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Source: *MIS Quarterly*, Vol. 4, No. 1 (Mar., 1980), pp. 13-20

Published by: Management Information Systems Research Center, University of Minnesota

Stable URL: <http://www.jstor.org/stable/248864>

Accessed: 26/03/2010 08:25

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MIS DESIGN: A CONTINGENCY APPROACH

By: Richard J. Schonberger

Abstract

This article identifies six MIS design approaches, ranging from no user involvement to considerable user involvement. It also examines the justification for their use under different conditions. The six approaches are merged with Gorry and Scott Morton's [10] MIS framework and Simon's [23] classes of decision making to create a contingency model for MIS design.

The contingency model provides for MIS design leadership to be dependent upon type of decision making. A broad view of MIS design is taken wherein executives or even various stakeholder groups may assume active leadership where warranted by the circumstances. With design leadership correctly placed, project purpose may be more carefully identified and design activities may be properly channeled to meet those objectives.

Keywords: MIS development, MIS design, contingency theory, systems analysis, information analysis, user involvement, information systems

ACM Categories: 3.3, 3.5, 8

Zani [27] wrote that disappointment over MIS in practice can be traced to bottom up MIS development. Lucas [16] proposes, in response to this sort of criticism, approaches in which the design effort is led by the user rather than the analyst. IBM [12] devised and promotes a step by step "top down planning," but bottom up implementation, approach called Business Information Planning (BIP) or, in the public sector, Information Systems Planning (ISP). Recent surveys reveal that spokesmen in numerous firms are asserting, validly or not, that top down and user oriented approaches to MIS design are at hand. In one survey report [22] the authors conclude that the EDP era of short sighted, technician oriented users of computers is ending and that the MIS era, with a manager oriented focus on needs for information, is here.

Practicability

The conceptual validity of top down and manager/user oriented design notwithstanding, there are serious questions regarding the practicability of the approach [5]. The approach is both slow and highly demanding of the expensive time and talents of managers and other MIS users. (Top down and bottom up seem subject to varying interpretations. In the interest of clarity, these terms are generally avoided in the remainder of this article as varying levels of manager/user involvement are examined.)

To illustrate, some years ago Deere and Company initiated a large scale, user oriented design effort. Named project MICS (Management Information Coordination System), it called for nine user groups, composed of functional managers from plants scattered about the country, to assemble in Deere's East Moline, Illinois, headquarters to fashion information subsystems. According to the Information System Manager [6] this design approach was short lived at Deere because it was overly demanding of the time of highly paid manager users.

As an example of a partially user oriented design, the University of Nebraska Systems Office began a large scale MIS development project following the guidelines set forth in IBM's ISP. While top administrators' views were solicited, the systems development was led by systems professionals

instead of users. Lucas' [16] term is "pseudoparticipation" since analysts are still in charge. This in between approach does appear to fit the purpose of the project, which was limited to information systems in the administrative support area. Most administrative support processes in a university appear to be in the realm of managerial control and operational decision making (as opposed to strategic decisions on university mission, programs, and objectives); for example, decisions on class scheduling, room assignments, financial aid, cash management, and physical plant management.

A contention in this article is that MIS development approaches of this kind—somewhere in the middle between those led by analyst/programmer and those led by manager/user—are appropriate for midlevel tactical decision making purposes. For other decision making purposes, more or

less user involvement is called for. Thus, we are attempting to delineate and recommend use of a contingency model for MIS design with type of decision making as a major independent variable.

Manager/User Involvement

MIS design approaches may be thought of as being on a continuum with programmer/analyst leadership at one extreme and manager/user leadership at the other. Figure 1 is a discrete representation of six design approaches along the continuum. These approaches are described in terms of (1) structural alignments, *i.e.*, design leadership, (2) major design support, (3) characteristic *modus operandi*, and (4) manager/user behavior.

Design Effort Led by . . .	Major Design Support	Characteristic Modus Operandi	Manager/User Behavior
1. Systems analyst/ programmer	Programmers	Largely independent effort.	Little or no involvement
2. Systems analyst/ programmer	Programmers	Actively seek out inputs from users/managers.	Respondent
3. Information analyst	Systems Analysts Programmers	Systems specifications determined in using departments.	Respondent
4. Team of managers and/or user representatives	Analysts Programmers	Analysts and programmers serve as sources of information and advice in design phase.	Operant
5. Executives (vice presidential level)	Middle managers Analysts Programmers	Requires full-time temporary assignment to lead design effort.	Operant
6. Stakeholders (Client groups)	Executives Middle managers Analysts Programmers	Design by consensus; confrontation of adversaries; dialectical goal-search. Determine important measures of success, and the MIS design follows.	Operant

Figure 1. MIS Design Approaches

While many hybrids of the six approaches occur in practice, these seem to describe basic distinctions. There are five distinctive loci of design leadership; approaches 1 and 2 go together since both are led by analyst/programmers. The five loci are associated with six design approaches. While approaches 1 and 2 both call for analyst/programmer leadership, it seems helpful to distinguish between the two dominant field practices under that leadership:

1. Largely independent effort by analysts/programmers—a tendency in cases of well defined design efforts.
2. Inputs from manager/users actively sought by analysts/programmers—a tendency in cases of less well defined design efforts.

Design leadership—formally vested authority and responsibility for MIS design—is the key characteristic. When leadership resides with analysts/programmers, managers/users are involved as respondents or, in one case, not at all; this is the pattern for approaches 1, 2, and 3 in the figure. Operant behavior is a label that describes designs led by manager/users, approaches 4, 5, and 6 in Figure 1.

The terms *respondent* and *operant*, borrowed from psychology, especially Skinnerian psychology, appear to be rather more precise than broader labels such as participation and involvement. Operant behavior refers to behavior freely emitted, whereas respondent behavior is elicited or coaxed [25].

All of the six design approaches are found in practice, but the higher numbered approaches seem to be less common. Commentary on uses of and rationale for the approaches follows.

Design Approaches in Practice

In Figure 1 the first two approaches are characterized by analyst/programmer leadership and either an independent or participatory *modus operandi*. These are well known approaches in which manager/user involvement is clearly minimal and in the respondent mode.

The third approach calls for leadership by analysts who have user oriented skills. This type of analyst was advocated by the ACM Curriculum Committee on Computer Education for Management [3], which coined the term *information analyst*, as distinct from computer systems analyst. This sort of approach is also called for in Gibson and Nolan's [9] fourth stage of EDP growth. The approach is led by analysts, but the information analyst is applications oriented more than technology oriented; the main business of the information analyst is users' needs for information.

Sometimes the information analyst works in a user department. For example, Goodyear has established an information analyst position—under the title, computer project manager—at each of the plants served by one of the firm's EDP centers. The computer project manager generally has a strong business but not a strong computer background, and he works for the satellite plant, not central EDP. The Nebraska state government follows a similar pattern: computer systems analysts and programmers are in central EDP, and information analysts (referred to as systems analysts) are employed by each of the larger state agencies, including roads, health, revenue, public institutions, and education.

Interviews with key personnel in these, and other, organizations suggest three motives behind adoption of the information analyst approach, each related to the often reported disappointment over returns on the computer investment: (1) Information services departments have become sensitive to issues of user satisfaction and may feel that one solution is hiring staff with a knowledge of business as information analysts. (2) Using departments may see fit to hire their own analysts, the better to represent those departments' information needs in dealings with the computer center staff. (3) A few computing centers actively encourage their analysts and programmers to apply for positions in line and other staff departments, which serves to inculcate computer technology in user departments as well as to shift more of the initiative for information system development project to the user. This was the policy in Deere and Company as far back as 1969 [6].

The fourth approach in Figure 1 is more clearly manager/user oriented, and it exemplifies operant behavior since the user has the primary

design role and the analyst a secondary supportive role. An early advocate of this approach, in the systems and procedures era, was Thurston. Based on his study of 36 cases of information system development practices, Thurston [26] concludes that "leadership responsibility in systems projects should rest with operating people." Lucas [17] offers considerable discussion of the rationale for this approach. The user teams are generally directed to dealing with some specific functional or interdepartmental problem, or they are composed of department representatives, such as bank tellers who use account inquiry terminals. The MIS they design may satisfy the need, but only from their restricted points of view as middle managers or functionaries.

The fifth approach captures high level viewpoints. In advocating this sort of approach, Siegel [23] asserts that executives should not get "involved" but should do the planning for the management information system. An early well documented example of this approach is a large MIS development that took place in Weyerhaeuser Company [13]. The development, beginning in 1962, was led initially by a vice president and included line executives who had been tabbed as "most likely to succeed" in the company in the next ten years.

The sixth approach is the highest level of manager/user involvement. It calls for executives to be joined by other groups having a major stake in the organization's pursuits (see discussion of *stakeholders* in [1]), with design leadership being assumed, perhaps informally, by whichever group has the most at stake—often the executives. This approach is consistent with the open systems view that a complex organization is more than its officers and employees. Barnard [4] saw organizational membership as consisting also of customers, suppliers, creditors, community, and any others who give to, or receive from the organization. For the profit making enterprise the sixth approach would be considered by some as being an abdication of the dominant responsibility of the firm to make a profit (this is the theme in [21]) and by others as being a desirable step toward social responsibility. It is seen here as responding to organizational/environmental complexity [7]. Risk is great under such conditions if vision is narrow; design by consensus among stakeholders increases breadth of the field of vision.

In the public sector client/group involvement in information system development is in a sense a far reaching modern phenomenon. We refer to the primarily government mandated requirements for citizen inputs into various kinds of social planning, parental involvement in schools, and client involvement in planning in connection with certain health and welfare programs. While thus far not generally concerned with computer based MIS's, these efforts do require information for planning and decision making. If such broad based participation becomes well established, it may be only a matter of time until supporting information systems with computer processing evolve. This would amount to management information systems providing (a) information for strategic planning to client groups serving in effect as executives, and (b) information for tactical decision making to agency officials serving more as operating managers carrying out the strategic plans.

Contingency Model

Figure 2 is a contingency model that suggests MIS design approaches to match types of information needs. The underlying assumption is that approaches led by programmer/analysts and/or manager/users are neither good nor bad. Rather their appropriateness depends on contingencies [18].

The model partially complements Norton and McFarlan's [20] contingency model of project management, Figure 2 serving as a front end design model and Norton and McFarlan's providing for the next phase, project management.

Figure 2 is also an adaptation and extension of Gorry and Scott Morton's [10] MIS framework. Their framework integrates Anthony's [2] classification of managerial functions (column 1 in Figure 2) with Simon's [24] classification of decision types (column 2 in Figure 2). The fourth column in Figure 2 integrates the six design approaches discussed earlier, which serves to transform the MIS framework into a prescriptive model.

The contingency approach to MIS design seems consistent with Blumenthal's [5] concept of MIS designs that are geared to adapt to change. His concept of a system of MIS modules that may

MIS Supporting Function	Type of Decision Making	Examples	Recommended Design Approach
Operational control	Structured	Transaction-oriented applications such as accounts receivable	1. Minimal manager/user involvement: largely independent effort led by systems analyst or programmer.
	Unstructured	Industry-peculiar repetitive processes; variable processes such as waiting lines	2. Minimal management user involvement: systems analyst or programmer seeks out user inputs.
Managerial control	Structured	Forecasts, budgets and variance reporting	3. Moderate manager/user involvement: led by information analyst from user department.
	Unstructured	Policies for overtime and subcontracting	4. Moderate manager/user involvement: led by team of manager/users.
Strategic planning	Structured	Warehouse location and tanker	5. Considerable manager/user involvement: led by executives.
	Unstructured	New products and labor contracts	6. Considerable manager/user involvement: led by stakeholders.

Figure 2. MIS Design: Contingency Model

be modified without affecting other modules apparently could accommodate a contingency approach in which some modules are designed with minimal manager/user involvement, some with moderate involvement, and some with full manager/user leadership.

The operational control function in Figure 2 involves decision making that often is repetitive and therefore amenable to automation. This tends to be a lower level managerial function that may be familiar and well structured, especially transaction oriented applications like accounts receivable and payroll processing. Such well structured processes are frequently within the design capabilities of programmers in small organizations and analysts in larger organizations. Computer models in support of structured decision making tend to be available in the literature or as modifiable application packages. By con-

trast, well known solutions are unlikely in the case of unstructured processes. At the operational level these include repetitive processes unique to specific industries and, in general, variable processes (for example, waiting line processes and situations involving group behaviors) in which there are difficulties with data definition collection and perhaps a management science requirement beyond the capabilities of computer programmers and analysts. Help from user departments is needed.

The managerial control function, the purview of middle managers, is at the level of the cost center or profit center. At this level structured decisions involve plans, standards, forecasts, and budgets, and variances therefrom. Those that are repetitive within the organization or are common throughout an industry are structured enough so that the supportive MIS design may be led by

user department analysts. Those that are variable and unstructured may require management information systems that incorporate principles or heuristics, serving as standards, as well as flexible or exception based reporting of variances. Examples are policies for use of overtime or subcontracting. This level of managerial sophistication tends to be beyond the capabilities of analysts; hence the need for a team of managers/users to lead the MIS design effort.

Strategic planning is a top executive and stakeholder function and, because of the sheer cost and risk involved, requires top executive and stakeholder leadership in designing the supportive MIS. A small amount of strategic planning may be considered as being structured, for example, warehouse location and tanker fleet mix [10]. Most strategic planning is less structured or more complicated; for example, new products, plant expansion, pricing policies, and labor contracts. It may be desirable for stockholders, employees, regulators, community citizens, and other stakeholders to join the executives in defining information systems to support these kinds of planning efforts.

Other Contingency Variables

The model in Figure 2 is intended to encompass the dominant contingency variables for MIS design. A few words must be said of other potentially important contingency variables, namely, size, cost, urgency, and technological change.

Size and cost as contingency variables

Should a large MIS be led by a manager/user and a small MIS be led by an analyst/programmer? While this may be the tendency, it does not seem essential. This may be illustrated by two examples. The first is a large MIS that seems to require only moderate manager/user involvement; the second is a small MIS that seems to require considerable managerial involvement.

1. An example of a large scale MIS is a material requirements planning system. It is large in that MRP entails complete overhaul of a key operational control system, the production and

inventory control system; and it has further impacts on sales order commitment and on cash management. But since it does not have significant effects on top executives or on various stakeholder groups, it may not be necessary to employ the highest degrees of manager/user involvement. More structured tasks such as inventory master file development and MRP package selection and adaptation might be led by an information analyst (the third approach in Figure 2). Less structured MRP tasks such as master production schedule design and bill of materials structuring might be led by a team of managers/users (the fourth approach).

2. An MIS that deals in politically sensitive information does not need to be large, but does seem to demand high level managerial involvement. In a university, for example, decisions on whether to support various programs of study are politically sensitive. Prime information support could come from a modest MIS that assesses support for programs of study among various client groups. MIS design leadership by representatives of those client groups seems desirable if the MIS is to be successful.

Similar reasoning applies to cost as a contingency variable. An MIS design led by high level users does not necessarily cost a lot, but costly MIS developments tend to involve some user leadership. Type of management function—operational control, managerial control and strategic planning—appears to overshadow both size and cost as a contingency variable.

Urgency as a contingency variable

Should MIS design approach depend on urgency? It is reasonable to expect an approach led by an analyst/programmer to be more expeditious than an approach led by a manager/user in situations involving structured decision making, and *vice versa*. The contingency model in Figure 2 allows for this in that more of an approach led by an analyst/programmer is prescribed in the structured case within each class of managerial

function. Beyond this, urgency seems irrelevant, because, for example, technicians with limited perspectives cannot be expected to lead an MIS development expeditiously; this effort requires the broader perspective of middle managers, executives, or client groups.

Technological change as a contingency variable

Technological change, the final factor to be considered, warrants more serious attention. One of Gehrmann's [8] main findings, which are based on a questionnaire survey, is that bottom up designs (his label) are deemed suitable for rapidly changing technology. The rationale is that a bottom up approach gets the MIS development under way while higher management endeavors to absorb and comprehend the implications of the technological change. There are two problems in interpreting this finding:

1. Gehrmann left it up to those surveyed to decide whether technological change refers to (a) computer/information technology, which would reasonably be associated with bottom up *project management* [19] though not MIS *design*, or to (b) "business" technology, which in this article has been related to need for more manager/user viewpoints, because managers and other users better understand business technologies.
2. The design approaches were limited to bottom up and top down rather than include a range of approaches.

There seems to be no clear place in the contingency model to add a technological change factor. Our present inclination is to consider it as being subsumed within the designations, structured (little change in technology) and unstructured (rapid change in technology), which results in a conclusion opposite to Gehrmann's. The rationale is that technological change—either in computer/information processing or in business functions—warrants more, not less, manager/user involvement. New technology means new risk. Database management systems, for example, constitute a powerful information processing technology, but those most likely to understand

it—computer professionals—are among the least likely to direct its use toward organizational objectives. (See related discussion in [11] and [15].)

Application

As a given field in management matures, universal principles develop into contingency approaches [14]. For the field of MIS, it is time for universal prescriptions for bottom up and top down design to develop into contingency theories, allowing for a range of approaches. An apparent obstacle to applying contingency theory to MIS design has been lack of a model. Frameworks for construction of such a model have been available for several years, and in this article existing MIS frameworks are elaborated upon to produce a contingency model for MIS design.

For the organization using a computer, the contingency model provides general guidance for improving cost and effectiveness in the design stage of MIS development. Cost improvements may arise from avoiding a slow and expensive manager/user oriented approach where, according to the model, more of an approach led by an analyst/programmer is sufficient. Effectiveness improvements may arise from assuring that MIS design leadership is placed at a level where the perspective is sufficiently broad, as specified in the model.

Operationalizing the model is up to the individual organization. Changes to the MIS department's procedures manuals for MIS development may be necessary. However, since the manager/user approaches in the model are associated with a broad perspective, perhaps decisions about the design approach and leadership should involve people who have a broader perspective than the professionals in the MIS department. The MIS steering committee may possess such a perspective. Stage four organizations [9], where the MIS steering committee is most commonly found, frequently are charged with making decisions on MIS project priorities. Perhaps in the fifth stage of EDP/MIS growth, the steering committee should also be charged with decisions on MIS design approach and leadership. The contingency model presented herein could serve as a guide for the steering committee's decisions.

References

- [1] Ackoff, R. L. *Redesigning the Future: A Systems Approach to Societal Problems*, New York, New York, Wiley, 1974.
- [2] Anthony, R. *Planning and Control Systems: A Framework for Analysis*, Division of Research, Graduate School of Business Administration, Harvard University, Boston, Massachusetts, 1965.
- [3] Ashenurst, R.L. (ed). "Curriculum Recommendations for Graduate Professional Programs in Information Systems: A Report of the ACM Curriculum Committee on Computer Education for Management," *Communications of the ACM*, May 1972, Volume 15, Number 5, pp. 363-398.
- [4] Barnard, C. I. *The Functions of the Executive*, The President and Fellows of Harvard College, Cambridge, Massachusetts, 1938.
- [5] Blumenthal, S. C. *Management Information Systems*, Prentice-Hall, Englewood Cliffs, New Jersey, 1969.
- [6] Bulen, R. Information Systems Director, Deere and Co., personal interview, 1969.
- [7] Emery, F. E. and Trist, E. L. "The Causal Texture of Organizational Environments," *Human Relations*, February 1965, Volume 18, Number 1, pp. 21-32.
- [8] Gehrman, P. R. "A Study to Identify Contingent Functional Relationships Between an Organization's External Environment and Its Design of Effective Management Information Systems," unpublished Ph.D. dissertation, University of Nebraska, 1976.
- [9] Gibson, C. F. and Nolan, R. L. "Managing the Four Stages of EDP Growth," *Harvard Business Review*, January-February 1974, Volume 52, Number 1, pp. 76-88.
- [10] Gorry, G.A. and Scott Morton, M.S. "A Framework for Management Information Systems," *Sloan Management Review*, Fall 1971, Volume 13, Number 1, pp. 55-70.
- [11] Hoffman, B. E. and Schonberger, R. J. "Data Base for Results," *Datamation*, August 1976, Volume 22, Number 8, pp. 155-156.
- [12] International Business Machines Corporation, "Business Systems Planning: Information Systems Planning Guide," IBM GE20-0527-1, 1975.
- [13] Johnson, R. A., Kast, F. E., and Rosenzweig, J. E. *The Theory and Management of Systems*, 2nd ed., McGraw-Hill, New York, New York, 1967.
- [14] Kast, F. E., and Rosenzweig, J. E. *Contingency Views of Organization and Management*, Science Research Associates, Chicago, Illinois, 1973.
- [15] Kriebel, C. H. "The Future MIS," *Infosystems*, June 1972, Number 6, pp. 18-19, 42 ff.
- [16] Lucas, H. C., Jr. *Information Systems Concepts for Management*, McGraw-Hill, New York, New York, 1978.
- [17] Lucas, H. C., Jr. *Toward Creative Systems Design*, Columbia University Press, New York, New York, 1974.
- [18] Luthans, F. *Introduction to Management: A Contingency Approach*, McGraw-Hill, New York, New York, 1976.
- [19] Nolan, R. L. "Systems Analysis of Computer-Based Information Systems Design," in F. W. McFarlan, R. L. Nolan and D. P. Norton, *Information Systems Administration*, Holt, Rinehart and Winston, New York, New York, 1973.
- [20] Norton, D. and McFarlan, F. W. "Project Management," in F. W. McFarlan and R. L. Norton, *The Information Systems Handbook*, Dow Jones-Irwin, New York, New York, 1975.
- [21] Rand, A. *Atlas Shrugged*, Random House, New York, New York, 1957.
- [22] Schonberger, R. J. and Buterbaugh, T. L. "Management Information Systems in Pittsburgh Business Firms," *Pittsburgh Business Review*, Winter 1976, Volume 46, (sic), Number 2, pp. 1-4.
- [23] Siegel, P. *Strategic Planning of Management Information Systems*, Petrocelli, New York, New York, 1975.
- [24] Simon, H. *The Shape of Automation for Men and Management*, Harper and Row, New York, New York, 1965.
- [25] Skinner, B. F. *Science and Human Behavior*, McMillan, New York, New York, 1953.
- [26] Thurston, P. H. "Systems and Procedures Responsibility: An Administrative View of the Division of Responsibility Between Operating People and Specialists for Systems and Procedures Work," Division of Research, Graduate School of Business Administration, Harvard University, Boston, Massachusetts, 1959.
- [27] Zani, W. M. "Blueprint for MIS," *Harvard Business Review*, November-December 1970, Volume 48, Number 6, pp. 95-100.

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