6 can be classified according to whether the concepts are measured in (a) a discrete/deterministic manner, as discrete events or types of behavior which occur at each of the stages of change [e.g., Cooper and Zmud 1990; Mintzberg et al. 1976; Rogers 1983], or (b) in a continuous/probabilistic manner, as particular behaviors which an individual intends to perform with some degree of probability [e.g., Fishbein and Ajzen 1975; Vroom 1964].

The approaches in Table 6 can also be classified according to the level of analysis that is used. For example, the studies in Table 6 indicate two approaches: (a) the individual level [Fishbein and Ajzen 1975; Rogers 1983; Vroom 1964], and (b) the innovation decision or event level [Cooper and Zmud 1990; Mintzberg et al. 1976].

Each of these approaches, however, possesses a degree of similarity to Lewin’s [1947, 1958] original change theory. Lewin’s theory combines both the discrete behaviors that may be found in different stages of change and the probabilistic notion of a force that induces progression along the stages. In this study, the criterion measure that
is used to indicate IS development or change phenomena is a decision maker's intention to undertake development, a probabilistic measure of change. As a result, the criterion measure of the present study is more similar to theories which utilize concepts of a probabilistic nature (e.g., Fishbein and Ajzen [1975]; Vroom [1964]) than to theories which utilize discrete concepts (e.g., Cooper and Zmud [1990]; Mintzberg et al. [1976]; Rogers [1983]).

The theories that utilize discrete concepts would also suggest that a change activity, such as IS development, would proceed through a number of sequential stages. The possibility of defining the criterion measure of this study in terms of a number of sequential stages has been considered. If that approach had been adopted, the criterion measure should have distinguished among intentions occurring at each of the stages, for example, an initial intention to introduce an IS project and an intention to adopt a given alternative solution. The approach adopted in this study, however, considers IS development phenomena at a single point in time where a specific "go" or "no-go" decision is made with respect to a project that is currently under consideration. Accordingly, a decision maker's intention to undertake development is assumed to result in a decision that is made at that single point in time. A decision maker's intention to develop is therefore measured in terms of a probability to undertake the IS project.
<table>
<thead>
<tr>
<th>Source</th>
<th>Concept/ Theory</th>
<th>Context of Application</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lewin [1947]</td>
<td>Forces of change.</td>
<td>Stages defined as unfreezing, moving and refreezing.</td>
<td>Specific types of behaviors are exhibited at each stage.</td>
</tr>
<tr>
<td></td>
<td>Theory of change.</td>
<td>Moving stage is where IS development would occur.</td>
<td>Motivational forces induce progress.</td>
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<tr>
<td>Rogers [1983]</td>
<td>Innovation decision process.</td>
<td>Individuals adopt innovations based on five stages: knowledge about innovation, formation of attitude, decision to adopt, implementation, confirmation.</td>
<td>Specific types of beliefs and behavior are exhibited.</td>
</tr>
<tr>
<td>Cooper and Zmud [1990]; Kwon and Zmud [1987] (Lewin).</td>
<td>Technological diffusion stages: initiation. adoption &amp; adaptation.</td>
<td>IS development would occur at adoption and adaptation (i.e., Lewin's moving stage).</td>
<td>Deterministic events occur at each phase. Decision maker forms beliefs/intentions that induce progress from one phase to the next.</td>
</tr>
<tr>
<td>Source</td>
<td>Concept/ Theory</td>
<td>Context of Application</td>
<td>Measurement</td>
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<tr>
<td>Fishbein and Ajzen</td>
<td>Intention</td>
<td>Behavioral intent</td>
<td>Intention is a person's subjective probability to</td>
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<td>[1975]; Ajzen and</td>
<td>behavior.</td>
<td>mediates between</td>
<td>perform some behavior.</td>
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<td>Fishbein [1977,</td>
<td>Theory of</td>
<td>attitude/beliefs and</td>
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<td>outcomes and their</td>
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<td>evaluation.</td>
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<td>Vroom [1964];</td>
<td>Force to</td>
<td>Force is the motivation</td>
<td>Level of effort exerted to perform the behavior,</td>
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<tr>
<td>Mitchell [1974,</td>
<td>perform</td>
<td>to perform the behavior.</td>
<td>e.g., zero effort to a great deal of effort.</td>
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<tr>
<td>1982].</td>
<td>behavior.</td>
<td>It is the result of a</td>
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<tr>
<td></td>
<td>Expectancy</td>
<td>cognitive calculus</td>
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<td></td>
<td>theory.</td>
<td>about outcome</td>
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<tr>
<td></td>
<td></td>
<td>expectations and their</td>
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<td>evaluation.</td>
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</table>
Theoretical and Empirical Support for the Research Model

A decision maker's intention to develop, the criterion measure of the present study, could be based upon a cost/benefit justification, as with any other capital budgeting project [e.g., Horngren 1982]. In the case of IS projects, however, the quantification of the necessary variables, and particularly the benefits, is not possible. Nevertheless, whether a quantitative analysis can be performed or not, the cost/benefit justification should always exist. The approach adopted in this study draws from the quantitative principle developed in accounting and applies that principle in a qualitative manner. As reviewed below, a similar qualitative application of the principle also is found in other disciplines.

In applying the cost/benefit principle, it may be difficult to establish the direction of causality. The problem is that the cost/benefit analysis could be performed for the purpose of justifying a decision that has already been made. Such after-the-fact justification has been observed by Mintzberg et al. [1976] in their analysis of decision processes and O'Reilly [1983] has coined the term "contextual rationality" to explain it.

Support for the cost/benefit principle in explaining development intentions can be drawn from several domains. In management accounting, capital budgeting decisions are often made using a quantitative cost/benefit analysis (such as the use of net present value and internal rate of return)
[e.g., Horngren 1982]. In organizational psychology, human motivation often is presented as a function of a cost/benefit cognitive trade-off. For example, Beach and Mitchell [1978] explain the cognitive processes that individuals use in selecting among alternative decision strategies, where a strategy refers to a set of rules used to gather information and/or combine the results of an information search. In their analysis, Beach and Mitchell suggest that a person's choice of a strategy is determined by a cognitive trade-off between the effort required to employ the strategy and the demands of the task, that is, the accuracy or quality of the outcome obtained by applying that strategy. Other expectancy-value theories also present a similar set of determinants for individual motivation. In expectancy theory [Mitchell 1974, 1982; Vroom 1964], an individual's force to perform some behavior is assumed to be the result of a cognitive calculus about outcome expectations and their positive or negative evaluation. In the theory of reasoned action [Ajzen and Fishbein 1977, 1980; Fishbein and Ajzen 1975], an individual's intention to perform a behavior is also the result of a cognitive calculus about the expected outcomes of behavior and their positive or negative evaluation. The relationship of these expectancy-value theories to the cost/benefit principle can be seen if the positively and negatively evaluated outcomes are labeled as benefits and costs, respectively.

Although there is no direct empirical evidence that
would support the cost/benefit principle in explaining development intentions, there is indirect evidence. Studies in human judgment and decision making processes have concluded that an individual's selection of an information processing strategy represents a deliberate trade-off between the benefits of minimizing errors (increased accuracy) and the expected costs of exerting effort in a particular task environment (demands on cognitive resources) [e.g., Creyer et al. 1990; Johnson and Payne 1985; Payne 1982]. Jarvenpaa [1989] has also reported significant results in a test of the cognitive trade-off implied by the effort/error model in a task that involved selection of decision strategies that were matched with either congruent or incongruent information display formats. Davis [1989] has contrasted the concept of system usefulness, which is also a central concept to the present study, with Beach and Mitchell's [1978] cost/benefit paradigm. He presented system usefulness to correspond to that component of the model which relates to a person's perceived benefits (that would result from use of a system). In the Davis et al. [1989] study, perceived system usefulness was found to be the most significant determinant of a user's intention to utilize a system.

Conclusions from the Literature Review

The literature that has been reviewed in this Chapter provides support for the research model and hypotheses advanced in Chapter 1. The following discussion summarizes
the conclusions that can be drawn from the literature reviewed here.

Alternative measures of IS success were examined. Those measures were found to converge to two broad concepts that can indicate IS success: (a) perceived information quality (IQ) and (b) perceived system usefulness (SU). Research in managerial and financial accounting also has utilized a concept similar to IQ, but with expanded boundaries. Related research in the field of organizational effectiveness has exemplified the complexity of the success construct and raised issues concerning the content validity of any limited set of success measures. Using the Quinn and Rohrbaugh [1983] multidimensional structure of effectiveness, however, the two concepts of IQ and SU were shown to receive support as partial constructs of effectiveness.

Basic research that developed theories explaining change processes has posited a variety of stage models. One set of such models assumes that change occurs as a sequence of discrete events along a number of stages. The present study examines IS development as a phenomenon that results in the introduction of a new system into an organization and does not investigate events along a number of different stages. Alternative models of change suggest that the phenomenon examined here could be represented by a probabilistic concept of an intention to develop. The generalized cost/benefit framework that was employed to
develop the research model of this study draws support from those models. A decision maker's intention to develop is posited to be determined by both positively and negatively evaluated outcomes of the development behavior, with those outcomes corresponding to expected benefits and costs, respectively. The research hypotheses advanced in the first Chapter examine relationships between the posited determinants of an intention to develop and the intention itself.
CHAPTER 3
SAMPLE, DATA COLLECTION AND MEASUREMENT OF RESEARCH VARIABLES

This chapter is organized into the following areas: (a) a presentation of the procedures used for sample selection and data collection, (b) a presentation of controls and procedures applied to ensure the quality and representativeness of the collected data and (c) a presentation of the method for the measurement of the research variables.

Sample Selection

A cross-sectional sample of 1,000 organizations was randomly selected from Lotus One Source corporate directory [CD/Corporate: U.S. Public Companies, July 1992]. This directory contains data for over than 10,000 companies. Each selected organization was mailed one copy of the research instrument for completion by the employee who had the most influence over IS development decisions. The criteria used for selecting organizations and potential respondents from the directory are presented in Table 7.

Following Cohen [1988], it was determined that at least 75 observations must be obtained in order to measure a medium effect size within acceptable confidence limits. It is also acknowledged, however, that in order to attain reliable results for the factor analysis, the size of the sample must satisfy the minimum level of 125 observations (for a minimum ratio of five observations per item [Gorsuch
Research Instrument

Prior to data collection, the research instrument used in the study was evaluated by expert panels. First, the research instrument was reviewed by the five-person doctoral committee, by a specialist in instrument construction in psychology and by one other faculty member in information systems. The research instrument was extensively revised based on those reviews.

Second, the instrument was evaluated by two persons who were more representative of potential respondents. One corporate officer read the cover letter and completed the research instrument. He then evaluated the materials on three criteria: (a) potential problems with the clarity of instructions and items, (b) capability of the instrument to motivate subjects to respond to it and (c) any possible

TABLE 7
SAMPLE SELECTION CRITERIA

Criteria for Selecting Organizations
Organization not included in the sample if:
(a) a partnership.
(b) a software house/developer or a computer hardware related company.
(c) a non profit organization.

Criteria for Selecting Potential Respondents
Potential respondent must be:
(a) the primary decision maker for information system development decisions.
(b) the organizational member having the best overall knowledge about business and information system needs.
sources of bias that might have been introduced in its design [Dillman 1978, 155-8]. The format of the research instrument was extensively revised as a result of that person’s evaluation. The revised instrument was then evaluated by a corporate officer from a different organization. This evaluation led to minor revisions of the instrument.

Data Collection Procedures

Data were collected by a mailed questionnaire. The research instrument was mailed to the identified corporate officers of the 1,000 organizations included in the sample. A cover letter was used to explain the purpose of the study and its potential usefulness to the respondent, to emphasize the importance of every single response in ensuring the representativeness of results and to promise confidentiality of the responses [Dillman 1978, 160-72]. Completed questionnaires were returned directly to the researcher in postage-paid, self-addressed envelopes that were included in the mailing package. A control number was printed on the return envelope in order to facilitate subsequent follow-up. To ensure return of any undelivered mailing packages, first-class postal service was used to handle all mailings.

Within one week of the original mailing, a postcard reminder was sent to all respondents [Dillman 1978, 180-6]. The postcard served as both a "thank you" for those who had responded and as a courteous reminder for those who had not.

Within three weeks of the original mailing, a follow-up
letter with a replacement questionnaire were sent only to nonrespondents [Dillman 1978, 186-8]. Using Dillman's recommendations, the cover letter in that mailout was shorter than the one used in the first mailing. Its purpose was to inform respondents that their questionnaire had not been received and appeal for its return.

Representativeness of the Collected Data

The final response rate from all mailings was 23.82 percent. A total number of 227 completed questionnaires was received, while 47 questionnaires were returned as undelivered. From the 227 completed questionnaires, 184 were used in the analysis (43 responses were not used). Table 8 presents in detail the various reasons for excluding those 43 responses from the analysis.

The 184 observations included in the analysis represented organizations in a wide range of industries: manufacturing (35 percent), financial institutions (12 percent), gas and electric utilities (12 percent), insurance and real estate (8 percent), services (7 percent), transportation (6 percent) and various other industry groups. The average number of employees in those 184 organizations was 632, with a standard deviation of 399 employees. Average revenue (gross sales) was $181 million, with a standard deviation of $364 million. Alternative organizational titles of respondents included financial controller (23 percent), VP-finance (13 percent), chief financial officer (8 percent), treasurer (5 percent),
information systems manager (25 percent), data processing manager (14 percent) and VP-information systems (12 percent).

Testing for Nonresponse Bias

The sample of responding firms was compared against the nonresponding firms to ascertain its representativeness. The comparison was made using three demographic variables: industrial classification (four-digit primary SIC code), sales (gross revenue) and number of employees. Classification tables were created using the first two digits of SIC code, sales level and employee level as

TABLE 8
FINAL DISPOSITION OF MAILED QUESTIONNAIRES

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Questionnaires Mailed</td>
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</tr>
<tr>
<td>Less</td>
<td></td>
</tr>
<tr>
<td>Undelivered Questionnaires</td>
<td>47</td>
</tr>
<tr>
<td>Net Number of Questionnaires Mailed</td>
<td>953</td>
</tr>
<tr>
<td>Total Number of Responses Received</td>
<td>227</td>
</tr>
<tr>
<td>Response Rate (227/953)</td>
<td>23.82%</td>
</tr>
<tr>
<td>Total Number of Questionnaires Received</td>
<td>227</td>
</tr>
<tr>
<td>Less</td>
<td></td>
</tr>
<tr>
<td>Projects undertaken because of government reporting requirement</td>
<td>11</td>
</tr>
<tr>
<td>Respondent reported having less influence than others on IS development decisions</td>
<td>10</td>
</tr>
<tr>
<td>Project reported did not include a change in application software (only listed systems software)</td>
<td>6</td>
</tr>
<tr>
<td>Items on the scales left unanswered</td>
<td>9</td>
</tr>
<tr>
<td>Apparent confusion on scale directions</td>
<td>5</td>
</tr>
<tr>
<td>Response was on the extreme step of every response scale</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Total Useable Responses</td>
<td>184</td>
</tr>
</tbody>
</table>
classification variables. A chi-square test was used to determine whether the distribution of the 1,000 organizations in the response (n=227) or nonresponse (n=773) categories was independent of their demographic characteristics. All chi-square tests produced insignificant differences, indicating that the 227 responding organizations were drawn from the same distribution as the 773 nonresponding organizations. Appendix E provides detailed information about these tests.

In addition to comparing respondents and nonrespondents on the original sampling list, Oppenheim [1966, 34-5] recommends a second method for testing for nonresponse bias. This method involves comparing early respondents with late respondents in terms of their answers to the questionnaire. This test is based on the assumption that late respondents are roughly similar to nonrespondents. The Hotelling’s $T^2$ statistic [Winer 1971, 54-7] was calculated to test for differences in the multivariate means of the early versus late group of respondents. The difference in the means was not significant ($T^2=1.676; p<.999$), indicating that observations from the two subgroups of early and late respondents could be pooled for further analysis.

Given the above satisfactory results, it was concluded that nonresponse did not bias the sample.

Quality of the Collected Data

A basic requirement of the study was to collect data
from decision makers who are influential in system development decisions within their organizations. The meaningfulness of this study's dependent variable (intention to develop) depends upon this influence relationship that each respondent must have. The cover letter instructed recipients to direct the questionnaire to the person with the highest responsibility over system development decisions, in the case that the recipients themselves did not fit that role. This redirection occurred in 51 percent of the cases. To control for this factor, a question was included in the research instrument to measure the level of a respondent's influence over system development decisions. The question reads: "How would you classify your level of influence on decisions concerning the development of information systems?" A five-point, fully-anchored response scale was used. The scale anchors were: (1) have primary authority -- own decision, (2) highly influential, (3) have equal influence as others, (4) have less influence than others in my organization, (5) have no influence at all. Ten responses which fell in the fourth category were dropped from the data set. No responses were observed in category (5). From the remaining 184 responses, 7 percent were in category (1), 78 percent were in category (2) and 15 percent were in category (3).

A second requirement necessary to ensure data quality is that the decision to introduce an IS project must lie with the individual respondent and not be mandated by some
other external entity, for example, a governmental reporting requirement. This is required if this study’s research variables are to have a meaningful impact upon a development decision. To control for this potentially contaminating effect, the following question was included in the instrument: "To what extent is the IS project a result of a reporting requirement mandated by the government?" A four-point, fully-anchored response scale was used. The scale anchors were: (1) sole reason for the development of this project, (2) to a great extent, (3) to a slight extent, (4) not at all. Eleven responses which fell in either of the first two categories, were dropped from the data set. For the remaining 184 responses, 22 percent fell into category (3) and 78 percent fell into category (4).

The information system projects which were to be used as a basis for responding to the research instrument were constrained in this study to include a change in application software. A list of the information system projects reported by all 227 respondents is presented in Appendix F. Six projects were identified to not include a change in application software. Those referred to either a change in hardware or a change in system software. As described in Table 8, those six observations were excluded from the analysis.

In summary, three groups of observations were excluded from the data set: (a) respondents with less influence than others in their organizations (N=10), (b) projects mandated
by governmental reporting requirements (N=11), and (c) lack of a change in application software (N=6). The impact, if any, of these three groups of observations on the significance of the research model of this study will be discussed in Chapter 5.

Measurement of Research Variables

The following describe the procedures for measuring the research variables in the study. The complete research instrument that has been used in the study is presented in Appendix G.

Measurement of IS Success Variables

Within the generalized cost/benefit model of equation (5), two concepts were presented to indicate IS success: (a) an individual's perception of information quality (IQ) derived by a new system, as compared with the existing IS and (b) an individual's perception of system usefulness (SU) for the new system, as compared with the existing system. In the following, the specific method of measuring those two concepts is presented.

Perceived Information Quality (IQ). As presented in the literature review section, a common set of information quality attributes was used in the prior IS literature. Those attributes can be summarized into five clusters, including: information accuracy, relevance, completeness, timeliness and output format. The content boundaries of information quality, however, were expanded in other
disciplines such as in managerial and financial accounting. The scope of the present study limits the measurement of information quality to only those attributes for which empirical support exists in the IS literature. The expansion of the content boundaries of information quality to include attributes developed in accounting is reserved for a future study.

A number of prior-developed instruments were considered for the measurement of perceived information quality. Two such instruments that were previously subjected to psychometric testing in the IS literature are the ones developed by Doll and Torkzateh [1988] and Bailey and Pearson [1983]. The decision has been made to measure this study’s information quality variable using items from the Bailey and Pearson [1983] instrument. Ives et al. [1983] and Baroudi and Orlikowski [1988] have examined the psychometric properties of the Bailey and Pearson [1983] instrument. The five items that were reported to load on the information quality factor in Ives et al. [1983] and Baroudi and Orlikowski [1988] were selected to measure perceived information quality.

The five items selected represent only three clusters of information quality attributes (accuracy, relevance and completeness) and exclude attributes in the information timeliness and output format clusters. In both Ives et al. [1983] and Baroudi and Orlikowski [1988], the five items were found to load on the same factor. Baroudi and
Orlikowski [1988] have also reported a scale reliability (Cronbach's alpha coefficient) of 0.89. Given the unidimensional structure of the five items and an adequate level of scale reliability, their use in the present study was considered more preferable than the adoption of a more encompassing set of items. The scale developed by Doll and Torkzateh [1988], for example, or other information quality attributes developed in the fields of accounting and organizational effectiveness could be adopted. This issue is reserved for a future study.

The items selected to measure perceived information quality are shown in Table 9. Two sets of adjectives are included for each item. Responses were given on the following seven-point (+3 to -3) scale: extremely, quite, slightly, neither or neutral, slightly, quite and extremely. Following Baroudi and Orlikowski [1988], each item was scored by taking the average of the responses on the two sets of adjectives. The interitem correlations for the pairs of items averaged together ranged from 0.72 to 0.97.

The five items shown in Table 9 were used to measure perceived information quality for both the existing information system that is available to an organization and the new system that will result from the introduction of a future IS project. Incremental scores to fit this study's cost/benefit model were calculated by taking the difference between a respondent's evaluation of the existing system and his or her evaluation of the new system. The sum of a
respondent's response to each of those items was used to indicate the respondent's beliefs or perceptions about the incremental benefit in information quality that could be due to the introduction of the new system.

Perceived System Usefulness (SU). The IS studies that examined system usefulness were reviewed in the literature review section of this paper and summarized in Appendix C. Based on that review, the six-item instrument developed by Davis [1989] was selected to measure perceived system usefulness.

TABLE 9
SCALE MEASURING PERCEIVED INFORMATION QUALITY

1. Accuracy of output information.
   accurate - inaccurate
   high - low
2. Reliability of output information.
   high - low
   superior - inferior
3. Precision of output information.
   high - low
   definite - uncertain
4. Relevancy of output information (to intended function).
   useful - useless
   relevant - irrelevant
5. Completeness of output information.
   sufficient - insufficient
   adequate - inadequate

The above items and adjectives were originally developed by Bailey and Pearson [1983]. The five-item scale represents the information quality items included in the short-form version of the Bailey and Pearson instrument, as reported by Ives et al. [1983].
Although Davis' instrument represents a more restricted view of usefulness, as compared to the whole range of system usefulness dimensions that can be found in the literature, it does span the most significant aspects of usefulness, such as perceived contribution of the system to job performance, effectiveness, productivity and perceived importance or functionality of the system to user needs. Davis [1989, Study 2] reported a reliability (Cronbach's α) coefficient of 0.98 for the six-item scale. Adams et al. [1992] had used the same six-item scale in two studies examining different types of systems and reported reliability coefficients of 0.94 and 0.93.

In order to fit the incremental cost/benefit model of this study, the same procedure as that used for the measurement of information quality was followed. In particular, the perceived system usefulness of both the existing system and the new system (the one that will result from the introduction of a future IS project) was measured and incremental scores were calculated by taking the difference of the two individual scores. The items that were used to measure perceived system usefulness in this study are presented in Table 10.

The same response scale as that originally reported in Davis [1989] has been adopted. The seven-point scale has likely-unlikely endpoints and is scored on a -3 to +3 basis. The perceived system usefulness score for each respondent is calculated by summing the responses on each of the six
items. The sum of the responses to each of those items was used to indicate a respondent's beliefs or perceptions about the incremental benefit in system usefulness that could be due to the introduction of the new system.

**Incremental Cost**

The development of a cost scale for use in this study was necessary as no other validated cost scale was located in the prior literature. The incremental cost of the IS project that will result in the development of the new system was measured using three items developed in this study. These items are presented in Table 11. Responses are measured on a seven-point scale with endpoints of strongly agree (+3) and strongly disagree (-3).

The cost items elicit beliefs about the level of cost

**TABLE 10**

SCALE MEASURING PERCEIVED SYSTEM USEFULNESS

Productivity:
1. Enabling system users to accomplish their tasks more quickly.
2. Increasing the productivity of system users.

Job Performance/Effectiveness:
3. Improving the job performance of system users.
4. Enhancing the effectiveness of system users on their jobs.

Importance to Job (System Functionality):
5. Making it easier for system users to do their jobs.

Overall Usefulness:
6. Being judged by system users as useful in their jobs.

Source: Davis [1989]
expenditure expected of the IS project, beliefs about the constraining nature of cost and about its significance as a factor in the development decision. The three items were designed to measure different qualitative facets of cost, as a quantitative assessment of it was not possible.

**Intention to Develop (Intent)**

In the first section of the research instrument that was designed for this study, individual respondents were asked to recall a specific IS project that they were considering for future introduction in their organization. The project was defined as a future possible change in existing software that has not yet commenced. The instructions in the instrument emphasized that the project selected must be the "most significant information system project" that a respondent "might adopt in the future."

Individual respondents expressed their intention to "go" or "not go" for that project. A decision maker's intention to develop, that is, make a "go/no-go"

**TABLE 11**

**SCALE MEASURING INCREMENTAL COST**

1. The cost of the information system project would be higher than the cost of other system projects my organization has had in the past.

2. The demands of the information system project on my organization's financial resources would hinder its introduction.

3. The cost of the project would consume a large portion of my organization's capital budget.
decision about the IS project that is under consideration, measured by the following question: "What would be the likelihood that you would undertake the IS project?"
Responses were given on the following nine-point (-4 to +4) scale: definitely no-go, extremely unlikely, quite unlikely, slightly unlikely, neither likely nor unlikely, slightly likely, quite likely, extremely likely and definitely go.
CHAPTER 4

DATA ANALYSIS AND RESULTS: CONSTRUCT VALIDITY

All instruments used in the study have been examined for reliability and validity [cf. Bohrnstedt 1970; Grove and Savich 1979; Kerlinger 1986; Nunnally 1978; Straub 1989]. This chapter presents the data analyses performed and results obtained in testing the reliability and construct validity of measures.

In testing for both reliability and construct validity, a number of alternative data analysis procedures were performed. The invariance of results obtained across alternative procedures should be an indicator of their strength. Such invariant results were obtained in all of the tests that are described below.

Reliability Analysis

Adequate reliability of an instrument is a necessary condition for its validity [Campbell and Fiske 1959]. Reliability is tested by examining the internal consistency of measures. Cronbach’s $\alpha$ coefficient [Cronbach 1951] of internal consistency has been computed and compared with desired standards of reliability [Nunnally 1978, 245-6]. Table 12 summarizes the results obtained on reliability and presents descriptive statistics about the scales used to measure this study’s research variables.

The perceived information quality (IQ) scale for the existing system (IQ-E) had an $\alpha$ of 0.90, while the IQ scale
for the new system (IQ-N) had an $\alpha$ of 0.87. Both of these values are at an acceptable level of reliability.

The internal consistency of the perceived system usefulness (SU) scale for the existing system (SU-E) had an $\alpha$ coefficient of 0.96, while the SU scale for the new system (SU-N) had an $\alpha$ of 0.85. Both are at an acceptable level.

Scale reliability (Cronbach’s $\alpha$ coefficient) for the three-item cost scale was 0.70. Although at a lower level than the alpha coefficients obtained for the other scales, the 0.70 $\alpha$ coefficient is at an acceptable level. The lower level of internal consistency for the cost scale was expected. The three cost items were created for this study and there is no prior standard to which they can be compared. The three items were also designed to tap different aspects of cost (cost level, constraining factor, significance). The fact that the three items attempt to measure different facets of cost does not contribute to a high internal scale consistency.

A second test for reliability has been proposed in the context of confirmatory factor analysis (CFA) [Fornell and Larcker 1981]. The results of this test were in complete agreement with those obtained using Cronbach’s $\alpha$ coefficient. The reliability results from CFA are presented below where the CFA model is discussed.

**Construct Validity**

Construct validity or meaningfulness of the measures [cf. Cronbach and Meehl 1955] is the subject of this
chapter. A number of tests were performed in order to assess the construct validity of scales used in the study. This section presents the tests performed and results obtained.

**Principal Component Analysis**

Principal component analysis was performed [Gorsuch 1983] in order to extract the factor structure of the IQ, SU and Cost scales. Prior to this analysis, application of the Bartlett's [1950] test has indicated that the correlation matrix could be legitimately factored ($\chi^2_{300} = 3,550; p<0.0001$) [cf. Gorsuch 1983, 149; Tinsley and Tinsley 1987, 416]. The correlation matrix among the items that define the main research variables of the study is presented in Table 13.

The principal component analysis identified five factors with eigenvalues greater than one. Examination of

<table>
<thead>
<tr>
<th>TABLE 12</th>
<th>DESCRIPTIVE STATISTICS  (N=184)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale</td>
<td>Number of Scale Items</td>
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<tr>
<td>SU-Existing</td>
<td>6</td>
</tr>
<tr>
<td>SU-New</td>
<td>6</td>
</tr>
<tr>
<td>IQ-Existing</td>
<td>5</td>
</tr>
<tr>
<td>IQ-New</td>
<td>5</td>
</tr>
<tr>
<td>Cost</td>
<td>3</td>
</tr>
<tr>
<td>Intention to Develop</td>
<td>1</td>
</tr>
</tbody>
</table>
the scree plot (a plot of the obtained eigenvalues) also indicated that five factors could reproduce the data. An additional test for determining the number of factors to be extracted was performed by calculating first differences in Bartlett's [1950] $\chi^2$ value on the residual correlation matrix [Gorsuch 1983, 150-2]. The change in $\chi^2$ lost significance when a sixth factor was extracted, indicating the existence of five factors.

A varimax rotation was performed on the five factors that were extracted. The five-factor solution explained 70 percent of the total variance. Table 14 presents the rotated factor pattern matrix with the loadings of each variable on the five factors. The five factors correspond to SU-existing system, IQ-existing system, SU-new system, IQ-new system and Cost. The magnitude of the loadings within each factor are quite high, with very little overlap among factors. Table 15 presents the percent of the original variance in each variable that is captured by each one of the five factors after rotation. An examination of Table 15 can more readily reveal the factorial structure of the data.

Using the five-factor solution, exact factor scores were calculated using regression weights from all variables. Simple algebraic differences in the factor scores between SU-new and SU-existing and between IQ-new and IQ-existing were calculated in order to form the independent variables to be used in hypothesis testing.
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<td>PEARSON PRODUCT-MOMENT CORRELATION COEFFICIENTS</td>
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</table>

1 Corrected item-total correlations.

Correlation Coefficients (r) significant at: 

α = .05 if r ≥ 0.14
α = .01 if r ≥ 0.19
α = .001 if r ≥ 0.24
Table 14

VARIMAX ROTATED FACTOR PATTERN MATRIX

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factors 1</th>
<th>Factors 2</th>
<th>Factors 3</th>
<th>Factors 4</th>
<th>Factors 5</th>
<th>h²</th>
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<td>0.76</td>
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Eigenvalue: 7.21, 4.14, 2.70, 2.00, 1.38
% Total Variance: .29, .16, .11, .08, .06, 70%
### TABLE 15
PERCENT OF ORIGINAL VARIABLE VARIANCE CAPTURED BY EACH FACTOR

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Note: Percent of a variable's variance captured by a factor is equal to the square of its loading on that factor (factor loadings are shown in Table 14).
Corrected Item-Total Correlations

An additional indicator of construct validity is the magnitude of the item-total correlations for the five scales (SU-existing system, SU-new system, IQ-existing system, IQ-new system and Cost). Corrected item-total correlations [Nunnally 1979, 281] between the items that define each scale and their (corrected) sum are presented in Table 13. In all cases, these correlations are high and significant at p<0.001.

Multitrait-Monomethod Analysis

Campbell and Fiske [1959] proposed two aspects of construct validity: convergent and discriminant validity. As discussed by Bagozzi et al. [1991, 425], convergent validity is the degree to which multiple attempts to measure the same concept are in agreement. Discriminant validity is the degree to which measures of different concepts are distinct.

Traditional multitrait-monomethod (MTMM) analysis has been performed [Campbell and Fiske 1959] to examine the discriminant validity of the five scales (IQ-existing system, IQ-new system, SU-existing system, SU-new system and Cost). It has not been possible to examine the convergent validity of the measures since a single method is used for data collection (mailed questionnaires). Even with a single method of data collection, however, the discriminant validity of the five traits can be examined.

Using the traditional Campbell and Fiske [1959]
criteria, a test of discriminant validity was performed using the correlation matrix reported in Table 13 (see also Treacy [1985] for an application of this test). Specifically, the lowest correlation of each item with all other items within its own scale is compared with the set of correlations of that item with all other items that belong to different scales. Using Treacy's [1985] approach, the number of violations to this criterion is noted. For the correlation matrix reported in Table 13, only two violations were noted out of a total of 494 comparisons. The two violations were due to a high correlation ($r=0.41; \ p<0.001$) between item Q13N (overall usefulness-new system) and item Q15N (information relevance-new system). A lower correlation ($r=0.35; \ p<0.001$) was found between Q13N and item Q9N (quick execution of tasks-new system) and between Q15N and item Q17N (information precision-new system), $r=0.40 \ (p<0.001)$. With only two violations out of 494 comparisons, it can be concluded that there is evidence of adequate discriminant validity among the five scales (SU-existing, SU-new, IQ-existing, IQ-new and Cost).

**Confirmatory Factor Analysis**

Bagozzi, Yi and Phillips [1991] have compared the traditional Campbell and Fiske criteria with confirmatory factor analysis (CFA) in addressing construct validity. Their analysis has shown that application of the traditional Campbell and Fiske criteria can result in Type I and Type II errors. CFA has been presented as a method that makes fewer
assumptions and provides more diagnostic information about reliability and validity than Campbell and Fiske's criteria. As a result, CFA has also been performed in order to examine the construct validity of the IQ, SU and Cost scales.

The CFA model was estimated using the LISREL 7 program [Joreskog and Sorbom 1989]. The measurement model in LISREL specifies relations between the unobserved or latent variables, that is, IQ-existing, IQ-new, SU-existing, SU-new and Cost and the observed variables, that is, the items measured on the research instrument. LISREL uses full-information maximum likelihood methods for parameter estimation. As these methods depend on large-sample properties, a concern is with the sample size needed to obtain meaningful parameter estimates. Anderson and Gerbing [1988] have conducted simulation studies and report that a sample size of 150 is needed for models with three or more indicators per factor. This requirement is met and exceeded in the present study.

Two sets of diagnostic indicators were used to assess construct validity [cf. Anderson and Gerbing 1988; Bagozzi et al. 1991; Byrne 1989; Fornell and Larcker 1981; Magner et al. 1992; Netemeyer et al. 1990]. First, measures of the overall degree of model fit were examined in order to assess the appropriateness of the hypothesized five-factor model (IQ-existing, IQ-new, SU-existing, SU-new, Cost). Second, several measures of convergent and discriminant validity were examined. Due to the fact that only one measurement
method was used in the study, the more rigorous partitioning of measured variance into trait, method and random error components was not possible. The results of these tests are presented below.

Measures of the Overall Degree of Model Fit. To examine the overall degree of model fit, the null hypothesis that the five-factor CFA model fits the data well was tested. The maximum likelihood $\chi^2$ value with 266 degrees of freedom was significant ($\chi^2_{266}=476; p<0.0001$), indicating that the above null hypothesis can be rejected. A widely acknowledged problem with this test, however, is that a large sample size will lead to the rejection of virtually any model, since the $\chi^2$ statistic is a direct function of sample size. An alternative indicator is the ratio of $\chi^2$ to degrees of freedom, with a ratio of less than two considered to represent good fit. The fit of the present model was adequate based on this criterion ($\chi^2/d.f.=1.79$). The value of root mean square residual (off-diagonal values of the covariance matrix reproduced by the model) was 0.06, where values less than 0.10 indicate good fit. Two goodness-of-fit statistics, the goodness of fit index (GFI) and adjusted GFI (AGFI), lie in a range from 0 to 1, with values approaching one indicating better fit [Joreskog and Sorbom 1989]. The GFI for the estimated model in this study was 0.834 and the AGFI was 0.797, indicating an acceptable level of fit. Bagozzi et al. [1991] propose using the noncentralized normed fit index (NCNFI) to evaluate the
practical significance of the variance explained by a model, with particular emphasis on overfitting. A proposed minimum value for this index is 0.90. The NCWFI for the model estimated in this study was 0.91, indicating that the five-factor model explains a significant amount of information from a practical standpoint. In conclusion, the results of the above tests support the overall fit of the five factor model with the data.

Measures of Convergent and Discriminant Validity. The measurement properties of the CFA model estimated in the study are presented in Table 16. Table 17 displays the correlations among the latent constructs measured in the study.

The indicators shown on Table 16 can be used to evaluate the convergent and discriminant validity of the five scales (latent constructs). The standardized loadings shown on Table 16 are all high, supporting the convergent validity of the five scales. In addition, the t-values for all 25 items ranged from 6.36 to 23.01 (p<0.001), offering additional support for the convergent validity of the items in each scale [Anderson and Gerbing 1988]. The magnitude of the composite reliability of the five scales, which is analogous to the α coefficient, indicates that there is high internal consistency in the items that comprise the scales. The variance extracted estimates (which represent the amount of variance captured by a construct relative to the variance due to random measurement error) for the SU-existing, IQ-
TABLE 16

MEASUREMENT PROPERTIES OF THE FIVE-FACTOR CONFIRMATORY MODEL

<table>
<thead>
<tr>
<th>Latent Construct and Indicators</th>
<th>Standardized Composite Loading</th>
<th>Reliability Estimate</th>
<th>Variance Extracted</th>
<th>α on Raw Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>SU - Existing System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8E - productivity</td>
<td>0.91</td>
<td></td>
<td>0.96</td>
<td>0.80</td>
</tr>
<tr>
<td>Q9E - quick</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q10E - job performance</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q11E - effectiveness</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q12E - easy</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q13E - useful</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SU - New System</td>
<td></td>
<td></td>
<td>0.86</td>
<td>0.50</td>
</tr>
<tr>
<td>Q8N - productivity</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q9N - quick</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q10N - job performance</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q11N - effectiveness</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q12N - easy</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q13N - useful</td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IQ - Existing System</td>
<td></td>
<td></td>
<td>0.90</td>
<td>0.65</td>
</tr>
<tr>
<td>Q14E - reliability</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q15E - relevancy</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q16E - accuracy</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q17E - precision</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q18E - completeness</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IQ - New System</td>
<td></td>
<td></td>
<td>0.87</td>
<td>0.57</td>
</tr>
<tr>
<td>Q14N - reliability</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q15N - relevancy</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q16N - accuracy</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q17N - precision</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q18N - completeness</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q19 - cost level</td>
<td>0.45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q20 - cost constraint</td>
<td>0.57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q21 - part of cap.budg.</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* All standardized loadings are significant at p<0.001
existing and IQ-new scales exceeded the 0.50 minimum level [Fornell and Larcker 1981, 46]. For the SU-new scale, the estimate was at the minimum level (0.50), while for the Cost scale the estimate was slightly below the minimum level (0.48). In general, the 25 items performed satisfactorily in terms of their convergence on their latent constructs.

To test for discriminant validity among the five scales, Anderson and Gerbing [1988, 416] suggest using two complementary tests. First, the estimated correlation parameter between two constructs is constrained to a value of one and a $\chi^2$ difference test is performed on the values

**TABLE 17**

**TRAIT CORRELATIONS**

<table>
<thead>
<tr>
<th>Trait (Factor)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SU-Existing</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. SU-New</td>
<td>.15</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.06)</td>
<td>(.10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. IQ-Existing</td>
<td>.40</td>
<td>.18</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.06)</td>
<td>(.05)</td>
<td>(.10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. IQ-New</td>
<td>.13</td>
<td>.47</td>
<td>.46</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.06)</td>
<td>(.06)</td>
<td>(.06)</td>
<td>(.10)</td>
<td></td>
</tr>
<tr>
<td>5. Cost</td>
<td>-.09</td>
<td>-.04</td>
<td>-.14</td>
<td>.06</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(.03)</td>
<td>(.03)</td>
<td>(.03)</td>
<td>(.03)</td>
<td>(.07)</td>
</tr>
</tbody>
</table>

---

a The correlations are adjusted for attenuation due to random measurement error [cf. Kenny 1979, 74-9].

b Standard errors are in parentheses.
Table 18 presents the results of this test performed on all ten possible pairs of constructs. For all ten comparisons, the $\chi^2$ value for the constrained model was significantly higher than the one for the unconstrained model ($p<0.005$), indicating that the five scales discriminate well between each other. A complementary assessment of discriminant validity can be performed by determining whether the confidence interval ($\pm$two standard errors) around the correlation estimate between each pair of factors (as presented in Table 17) includes the value of one. For all ten pairs, the confidence interval did not include the value of one, rendering additional support for the discriminant validity of the scales.

In conclusion, the results of the above tests offer strong support about the construct validity of the five scales used in the study.
TABLE 18

CHI-SQUARE DIFFERENCE TESTS

<table>
<thead>
<tr>
<th>Perfect Correlation in Pair of:</th>
<th>Restricted Model</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\chi^2$</td>
<td>d.f.</td>
<td>$\Delta\chi^2$</td>
<td>$p^*$</td>
</tr>
<tr>
<td>SU-Existing With SU-New</td>
<td>3,505</td>
<td>267</td>
<td>3,029</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>IQ-Existing</td>
<td>6,053</td>
<td>267</td>
<td>5,577</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>IQ-New</td>
<td>6,272</td>
<td>267</td>
<td>5,796</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>Cost</td>
<td>614</td>
<td>267</td>
<td>138</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>SU-New With IQ-Existing</td>
<td>4,916</td>
<td>267</td>
<td>4,440</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>IQ-New</td>
<td>3,841</td>
<td>267</td>
<td>3,365</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>Cost</td>
<td>895</td>
<td>267</td>
<td>419</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>IQ-Existing With IQ-New</td>
<td>4,002</td>
<td>267</td>
<td>3,526</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>Cost</td>
<td>626</td>
<td>267</td>
<td>150</td>
<td>&lt;.005</td>
</tr>
<tr>
<td>IQ-New With Cost</td>
<td>763</td>
<td>267</td>
<td>287</td>
<td>&lt;.005</td>
</tr>
</tbody>
</table>

* Probability at which the observed change in $\Delta\chi^2$ is less than the critical value.

Notes:
(a) The change in $\chi^2$ is calculated as the $\chi^2$ from the restricted model minus the $\chi^2$ from the full, unrestricted model (with all parameters freely estimated). Since the two models are nested (each of the restricted models is a special case of the unrestricted model), the difference between the two $\chi^2$'s is also distributed as a $\chi^2$ with degrees of freedom equal to the difference between the degrees of freedom for the two models [Bagozzi et al. 1991, 431]. The $\chi^2$ value for the unrestricted model was 476, with 266 degrees of freedom.

(b) Anderson and Gerbing [1988, 416] recommend that the significance level for each difference test should be adjusted in order to maintain the "true" overall significance level for the family of tests. For an overall significance level of .05 and ten difference tests, the adjusted significance level is .005. At an $\alpha$ of .005 and one degree of freedom, the critical $\chi^2$ value is 7.88. All $\Delta\chi^2$'s in the above table exceed this critical value.
CHAPTER 5

HYPOTHESIS TESTING AND RESULTS: CRITERION VALIDITY

The purpose of this study is to examine the criterion validity of the two IS success measures in determining intentions to develop an information system. The hypothesized relationships were based upon the cost/benefit principle. The research model of the study can be expressed in the form of an equation as follows:

\[ \text{Intent} = \alpha_1 + \alpha_2 \Delta IQ + \alpha_3 \Delta SU + \alpha_4 \Delta C + \epsilon \]  

(6)

where:
- \( \Delta IQ \) is a measure of the perceived information quality of the new system relative to the existing IS.
- \( \Delta SU \) is a measure of the perceived usefulness of the new system relative to the existing IS.
- \( \Delta C \) is the perceived incremental cost of the IS project that will result in the development of the new system.
- \( \alpha_k \) are standardized regression coefficients (beta weights).
- \( \epsilon \) is the error term and \( \alpha_i \) is the intercept of the model.

The three research hypotheses that were presented in Chapter 1 can be tested by estimating the above model through ordinary least squares and testing the coefficients of \( \Delta IQ, \Delta SU \) and \( \Delta C \) for both significance and direction of their effects upon the dependent variable, development intention. The results of these tests are presented in the following sections.
Data Analysis and Results on Testing the Three Research Hypotheses

The model presented in equation (6) was estimated through ordinary least squares (multiple regression analysis) using two forms of data (N=184): (a) raw data, where each research variable was formed by summing scores on individual items that were used to define it, and (b) orthogonal factor scores derived from a principal component analysis (varimax rotation) that would avoid any multicollinearity problems in the raw data. The significance of the overall regression model has been tested through the F-test. In order to generate estimates that would provide a more direct comparison of the strength of the effect due to each research variable, the estimated regression coefficients were standardized (zero mean and unit variance).

The estimated parameters for each regression model, together with their significance levels and overall model statistics, are presented in Table 19. The overall regression model was significant ($F_{3,180}=6.97; p<0.001$, using factor scores and $F_{3,180}=5.79; p<0.001$, using raw data). The three research variables have jointly explained 11 percent (using factor scores) and 9 percent (using raw data) of the variance in the dependent variable, development intention.

Research hypothesis H1 was predicting that beliefs about incremental information quality (AIQ) would be significantly associated with Intent. An examination of
Table 19 reveals that the estimated parameter for ΔIQ was not significant ($F_{1,180}=2.16$; $p=0.14$, using factor scores and $F_{1,180}=0.54$; $p=0.46$, using raw data), thus failing to support hypothesis H1.

Research hypothesis H2 was predicting that beliefs about incremental system usefulness (ΔSU) would be significantly associated with Intent. Table 19 reveals that the estimated parameter for ΔSU was significant ($F_{1,180}=10.67$; $p<0.001$, using factor scores and $F_{1,180}=7.46$; $p<0.01$, using

| TABLE 19 |
| ESTIMATED REGRESSION MODELS OF INTENT ON THE THREE INDEPENDENT VARIABLES (N=184) |

<table>
<thead>
<tr>
<th>Panel A</th>
<th>Panel B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variables Formed Using Factor Scores</td>
<td>Independent Variables Formed Using Raw Data</td>
</tr>
<tr>
<td>Parameter</td>
<td>Parameter</td>
</tr>
<tr>
<td>Independent Variable</td>
<td>Estimate</td>
</tr>
<tr>
<td>Intercept</td>
<td>2.82</td>
</tr>
<tr>
<td></td>
<td>(32.36)***</td>
</tr>
<tr>
<td>ΔIQ</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>(1.47)</td>
</tr>
<tr>
<td>ΔSU</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>(3.27)***</td>
</tr>
<tr>
<td>Cost</td>
<td>-0.25</td>
</tr>
<tr>
<td></td>
<td>(-2.84)**</td>
</tr>
<tr>
<td>$R^2=0.11$; $F_{3,180}=6.97$***</td>
<td>$R^2=0.09$; $F_{3,180}=5.79$***</td>
</tr>
<tr>
<td>Adj. $R^2=0.09$</td>
<td>Adj. $R^2=0.07$</td>
</tr>
</tbody>
</table>

* Significant at the .05 level
** Significant at the .01 level
*** Significant at the .001 level
raw data), thus supporting hypothesis H2.

Research hypothesis H3 was predicting that beliefs about incremental cost (Cost) would also be significantly associated with Intent. The estimated parameter for the Cost variable reported in Table 19 was also significant ($F_{i,180}=8.07; p<0.01$, using factor scores and $F_{i,180}=8.32; p<0.01$), thus supporting hypothesis H3.

The signs of the estimated coefficients for all three research variables were in the expected direction. As hypothesized, incremental benefits in perceived information quality and perceived system usefulness were positively associated with development intention, whereas perceptions about the incremental cost of the IS project were negatively associated with development intention. The predictions made by the cost/benefit principle about the direction of the effect of expected benefits and costs upon a decision, therefore, are upheld in this study.

Omitted Observations

To evaluate the effect of the omitted observations (as presented in Table 8) upon the estimated regression model of equation (6), the model was estimated using the 184 useable observations plus the omitted observations. Uncorrelated factor scores were used to define the independent variables included in those regressions. Similar results were obtained with or without the omitted observations. Appendix H presents detailed results for those regressions.
Robustness Testing

A test was also conducted to identify influential observations. The purpose of this testing is to assess the robustness of the regression estimates by removing influential observations from the data set and re-estimating the model using the remaining observations [cf. Hogg 1979]. Three criteria were used for the identification of influential observations [Belsley et al. 1980; Freund and Littell 1986]: (a) diagonal values on the hat matrix $H$ exceeding a cut-off level; (b) a relative change in model fit (DFFIT) when an observation is deleted by more than a cut-off level (the values of the cut-off levels for both the diagonal value on the hat matrix and DFFITs depend upon the size of the sample and the number of parameters estimated); and (c) for those observations that did not satisfy the DFFIT criterion, relative changes in the estimated regression coefficients (DFBETA) were examined, providing an indicator of the direction and magnitude of that observation's influence. Appendix I presents detailed statistics about the influence of each of the 184 observations.

Based on the above criteria, and using the regression model with uncorrelated factor scores as its independent variables, a total of ten observations were identified as influential. Of the ten observations, six observations had a unique characteristic. In the entire sample, only five projects were reported as unlikely to be implemented (a
negative score on the Intent variable). All five of those observations were identified as influential. Another three projects were reported as neither likely nor unlikely to be implemented (a zero score on the Intent variable). One of those three observations was also identified as influential. The observed range of variation in intention, therefore, was restricted to projects that were only likely to be implemented. The model of equation (6) could not explain observations with a low likelihood of introducing an IS project, as only a few observations were available at that range. The ten observations identified as influential were deleted from the data set and the model of equation (6) was re-estimated using the remaining 174 observations.

Table 20 presents the estimates of the regression model with 174 observations. As can be seen from Table 20, the results are similar to those obtained using the full sample.

**Use of Component Versus Difference Scores**

In presenting the method of measuring the IQ and SU variables, it was discussed that simple algebraic differences between the score on the existing system and new system will be taken to represent the incremental benefit in IQ or SU. The use of difference scores, however, has been criticized in the literature [e.g., Johns 1981].

Difference scores have been primarily criticized on the basis that they may reduce reliability and may not represent valid measures of the underlying construct, as compared to their individual component scores (that is, the individual
scores on the existing system and the new system).

The validity of these two criticisms has been directly tested in this study. In particular, the reliability of difference scores computed before factor analysis was performed was compared with the reliability of the component scores. The results indicated that difference scores were at acceptable levels of reliability and not very different from those of the component scores. Cronbach's α coefficient for the difference score in IQ was 0.86, compared to an α of 0.90 for IQ-existing and 0.87 for IQ-new. The Cronbach's α coefficient for the difference score

### TABLE 20

**ESTIMATED REGRESSION MODEL OF INTENT ON THE THREE INDEPENDENT VARIABLES (N=174)**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Parameter Estimate (t-statistic)</th>
<th>Standardized Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2.98 (44.10)**</td>
<td></td>
</tr>
<tr>
<td>ΔIQ</td>
<td>0.04 (0.89)</td>
<td>0.06</td>
</tr>
<tr>
<td>ΔSU</td>
<td>0.14 (2.71)**</td>
<td>0.20</td>
</tr>
<tr>
<td>Cost</td>
<td>-0.24 (-3.51)**</td>
<td>-0.25</td>
</tr>
</tbody>
</table>

$R^2=0.11; F_{3,170}=6.77^{***}$  
Adj. $R^2=0.09$

* Significant at the .05 level  
** Significant at the .01 level  
*** Significant at the .001 level
in SU was 0.93, compared to a coefficient of 0.96 for SU-existing and 0.85 for SU-new. A large reduction in reliability did not occur from the use of differences.

The meaningfulness of using difference scores versus component scores has also been tested through a comparison of the explanatory power of the regression model (the estimated research model shown in equation (6)) with component scores versus the explanatory power of the model using difference scores as its predictors. The resulting F statistic [cf. Fisher 1970] was not significant ($F_{2,178} = 0.15; p < 0.75$), indicating that the more restricted model using difference scores could be validly used in the analysis.

In addition to the analysis above, a further comparison between component and difference scores was made. The principal component analysis that was reported in Chapter 4 was based upon factoring component scores. A second principal component analysis was performed using differences calculated on the raw data. Using the same criteria for factor extraction as those discussed in Chapter 4, the analysis identified a three-factor solution, with items loading on SU-difference, IQ-difference and Cost. Appendix J shows the loadings of each item on the three factors. The three-factor solution explained 69 percent of the total variance, as compared to 70 percent of the total variance explained by the five-factor solution. As in the first principal component analysis, exact factor scores were calculated. The correlations of these factor scores with
the ones obtained from the first analysis were 0.93 for SU and 0.91 for IQ (no differences were taken on the Cost variable). Given these high correlations, the factor scores from the first analysis were used in subsequent hypothesis testing, as the calculation of differences either before or after the factor analysis should not produce different results.

Two additional criticisms that were directed toward the earlier literature that had used difference scores was the ignorance of the reliability and validity of component scores and the inattention given to the direction of differences. These two criticisms are completely addressed in this study. The analysis of the reliability and validity of the research measures, as reported in Chapter 4, was directed toward the component scores so that meaningful relationships could be established, whether or not differences were ultimately used. A simple algebraic method was also used to calculate differences so that the direction in the relationships could be maintained.
CHAPTER 6
DISCUSSION

This chapter summarizes and discusses the results obtained in the study, identifies limitations, presents suggestions about the potential usefulness of the results for the practice of information systems, and identifies avenues for future research.

Discussion of Results

This study examined the validity of IS success in explaining system development intentions. The generalized form of the cost/benefit principle was used to operationally define three variables that may indicate IS success. Three research hypotheses, one for each variable, are advanced:

A decision maker's intention to develop an information system will be:

H1: positively associated with his or her incremental information quality beliefs;

H2: positively associated with incremental system usefulness beliefs; and

H3: negatively associated with incremental cost beliefs.

The results indicated that perceived system usefulness (research hypothesis H2) and perceived cost of the IS project (research hypothesis H3) were significantly associated with intentions to develop an IS. Perceived information quality (research hypothesis H1) was not found to be significantly associated with development intention.

With the exception of the results on perceived
information quality, the results were consistent with the predictions made by expectancy-value theories [e.g., Ajzen and Fishbein 1980; Fishbein and Ajzen 1975; Vroom 1964]. Those theories would propose that development intention (or an intention toward any other type of behavior) is determined by a combination of beliefs about the outcomes of behavior and the evaluation of those outcomes. Perceived system usefulness represents a positively evaluated outcome of the system development behavior, while perceived cost represents a negatively evaluated outcome of system development.

The significant association of perceived system usefulness with an intention for future development lends validity to the concept of system usefulness as an indicator of IS success. An approach that was adopted in past IS research was to utilize IS success measures to evaluate the effectiveness of controllable interventions during the system development process. This approach is called "upstream research." The results of this study suggest that the concept of perceived system usefulness can be validly used in upstream research as an indicator of performance outcomes that result from controllable interventions in systems development.

The perceived information quality of the system that would result from a future development activity was not found to be significantly associated with a development intention. Past upstream IS research has used indicators of
IS success that included an information quality component. The results of this study do not support perceived information quality as a valid indicator of IS success. This finding suggests the need for further research to ascertain the nature of the information quality concept and to determine its relationship with both situational and other controllable variables that operate during the process of system development.

Contributions of the Study

This study contributed useful results for the practice of information systems. It has shown that the system usefulness measure may represent a valid measure that can be utilized to evaluate the feasibility of a variety of system development projects. The expected cost of an IS project is also shown to have a significant impact upon such an evaluation. The respondents to this study have indicated reliance upon those two variables in forming their future development intentions. To the extent that consensus about the effect of those two variables implies accuracy in the resulting decision, the measures of perceived system usefulness and perceived project cost can be utilized to guide similar decisions in other organizations.

The study also contributed useful results for IS research. Although system usefulness as a concept has been discussed in the IS literature for many years [e.g., Schultz and Slevin 1975], a specific measure of it has not been developed until very recently [Davis 1989]. That measure,
however, has only been examined in experimental situations using specific types of software programs as, for example, word processing and graphics software packages. This study has investigated the validity of that measure in a different context, using real-world decision makers as its respondents and using a great variety of system development projects as its target. In that regard, this study has demonstrated the potential benefits of using the measure in the process of deciding about a system development project.

Limitations of the Study

Two caveats associated with survey research [cf. Kerlinger 1986, 380] apply to this study as well. First, although the identity of respondents could not be confirmed, a number of control questions were incorporated into the research instrument designed to collect data for this study. The quality of collected data has been partly insured by those control questions. In particular, a number of observations which were provided by respondents with no significant influence over system development decisions were excluded from the analysis. Second, nonresponse has been a problem in the data collection phase of this study. A different research design, for example, a field study in a number of preselected organizations, could have allowed a better response rate than the one achieved (24 percent). Nevertheless, all tests for nonresponse bias have provided satisfactory results.

This study measured all research variables at a single
point in time and used correlational analysis. This approach limits statements about causation. Potential problems and possible research strategies relevant to IS survey research are thoroughly discussed in Kraemer [1991]. Specific recommendations to be considered for adoption in future research will be presented in the next section.

The study was limited in its scope in that it did not measure variables that were examined in prior upstream research, for example, user involvement in systems development. Although past IS research has extensively examined such relationships, the replication of those findings in this study could have enhanced the strength of the conclusions presented here.

Another limitation relates to the breadth of the perceived information quality scale used in this study. Bailey and Pearson [1983] have originally developed an instrument consisting of 39 items representing a variety of factors in addition to information quality. Ten of the 39 items represented information quality. Those ten items were further reduced to a set of five by Ives et al. [1983]. Those five items were used in this study to measure information quality. The review of information attributes that was presented in the literature review chapter, has shown that information quality could have a much wider scope than those five items.

In addition to the breadth of the perceived information quality scale, another limitation relates to its prior
psychometric testing. Both Ives et al. [1983] and Baroudi and Orlikowski [1988] have examined the psychometric properties of the Bailey and Pearson [1983] instrument which included information quality as one of its factors. In contrast to the system usefulness scale which has undergone extensive psychometric testing by Davis [1989], Ives et al. [1983] and Baroudi and Orlikowski [1988] did not examine the psychometric properties of the information quality scale when administered by itself. Such an examination could have expanded the scope of the items included in the scale.

This study was also limited with regard to the adopted scope of IS success. Only three variables were defined to indicate IS success. Decision making effectiveness is an additional variable that was developed in the past IS literature [Sanders 1984]. Task redesign is suggested as an impact of IS implementation [Keen 1991]. Studies in organizational effectiveness suggest additional criteria of success [cf. Campbell 1977; Quinn and Rohrbaugh 1983]. The scope of perceived IS success could therefore be expanded to incorporate the above indicators.

**Recommendations for Future Research**

A direction for future research is to reexamine the predictive validity of perceived information quality using a scale with an expanded scope, that is, including additional information attributes that were not measured in this study. The information quality scale developed by Doll and Torkzateh [1988], which represents an adaptation of the
original Bailey and Pearson [1983] instrument, would represent an expanded scope for information quality. Additional information quality concepts that were developed in accounting [cf. FASB 1980; Chennhall and Morris 1986] may also be examined for inclusion in a future research instrument.

Specific strategies for strengthening IS survey research have been proposed by Lucas [1991]. One such strategy suggests designing studies that capture the effect of longitudinal events and utilize a control group. Future research could benefit from that suggestion. For example, the system development process could be conceptualized as a series of events each occurring at a discrete stage of a system's development. Capturing the occurrence of each of those events, along with their effect on the organization and users, could provide the needed longitudinal data that could permit statements about causal relationships. The strength of those statements could be enhanced by examining organizations which are both active and inactive in IS development.

The investigation of additional measures of success could also be the subject of future research. For example, perceived benefits relating to decision making performance [e.g., Sanders 1984] may be included in a future research instrument. Additional indicators of IS success, as those suggested by studies in the organizational effectiveness literature and by Keen [1991], could also be examined.
The examination of other variables that complement or moderate the effect of IS success upon system development decisions, represents a fruitful avenue for future research. An example of such variables in the present study was represented by the characteristic of government-mandated projects. Such projects were excluded from the analysis in this study. There is likely to be a spectrum of discretionary/nondiscretionary system development with government-mandated projects being only the extreme. Future research should therefore more clearly establish those boundaries of generalization.
REFERENCES


APPENDICES
APPENDIX A

DETAILED CONCEPTS IN STUDIES EXAMINING INFORMATION QUALITY

Gallagher [1974]

Quantity
   complete - incomplete
   enough - sufficient

Quality - Format
   readable - unreadable
   orderly - disordered
   logical - illogical
   clear - unclear
   simple - complex

Quality - Reliability
   true - false
   reliable - unreliable
   valid - invalid
   accurate - inaccurate

Timeliness
   current - outdated
   timely - untimely

Nolan and Seward’s [1974] Information Dimensions

Currency of reporting: how often a report is received by the user, i.e., frequency of reporting.
Level of report detail: breakdown of the information in the report.
Report format: methods of portraying information, such as accounting statements, histograms, narrative.
Content of report.
Mode of dissemination.

Zmud [1978]: Dimensionality of Information

Overall Quality of Information:
- Relevant: applicable, helpful, needed, significant, useful.

Relevancy Components:
- Accurate: accurate, believable.
- Factual: factual, true.
- Quantity: complete, effective, material, sufficient.
- Reliable/Timely: current, reliable, timely, valid.

Quality of Format:
- Arrangement: orderly, precise.
- Readable: clear, convenient, readable, simple.

Quality of Meaning:
- Reasonable: logical, sensible.
Zmud [1979]: Factors that impact upon Information Value (reduction in decision making uncertainty)
Source of information.
Timeliness.
Level of aggregation.
Completeness.
Accuracy.
Reliability.
Validity.
Currentness.

Larcker and Lessig [1980]: Dimensions of Perceived Usefulness of Information
A. Perceived Importance: related to whether the information is relevant, informative, meaningful, important, helpful or significant. Based upon Zmud’s [1978] relevant, factual, quantity, and reasonable dimensions.
Individual items:
1) It would be extremely difficult to complete the decision without at least the information presented.
2) The information presented is sufficient to complete the decision.
3) The information presented is essential for or instrumental in completing the decision.

B. Perceived Usableness: related to whether the information format is unambiguous, clear, or readable (a concern with the accessibility of information in the report). Based upon Zmud’s [1978] quality of format (arrangement, readable) dimension.
Individual items:
1) Extremely complex recalculation are needed in order to use the information.
2) The information presented is in correct form.
3) The information presented is interpretable without recalculation or adjustments.

O’Reilly [1982]: Dimensions of Information Quality
Accuracy.
Relevance and specificity.
Reliability.
Timeliness.

Ahituv and Neumann [1982]
Timeliness: age, response time, frequency.
Content: accuracy, level of detail, completeness, relevance.
Format: medium, graphic design, ordering, access.
Confidence in system.
Timeliness of output.
Currency of output.
Reliability of output.
Relevancy of output.
Volume of output.
Accuracy of output.
Precision of output.
Completeness of output.

Swanson [1987]: Dimensions of Information Value
Valuable.
Useful.
Relevant.
Important.
Meaningful.

Doll and Torkzateh [1988]: Dimensions of Satisfaction with End-User Computing Applications
1) Content:
- Does the system provide the precise info you need?
- Does the information content meet your needs?
- Does the system provide reports that seem exactly what you need?
- Does the system provide sufficient information?
* Do you find the output relevant?
2) Accuracy:
- Is the system accurate?
- Are you satisfied with the accuracy of the system?
* Is the output reliable?
* Is the system dependable?
3) Timeliness:
- Do you get the information you need in time?
- Does the system provide up-to-date information?
4) Format:
- Is the output presented in a useful format?
- Is the information clear?
* Are you happy with the layout of the output?
* Is the output easy to understand?
5) Ease of Use:
- Is the system user friendly?
- Is the system easy to use?
* Is the system efficient?
(Items preceded by an asterisk were excluded from the final 12-item instrument).

Items in Industry Questionnaires [Newman 1989]
Quality of output (batch systems).
Mode of output (online viewing of batch reports).
Usefulness of output content: a lot of data available but little useful information for running the business better.
Timeliness of output.
Content of output.

Zmud et al. [1990]: Information Quality Dimensions
Timely.
Precise.
Accurate.
Reliable.
Tailored (vs. standardized).
Personal.
Appendix B

Detailed Concepts in Studies Examining Accessibility

MIS Refinements [Schewe 1976]
1) Mental search effort: amount of mental energy expended to use the IS.
2) Physical movement: distance between user’s work and the place where he interacts with the system.
3) Interface with special codes: need for user knowledge of special codes to use the system.
4) Output complexity: the difficulty in interpreting the output (i.e., output format).

Zmud [1979]: MIS Design Characteristics
a) Value of information received.
b) Decision aids provided.
c) Delivery system (user-system interface).
Accessibility presented as a delivery system issue, that is, convenience and ease of use of the MIS.

O’Reilly [1982]: Information Source Accessibility
Ready availability of information.
Ease or accessibility of obtaining information.
Difficulty of obtaining information.

Ives et al. [1983] on accessibility items of Bailey and Pearson [1983]
Items loading on the "EDP Staff and Services" factor, after excluding the "EDP Staff" questions:
- Convenience of access.
- Flexibility of systems.
- Time required for systems development.
- Personal control of EDP services.
- Processing of requests for system changes.
- Allocation priorities for EDP resources.

Culnan [1984, 1985]
Accessibility is a multidimensional concept, encompassing
a) a physical dimension, i.e., gaining physical access to a terminal and the system.
b) an interface dimension, i.e., the ability to formulate a query using the system’s command language.
c) an informational dimension, i.e., the ability to physically retrieve potentially relevant information.

Measures for the three dimensions:
A) Hardware or Terminal Accessibility (physical access to a source):
- Available, convenient, close, immediate, unimpeded, unobstructed, unrestricted.

B) Interface Dimension:
- Ease of use of the system and its command language.
- Availability of others who can provide assistance in using the system.
- Quality of available documentation.
- Friendly and flexible.
- Clear error messages.
- Ease of learning commands.

C) Information Accessibility (no clear results about this dimension):
- Reliability (dependable, failure-free, reliable, certain).

Swanson [1987]
Adjectives Loading on Information Value:
- Valuable.
- Useful.
- Relevant.
- Important.
- Meaningful.

Adjectives Loading on Accessibility (similar to Culnan’s physical accessibility):
- Unobstructed.
- Untroublesome.
- Unburdensome.
- Unrestricted.
- Convenient.
- Easy.
- Responsive.
- Flexible.
- Time-saving.
- Failure-free.
- Friendly.

Adjectives Loading on Information Technique (a factor combining adjectives from both of the above factors):
- Reliable.
- Precise.
- Accurate.
- Timely.
- Comprehensive.
- Concise.
- Dependable.
- Undistorted.
- Failure-free.
- Responsive.
- Time-saving.
- Instructive.

Accessibility of IS Tools [Newman 1989]
- Availability of computing services.
- Availability of mainframe processing (system uptime).
- Timeliness of processing (batch systems on mainframe).
- Response time (terminals).
- System response time.
- Problem resolution support provided by system.
- Availability of system.
- System availability, response time, batch turnaround time, usability (ease of use), availability of printers.
- Online applications' uptime.

Organizational Support [Lucas et al. 1990]
1) Place of Access / Terminal accessibility.
2) Few impediments to use.

Zmud et al. [1990]: Accessibility Dimensions
Available - not available.
Dependable - not dependable.
Ambiguous - Clear.
Feedback immediate - feedback delayed.
Easy to use - hard to use.
Simple - complex.
Technical - nontechnical.
APPENDIX C

DETAILED CONCEPTS IN STUDIES EXAMINING SYSTEM USEFULNESS

Schultz and Slevin [1975] Effectiveness Factors
1. Effect of system on user's job performance and performance visibility.
2. Interpersonal relations, communication, and increased interaction and consultation with others.
3. Changes in organizational structure.
4. Goal clarity, congruence, achievability.
5. Top management, technical, and organizational support to the system; low resistance.
7. Urgency for results; System importance to user's job.

Schewe [1976] Effectiveness Dimensions (consequences of use)
1) Decision making effectiveness: effect on user's ability to make decisions.
2) Importance:
   - Managerial capabilities: effect on user's opportunities to use his managerial talents.
   - Personal prestige: effect on user's prestige in the organization.
3) Job Productivity: effect on manager's own productivity.
4) Management Control: effect on general management's ability to control its operation.
5) Administrative Efficiency: effect of system on:
   - operating corporate costs.
   - clerical costs.
   - company's policies and procedures.

Sanders [1984]: Dimensions of DSS Success
A) Overall Satisfaction (contribution of system to better job performance):
1. Dependence on DSS.
2. User becomes more valuable to the organization through the system.
3. User personally benefits from the system.
4. User relies on the system in performing his job.
5. Importance of system to the organization.
6. The system is useful.

B) Decision-Making Satisfaction (contribution to personal decision making):
My utilization of the system, has helped me:
1. Make better decisions.
2. Set priorities better.
3. Present arguments more convincingly.
4. Improve the quality of my decisions.
5. Increase the speed of my decision making.
6. More relevant information has been made available to me.
7. Use analytical aids to a greater extent.

Effects of System Adoption or Perceived System Performance
[Bikson et al. 1987]
A) Effects on Individual Job Performance: Individual user's perception of system impact upon work speed, quality, type, and quantity.
B) Effects on Work Group Productivity: Office manager's judgment about increases in output or reduction in labor costs.
C) Value-Added Gains: Office manager's assessment of performance-related effects other than productivity, e.g.,
   - improved planning accuracy.
   - quicker completion of information-intensive projects.
   - enhanced product quality and/or product differentiation.
   - enhanced competitive advantage through improved timeliness and specificity of information.

System Functionality/Usefulness [Newman 1989]
- Functionality of computing products for end-user tasks, e.g., word processing, graphics, spreadsheets, data analysis and reporting, and electronic conferencing.
- User's perception of the extent to which system meets user needs in technology and in providing guidance.
- Functionality of system: menus, help screens, etc.
- System meets top management's expectations concerning the provision of information to support strategic planning.
- Quality of computing services.
- User-perceived quality of system relative to competitors' information systems.
- User-perceived quality of system relative to the quality of the same organization's system 8 years ago.
- The firm's information system is instrumental in meeting:
  (a) a user's personal information needs, (b) organizational information needs, and (c) organizational operational needs.

Overall Satisfaction [Newman 1989]
- Importance of information processing to one's job.
- Overall satisfaction with the information processing services one uses.
- User-perceived effectiveness of the firm's information system as compared to the information systems of other companies the user is familiar with.

Perceived Benefits of IS Use [Newman 1989]
- Importance of benefits provided by the firm's system.
- Performance of the firm's current information system in providing those benefits. List of benefits includes:
  - white collar productivity.
- user productivity.
- external customer satisfaction.
- strategic decision support.
- operational decision support.
- organizational flexibility.
- financial control.
- process standardization.
- competitive advantage.
- sales support.
- cost containment.
- labor saving.

Davis [1989] Usefulness Measures (original list of 14 items)
A) Job Effectiveness or Performance Cluster:
* Using the system improves my job performance (from Shultz and Slevin's [1975] performance factor).
* Using the system enhances my effectiveness on the job (from Schewe [1976]).
- Using the system improves the quality of work I do.

B) Productivity and Time Savings Cluster:
- Using the system saves me time (from Schultz and Slevin [1975]).
* The system enables me to accomplish my tasks more quickly.
- Using the system allows me to accomplish more work than would otherwise be possible (similar to Sanders' [1984] item #16, which loaded weakly on the "decision making satisfaction" factor).
- Using the system reduces the time I spend on unproductive activities.
* Using the system increases my productivity.

C) Importance of the System to One's Job Cluster:
- My job would be difficult to perform without the system (similar to Sander's [1984] dependency and reliance items).
- The system addresses my job-related needs (similar to Schultz and Slevin's [1975] urgency factor).
- The system supports critical aspects of my job (also similar to Schultz and Slevin's [1975] urgency factor).
* Using the system makes it easier to do my job (from Schultz and Slevin [1975] performance factor).

D) Not Clustering:
- Using the system would give me greater control over my work (from Schultz and Slevin [1975] performance factor).

E) Overall Usefulness:
* Overall, I find the system useful in my job.
(Items preceded by an asterisk were included in the final six-item instrument).

Personal Stake [Lucas et al. 1990]
1) Stake:
- extent system is part of job.
- extent system contributes to job performance.
- extent job performance would be hurt if system or data
source no longer available.
- extent expected by others to use system.
2) Contributes to Objectives:
- extent use of the system helps achieve personal objectives.
- extent use of the system achieves company objectives.

Rice and Aydin [1991]
1) The new computer system is worth the time and effort required to use it.
2) The system changed the "ease of performing the department's work."
3) The system changed "the quality of the department's work."

Summary of Factors Used in the DSS Effectiveness Literature to Represent DSS Success or Performance

Keen and Scott Morton [1978]
- Decision making effectiveness: quality or accuracy of decision.
- Decision making efficiency: speed or reliability of decisions.

Goslar et al. [1986]
- Number of alternatives considered.
- Amount of time spent for decision process.
- Perceived confidence in decisions.
- Amount of data considered in decision making.

Cats-Baril and Huber [1987]
- Decision quality.
- Productivity of ideas (number of alternatives generated, number of alternative strategies prioritized).
- Confidence in decisions.

Dos Santos and Bariff [1988]
- Problem identification/finding ability.
- Problem prioritization ability.

Sharda et al. [1988]
- Decision effectiveness: experimental earnings.
- Efficiency of group performance: self-report of the amount of time spent in decision making.
- Number of alternatives considered.
- Confidence in decisions.

Sainfort et al. [1990]
- Impact of DSS upon problem solving phases, such as, problem understanding, understanding of others' views, perceived clarity of implementation strategy, solution implementation.
APPENDIX D

CATEGORIZATION AND LISTING OF INFORMATION SYSTEM BENEFITS IDENTIFIED IN STUDIES ON SYSTEM VALUE ANALYSIS

Operational Benefits

1) Clerical.
   - Time and labor savings.
   - Improved data administration.
   - Greater accuracy, speed, and reliability in data handling.
2) Data Utilization.
   - Improved timeliness, accuracy, access, availability of data.
   - System contributes to better use of data resources that were previously inaccessible.

Managerial/Organizational Benefits

1) Improved Communication Between Management Levels.
   - System can be used to explain rationale for a decision.
   - Improved customer relations.
   - More effective team work (reduced conflict).
2) Improved Planning and Control.
   - Improved long-term planning (better understanding of business).
   - Improved identification of critical relationships.
   - Improved operational planning.
     - System helps reduce length of planning cycle.
     - Improved scheduling and production control, resulting in a more efficient employment of personnel and machinery.
     - Improved customer service by anticipating customer requirements resulting in such organizational outcomes as fewer lost sales, less overtime due to rush orders.
   - Improved control.
     - Better tracking of services/jobs.
     - Identification of discrepancies with plans.
     - Improve frequency and quality of internal reviews.
     - Timely comparisons with budgets, standards, or forecasts.
     - Improved control over credit risk, expense patterns.
3) Improved (effective and efficient) Utilization of Management Time.

Personal Benefits

1) Decision Search Benefit.
   - Increased depth and scope of alternatives exploration.
2) Decision Making Benefit.
   - Better decisions, possible to cope with more complex
decisions.
- Fast response to unexpected situations.
- Ability to carry out ad hoc analysis.
3) Problem Appreciation Benefit.
- Improved understanding of problems, learning value, management skills leverage, increased decision confidence.

APPENDIX E

FREQUENCY TABLES USED TO TEST FOR NONRESPONSE BIAS

A. Industrial Classification Category by Responding or Nonresponding Firms

<table>
<thead>
<tr>
<th>Industrial Classification</th>
<th>Number Responding</th>
<th>Number Nonresponding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Manufacturing</td>
<td>78</td>
<td>253</td>
<td>331</td>
</tr>
<tr>
<td>2. Financial Institutions</td>
<td>28</td>
<td>67</td>
<td>95</td>
</tr>
<tr>
<td>3. Electric and Gas Utilities</td>
<td>27</td>
<td>65</td>
<td>90</td>
</tr>
<tr>
<td>4. Holding/Investment</td>
<td>12</td>
<td>64</td>
<td>76</td>
</tr>
<tr>
<td>5. Real Estate</td>
<td>18</td>
<td>58</td>
<td>76</td>
</tr>
<tr>
<td>6. Wholesale Trade</td>
<td>11</td>
<td>61</td>
<td>72</td>
</tr>
<tr>
<td>7. Services</td>
<td>15</td>
<td>54</td>
<td>69</td>
</tr>
<tr>
<td>8. Transportation</td>
<td>12</td>
<td>48</td>
<td>60</td>
</tr>
<tr>
<td>9. Retail Trade</td>
<td>7</td>
<td>48</td>
<td>55</td>
</tr>
<tr>
<td>10. Construction</td>
<td>8</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td>11. Mining</td>
<td>9</td>
<td>24</td>
<td>33</td>
</tr>
<tr>
<td>12. Agricultural</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>227</strong></td>
<td><strong>773</strong></td>
<td><strong>1,000</strong></td>
</tr>
</tbody>
</table>

Chi-Square (11)=12.623; p=0.319

Power (1-β) of χ² test [Cohen 1988]:
- Small effect, α=.05: 50%
- Medium or large effect, α=.05: 99%

B. Sales Category by Responding or Nonresponding Firms

<table>
<thead>
<tr>
<th>Sales Category</th>
<th>Number Responding</th>
<th>Number Nonresponding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Less than 50 million (50M)</td>
<td>55</td>
<td>204</td>
<td>259</td>
</tr>
<tr>
<td>2. Greater than 50M but</td>
<td>39</td>
<td>173</td>
<td>212</td>
</tr>
<tr>
<td>less than 100M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Greater than 100M but</td>
<td>43</td>
<td>108</td>
<td>151</td>
</tr>
<tr>
<td>less than 150M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Greater than 150M but</td>
<td>29</td>
<td>68</td>
<td>97</td>
</tr>
<tr>
<td>less than 200M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Greater than 200M</td>
<td>51</td>
<td>178</td>
<td>229</td>
</tr>
<tr>
<td>6. Missing values</td>
<td>10</td>
<td>42</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td><strong>227</strong></td>
<td><strong>773</strong></td>
<td><strong>1,000</strong></td>
</tr>
</tbody>
</table>

Chi-Square (5)=7.257; p=0.202

Power (1-β) of χ² test [Cohen 1988]:
- Small effect, α=.05: 68%
- Medium or large effect, α=.05: 99%
C. Employee Size Category by Responding or Nonresponding Firms

<table>
<thead>
<tr>
<th>Employee Size Category</th>
<th>Number Responding</th>
<th>Number Nonresponding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 1 to 100 employees</td>
<td>14</td>
<td>39</td>
<td>53</td>
</tr>
<tr>
<td>2. 101 to 500 employees</td>
<td>94</td>
<td>344</td>
<td>438</td>
</tr>
<tr>
<td>3. 501 to 1000 employees</td>
<td>68</td>
<td>235</td>
<td>303</td>
</tr>
<tr>
<td>4. Greater than 1,000 employees</td>
<td>51</td>
<td>155</td>
<td>206</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>227</strong></td>
<td><strong>773</strong></td>
<td><strong>1,000</strong></td>
</tr>
</tbody>
</table>

Chi-Square (3) = 0.840;  p = 0.840

Power (1-β) of χ² test [Cohen 1988]:
- Small effect, α = .05: 76%
- Medium or large effect, α = .05: 99%
<table>
<thead>
<tr>
<th>#</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Replace current minicomputer-based manufacturing system with networked PC-based system.</td>
</tr>
<tr>
<td>2</td>
<td>To enhance the effectiveness and efficiency of current operations using up-to-date technology.</td>
</tr>
<tr>
<td>3</td>
<td>Install/evaluate distribution system package in wholesale distribution centers.</td>
</tr>
<tr>
<td>4</td>
<td>Total switchover to (most likely) IBM AS-400 computer and full package software for accounting, management reporting, sales, order entry, shipping.</td>
</tr>
<tr>
<td>5</td>
<td>Bar code stock in warehouse - Update inventory.</td>
</tr>
<tr>
<td>6</td>
<td>Installation of new hardware and software, including the UNIX operating system.</td>
</tr>
<tr>
<td>7</td>
<td>Financial programs (general ledger, inventory, order entry) to be used at pre-publishing stage.</td>
</tr>
<tr>
<td>8</td>
<td>Platform automation (front-office and back-office banking systems).</td>
</tr>
<tr>
<td>9</td>
<td>Automation of retail sales, distribution, POS hardware and software linked to accounts payable, accounts receivable, and ledger.</td>
</tr>
<tr>
<td>10</td>
<td>Production scheduling.</td>
</tr>
<tr>
<td>11</td>
<td>Remove major financial systems from the mainframe environment and install them on a PC-LAN system.</td>
</tr>
<tr>
<td>12</td>
<td>Upgrade System 38 and all software.</td>
</tr>
<tr>
<td>13</td>
<td>On-line payment application for accounts receivable system.</td>
</tr>
<tr>
<td>14</td>
<td>Upgrade existing integrated manufacturing system to its current version or replace with state of the art package.</td>
</tr>
<tr>
<td>15</td>
<td>Pension Plan Accounting.</td>
</tr>
<tr>
<td>16</td>
<td>A system to maintain process and tooling data for our manufacturing operations.</td>
</tr>
<tr>
<td>17</td>
<td>Upgrade software to latest version.</td>
</tr>
<tr>
<td>18</td>
<td>Add unified check printing.</td>
</tr>
<tr>
<td>19</td>
<td>Freight bill tracking/payment to replace manual system.</td>
</tr>
<tr>
<td>20</td>
<td>Point of sale system.</td>
</tr>
<tr>
<td>21</td>
<td>Implement EDI with European office and with customers.</td>
</tr>
<tr>
<td>22</td>
<td>Implementation of Image Processing and full integration into the business process.</td>
</tr>
<tr>
<td>23</td>
<td>Upgrade payroll system.</td>
</tr>
<tr>
<td>24</td>
<td>Integrate the marketing/sales/order entry system into the Accounts Receivable and General Ledger update system.</td>
</tr>
<tr>
<td>25</td>
<td>Shop load distribution by forecasted ship date rather than by scheduled ship date.</td>
</tr>
<tr>
<td>26</td>
<td>Add optical disk capability to replace microfiche record retention medium.</td>
</tr>
<tr>
<td>27</td>
<td>Replace an existing lease billing/invoicing system.</td>
</tr>
</tbody>
</table>
28 Control and account for purchases of crude vegetable oil.
29 Executive information reporting.
30 Update existing fully integrated system (accounting, purchasing, engineering).
31 Accounts payable, receivable and general ledger package.
32 Upgrade a heavily modified release of existing software and add new users.
33 Currently running software on an IBM Model 36; replacement with AS/400 and with new software.
34 Modify existing IBM mainframe gas information systems to include functionality of WANG-based gas IS in order to eliminate need for WANG hardware.
35 Update existing custom software.
36 New general ledger system with consolidation ability.
37 Migrate from centralized mainframe to host/server arrangement.
38 Raw materials, manufacturing process control.
39 Petroleum terminalling system: Inventory control, customer profile databases, transaction capture and upload, customer control download.
40 Complete MRP II, fully integrated manufacturing and distribution system.
41 Revise input to payroll program.
42 Mainframe based accounts payable systems for use by all divisions of company.
43 Replace mini computer driven customer service system with a PC-LAN-based system.
44 Mechanize the printing of contract documents in remote locations.
45 Upgrade basic canned package to user specifications.
46 Rewrite purchasing system to incorporate several changes in mode of operations and requirements.
47 Update inventory system to provide daily perpetual record.
48 Upgrade current general ledger system to input data downloaded from mainframe.
49 Redevelop gas marketing application.
50 LAN-based personnel system.
51 On-line teller system: platform automation.
52 Sales/Cost reporting systems.
53 Loan processing package.
54 Update accounting system to improve system utilization and data access capability.
55 New accounts receivable, order entry, perpetual inventory, sales analysis system.
56 New order entry system.
57 Upgrade system with new hardware.
58 Upgrade hardware to implement new version of canned software with some custom modifications.
59 Loan processing and document preparation.
60 Replace existing computer because of capacity.
61 Plan to replace current OS with UNIX OS and with more powerful hardware.
62 Move to client-server environment using HP9000 as database server.
63 Upgrade IBM AT to a 386 machine and install accounts payable software upgrade.
64 Acquire new personal computers with canned packages.
65 Upgrade of construction cost accounting software.
66 (No project reported).
67 Replace all core business applications (financial, sales, marketing, manufacturing).
68 New materials requirement planning (MRP) system, interfaced with existing order entry and inventory systems.
69 Certification of incoming raw materials.
70 Re-engineer a 20-year-old business support system to provide new functions in an open system client-server environment.
71 Consider complete software change to fully use AS/400.
72 Production planning (MPS-MRP-CCM).
73 New general ledger programs.
74 New accounts payable program.
75 Installation of point-of-sale hardware and software.
76 Convert to new software which will require different hardware.
77 Automation of the packaging and shipping departments. Installation of scanners and personal computers at five packing stations and development of custom software to control scanners and update files.
78 Replace current card-based payroll system and add human resource component as integrated system.
79 Real-time capture of delivery information from our trucks during delivery rather than after they return to their point of dispatch.
80 Update of canned accounting system and writing custom code to interface with construction cost system.
81 Advertising system on AS/400.
82 Replace existing payroll/human resource system.
83 Add front-end gross pay calculation.
84 (No project reported).
85 Rewrite shareholder accounting system to allow unlimited money market accounts.
86 Automate existing document control system. Automate signature loop and provide electronic document storage/access.
87 Customize canned software to fit functions of company.
88 Costing and tracking of defective manufactured and purchased items.
89 System for electronic exchange of freight rate data with other rail carriers.
90 Add relational database information system capabilities.
91 Add production inventory capability.
92 (No project reported).
93 A new freight billing system and interline settlement system combination.
94 Integrated cost accounting system to track, budget, and evaluate costs at the product level.
95 Replace existing AS/400 with a PC network system.
96 Conference management and support system.
97 New financial programs (general ledger, accounts receivable/payable) on PC network.
98 Upgrade accounting software to run under Windows or OS/2.
99 Replacement of budgeting system.
100 Upload a new inventory subsystem into the currently integrated system.
101 Upgrade IBM System/36 to IBM AS/400.
102 Replace an existing "CIS" system with client/server technology.
103 Changes to distribution process.
104 Redo and update company wide financial programs on AS/400.
105 Convert service bureau marketing/accounting systems to in-house.
106 Change entire system from IBM System 36 to IBM AS/400.
107 RFP covered all system needs. Task force representing all major users. Deciding delivery system between in-house/out-sourcing.
108 Platform automation (branch banking).
109 Expand office automation/imaging.
110 An executive information system that will be an add-on to our current system.
111 Installation of an accounts payable system.
112 Replace current IBM S/38 and software with IBM AS/400 and new software applications.
113 Fixed asset system including continuing property records.
114 Adding manufacturing software.
115 Marketing query system (combining marketing system with a customer database to provide information about marketing trends, customer patterns, etc.).
116 Integrated software: Maintenance planning, inventory, purchasing, accounting and budgeting.
117 A new customer billing system.
118 Automate collection and consolidation of monthly actual, forecast, and planned subsidiary financial data.
119 Purchase software to run on AS/400.
120 New mortgage loan system.
121 Replace microfiche with text image on a RISC-based LAN with CICS access.
122 Rightsizing our existing mainframe and software.
123 Order entry system for specific business unit within our company.
124 Branch bank platform automation.
125 Replace entire operating system for property/casualty insurance company.
126 Installation of a completely new system, including new software, hardware, and telecommunications.
127 Create network node to handle remote location.
Customer profitability.
Interface a new finished goods warehouse with our current system and provide new enhancements.
Migrate general ledger from mainframe to mid-range, UNIX platform.
Convert software to run on a network system.
Downsize mainframe general ledger and accounts payable systems to LAN-based systems.
Materials requirement planning.
Upgrade operations reporting (manufacturing, distribution, materials) to enhance efficiency and problem identification.
Broker trading system.
New computer for customer service, billing and work scheduling, servicing 53 remote locations on-line.
Replace financial suite of programs.
Replace existing significant spreadsheet applications with a database application.
Change accounting system (run on newly acquired AS/400) to calculate cost of goods sold based on actual units rather than estimates.
Manufacturing, sales and finance software.
Upgrade deposit systems.
Replace accounting system software.
Create a data base on a file server for management reports to allow for custom management inquiry.
Replace existing DEC 4000-200 and IBM 4381 with a single platform running integrated software modules.
New accounting system.
Replace a 10-year old line of business applications which is central to one of our divisions.
Fixed asset accounting system.
Replace the programming language vendor used for our key accounting systems.
Installing a wide area network. Access required for signatures and other reporting capabilities for FDIC.
Transportation system: information about cost/performance of each vehicle, mechanical maintenance and cost allocation to expense accounts.
Strategic systems plan to select new manufacturing and financial software.
Replace all software running on corporate mainframe. "Rightsize" project.
Replace existing manufacturing and financial systems with new technology using client server architecture, GUI's, etc.
New billing system on AS/400.
Design, develop and implement systems to deliver drug applications on optical media to the FDA.
Gas Information System: core software for the management of the company.
Customize on-line system for more convenience in reporting and more accessible information.
Rewrite reinsurance sub-system.
159 Laptop implementation of utilization review application (company is a management carer; PCs used by nurses to enter/access member/doctor data).
160 Replace management accounting system (mainframe) with a distributed system (mini(s) and PCs).
161 Replace existing customer information system.
162 Fixed income portfolio management system.
163 Linkage of engineering CAD systems on workstations with mainframe integrated software.
164 National account tracking system.
165 Budget system.
166 Replace accounting system.
167 Expand inventory management capabilities at distribution sites through customized code attached to canned package.
168 Upgrade of proposal systems to more fully disclose consumer information.
169 Migrate financial reporting system (general ledger, payroll, project cost) from IBM mainframe to PC LAN.
170 Replace mainframe system with AS/400 and new software.
171 Pipe manufacturing information system to replace obsolete existing system developed on proprietary database.
172 Implement imaging system.
173 Automation of platform customer service functions in a bank.
174 Electronic imaging of land records.
175 Accounts payable and purchasing system.
176 Fixed assets system for tracking asset additions/disposals and book/tax depreciation.
177 Replace current batch inventory system with on-line system and add purchasing system.
178 Business information system.
179 Teller automation.
180 Upgrade commercial real estate loan servicing system.
181 Platform automation.
182 Movement to PC-based loan origination system.
183 Replace current customer information system.
184 Replace current project accounting and reporting system.
185 Referral tracking system for helpline calls.
186 Project cost / maintenance system.
187 Downsizing and rightsizing to enhance information processing and to meet timing demands.
188 Upgrade existing cash management system to a PC based system for on-line interaction with mainframe.
189 Establish a PC/modem based system for sales agents.
190 New leasing system.
191 (No project reported).
192 Teleservicing control system.
193 Maintenance of physical location of customer address into customer record to assist in scheduling/routing work orders (service calls for electric utility company).
194 (No project reported).
195 Oil and gas revenue system.
196 Downsize a portion of the customer system (currently running on a mainframe) to run on a departmental configuration.
197 Change accounting system and main hospital system.
198 New accounting system.
199 Distribution system control.
200 Replace accounting software from System 36 hardware to PC network.
201 Replace financial software with integrated system to run on a network.
202 Install an equipment maintenance scheduling package and any needed hardware.
203 Conversion to new general ledger, accounts payable/receivable, purchasing.
204 Update/rewrite existing accounting database - Use of existing hardware in fourth generation language.
205 Replace mainframe customer information system in an open systems environment.
206 Develop front-end software to process business to back-end core system.
207 Migrate applications from Wang VS to a hybrid network of PCs on Novell LAN and SUN database servers.
208 New hardware and software to replace existing system.
209 Shop floor control: Plant floor data collection and reporting.
210 Replacing existing customer information system.
211 Migrate the company's "LEGACY" systems from a minicomputer to a PC-LAN client/server.
212 Executive information system.
213 Merchandise system (planning and analysis tool).
214 Rewrite and integrate various payroll, human resource, benefits, salaries, EEO, administration systems.
215 Power plant work order management system.
216 Modify functions and approaches of an existing branch automation system.
217 General ledger and financial reporting package.
218 Rewrite the agent management system which provides agent data to all production runs.
219 Direct sales in international market.
220 Automate the new accounts area - currently manual system.
221 Re-design order entry, invoicing, inventory, purchasing, and manufacturing reporting.
222 Accounts payable interface to general ledger.
223 Automation of sales and marketing data base.
224 "Open database," to obtain information from a variety of departments (payroll, general accounting, plant accounting).
225 Replace core order processing and product management systems.
226 Replace current vendor payables, upgrade overall accounting system.
227 Data entry via bar codes.
APPENDIX G

RESEARCH INSTRUMENT USED IN THE STUDY

Cover Letter Used in Initial Mailing

In the past few years, much study has been made of the factors which increase the value and success of a business's computer-based information system. Information systems range from providing only basic information to that of having great importance to a business. Evaluating the success of an information system depends upon asking the right questions. Our goal is to identify standard questions which everyone should ask when assessing the success of a given information system.

Your company is one of a small number of firms (randomly selected from Lotus' One Source corporate directory) which are being asked to assess their information system with our questions. Your help is especially valuable since your firm is representative of a much larger group of firms. To ensure sampling representativeness, it is important that each questionnaire be completed and returned.

We need our questions to be answered by the manager who has the most responsibility for (or influence upon the development of) your firm's information system. If another manager has that role instead of you, could we ask you to pass our material on to that individual.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off of the mailing list when your questionnaire is returned. While we do not ask for sensitive information, individual questionnaires will not be shared with anyone.

The results of this research will be published in journals concerned with information systems. You may receive a summary of results by checking the "copy of results requested" box in the questionnaire.

We would be happy to answer any questions you might have. Please write or call. The telephone number is (618) 453-1405.

Thank you for your assistance.

P.S.: This project has been reviewed and approved by the Southern Illinois University at Carbondale Human Subjects Committee. The committee's telephone number is (618) 453-4533.
Follow-Up Materials

A. A postcard reminder sent to everyone in one week after the initial mailing:

Last week a questionnaire seeking your opinion about your information system was mailed to you. Your name was drawn in a random sample of firms from Lotus's One Source corporate directory.

If you have already completed and returned it to us please accept our sincere thanks. If not, please do so today. Because it has been sent to only a small, but representative, sample of firms it is extremely important that yours also be included in the study if the results are to accurately represent the opinions of people in firms like yours.

If by some chance you did not receive the questionnaire, or it got misplaced, please call us right now (618-453-1405) and we will get another one in the mail to you today.

B. Second letter and replacement questionnaire sent only to nonrespondents in three weeks after the initial mailing.

About three weeks ago we wrote to you seeking your opinion on your information system. As of today we have not received your completed questionnaire.

Our goal is to identify standard questions which should be asked when assessing the success of a firm's computer-based information system.

We are writing to you again because of the significance each questionnaire has to the usefulness of this study. Your name was drawn through a scientific sampling process in which every firm in Lotus's One Source corporate directory had an equal chance of being selected. This means that only a small number of firms were being selected. In order for the results of this study to be truly representative of the opinions of people in firms like yours, it is essential that each person in the sample return their questionnaires.

As mentioned in our last letter, we need our questionnaire to be answered by the manager who has the most influence upon the development of your firm's information system. If another manager has that role instead of you, could we ask you to pass our material on to that individual.

In the event that your questionnaire has been misplaced, a replacement is enclosed. Your cooperation is greatly appreciated.
ASSESSING INFORMATION SYSTEMS SUCCESS:
A SURVEY OF DECISION MAKERS IN
INFORMATION SYSTEMS.

This questionnaire is designed to identify standard
questions which every information systems study should ask
when assessing the success that different companies are
having with their information systems. Your responses will
help us provide recommendations in this area.

Please answer all of the questions in this questionnaire.
If you wish to comment on any questions or qualify your
answers, please use the margins or a separate sheet of
paper. Your comments will be read and taken into account.
Thank you for your help.

Return this questionnaire to:

School of Accountancy
Southern Illinois University at Carbondale
Carbondale, Illinois 62901
"Information System" is defined as the set of software and hardware available at your organization.

"Existing System" is the information system currently in use at your organization.

"Information System Project" is a future possible change in existing software that has not yet commenced. The change does not have to be a completely new system -- a software update or a sub-system addition would also apply.

Before Answering Question Q-1
Please bring to mind the most significant "information system project" (as defined above) which you might adopt in the future.

Q-1 Is software (either canned or custom-developed or both) part of the information system project you have in mind? Please circle the appropriate response.

If yes, please continue with question Q-2.

If no, please recall a different project that does include software. Then go to question Q-2.

(If Project Includes Software)
Q-2 Has the project you have in mind already commenced? Specifically, has canned software already been purchased or, has a consultant or employee begun programming (or coding) software?

If no, please continue with question Q-3.

If yes, please recall a different project that has not yet commenced and that includes software. Then go to question Q-3.

(If Project Has Not Yet Commenced and Includes Software)
Q-3 Please circle the one software description that would best represent your information system project.

1 REPLACE CORE: Replace an entire software system which is completely new and different from your existing system (that is, not an update).
2 ADD SUB-SYSTEM: Add a completely new and different module or program related to only part of the entire software system.
3 UPDATE: Later version of canned software or custom software revised to add new capabilities.
Q-4 Please circle the one type of software that your information system project would contain.

1 CANNED SOFTWARE
2 CUSTOM SOFTWARE
3 BOTH CANNED AND CUSTOM SOFTWARE

Q-5 Please circle the one hardware description, if applicable, that would best represent your information system project.

1 NO HARDWARE: Only software in project.
2 REPLACE COMPUTER: New computer running new or existing software.
3 ADD COMPUTER: Add a new computer running new or existing software.
4 COMPONENT: Additional components and peripherals (for example, additional disk storage or printer).

Q-6 Please briefly describe the project.

Q-7 To what extent was the information system project you recalled a result of a reporting requirement mandated by the government? (Please circle a number).

1 SOLE REASON FOR THE DEVELOPMENT OF THIS PROJECT
2 TO A GREAT EXTENT
3 TO A SLIGHT EXTENT
4 NOT AT ALL

In this section, we ask you to rate two information systems: a. your existing information system, and b. the future information system that would result from the project you specified.

Definitions

"Future System" is the system created, once the information system project is completed. That is,

Existing -----> Project -----> Future System

"System Users" is an all-inclusive term which might include indirect users of the system's information, people who directly interact with the system, non-technical people, and technical people.

The scale positions are defined as follows:
1: extremely
2: quite
Q-8 Increasing the productivity of system users.

Existing system: likely

Future system: likely

Q-9 Enabling system users to accomplish their tasks more quickly.

Existing system: likely

Future system: likely

Q-10 Improving the job performance of system users.

Existing system: likely

Future system: likely

Q-11 Enhancing the effectiveness of system users on their jobs.

Existing system: likely

Future system: likely

Q-12 Making it easier for system users to do their jobs.

Existing system: likely

Future system: likely

Q-13 Being judged by system users as useful in their jobs.

Existing system: likely

Future system: likely

Definition: "Output information" includes printed reports from the system, as well as on-line data retrievals.
Q-14 **Reliability** of output information.

<table>
<thead>
<tr>
<th></th>
<th>Existing system</th>
<th>Future system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-14</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>Q-14</td>
<td>superior</td>
<td>superior</td>
</tr>
</tbody>
</table>

Q-15 **Relevancy** of output information (to intended function).

<table>
<thead>
<tr>
<th></th>
<th>Existing system</th>
<th>Future system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-15</td>
<td>useful</td>
<td>useful</td>
</tr>
<tr>
<td>Q-15</td>
<td>relevant</td>
<td>relevant</td>
</tr>
</tbody>
</table>

Q-16 **Accuracy** of output information.

<table>
<thead>
<tr>
<th></th>
<th>Existing system</th>
<th>Future system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-16</td>
<td>accurate</td>
<td>accurate</td>
</tr>
<tr>
<td>Q-16</td>
<td>high</td>
<td>high</td>
</tr>
</tbody>
</table>

Q-17 **Precision** of output information.

<table>
<thead>
<tr>
<th></th>
<th>Existing system</th>
<th>Future system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-17</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>Q-17</td>
<td>definite</td>
<td>definite</td>
</tr>
</tbody>
</table>

Q-18 **Completeness** of output information.

<table>
<thead>
<tr>
<th></th>
<th>Existing system</th>
<th>Future system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-18</td>
<td>sufficient</td>
<td>sufficient</td>
</tr>
<tr>
<td>Q-18</td>
<td>adequate</td>
<td>inadequate</td>
</tr>
</tbody>
</table>
Please indicate agreement or disagreement by marking an 'X' on the following scales.

The scale positions are defined as follows:
1   Strongly agree
2   Moderately agree
3   Slightly agree
4   Neither agree nor disagree
5   Slightly disagree
6   Moderately disagree
7   Strongly disagree

Q-19 The cost of the information system project would be higher than the cost of other system projects my organization has had in the past.

agree   1  2  3  4  5  6  7   disagree

Q-20 The demands of the information system project on my organization's financial resources would hinder its introduction.

agree   1  2  3  4  5  6  7   disagree

Q-21 The cost of the project would consume a large portion of my organization's capital budget.

agree   1  2  3  4  5  6  7   disagree

Q-22 Given other relevant problems, such as your organization's financial condition, management turnover, etc., please circle the one best time estimate that you would expect your organization to undertake the information system project you brought in mind.

1   WITHIN THE NEXT TWELVE MONTHS
2   WITHIN ONE TO THREE YEARS
3   WITHIN THREE TO FIVE YEARS
4   SOME TIME BEYOND FIVE YEARS
5   AS SOON AS THE SOFTWARE BECOMES AVAILABLE (IF THE PROJECT REQUIRES PRESENTLY NON-EXISTING CANNED SOFTWARE).

Q-23 What would be the likelihood that you would undertake the information system project? Please indicate your response by marking an 'X' on a line along the scale below.

definitely   extremely   slightly   neither
"no-go"  unlikely      unlikely    likely nor
unlikely
Q-24 How long have you been with your present organization?

_____ YEARS, OR _____ MONTHS (if less than one year).

Q-25 What is your title or position?


Q-26 How many levels is your position below the top executive in your organization? (for example, chief executive officer or president).

1 ONE LEVEL
2 TWO LEVELS
3 THREE LEVELS
4 MORE THAN THREE LEVELS

Q-27 How would you classify your level of influence on decisions concerning the development of information systems?

1 HAVE PRIMARY AUTHORITY -- OWN DECISION
2 HIGHLY INFLUENTIAL BUT INPUT OF OTHERS IN MY ORGANIZATION IS ALSO CONSIDERED
3 HAVE EQUAL INFLUENCE AS OTHERS IN MY ORGANIZATION
4 HAVE LESS INFLUENCE THAN OTHERS IN MY ORGANIZATION
5 HAVE NO INFLUENCE AT ALL

Q-28 Please print your name here.


Q-29 Can we call you in case we have a question about one of your answers?

☐ YES, MOST CONVENIENT DAYS AND TIMES ARE ____________.
☐ NO, I MUST DECLINE

Q-30 Would you agree to a brief telephone interview about your information system (which would occur in six months to a year)?

☐ YES
☐ NO, I MUST DECLINE

☐ Check the box here if you would like a summary of results.
APPENDIX H

EFFECT OF OMITTED OBSERVATIONS ON THE REGRESSION MODEL OF THE STUDY

A. Regression of intent on the three predictors using all 218 observations (227 total minus 9 with missing values)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimate</th>
<th>Standard Error</th>
<th>t-value</th>
<th>Prob.</th>
<th>Standardized Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>2.83</td>
<td>0.08</td>
<td>35.134</td>
<td>0.0001</td>
<td>0.00</td>
</tr>
<tr>
<td>ΔIQ</td>
<td>0.08</td>
<td>0.06</td>
<td>1.47</td>
<td>0.1492</td>
<td>0.09</td>
</tr>
<tr>
<td>ΔSU</td>
<td>0.20</td>
<td>0.06</td>
<td>3.452</td>
<td>0.0007</td>
<td>0.22</td>
</tr>
<tr>
<td>ΔCOST</td>
<td>-0.25</td>
<td>0.08</td>
<td>-3.135</td>
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F_{3,214}=7.945; p=.0001
Model R^2=.10

B. Regression of intent on the three predictors using 195 observations (184 useable plus 11 observations with government-mandated projects)

<table>
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<tr>
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F_{3,191}=8.255; p=.0001
Model R^2=.11

C. Regression of intent on the three predictors using 194 observations (184 useable plus 10 with low influence over systems development decisions)

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F_{3,190}=7.037; p=.0002
Model R^2=.10
D. Regression of intent on the three predictors using 190 observations (184 usable plus 6 with no application software development)

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$F_{3,186}=8.125; \ p=0.0001$

Model $R^2=.12$

E. Regression of intent on the three predictors using 189 observations (184 usable plus 5 with confounded responses)

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$F_{3,185}=5.793; \ p=0.0008$

Model $R^2=.09$

F. Regression of intent on the three predictors using 186 observations (184 usable plus 2 with responses on the extremes of every scale)

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$F_{3,184}=6.618; \ p=0.0003$

Model $R^2=.10$
## APPENDIX I

### INFLUENCE STATISTICS FOR THE 184 OBSERVATIONS IN THE SAMPLE

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<thead>
<tr>
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<th>Var.</th>
<th>Residual</th>
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<th>Dffits</th>
<th>ΔIQ</th>
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## APPENDIX J

**VARIMAX ROTATED FACTOR PATTERN MATRIX ON RAW DIFFERENCE SCORES**

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| Eigenvalue | 5.53 | 2.36 | 1.76 |
| % Total Variance | .40 | .17 | .13 | 70% |
SIUC HSC Form A

REQUEST FOR APPROVAL OF RESEARCH ACTIVITIES INVOLVING HUMAN SUBJECTS

This form must be included in all Master's theses/research papers and Doctoral dissertations involving human subjects to be submitted to the Graduate School.

PROJECT TITLE: AN EMPIRICAL EXAMINATION OF INFORMATION SYSTEMS SUCCESS IN RELATION WITH INFORMATION SYSTEMS DEVELOPMENT PHENOMENA.

CERTIFICATION STATEMENT:

In making this application, I(we) certify that I(we) have read and understand the University's policies and procedures governing research activities involving human subjects, and that I(we) shall comply with the letter and spirit of those policies. I(we) further acknowledge my(our) obligation to (1) accept responsibility for the research described, including work by students under my(our) direction, (2) obtain written approval from the CCRlHS of any changes from the originally approved protocol BEFORE making those changes, (3) retain signed informed consent forms, in a secure location separate from the data, for at least three years after the completion of the research, and (4) report immediately all adverse effects of the study on the subjects to the Chairperson of the Carbondale Committee for Research Involving Human Subjects, Carbondale, Illinois, (618) 453-4533, and to the Director of the Office of Research Development and Administration, Southern Illinois University at Carbondale, (618) 453-4531.

ANDREAS I. NICOLAU 8/19/92
RESEARCHER(S) or PROJECT DIRECTORS **Please print or type out name below signature**

MICHAEL M. MASONER 8/19/92
RESEARCHER'S ADVISOR (required for all student projects) DATE
**Please print or type out name below signature**

The request for approval submitted by the above researcher(s) was considered by the Carbondale Committee for Research Involving Human Subjects on 8/28/92. The application was approved XX not approved by the Committee. Special conditions were set by the Committee.

ROBERT C. POULIN 8/28/92
CHAIRPERSON, SOUTHERN ILLINOIS UNIVERSITY HUMAN SUBJECTS COMMITTEE DATE
VITA
Graduate School
Southern Illinois University

Andreas I. Nicolaou  Date of Birth: November 30, 1956
6436 Enright Avenue, University City, Missouri 63130
9A Einstein Street, Larnaca  1957, Cyprus

The Athens Graduate School of Economic and Business Sciences
Bachelor of Science  Business Administration
Southern Illinois University at Carbondale
Master of Accountancy  Accountancy

Special Honors and Awards:
The A. G. Leventis Foundation Graduate Fellowship.

Dissertation Title:
An Empirical Examination of Information Systems Success
in Relation with Information Systems Development
Phenomena.

Major Professor: Dr. Michael M. Masoner

Publications:
Use of the microcomputer as an audit tool. The Institute of Internal Auditors Capital Auditalk.
October 1986.
