

A CONTINGENCY MODEL FOR THE MANAGEMENT OF END-USER COMPUTING:
MODEL DEVELOPMENT AND EXPLORATORY VALIDATION

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ABSTRACT

A contingency model of EUC management effectiveness which applies a theoretical framework from innovation management research to relevant prior MIS research is first developed and then revised after exploratory field interviews. The next step is preliminary validation of the model for the management of a subset of EUC activities: application development by non-MIS personnel utilizing micro, mini, and/or mainframe computer technologies (UAD). Cross-sectional, field study data collected from two organizational informants reporting "high" and two reporting "low" levels of UAD management effectiveness provide partial support for the "face validity" of the model.

provide partial answers to the general research question of interest for this study. A review of this literature from an organizational theory framework has previously been presented by one of the authors [7]. No empirical study which investigates all three factors in this EUC management framework—EUC Strategy, EUC Structure, and EUC Performance—has yet appeared. However, several empirical studies which address some aspects of EUC structure and performance, as well as conceptual studies which address the matching of an EUC structure with an EUC "strategy," have recently appeared. These studies, we believe, provide partial answers to our research question.

EUC Strategy and Structure

Several MIS researchers have proposed an evolutionary approach to EUC management based on the assumption that the organization's EUC strategy should change over time to match the stage of EUC assimilation within the given organization [1, 16, 17, 18, 20, 24, 25, 27]. Of these, three evolutionary models provide the most comprehensive guidelines for the EUC structure [1, 16, 24(25)].

The four-stage, normative model for EUC management developed by Henderson and Treacy [16] is based in turn on McKenney and McFarlan's innovative information technology assimilation model [22]. A primary, unstated assumption of this model is that the organization's overall EUC management objective is to maximize the pace of EUC growth (or rate of EUC diffusion) within the organization. An additional assumption specific to Henderson and Treacy's model is that the relative importance of four critical managerial "issues"—the support infrastructure, technological infrastructure, data infrastructure, and evaluation/planning—changes over time. Different strategic perspectives and structuring mechanisms (for which they use the terms "structure" and "control mechanisms") are therefore prescribed for each of the four stages: Implementation, Marketing, Operations, and Economic. Henderson and Treacy observe, however, that organizations frequently impose the highly controlled "Operations" perspective "too early" in the EUC growth curve (p.13).

Taking a descriptive rather than prescriptive research approach, Munro and Huff [24, 25] have proposed a 2x2 model of four strategies defined by the degree to which the organization applies what they categorize as "control" and "expansion"

1. Introduction

Under the assumption that End-User Computing (EUC) is an organizational innovation, this study focuses on the implementation of EUC. More specifically, it addresses the following research question from a contingency perspective:

What structural implementations of the EUC management tasks contribute to effective EUC management?

Here, the EUC structural implementation (or "structure") refers to the organizational design of the tasks needed to manage EUC: e.g., the locus of decision-making authority, the specificity of policies and procedures, and the division of labor across functional boundaries. Finally, EUC management effectiveness is assumed to be a function of an organization's level of performance for the management of four EUC task areas [16]: people support, technology, data, and planning/evaluation.

2. Previous Research

Within the MIS literature, several studies have addressed the EUC phenomenon with an organization-level perspective and therefore

levers. Like Henderson and Treacy, these authors found some organizations selecting a high control/low acceleration approach (here called "Containment") early in the EUC implementation process. However, Munro and Huff view this "Containment" strategy as an appropriate early strategy, dependent on the organization's choice of EUC growth pattern. That is, the authors propose that the degree of control is chosen by the organization in relation to their specific EUC objective, which could be either an accelerated or less accelerated pace of EUC growth.

Alavi et al. [1] build on the two somewhat "conflicting" models discussed above, as well as exploratory interviews the authors conducted with five companies. Five EUC strategies are profiled according to the implementation or non-implementation of four categories of EUC management "activities": planning, policy setting, support, and control. The authors then prescribe an evolutionary progression of these strategies based on the organizational learning-curve assumption of McKenney and McFarlan's model [22]. Like Henderson and Treacy, therefore, Alavi et al. implicitly assume that an organization's EUC objective is to maximize the rate of EUC growth. These authors also concur with Henderson and Treacy's evolutionary progression in that a high-control "containment" strategy is prescribed for a late phase of EUC implementation, just prior to a mature "operations" strategy.

Although the above three evolutionary models remain untested (except for their authors' initial validation efforts), it is noteworthy that all three share the assumption that effective management of EUC requires a "fit" between the EUC "strategy" (or growth objective) and the EUC structure. Two of the models also assume a "fit" between the organization's current level of organizational learning (or stage of EUC implementation) and the EUC structure.

EUC Structure and Performance

The assignment of many of the EUC management tasks to a new, separate organizational unit is a management action well-documented in both the practitioner and academic literature. This unit is most commonly called an Information Center, a term originally coined for an IBM product. Several field studies investigating the roles of the Information Center (IC) staff, end-user tools and resources, the types of applications developed by IC users, the critical success factors for IC management, and real-world implementations vs. normative IC models have been recently published [4, 10, 19, 21, 31, 32, 33]. Conceptual models of 1) organizational factors affecting the success of an end-user computing facility [11], and 2) individual and organizational factors affecting the satisfaction of end-user developers [29], have also recently been developed. Finally, a preliminary investigation of the relationships between extent of EUC and various structuring "mechanisms"—both within and outside of an IC structure—[35] has also been reported.

However, of more relevance to the research question here are three recently completed U.S. dissertations which empirically test hypothesized relationships between EUC "structure" variables

and variables which measure EUC management performance. Both Amoroso and Crawford hypothesized 1) a positive relationship between levels of "support" for EUC and levels of performance, and 2) a negative relationship between levels of "control" for EUC and levels of performance. Amoroso [2] studied these relationships within an overall investigation of his model of organizational, technical, and individual end-user variables based on an EUC literature review. At the individual level of analysis, he then measured the relationships between these variables and two performance measures from the perspective of the end-user developer only: 1) user satisfaction with and 2) utilization of a specific end-user developed application. Crawford [12] measured several indicators of "support" and "control" from IS managers and then collected performance measures from both end-user developers and their managers.

Neither Amoroso nor Crawford found strong support for either of the above hypothesized relationships. However, neither of the EUC implementation models developed by these authors included two of the primary variables in the evolutionary models discussed above: 1) the organization's strategic objective for EUC growth (that is, maximum vs. low pace of EUC growth), and 2) the organization's current "stage" of EUC implementation.

Finally, within a larger study of the adoption and utilization of spreadsheet software from an information technology innovation perspective, Brancheau [5] undertook an exploratory investigation of the relationship between levels of support (expansion) and control for EUC and the diffusion of spreadsheet software within an organization. Similar to Amoroso and Crawford, he hypothesized that 1) a positive relationship between levels of "expansion" tactics and the organization's rate of spreadsheet adoption, and 2) a negative relationship between levels of "control" tactics and the organization's rate of spreadsheet adoption, but did not find support for them. However, Brancheau also cautions against the generalizability of his results. In most of the organizations he studied, Information Centers were established too late to have an effect on the early adopters of this technology.

3. A Model of EUC Management Effectiveness

Although the developers of all three of the evolutionary models discussed in Section 2 above could be said to share the perspective of EUC as an organizational innovation, none of these models purports to build on a specific management of innovation theory. Under the assumption that EUC is an organizational innovation, we have developed a contingency model of EUC management effectiveness which applies a theoretical framework from innovation management research to the prior MIS research.

More specifically, portions of a theoretical framework developed by Duncan [13] appear to be especially congruent with the EUC evolutionary models of Henderson and Treacy [16] and Alavi et al. [1] discussed in Section 2. Duncan's model

prescribes a different "structure" for two stages of innovation diffusion. An "organic" structure is prescribed for an initial stage • of the innovation diffusion process, while a "mechanistic" structure is proposed as most effective for a later implementation stage.

Duncan's definitions of the "organic" and mechanistic" organizational designs include three primary variables: Centralization, Formalization, and Complexity. A discussion of Duncan's definitions for these three primary variables and how they have been operationalized for this study follows.

Centralization refers to the degree to which decision-making is dispersed in terms of 1) the locus of authority for decision-making and 2) the hierarchical levels of the organizational employees who participate in the decision process. Low centralization (decentralization) is a characteristic of the "organic" form; high centralization characterizes the "mechanistic" form.

The management of EUC requires the dispersion of tasks traditionally the responsibility of the IS professional. The measurement of the locus of authority for EUC management decision-making should therefore include the degree to which authority is shared by the IS department and the user departments as well as the hierarchical locus of authority. Organizations with very high centralization of the EUC management tasks would therefore have the decision-making authority in the top management levels of either the IS department alone or user departments alone, and would not involve user-developers or first-line supervisors in decisions such as EUC resource prioritization, the development of policies and procedures for data "sharing," and the creation or dissolution of an Information Center as a separate organizational unit.

Formalization refers to the extent to which appropriate rules and procedures for performing a job task exist in formal written statements, and the extent to which there is an organizational emphasis on following them. Low formalization is a characteristic of the "organic" form; high centralization characterizes the "mechanistic" form.

Organizational designs with very high levels of formalization would be characterized by specific operating rules and procedures, in written form, for the personnel performing the EUC support, data, and technology tasks. In addition, the norm within the work units of these personnel would be to rigidly adhere to all rules and procedures.

Complexity refers to the number of occupational specialties and the degree of differentiation in the task structure. The degree of complexity is measured by the reliance on separate units to perform the tasks, the degree of discretion the personnel have in performance of the tasks, and the degree to which division of

• The pre-adoption steps in Duncan's "initiation" stage are not of relevance here.

labor has occurred. High complexity is a characteristic of the "organic" form; low complexity characterizes the "mechanistic" form.

Organization designs with very high levels of complexity would be highly reliant on separate units for the performance of the EUC management tasks (for example, an Information Center for EUC support, data, and technology tasks; a Steering Committee for EUC planning and evaluation tasks). In addition, the personnel performing these Information Center tasks would have little direct supervision and the freedom to tailor their job positions.

If one adopts the assumptions that 1) EUC is an organizational innovation and 2) organizations have an objective of a high EUC growth rate, a model of EUC management effectiveness which integrates the evolutionary model of Henderson and Treacy [16] with portions of Duncan's model has just two cells—as shown in Figure 1a*. The first cell models organizations in an initial phase of EUC implementation as being effective when they implement an "organic" structure for the EUC management tasks. The second cell models organizations in an integrated phase of EUC implementation as being effective when they implement a "mechanistic" structure for the EUC management tasks. In addition, the model depicts the assumption that a stage/structure "fit" is required for EUC management effectiveness.

FIGURE 1a:
PRELIMINARY MODEL OF EUC MANAGEMENT
EFFECTIVENESS

| | |
|---------------------------|--|
| EUC Implementation Phase: | |
| INITIAL | Organic Structure Low Centralization Low Formalization High Complexity |
| INTEGRATED | Mechanistic Structure High Centralization High Formalization Low Complexity |

The two-cell model presented in Figure 1a, however, ignores the discrepant findings of Munro and Huff discussed in Section 2 above. Namely, some organizations choose NOT to maximize the pace of EUC growth, select a more "controlled" growth approach early in EUC implementation, and this approach appears to be effective.

In order to resolve this "conflict" as well as to explore the validity of the assumption that EUC implementation is a multi-stage phenomenon, exploratory interviews with managers of five different organizations were held with one of the

• The labels for the two phases—"initial" and "integrated" —are adapted from Henderson and Treacy's narrative (pp.10-11).

authors during the summer of 1987. The research process, mini-case descriptions, and a summary of the findings from these interviews are detailed elsewhere [8]. Of importance here are the following: 1) a stage-approach "made sense" to the managers interviewed, and 2) a "controlled" growth approach was viewed as an effective strategy for organizations in an early implementation phase with a low EUC growth goal.

Our model was therefore expanded to include an organizational objective of a low rate of EUC growth. Based on the prior literature and the above exploratory interviews, "opposite" structural forms were modeled for these two additional cells. That is, it is proposed that organizations in the initial implementation stage which have a low EUC growth objective should implement a "mechanistic" structure: high-level decision-making (high centralization), extensive procedural controls (high formalization), and little task discretion for those performing the EUC people support, technology and data tasks (low complexity) is presumed to inhibit organizational learning and therefore EUC growth.

Similarly, organizations in the integrated implementation stage which have a low EUC growth objective should implement an "organic" structure: the lack of centralized authority (low centralization), lack of standardized procedures (low formalization), and high task discretion for those performing the EUC people support, technology, and data tasks (high complexity) will inhibit progress toward the inter-departmental sharing of data and applications and therefore EUC growth.

The resulting 4-cell model is presented in Figure 1b.

FIGURE 1b:
REVISED MODEL OF EUC MANAGEMENT EFFECTIVENESS

| | | EUC Growth Objective: | |
|---------------------------|------------|--|-----------------------|
| | | HIGH | LOW |
| EUC Implementation Phase: | INITIAL | Organic Structure Low Centralization Low Formalization High Complexity | Mechanistic Structure |
| | INTEGRATED | Mechanistic Structure High Centralization High Formalization Low Complexity | Organic Structure |

4. Exploratory Testing of the Model

Research Methodology

The next step is preliminary validation of the 4-cell contingent model. The authors are currently undertaking two concurrent, non-experimental studies in natural settings for the purposes of empirically testing hypotheses derived from the model. For both of these studies, the

selected scope is EUC activities that were "traditionally" performed by MIS personnel—that is, user application development (UAD). The research design selected for both studies is a cross-sectional field survey due to the variables of interest, the current state of EUC research, and sample size vs. research cost tradeoffs.

For the portion of the field study reported on here, four working hypotheses—one per cell—are of interest (Figure 2). A listing of the research variables needed to test the hypotheses is given in Figure 3. There is one dependent variable for this study: UAD Management Effectiveness. The three independent variables are UAD Implementation Phase, UAD Growth Objective, and UAD Structure. The seven indicators of the UAD Structure variable are derived from Duncan's definitions (see Section 3).

FIGURE 2: WORKING HYPOTHESES

- H1: Among organizations with an objective of a **high** rate of UAD diffusion that are in an **initial** implementation phase,
- those that manage UAD with an **organic** structure will report **high** UAD management **effectiveness**
 - those that manage UAD with a **mechanistic** structure will report **low** UAD management **effectiveness**
- H2: Among organizations with an objective of a **high rate** of UAD diffusion that are in an **integrated** implementation phase,
- those that manage UAD with a **mechanistic** structure will report **high** UAD management **effectiveness**
 - those that manage UAD with an **organic** structure will report **low** UAD management **effectiveness**
- H3: Among organizations with an objective of a **low rate** of UAD diffusion that are in an **initial** implementation phase,
- those that manage UAD with a **mechanistic** structure will report **high** UAD management **effectiveness**
 - those that manage UAD with an **organic** structure will report **low** UAD management **effectiveness**
- H4: Among organizations with an objective of a **low rate** of UAD diffusion that are in an **integrated** implementation phase,
- those that manage UAD with an **organic** structure will report **high** UAD management **effectiveness**
 - those that manage UAD with a **mechanistic** structure will report **low** UAD management **effectiveness**

For this exploratory "testing" of the model, data was collected by mailed survey from one informant per organization with the same position bias: an upper manager with organization-wide responsibilities for the management of EUC. A questionnaire for this informant was developed by the authors. Prior organization theory studies served as the primary sources for the operationalizations of both the Structure and Management Effectiveness constructs. Prior conceptual and descriptive studies by MIS

researchers were used to ground the above two constructs to the UAD domain, as well as to operationalize the two remaining independent variables (Growth Objective and Implementation Phase).

FIGURE 3: RESEARCH VARIABLES

| CONSTRUCT | INDICATOR NAME | ABBREV | |
|--|---|---|--------|
| <u>Independent Variables</u> UAD Implementation Phase (Initial, Integrated) | Stage of user-developed applications | STAGE | |
| | Extent of UAD implementation | EXTENT | |
| | UAD Growth Objective (High, Low) | UAD growth rate goal | GOAL |
| | UAD Structure (Organic, Mechanistic) | <u>Centralization:</u> Horizontal dispersion of decision-making authority (IS/user) | HORIZ |
| | | Locus of decision-making authority within hierarchy | HIER |
| | | Participation in decision-making throughout hierarchy | PARTIC |
| | | <u>Formalization:</u> Extent of UAD guidelines/rules | RULES |
| | | Extent to which above are followed | FOLLOW |
| | <u>Dependent Variable</u> UAD Management Effectiveness | <u>Complexity:</u> Division of Labor for UAD mngt tasks | DIVLAB |
| | | Degree of UAD task specialization | TASK |
| Perceived UAD management performance | | OVERAL | |

Two "expert review" processes involving academics and practitioners were undertaken to pretest the questionnaire; the instrument was extensively revised as a result of this procedure. Thirty-three MIS managers who were members of professional organizations in the Indianapolis area were then targeted as potential participants for this study. After an initial mailing describing the study, follow-up contacts by phone were made with twenty-eight of them for the purposes of both requesting organizational participation and "placing" the questionnaire. Six of the organizations were excluded due to current internal reorganizations or lack of relevancy. In early March 1988 the questionnaire was sent to the remaining twenty-two managers; completed surveys were received from fourteen (a 64% response rate).

As anticipated, some ambiguities in the responses to the questionnaire were encountered. (A copy of the questionnaire and a report on the

range of values obtained for each construct and all data collection problems are available from the authors.) Of importance for this study, the measures for the two Complexity indicators for the UAD Structure variable were more problematic than expected. In addition, the instructions for the collection of numeric data on the extent of UAD were less precise than expected. As a result, some of the measures for the Complexity, Growth Objective, and Implementation Phase variables were not collected from several informants.

Findings

A conservative approach has been chosen for the reporting of the findings of this study. First of all, organizations which reported the sample's median value for either the Growth Objective or the overall Management Effectiveness variable were excluded from this analysis. Of the remaining seven organizations in the sample, two organizations with "high" effectiveness and two with "low" effectiveness reported for the overall management of EUC were chosen for this exploratory test of the model due to their lack of unstable responses for three other variables.* Secondly, due to measurement problems for the two Complexity indicators, the analysis will only include the Centralization and Formalization variables—i.e., five of the seven UAD Structure indicators.

Profiles of the two "high" (A, B) and two "low" (C, D) organizations are provided in Figure 4a. The mapping of these organizations into the four cells of the model is shown in Figure 4b. For the responses to the 9-point Growth Objective scale, 6 was the median value for the entire sample (n=14). Organizations A and C (with responses 9 and 7) were therefore categorized as High Growth, B and D (with responses of 4) as Low Growth. For the Implementation Phase variable, those organizations reporting stages 4 or 5 for the Huff et al. model [17] were categorized as Integrated (A and D), the remainder as Initial (B and C).

The "face validity" of the model was explored by the following two questions:

1) Do the indicators of UAD Structure for the two organizations reporting HIGH effectiveness support the working hypotheses for those cells?

2) Do the indicators of UAD Structure for the two organizations reporting LOW effectiveness support the working hypotheses for those cells?

Looking first at the cell placements for the two reporting HIGH effectiveness, both Organizations A and B would be expected to have a mechanistic structural implementation for the UAD management tasks. That is, according to our model (Figure 2b), both of these organizations would be expected to report high values on the Centralization and Formalization measures.

* The other three organizations were excluded due to one of the following reasons: 1) a large discrepancy between the overall effectiveness score and the average of the four effectiveness scores for each EUC task area; 2) a large change in Growth Objective within the past six months; and 3) a significant difference reported between mainframe and pc support.

FIGURE 4a: PROFILE OF 4 ORGANIZATIONS AND INFORMANTS

Organization profile:

| | SECTOR/ INDUSTRY | STATUS | NO. EMPLOYEES |
|---|---------------------------|-----------|------------------|
| A | Government | Division | NR |
| B | Private/Service | Corporate | 1500 |
| C | Non-Profit | Division | 3500 |
| D | Private/ Manufacturing | Division | 3880 |

Informant profile:

| | LEVELS FROM CEO | YRS. RESPON.* |
|---|--------------------|------------------|
| A | 2 | 2 |
| B | 1 | 3 |
| C | 3 | 1 |
| D | 2 | 4 |

* No. years informant has had UAD responsibilities in this position.

FIGURE 4b: CELL PLACEMENT OF 4 ORGANIZATIONS

UAD Growth Objective:

| UAD Implementation Phase: | HIGH | LOW |
|---------------------------|------|-----|
| INITIAL | C | B |
| INTEGRATED | A | D |

Figure 5a displays the "expected" vs. the reported values for the Centralization and Formalization indicators for UAD Structure. Each of the five indicators was measured by multiple questions with interval scales. Due to the small sample size, the HI vs. LO classifications were based on the 7-point scale values (rather than the range of sample responses), as follows:

| Indicator score | Classification |
|-----------------|----------------|
| 1.0-3.5 | LO |
| 3.6-4.4 | MID |
| 4.5-7.0 | HI |

As can be seen from Figure 5a, the working hypotheses for these cells are only partially supported. The "expected" mechanistic values were reported by both organizations for only three of the five indicators (HIER, RULES, FOLLOW).

FIGURE 5: UAD STRUCTURE INDICATORS FOR

5a: HIGH Effectiveness Organizations

| Centralization: | "Expected" | A | B |
|-----------------|------------|------------|------------|
| HORIZ | HI | MID (4.4) | * HI (4.9) |
| HIER | HI | * HI (6.5) | * HI (6.6) |
| PARTIC | HI | LO (2.5) | * HI (5.0) |

Formalization:

| | | | |
|--------|----|------------|------------|
| RULES | HI | * HI (6.1) | * HI (5.0) |
| FOLLOW | HI | * HI (6.3) | * HI (5.0) |

5b: LOW Effectiveness Organizations

| Centralization: | "Expected" | C | D |
|-----------------|------------|-----------|------------|
| HORIZ | LO | MID (4.0) | HI (4.7) |
| HIER | LO | HI (7.0) | HI (6.1) |
| PARTIC | LO | MID (3.8) | * LO (3.5) |

Formalization:

| | | | |
|--------|----|-----------|------------|
| RULES | LO | MID (3.8) | * LO (2.7) |
| FOLLOW | LO | HI (6.1) | MID (4.7) |

* Indicates a match between "expected" and "reported."

Looking next at the cell placements for the two reporting LOW effectiveness, both Organizations C and D would be expected to have an organic structural implementation for the UAD management tasks if they had reported high effectiveness. That is, according to our model, these organizations would be expected to report low values on the Centralization and Formalization measures, if they had reported high effectiveness.

Figure 5b displays the "expected" vs. the reported values for the five Structure indicators. If one were to predict the effectiveness ratings for Organizations C and D based on our model, then low effectiveness would be predicted. Only two of the five indicators for Organization D (PARTIC, RULES) had the "expected" values, but a third indicator (FOLLOW) approached the low range. Organization C reported three middle range and two high range values. Although the data from these two organizations cannot be said to "support" the model since their patterns of indicators are neither organic nor mechanistic, the "face validity" of the model is not disconfirmed by

them.

Due to the exploratory nature of this study, any conclusions about the data reported here can only be speculative. However, a further look at the organizational responses across the LOW and HIGH effectiveness categories may be useful for future hypothesis generation. For example, of interest to the authors are the mid-range scores (4.0-4.9) for the HORIZ indicator—which measures the dispersion of the locus of decision-making authority with respect to both the IS and user departments—reported by all four organizations. It is entirely possible that effective UAD management may require joint IS/user department decision-making in all stages.

Secondly, we compared the average scores of each indicator for the HIGH effectiveness organizations with the average scores for the LOW, and found that the RULES indicator scores had the greatest difference. The RULES indicator (i.e., the extent of UAD guidelines/ rules) may come closest to measuring what many EUC researchers have termed "Control." Unfortunately, since the two organizations reporting LOW effectiveness were also the two organizations with "expected" organic structures, further speculation without additional data becomes too tenuous.

5. Conclusion

The authors are currently undertaking a more rigorous testing of the model with a revised questionnaire. Several of the data collection limitations of the exploratory study reported on here (e.g., incomplete measurements and small sample size) will therefore be eliminated. In addition, the research design of this larger study includes controls for potentially confounding organizational factors, measures of potential "bias" for the organizational informant, as well as the testing of two additional hypotheses of "fit" implied by the model.

Finally, although considerable effort has been made to minimize the personal bias of the single informant in the above studies, it is recognized that validation of the model must also take into account different organizational member viewpoints. Towards this end, one of the authors is also currently engaged in a study conducted on-site which collects UAD management effectiveness ratings from not only the perspective of the informant used here, but also that of other relevant IS managers, user department managers, and end-user developers. It is anticipated that the combined results of both studies will serve to decrease the current knowledge gap surrounding our research question.

REFERENCES

- [1] Alavi, M.; Nelson, R.R.; and Weiss, I.R. "Strategies for End-User Computing: An Integrative Framework." Journal of Management Information Systems (4:3) Winter 1987-88, pp. 28-49.
- [2] Amoroso, D.L. "Effectiveness of End-User Developed Applications in Organizations: An Empirical Investigation." Unpublished Ph.D. dissertation, University of Georgia, 1986.
- [3] Brancheau, J.C. "The Diffusion of Information Technology: Testing and Extending Innovation Diffusion Theory in the Context of End-User Computing." Unpublished Ph.D. dissertation, University of Minnesota, 1987.
- [4] Brancheau, J.C. and Wetherbe, J.C. "A Comparative Analysis of Higher and Lower Rated Information Centers." Unpublished working paper 86-09, MISRC, University of Minnesota, April 1986.
- [5] Brancheau, J.C. and Wetherbe, J.C. "Issues in Information Systems Management." MIS Quarterly (11:1) March 1987, pp. 23-45.
- [6] Brown, C.V. "The Management of End-User Computing: Strategies, Structures, and Success Factors for User Developed Applications." Unpublished paper, Operations & Systems Management, School of Business, Indiana University, May 1986.
- [7] Brown, C.V. "Management of End-User Computing." In "An IRMIS Report on the State-of-the-Art in High Priority Research Areas." Unpublished working paper, Institute for Research on the Management of Information Systems, Indiana University-Bloomington, June 1987, pp. 59-82.
- [8] Brown, C.V. and Bostron, R.P. "Effective Management of End-User Computing: A Total Organization Perspective." Unpublished working paper #W807, IRMIS, Indiana University, May 1988.
- [9] Burns, T. and Stalker, G.M. The Management of Innovation. London: Tavistock Publications, 1961.
- [10] Carr, H.H. "Information Centers: The IBM Model vs. Practice." MIS Quarterly (11:3) September 1987, pp. 325-38.
- [11] Cheney, P.H.; Mann, R.I.; and Amoroso, D.L. "Organizational Factors Affecting the Success of End-User Computing." Journal of Management Information Systems (3:1) Summer 1986, pp. 65-80.
- [12] Crawford, J.B., IV. "An Investigation of Strategies for Supporting and Controlling User Development of Computer Applications." Unpublished Ph.D. dissertation, University of California-Irvine, 1986.
- [13] Duncan, R.B. "The Ambidextrous Organization: Designing Dual Structures for Innovation." In Ralph H. Kilman et al., ed. The Management of Organization Design. Vol. I: Strategies and Implementation. New York: North-Holland, 1976. pp. 167-88.
- [14] Gerrity, T.P. and Rockart, J.F. "End-User Computing: Are You a Leader or a Laggard?" Sloan Management Review, Summer 1986, pp. 25-34.
- [15] Guimaraes, T. and Ramanujam, V. "Personal Computing Trends and Problems: An Empirical Study." MIS Quarterly (10:2) June 1986, pp. 179-85.
- [16] Henderson, J.C. and Treacy, M.E. "Managing End-User Computing for Competitive Advantage." Sloan Management Review (27:2) Winter 1986, pp. 3-14.

- [17] Huff, S.L.; Munro, M.C.; and Martin, B.H. "Growth Stages of End User Computing." Communications of the ACM (31:5) May 1988, pp. 542-50.
- [18] Laudon, K.C. "From PCs to Managerial Workstations: Organizational Environment and Management Policy in the Financial Industry." In M. Jarke, ed. Managers, Micros and Mainframes. New York, Wiley, 1986.
- [19] Leitheiser, R.L. and Wetherbe, J.C. "The Successful Information Center: What Does It Take?" ACM Proceedings of the Computer Personnel and Business Data Processing Research Conference, Minneapolis, MN, May 1985, pp. 56-65.
- [20] Leitheiser, R.L. and Wetherbe, J. "Approaches to End-User Computing: Service May Spell Success." Journal of Information Systems Management (3:1) Winter 1986, pp. 9-14.
- [21] Magal, S.R.; Carr, H.H.; and Watson, H.J. "Critical Success Factors for Information Center Managers." Unpublished working paper, End User Computing Research Center, University of Georgia, 1987.
- [22] McKenney, J.L. and McFarlan, F.W. "The Information Archipelago—Maps and Bridges." Harvard Business Review, Sept./Oct. 1982, pp. 109-19.
- [23] Moore, G.C. "End User Computing and Office Automation: A Diffusion of Innovations Perspective." Infor (25:3) 1987, pp. 214-35.
- [24] Munro, M.C. and Huff, S.L. "Information Technology Assessment and Adoption: Understanding the Information Centre Role." ACM Proceedings of the Computer Personnel and Business Data Processing Research Conference, Minneapolis, MN, May 1985, pp. 29-37.
- [25] Munro, M.C.; Huff, S.L.; and Moore, G. "Expansion and Control of End User Computing." Journal of Management Information Systems (4:3), Winter 1987-88, pp. 5-27.
- [26] Panko, R.R. "Directions and Issues in End User Computing." Infor (25:3) 1987, pp. 181-97.
- [27] Pyburn, P.J. "Managing Personal Computer Use: The Role of Corporate Management Information Systems." Journal of Management Information Systems (3:3) Winter 1986-87, pp. 49-70.
- [28] Rivard, S. "Successful Implementation of End-User Computing." Interfaces (17:3) May-June 1987, pp. 25-33.
- [29] Rivard, S. and Huff, S.L. "Factors of Success for End-User Computing." Communications of the ACM (31:5) May 1988, pp. 552-61.
- [30] Rockart, J.F. and Flannery, L.S. "The Management of End-User Computing." Communications of the ACM (26:10) Oct. 1983, pp. 776-84.
- [31] Sumner, M.R. "Organization and Management of the Information Center." Journal of Systems Management, Nov. 1985, pp. 10-15.
- [32] Wetherbe, J.C. and Leitheiser, R.L. "Information Centers: A Survey of Services, Decisions, Problems, and Successes." Journal of Information Systems Management (2:3) Summer 1985, pp. 3-10.
- [33] White, C.E., Jr. and Christy, D.P. "The Information Center Concept: A Normative Model and a Study of Six Installations." MIS Quarterly (11:4) December 1987, pp. 451-58.
- [34] Zaltman, G.; Duncan, R.; and Holbeck, J. Innovations & Organizations. New York: Wiley, 1973.
- [35] Zmud, R.W. and Lind, M.R. "The Use of Formal Mechanisms for Linking the Information Systems Function with End-Users." In M. Jarke, ed. Managers, Micros and Mainframes. New York: Wiley, 1986. pp. 133-49.