*Decision Sciences*
*Volume 27 Number 4*
*Fall 1996*
*Printed in the U.S.A.*

# An Empirical Test of the Strategic-Grid Model of Information Systems Planning*

Semi Tukana
*Management Information Systems, Fiji Development Bank, Suva, Fiji*

Ron Weber
*Department of Commerce, The University of Queensland, Brisbane, Qld 4072, Australia*

## ABSTRACT

Contingency models of information systems planning predict that no single planning approach will suit all organizations' needs. Little empirical research has been undertaken, however, to evaluate this prediction. Accordingly, we used McFarlan, McKenney, and Pyburn's (1983) strategic-grid model to study the information systems planning problems encountered by 49 governmental agencies. Twenty-seven agencies were required to follow a planning approach best suited to organizations that had a high level of dependence on both their existing and proposed systems. We predicted that agencies not having these characteristics would encounter the most problems with the approach. The remaining 22 agencies could choose their own planning approach. We studied this latter group to determine whether the problems encountered by the first group could be attributed to the mandated approach. Overall, the empirical results obtained were equivocal. Some results indicated that more planning problems were encountered by agencies in which the mandated approach was not appropriate to their position in the strategic grid. Other results were not supportive of this proposition. More work needs to be undertaken, therefore, to evaluate the predictive and explanatory power of contingency models of information systems planning. In addition, our research indicates a need to develop more rigorous theories of information systems planning behaviors, to improve the instruments needed to measure these behaviors, to explore the relationship between information systems planning behaviours and organizational effectiveness, to investigate how organizational learning impacts planning behaviors, and to determine the types of information systems planning problems that diffuse through organizations and those that remain localized.

*We are indebted to Mr. Ken Pope, past chairman, Queensland Government Information Policy Board for his support of our research. We are also indebted to the Queensland Government Information Policy Board consultants for their assistance in conducting this research and to the representatives of the various Queensland and South Australian government agencies who participated in the research. Helpful comments were received on an earlier version of this paper from Warren McFarlan and participants in a workshop at the University of British Columbia. In particular, we thank Izak Benbasat, Hugo Chen, and Al Dexter. Our thanks, also, to Jon Heales for research assistance on this project, to Tony Baglioni and Paul Bowen for statistical advice, and to Neo Boon Siong, Barry Williams, the associate editor, and two reviewers for their helpful comments. The research described in the paper was supported by grants from the Australian Research Council and GWA Ltd.

***Subject Areas: Information Management, Management Information Systems, Planning/ Strategy, and Public Enterprise.***

## INTRODUCTION

In spite of the large number of methodologies that have been developed to facilitate the development of information systems (IS) plans (see Galliers (1987) for a review), many organizations still confront substantial problems when they undertake IS planning. After an extensive review of the literature, Lederer and Sethi (1988) assigned these problems to three categories: (1) resource-related problems associated with having insufficient time, money, personnel, and top management support to undertake IS planning; (2) process-related problems associated with deficiencies in the IS planning methodology used; and (3) output-related problems associated with the scope and relevance of the final plan produced. Based on empirical work they then conducted, Lederer and Sethi (1988) found yet another class of information systems planning problems, namely, implementation-related problems associated with failures to put in place the projects recommended in the plan.

While the causes of these problems may be many and varied (see, e.g., Lederer & Mendelow, 1986; and Pyburn, 1983), two major themes dominate the literature. First, many researchers believe problems arise because existing IS planning methodologies are still deficient. For example, the methodologies fail to establish a proper link between the overall corporate plan and the IS plan (e.g., Atkinson & Montgomery, 1990). Second, a smaller group of researchers argue that problems arise when the information systems planning approach used by an organization does not properly take into account certain environmental, structural, task, and managerial factors (e.g., Boynton & Zmud, 1987; and Cash, McFarlan, McKenney, & Applegate, 1992). These researchers contend that a contingency approach to information systems planning must be used if IS planning problems are to be mitigated.

In this paper, we describe an empirical test of a contingency model of information systems planning we undertook in 49 governmental organizations. During 1990-1991, 27 of these organizations could no longer follow their own, idiosyncratic approaches to IS planning. Instead, they were required to follow a government-wide, unilateral approach to information systems planning developed in light of a major review of IS activities undertaken within these organizations. We used a particular contingency model of information systems planning to predict the likely levels of problems these organizations would encounter during various phases of IS planning. We then gathered data to determine whether our predictions were borne out in practice. To evaluate whether the problems encountered by these 27 organizations were independent of the information systems planning approach they were required to use, we contrasted their experiences with 22 other governmental organizations that were not constrained in terms of the IS planning approaches they chose.

Our motivations for undertaking the research were fourfold. First, we wished to obtain empirical evidence about the merits of contingency models of information systems planning. We believe contingency models provide a more compelling explanation of why IS planning problems arise than arguments based on deficiencies in existing IS planning methodologies. Nonetheless, the empirical work undertaken so far to test these models has been limited. Second, we sought to obtain better insights

into the factors that underlie information systems planning problems. IS planning continues to remain a critical task facing IS executives (see, e.g., Broadbent, Hansell, Lloyd, & Dampney, 1992; Caudle, Gorr, & Newcomer, 1991; Clark, 1992; Goodhue, Kirsch, Quillard, & Wybo, 1992; Moynihan, 1990; Niederman, Brancheau, & Wetherbe, 1991; and Watson, 1989). Thus, the resolution of information systems planning problems has considerable practical significance. Third, we wished to obtain a better understanding of IS planning practices as a basis for building improved theories. Like Boynton and Zmud (1987), we believe prior research has focused too much on introducing new items onto the IS planning agenda. Too little work has been undertaken, on the other hand, to understand, improve, and predict IS planning behaviors. Fourth, expenditure on information technology-related capital investment is now a significant factor in many advanced economies, perhaps accounting for as much as 50% or more, on average, of an organization's capital expenditures (see, e.g., Earl, 1989; and Kriebel, 1989). We believe good information systems planning is central to obtaining acceptable returns on this investment.

## BACKGROUND TO AND MOTIVATIONS FOR THE RESEARCH

For purposes of the research described in this paper, like Boynton and Zmud (1987) we view information systems planning as any activity organizations undertake to (1) recognize opportunities and problems in which information systems might be used profitably, (2) determine the resources needed to develop, operate, and maintain information systems that address these opportunities and problems, and (3) develop strategies and procedures to realize the opportunities, resolve the problems, and attain the needed resources. Using Earl's (1989) framework, this notion of IS planning includes information systems strategy planning (deciding what to do) and information technology strategy planning (deciding how to do it). It does not include information management strategy planning (deciding how to manage information systems and technology). Using Zmud's (1988) framework, it includes strategic planning (determining how information technology can influence competitive position), systems planning (determining how an organization should use information products and services), and technology planning (determining the infrastructure needed to support strategic and systems plans).

IS plans can be prepared using an IS planning methodology. These methodologies prescribe which activities should be undertaken to prepare all or some parts of an IS plan and how these activities should be undertaken (e.g., Hackathorn & Karimi, 1988). A widely held belief is that use of an IS planning methodology allows better IS plans to be prepared.

Two dimensions of information systems planning methodologies are scope and applicability. The scope may be global or local. If it is global, the methodologies would be used to address strategic planning, systems planning, and technology planning in an integrated manner. If it is local, the methodologies would address only a proper subset of these three aspects of IS planning. From still another perspective, if it is global, the methodologies would address the organization's enterprise-level IS planning needs. If it is local, the methodologies would address the organization's business-unit level IS planning needs.

The applicability of methodologies may be unilateral or contingent. If it is unilateral, the methodologies prescribe planning activities that supposedly are useful in all information systems planning situations (e.g., Bowman, Davis, & Wetherbe, 1983; Earl, 1993; Lederer & Gardiner, 1992; and Parker & Benson, 1989). If it is contingent, the methodologies prescribe different planning activities depending on the environmental, structural, task, and managerial contexts in which the IS plans must be formulated (e.g., Byrd, Sambamurthy, & Zmud, 1995; and Sullivan, 1985).

A priori, we might expect few conflicts between local and global information systems planning methodologies. Presumably, local methodologies will be used to flesh out the bare bones of IS plans created using global methodologies. For example, using a global IS planning methodology, organizations might conclude that strategic systems are critical to their survival. Using a local methodology, such as the customer-resource life cycle approach (Ives and Learmonth, 1984), organizations might then identify specific strategic systems they should implement.

Unilateral and contingency approaches to information systems planning, on the other hand, are more difficult to reconcile. The very nature of contingency approaches precludes a belief that planning activities applicable to all types of situations can ever be identified. In short, the value of unilateral planning methodologies is fundamentally undermined if one accepts the premises underlying contingency models of IS planning.

In spite of the basic conflict that exists between unilateral and contingency models of planning, however, little research has been undertaken to evaluate the relative merits of the two approaches. Ironically, a natural link exists between the two that can form the basis of any research that seeks to compare them. Specifically, contingency models can be used to predict the likely problems organizations will encounter if they use unilateral models. It is this relationship we seek to exploit in the research described below.

## STRATEGIC-GRID MODEL OF IS PLANNING

The particular contingency model of information systems planning we use as the basis for our empirical research is McFarlan, McKenney, and Pyburn's (1983) strategic-grid model. McFarlan et al. argue that variations in IS planning practices should exist across organizations based upon the levels of two dimensions: first, the importance of the existing information systems to the organization's survival; and second, the importance of future information systems to the organization's survival. Using a high-low rating for each dimension, they identified four types of organization: support, factory, turnaround, and strategic. Figure 1 shows the nature of each of the four types of organization and the predicted IS planning activities that each will undertake.

We might have used other contingency models to predict how information systems planning activities will vary across organizations—for example, Nolan's (1973, 1979) stage-growth model or Sullivan's (1985) infusion-diffusion model. Nolan's model has been criticized on a number of grounds (see, Benbasat, Dexter, Drury, & Goldstein, 1984; and King & Kraemer, 1984) however, and empirical tests of his model have produced equivocal results (e.g., Drury, 1983; Lucas & Sutton, 1977). Sullivan's model also could not account for approximately 60% of the IS planning behaviors exhibited by the organizations he investigated. Moreover, in light

**Figure 1:** Relationship between strategic-grid quadrant and information systems planning behaviors.

| Importance of Existing Information Systems | Importance of Future Information Systems: Low | Importance of Future Information Systems: High |
|---|---|---|
| Low | **Support Organizations**<br>Little information systems planning | **Turnaround Organizations**<br>Some long-run strategic information systems planning |
| High | **Factory Organizations**<br>Some short-run operational information systems planning | **Strategic Organizations**<br>Substantial short-run operational and long-run strategic information systems planning |

Adapted from McFarlan et al. (1983)

of our knowledge of and experience with IS planning, we find McFarlan et al.'s model to be the most compelling (see also Earl, 1989, p. 59). Nevertheless, few empirical tests of the strategic-grid model appear to have been undertaken (Pyburn, 1983; Raghunathan & Raghunathan, 1990).

## TESTING THE STRATEGIC-GRID MODEL

At the outset of our research, we identified two ways in which the strategic-grid model's ability to predict and explain the information systems planning approaches adopted by organizations could be tested. Neither is straightforward, and each has its strengths and limitations.

The first tests the proposition that the characteristics of an organization (as determined by the strategic grid) are associated with the type of information systems planning approach it adopts—the congruency proposition. The basic notion underlying this proposition is that over time, organizations will choose an optimum IS planning approach. The strategic-grid model predicts how the characteristics of organizations and the characteristics of their optimum IS planning approaches will be matched.

Several conditions must be satisfied if tests of the congruency proposition are to be valid. First, the organizations studied must have reached stability in terms of the information systems planning approach they use. If they are still in a learning phase, they may not have chosen an optimum approach. Second, the organizations studied must experience forces that cause them to adopt an optimum IS planning

approach. For example, it might be argued that competitive markets expunge IS planning inefficiencies or that organizations that survive evolve naturally to efficient states (Nelson & Winter, 1982). Third, the organizations studied must operate in an environment where the forces that drive out IS planning inefficiencies can operate freely. For example, monopolists may not choose an optimum IS planning approach because they face only muted competitive forces.

The second way to evaluate the explanatory and predictive power of the strategic-grid model is to test the proposition that the level of congruency between the characteristics of the organization (as determined by the strategic grid) and the type of information systems planning approach adopted by the organization is associated with the level of IS planning problems encountered by the organization—the incongruency proposition. The basic notion underlying this proposition is that higher levels of incongruency will be associated with higher levels of IS planning problems.

We see three ways in which the incongruency proposition can be tested. First, researchers might seek to identify organizations that have reached stability in terms of their information systems planning approach but which, for some reason, are constrained from choosing an optimum approach. Alternatively, they might choose organizations that lack incentives to choose an optimum approach. For example, as discussed previously, a monopolist may lack incentives to choose an optimum IS planning approach. As a result, the organization may encounter IS planning problems (although it might choose to live with these problems). Unfortunately, the validity of this approach to testing the incongruency proposition may be undermined because the level of constraints or disincentives experienced by the organization confound stakeholder perceptions of the level of IS planning problems encountered. In other words, stakeholders in two organizations that are subject to the same level of incongruency may rate their levels of IS planning problems differently because they experience different levels of constraints or disincentives in their choice of an optimum IS planning approach.

Second, researchers might seek to identify organizations that have not yet reached stability in terms of the information systems planning approach they will adopt. Some level of incongruency will still exist, therefore, between the characteristics of these organizations and their optimum IS planning approach. This level of incongruency should be associated with the level of IS planning problems they are experiencing. Unfortunately, the validity of this test may be undermined because learning effects may be confounded with incongruency effects. In other words, stakeholders in two organizations that are subject to the same level of incongruency may rate their levels of IS problems differently because they are at different stages of the learning curve in their use of IS planning approaches.

Third, researchers might seek to identify organizations that are suddenly forced to follow a common information systems planning approach. For example, the head office of a multinational corporation might instruct all its divisions to adopt a particular approach. If the approach is not congruent with each division's needs, however, IS planning problems could arise. Like the previous two methods of testing the incongruency proposition, this one is also problematical. Confoundings can arise because organizations face varying levels of constraints or disincentives when choosing an IS planning approach. Moreover, they may be at different stages of learning in their use of IS planning approaches. Nevertheless, one advantage of this

method is that researchers do not have to determine the different approaches used by the organizations they study. Because the IS planning approach is enforced, only the characteristics of the mandated approach need be determined.

## THEORY AND PROPOSITION

The research described in this paper used the incongruency proposition to test the strategic-grid model. We formalize the incongruency proposition as follows:

> The level of problems experienced by an organization when it undertakes information systems planning is associated with the level of congruence between its information systems planning needs (as determined by McFarlan et al.'s (1983) strategic-grid model) and the information systems planning approach it uses.

We tested this proposition using a group of organizations that suddenly were forced to change their own idiosyncratic approaches to IS planning to an approach mandated by a higher authority (the third method of testing described above). We describe the circumstances surrounding our empirical research in a subsequent section below. In the following two subsections, however, we provide brief theoretical support for the proposition.

### Evolutionary Theory of Economic Change

The first way in which we marshal support for the incongruency proposition is via Nelson and Winter's (1982) evolutionary theory of economic change. Basically, Nelson and Winter borrow ideas from biology to support the idea of "economic natural selection." Those organizations that survive in marketplaces have "routines" (traits, behavioral patterns, or capabilities) that allow them to adapt to unexpected, adverse environmental exigencies. Those that fail lack routines that would allow them to adapt in a timely way. Moreover, Nelson and Winter argue that organizations are "typically better at the tasks of self-maintenance in a constant environment than they are at major change, and much better at changing in the direction of 'more of the same' than they are at any other kind of change" (pp. 9-10).

Consider, then, the implications for an organization if it is suddenly forced to follow a particular information systems planning approach. Consistent with Nelson and Winter's (1982) theory, we argue that the organization will encounter fewer problems in adapting to the new IS planning approach to the extent that the new approach is congruent with its existing IS planning approach. The organization is more likely to already possess the routines needed to undertake the IS planning activities evoked under the new approach or to be able to adapt its extant IS planning routines to the demands of the new approach. Where differences between the old and the new approach are more substantial, however, the organization will be less adept at coping with the changes that must be made.

### Theory of Absorptive Capacity

The second way in which we marshal support for our incongruency proposition is via Cohen and Levinthal's (1990) theory of "absorptive capacity." An organization's absorptive capacity refers to its ability to perceive the value of new information,

assimilate it, and apply it successfully. Cohen and Levinthal's thesis is similar to Nelson and Winter's, and they argue that an organization's "ability to evaluate and utilize outside knowledge is largely a function of the level of prior related knowledge" (p. 128). Moreover, Cohen and Levinthal contend that "learning is cumulative, and the learning performance is greatest when the object of learning is related to what is already known. As a result, learning is more difficult in novel domains . . ." (p. 131).

Consider, again, an organization that suddenly is forced to follow a particular information systems planning approach. Consistent with Cohen and Levinthal's (1990) theory, we argue that the organization will encounter fewer problems in adapting to the new IS planning approach when it has greater absorptive capacity. This situation will occur when the organization is already undertaking IS planning activities similar to those required under the new IS planning approach.

## RESEARCH METHOD

To test our research proposition, we used a combination of field study and survey. In the subsections below, we discuss why we adopted this research approach and describe the specific procedures we followed.

### Background to the Empirical Research

In 1989, a new state government was elected in the state of Queensland, Australia. The previous government had held power for 32 years. The new government immediately initiated a number of major reviews of existing governmental administrative practices. One such review addressed the government's use of information technology. A committee was established "to recommend action plans for policy, coordination, management and rationalisation of the use of IT within the government, and utilising IT's potential to assist the economic development of the State" (Information Technology Review Committee, 1990, p. 1).

After studying computing practices in all departments, the review committee concluded that the State government could substantially improve its use of information technology. While some departments used information systems strategically, others still viewed information as a collection of records about government activities and not as a strategic resource. To rectify this situation, the review committee proposed that an Information Policy Board (IPB) be established. Among the major tasks given to the IPB was the development of a strategic plan for the government's overall use of information technology. To establish the basis for this plan, all government agencies were to provide the IPB with a plan that addressed the strategic and operational aspects of their proposed use of information technology.

Shortly after the establishment of the IPB but before the submission of agency plans, the then-Chairman of the IPB approached us to determine whether we wished to conduct research on the planning process that would occur during the period leading up to the preparation of the overall information technology strategic plan for the government. We used this opportunity to determine whether our beliefs about the importance of contingency models of information systems planning were well founded.

## Experimental Group

Two groups of organizations participated in our research—an experimental group and a control group. Because the procedures we followed with each group differed slightly, the following subsections discuss those used with the experimental group. The next section then describes those used with the control group.

### *Participants*

The experimental group comprised all 31 autonomous and semiautonomous agencies of the Queensland State Government. Under a covering letter from the then-Chairman of the IPB, we contacted the agencies seeking their assistance with this research. Table 1 shows the characteristics of the 27 organizations that eventually provided us with data. Note that most of the organization are fairly large in terms of revenues and number of employees, and most also have substantial IS functions. The activities they undertake are representative of state or provincial public-sector organizations in many countries—for example, police, corrective services, health, education, tourism, transport, justice, primary industries, environment, and government audit.

An important feature of the participant agencies was that they were subject to ongoing processes of corporatization. As a result, they were often permitted to purchase goods and services from private sector organizations if they could not find favorable prices and terms within the public sector. Moreover, the agencies were increasingly being forced to sell their goods and services to other agencies, private sector organizations, and the public to obtain the revenues needed to support their activities. The agencies were acutely aware that they could no longer assume the government would provide them with monopoly powers. In addition, these agencies clearly understood that they had to be competitive with both private sector and other public sector organizations. Indeed, during our conversations with many agency executives, they talked of finding IS applications to give their agencies "strategic advantage."

### *The IS Planning Methodology Treatment*

An important characteristic of our field study was that all agencies in the experimental group were required to follow a particular approach during the preparation of their IS plans. The IPB (1991a, 1991b) issued two sets of guidelines: one for strategic information systems planning (plans covering a 3- to 5-year time horizon); the other for operational information systems planning (plans covering a 1- to 3-year time horizon). These guidelines were based, in part, on the need for agencies to address certain key planning issues discussed in the final report of the Information Technology Review Committee (1990).

In an experimental design sense, the planning guidelines issued by the IPB constitute the treatment in our research. The agencies were required to comply with these guidelines. Their draft plans then had to be submitted to the IPB for review. Agency representatives were also invited to make presentations before the IPB on their draft plans. IPB consultants reviewed the draft plans for compliance with the guidelines. They then provided verbal and written feedback to the agencies on any issues requiring further attention. Subsequent to the review, the agencies prepared and submitted their final plans.

**Table 1:** Characteristics of participant organizations.

| Characteristic | Experimental Group | | Control Group | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Total Funds and Revenue | | | | |
| Less than $2 m | 0 | 0.0 | 0 | 0.0 |
| $2 m - $10 m | 1 | 3.7 | 3 | 14.3 |
| $10 m - $50 m | 5 | 18.5 | 4 | 19.0 |
| $50 m - $200 m | 9 | 33.3 | 4 | 19.0 |
| $200 m - $500 m | 6 | 22.2 | 7 | 33.3 |
| Over $500 m | 6 | 22.2 | 3 | 14.3 |
| Total IS/IT Budget | | | | |
| Less then $1 m | 5 | 18.5 | 7 | 33.3 |
| $1 m - $2 m | 7 | 25.9 | 3 | 14.3 |
| Over $2 m | 15 | 55.5 | 11 | 52.4 |
| Number of Employees | | | | |
| Less than 100 | 3 | 11.1 | 4 | 19.0 |
| 100 - 500 | 9 | 33.3 | 6 | 28.6 |
| 500 - 1,000 | 2 | 7.4 | 4 | 19.0 |
| 1,000 - 10,000 | 11 | 40.7 | 7 | 33.3 |
| Over 10,000 | 2 | 7.4 | 0 | 0.0 |
| Number of Employees in IS Function | | | | |
| Less than 10 | 9 | 33.3 | 6 | 28.6 |
| 10 - 50 | 11 | 40.7 | 10 | 47.6 |
| 50 - 100 | 5 | 18.5 | 5 | 28.8 |
| Over 100 | 2 | 7.4 | 0 | 0.0 |

For three reasons, we believe the planning guidelines issued by the IPB to agencies were most appropriate for organizations that were in the strategic quadrant of McFarlan et al.'s (1983) strategic grid. First, the contents of the planning guidelines address issues appropriate to an organization in the strategic quadrant of the strategic grid. For example, under the topic, "Strategic Application of New Information," the IPB's (1991a, p. 3) strategic planning guidelines state:

> Describe the directions for the application of the Agency's information resources, covering such matters as:
>
> - the strategic advantage to the agency and the government through new services and improved levels of client service
> - stimulation of economic activity in Queensland

Similarly, under the topic "Information Technology Initiatives Report," the IPB's (1991b, p. 5) operational planning guidelines state:

> This section should provide details of each information systems initiative/activity which is either currently being undertaken or is planned to be undertaken as a result of the agency's analysis of the strategies identified in the information systems strategic plan.

Second, the guidelines clearly communicated a view that information technology was central to the attainment of an agency's overall mission. For example, the IPB's (1991a, pp. 1-2) guidelines state:

> The information strategic plan is an essential document which seeks to identify the overall information requirements and IT issues and strategies to support the agency in achieving its corporate goals and vision. *This implies that information must be treated as a major resource within the agency* (our emphasis).

Third, the final report of the Information Technology Review Committee (1990) was highly critical of the prior government's failure to use information technology as a strategic resource. The need for agencies to use information strategically is a recurring theme in the report. Moreover, substantial press coverage was given to the newly elected government's promise to use information technology strategically for the overall good of the State. The planning guidelines were prepared against this backdrop.

### *Measures*

To evaluate the level of problems faced by the agencies when they prepared their IS plans, we used three instruments. Consistent with Lederer and Sethi's (1988) classification of IS planning problems, the instruments measured the level of resource problems, planning process problems, and planning output problems the agencies encountered. Because the plans had not been implemented, we could not assess the level of implementation problems.

Tables 2, 3, and 4 show the items on each instrument. Most were obtained from Lederer and Sethi's (1988) listing of the specific information systems planning difficulties organizations might encounter under their three categories of problems. A few were included at the request of the IPB. Consistent with Lederer and Sethi's (1988) and McLean and Soden's (1977) approach, for each item the following 5-point scale was used: "not a problem," "a minor problem," "a moderate problem," "a major problem," and "an extreme problem." In Tables 2, 3, and 4, each item is scored as follows as the basis for calculating the mean and standard deviation: not a problem = 1; a minor problem = 2; a moderate problem = 3; a major problem = 4; an extreme problem = 5.

To assess an agency's position on McFarlan et al.'s (1983) strategic grid, we used two instruments. The first was the operational dependence questionnaire provided in McFarlan et al. (p. 153) to measure the strategic impact of an organization's existing systems. The second was the application development portfolio questionnaire provided in McFarlan et al. (p. 151) to measure the strategic impact of an organization's future systems.

We also used questionnaires to obtain data on other characteristics of the agencies and their information systems planning efforts, including the total number of employees, the number of IS employees, the total revenue, the total funds allocated to the IS/IT budget, the number and experience of the IS planners, the general attitude of the planners, the attitude of the chief executive officer toward the planning process, whether the planning process was championed, whether the preparation of the plan involved some power plays, the level of detail in the plan, and whether the

**Table 2:** Resource-related problem items.

| | | Experimental | | Control | |
|---|---|---|---|---|---|
| | Item | Mean | Standard Deviation | Mean | Standard Deviation |
| R1 | Adequate guidelines were not available to describe the steps that should be followed in the planning process. | 2.444 | 1.155 | 2.360 | 1.221 |
| R2 | It was difficult to get top management to communicate their strategic goals for the organization. | 2.444 | 1.368 | 3.417 | 1.248 |
| R3 | It was difficult to relate the information systems strategies to the objectives of the Information Policy Board. | 2.370 | 1.245 | — | — |
| R4 | It was difficult to find team members who were qualified to do the planning. | 2.333 | 1.109 | 2.083 | 1.213 |
| R5 | The planning exercise took a long time. | 2.296 | 1.068 | 2.375 | 1.279 |
| R6 | To prepare the plans, many support personnel were required for data gathering and analysis. | 2.185 | 1.039 | 1.875 | .797 |
| R7 | The success of the planning process was greatly dependent on the team leader. | 2.080 | 1.115 | 2.333 | 1.049 |
| R8 | The planning process was not based on any conceptual model or framework. | 2.077 | 1.230 | 1.680 | 1.030 |
| R9 | Adequate external consultant support was not available to develop the plans. | 2.000 | 1.271 | 1.304 | 0.635 |
| R10 | The plans did not take into account the organization structure. | 1.963 | 1.344 | 1.833 | 1.007 |
| R11 | The planning process lacked adequate computer support. | 1.852 | 0.989 | 1.800 | 1.118 |
| R12 | It was difficult to find a team leader who was qualified to do the planning. | 1.815 | 1.075 | 1.958 | 1.233 |
| R13 | The planning exercise was very expensive. | 1.815 | 0.962 | 1.875 | 0.992 |
| R14 | The plans did not take into consideration the organization size. | 1.815 | 1.111 | 1.583 | 0.929 |
| R15 | Little knowledge and experience was gained as a basis for determining how future information systems plans should be prepared. | 1.778 | 0.934 | 1.960 | 1.172 |
| R16 | The plans are of little use in determining how information systems should evolve in the organization. | 1.741 | 1.095 | 2.083 | 1.060 |
| R17 | It was difficult to convince top management to support the development of the plans. | 1.593 | 0.931 | 1.792 | 1.141 |
| R18 | It was difficult to convince the steering committee to support the development of the plans. | 1.481 | 0.802 | 1.417 | 0.881 |
| R19 | The size of the planning team was very large. | 1.444 | 0.641 | 1.440 | 0.870 |

**Table 3:** Process-related problem items.

| | Item | Experimental | | Control | |
|---|---|---|---|---|---|
| | | Mean | Standard Deviation | Mean | Standard Deviation |
| P1 | The plans did not take into account issues related to their implementation. | 2.222 | 0.934 | 2.292 | 1.233 |
| P2 | The plans did not assess the external technological environment. | 2.185 | 1.111 | 1.792 | 1.062 |
| P3 | The plans did not analyze the current strengths and weaknesses of the IS department. | 2.037 | 1.018 | 2.417 | 1.060 |
| P4 | Users were not involved sufficiently in the planning process. | 2.037 | 1.091 | 2.080 | 1.222 |
| P5 | The organization's steering committee was not involved sufficiently in the planning process. | 1.947 | 1.129 | 1.792 | 1.021 |
| P6 | The plans did not take into account organizational goals and strategies. | 1.889 | 1.050 | 2.438 | 1.362 |
| P7 | The plans did not assess the organization's competitive environment. | 1.846 | 1.048 | 1.870 | 1.254 |
| P8 | Top management was not involved sufficiently in the planning process. | 1.815 | 1.145 | 1.760 | 0.970 |
| P9 | The plans did not take into account changes in the organization. | 1.778 | 0.847 | 2.417 | 1.248 |
| P10 | The plans did not take into account the current information systems applications portfolio. | 1.148 | 0.456 | 1.417 | 0.929 |
| P11 | The planning process required too much user involvement. | 1.148 | 0.456 | 1.583 | 0.717 |
| P12 | The planning process required too much top management involvement. | 1.111 | 0.320 | 1.500 | 0.834 |
| P13 | The planning process was too rigid. | 1.074 | 0.267 | 1.261 | 0.689 |

plan was externally or internally oriented. This data was ancillary to our main purposes. We collected the data in case some might prove useful as control variables (covariates) in our data analysis or might assist us in interpreting our results. In some cases, the variable is considered by some researchers to be an important factor in the IS planning process—for example, the support of top management (see, e.g., Lederer & Mendelow, 1986). None of this data proved useful in our statistical analyses. To increase degrees of freedom, it was dropped from the final analyses.

### *Administration*

The various measurement instruments were assembled into two packages. The first was comprised of the questionnaire to measure resource problems, McFarlan et al.'s

**Table 4:** Output-related problem items.

| | | Experimental | | Control | |
|---|---|---|---|---|---|
| | Item | Mean | Standard Deviation | Mean | Standard Deviation |
| O1 | Implementing the projects and the data and communications architecture identified in the plans requires substantial further analysis. | 2.778 | 1.188 | 2.522 | 1.082 |
| O2 | The plans did not include a plan for end-user computing in the organization. | 2.519 | 1.087 | 2.000 | 1.206 |
| O3 | The plans did not sufficiently address the need for Data Administration in the organization. | 2.444 | 1.086 | 2.130 | 1.140 |
| O4 | The plans did not include an overall personnel and training plan. | 2.444 | 1.155 | 2.348 | 1.229 |
| O5 | The plans did not determine a basis for prioritizing projects. | 2.259 | 1.163 | 2.304 | 1.396 |
| O6 | The plans did not show who will be responsible for implementing the initiatives in the plans. | 2.148 | 0.989 | 1.913 | 1.240 |
| O7 | The plans did not determine an overall data architecture for the organization. | 2.148 | 0.989 | 2.125 | 1.227 |
| O8 | The plans did not include an overall organizational data communications plan. | 2.037 | 1.160 | 1.957 | 1.065 |
| O9 | The plans did not show how they are linked with the organization's strategic goals. | 1.926 | 0.958 | 2.348 | 1.229 |
| O10 | The plans did not capture all the information required by the Information Policy Board's guidelines. | 1.926 | 1.141 | - | - |
| O11 | The plans did not include an overall financial plan for the IS function. | 1.810 | 0.981 | 2.043 | 1.261 |

(1983) operational dependence questionnaire, and two questionnaires to elicit some of the control data we listed above. Shortly after the agency had completed its draft IS plan, this package was distributed to the person having primary responsibility for the information systems planning effort in each agency (Table 5). The completed packages were returned within 2 weeks of their distribution. In a few cases, follow-up telephone calls had to be made.

The second package was comprised of the questionnaire to measure planning process problems, the questionnaire to measure planning output problems, McFarlan et al.'s (1983) application development portfolio questionnaire, and a questionnaire to elicit some of the control data we listed above. This package was distributed to the IPB consultants (Table 5). Two consultants completed the package after they had reviewed the draft IS plans submitted by the agencies and after they had heard

**Table 4:** (continued).

| | Item | Experimental Mean | Experimental Standard Deviation | Control Mean | Control Standard Deviation |
|---|---|---|---|---|---|
| O12 | The plans did not outline changes needed in reporting relationships. | 1.765 | 1.147 | 1.957 | 1.107 |
| O13 | The plans are not flexible enough to take into account unanticipated changes in the organization and its environment. | 1.741 | 0.764 | 2.130 | 1.100 |
| O14 | The plans did not provide a statement of organizational objectives for the IS function. | 1.741 | 0.903 | 1.917 | 1.060 |
| O15 | The plans did not identify projects that will give the organization a strategic advantage. | 1.741 | 1.095 | 2.000 | 1.285 |
| O16 | The plans did not provide priorities for developing specific databases. | 1.667 | 0.961 | 2.000 | 1.243 |
| O17 | The knowledge and experience gained implementing the plans are unlikely to be useful. | 1.519 | 0.975 | 1.348 | 0.573 |
| O18 | The plans did not include an overall organizational hardware plan. | 1.481 | 1.014 | 1.522 | 0.994 |
| O19 | The plans did not sufficiently address the role of a permanent information systems planning group. | 1.481 | 0.935 | 2.087 | 1.311 |
| O20 | The plans did not identify specific new projects to be undertaken. | 1.333 | 0.877 | 1.375 | 0.924 |
| O21 | Top management is unlikely to make a commitment to implementing the plans. | 1.320 | 0.748 | 2.042 | 1.334 |
| O22 | The plans are not in accordance with the expectations of top management. | 1.136 | 0.640 | 1.435 | 0.590 |

each agency's presentation of its plan. For purposes of evaluating agency plans, the IPB had split its eight consultants into four teams of two consultants. Teams were allocated to an agency on the basis of their knowledge of the agency.

We assigned the individual questionnaires to either the agency or the IPB on the basis of which respondents we concluded were best able to complete the questionnaire. We believed agency personnel would best know the resource problems they encountered in preparing their plan. However, we believed the IPB consultants could best judge the problems encountered in the planning process and the planning output. Through their evaluation role, the consultants acquired in-depth knowledge of how the agency had prepared the plan. They were also in a position to make comparative evaluations across agencies. Similarly, we believed the agency was best able to assess its operational dependence on information systems, but we felt the

**Table 5:** Questionnaires and their experimental-group respondents.

| Questionnaire | Respondent |
|---|---|
| Resource-Problems Questionnaire | Agency representative |
| Process-Problems Questionnaire | IPB consultants |
| Output-Problems Questionnaire | IPB consultants |
| Operational Dependence Questionnaire | Agency representative |
| Application Development Portfolio Questionnaire | IPB consultants |
| Control Data (Covariates) Questionnaires | Agency representatives plus IPB consultants |

consultants were best able to assess the strategic importance of an agency's application portfolio given their overall knowledge of the way in which the government as a whole was proceeding with information technology. In terms of the various control data we collected, again we sought responses from those we considered best able to provide the data. We reached these decisions on the allocation of questionnaires based upon consultation with and advice from the agencies and the IPB consultants.

By using the IPB consultants to rate the level of process problems and output problems, we also sought to mitigate the effects of any "resentful demoralization" that might have occurred among participants in the experimental group (see Cook & Campbell, 1979, p. 55). Because the experimental group participants were forced to use a particular IS planning approach, some may have reacted unfavorably. As a result, the participants may not have provided reliable assessments of the IS planning problems they experienced.

Throughout the period of our research, the agencies, the IPB consultants, and the then-Chairman of the IPB were blind to the proposition we were testing. On the basis of conversations we had with them, we were also confident they did not guess the nature of the research proposition.

### *Control Group*

The level of information systems planning problems encountered by organizations may vary as a function of their position in the strategic grid, irrespective of the IS planning approach they adopt. Unless we have a control group, therefore, we cannot ascribe such differences to the treatment administered to the experimental group. Accordingly, the following subsections describe the research method we followed with a second group of governmental agencies.

### *Participants*

In Australia, the states considered similar to Queensland (in terms of measures like population size and economic activity) are South Australia and Western Australia. In this light, we first approached the director in the South Australian State Government, who had overriding responsibility for agency IS plans, to assist us with our research. He agreed to help under a guarantee that respondents would remain anonymous. To preserve anonymity, he contacted 55 South Australian State Government agencies

directly on our behalf, mailed them our questionnaires, and wrote a letter in support of our research. Twenty-six agencies responded; 22 provided usable replies. Table 1 shows the demographic characteristics for 21 of these 22 organizations (one declined to provide demographic information). Note that the control group's and experimental group's demographic characteristics are similar. Both groups also perform similar functions on behalf of their state governments. Thus, we believe they are comparable in terms of factors that might influence the approaches they choose to IS planning.

### *Measures*

The measures used with the control group were the same as those used with the experimental group. Lederer and Sethi's (1988) three instruments were employed with slight adaptations to measure the level of information systems planning resource problems, process problems, and output problems. The operational dependence questionnaire and application development portfolio questionnaire provided in McFarlan et al. (1983) were used to measure the levels on the two dimensions of the strategic grid.

### *Administration*

The administrative procedures used with the control group were different from those used with the experimental group. With the experimental group, recall that the five instruments were assembled into two packages: the first was sent to each agency, the second was sent to the IPB. With the control group, however, there was no equivalent of the IPB in the IS planning process. Each agency had complete responsibility for its IS planning. Accordingly, all five instruments were assembled into a single package. In compliance with our anonymity agreement, we provided multiple copies of this package to the director responsible for IS planning in South Australian governmental agencies. He, in turn, sent the package to the person primarily responsible for preparing the IS plan within each agency. This person returned their response in a reply-paid envelope addressed to us. Thus, we have no knowledge of which agencies were contacted nor which replied.

## HYPOTHESES TESTED

We tested two sets of hypotheses to evaluate the incongruency proposition. The first set, Hypotheses 1 and 2, are based upon an overall measure of the resource problems, process problems, and output problems encountered by the participant organizations (Table 6). The levels of resource problems, planning process problems, and planning output problems were calculated as the average rating for all completed items on each of the three instruments described previously. Because we have argued that the mandated IS planning approach was best suited to strategic organizations, consistent with our theoretical analyses we hypothesized that the level of resource problems, process problem, and output problems would decrease as the strategic importance of both existing systems and future systems increased.

The assumption underlying the first set of hypotheses is that the problems encountered by organizations as incongruency increases will diffuse widely across information systems planning activities, irrespective of an organization's prior experience with an activity. In other words, problems associated with an activity in which the

**Table 6:** Research hypotheses.

| | |
|---|---|
| **Diffusion Hypotheses** | |
| Hypothesis 1 | If a strategic approach is used to information systems planning, the level of resource problems, planning process problems, and planning output problems experienced by an agency will decrease as the strategic impact of its existing systems increases. |
| Hypothesis 2 | If a strategic approach is used to information systems planning, the level of resource problems, planning process problems, and planning output problems experienced by an agency will decrease as the strategic impact of its proposed systems increases. |
| **Localization Hypotheses** | |
| Hypothesis 3 | If a strategic approach is used to information systems planning, the level of costs-related problems, competence-related problems, guidance-related problems, support-related problems, involvement-related problems, and rigidity-related problems experienced by an agency will decrease as the strategic impact of its existing systems increases. |
| Hypothesis 4 | If a strategic approach is used to information systems planning, the level of costs-related problems, competence-related problems, guidance-related problems, support-related problems, involvement-related problems, and rigidity-related problems experienced by an agency will decrease as the strategic impact of its proposed systems increases. |

organization has little experience will spill over to cause problems in activities in which the organization does have experience. Hence, we call this first set of hypotheses the "diffusion hypotheses."

If our diffusion hypotheses are not supported, it is still possible that the organizations experienced problems in specific areas of planning in which they had little experience in which the planning approach was inappropriate (Hypotheses 3 and 4, Table 6). In other words, we are testing whether the effects of incongruency are localized rather than generalized. Hence we call this set of hypotheses the "localization hypotheses."

To provide a basis for this second set of hypotheses, we analyzed the individual items in each of the three instruments and grouped them into categories that reflected various types of information systems planning problems. Table 7 shows the 11 categories we identified and the items from Tables 2, 3, and 4 we assigned to each category. The following paragraphs provide brief support for the localization hypotheses shown in Table 6:

1. Resources: Costs of Planning

> If the strategic impact of an organization's existing systems or proposed systems is low, stakeholders in the planning process should perceive the costs of following a planning approach best suited to strategic organizations to be high. Stakeholders will deem some planning activities to be unnecessary.

**Table 7:** Localization-related measures.

| | Dependent Measure | Tables 2-4 Items |
|---|---|---|
| 1. | Resource: Costs | R5, R6, R13, R19 |
| 2. | Resource: Competence | R4, R7, R12 |
| 3. | Resource: Guidance | R1, R8, R9, R11 |
| 4. | Resource: Support | R2, R17, R18 |
| 5. | Process: Scope | P1, P2, P3, P6, P7, P9, P10 |
| 6. | Process: Involvement (Too Little) | P4, P5, P8 |
| 7. | Process: Involvement (Too Much) | P11, P12 |
| 8. | Process: Rigidity | P13 |
| 9. | Output: Value | O9, O13, O14, O15, O17, O20, O22, R10, R14, R15, R16 |
| 10. | Output: Infrastructure | O2, O3, O4, O7, O8, O11, O12, O18, O19 |
| 11. | Output: Implementation | O1, O5, O6, O16, O21 |

2. Resources: Competence

   If the impact of an organization's existing systems or proposed systems is low, it will lack personnel with the competence needed to undertake the full range of activities associated with IS planning best suited to strategic organizations.

3. Resources: Guidance

   If the impact of an organization's existing systems or proposed systems is low, it will lack adequate models, procedures, and computer support to undertake IS planning best suited to strategic organizations. Stakeholders will also lack knowledge about consultants who can provide appropriate guidance.

4. Resources: Management Support

   If the impact of an organization's existing systems or proposed systems is low, senior management will lack the experience and commitment needed to provide the support required for IS planning activities best suited to strategic organizations.

5. Process: Scope/Relevance

   We do not hypothesize any effect for this category of problem. An IS plan best suited to a strategic organization should address all the problem items included within this category.

6. Process: Involvement—Too Little

   We do not hypothesize an effect for this category of problem. IS planning suited to a strategic organization requires high involvement on the part of stakeholders.

7. Process: Involvement—Too Much

> If the impact of an organization's existing systems or proposed systems is low, we hypothesize that stakeholders will perceive too much management and user involvement is needed when they are forced to use a planning approach best suited to strategic organizations.

8. Process: Rigidity

> If the impact of an organization's existing systems or proposed systems is low, we hypothesize that stakeholders will perceive a planning approach best suited to strategic organizations to be too rigid. It will require them to undertake planning activities they consider to be unimportant to their needs.

9. Output: Value of the Resulting Plan

> We do not hypothesize any effect for this category of problem. An IS plan best suited to a strategic organization should address all the problem items included within this category.

10. Output: Infrastructure Needs

> We do not hypothesize any effect for this category of problem. An IS plan best suited to a strategic organization should address all the problem items included within this category.

11. Output: Implementation Needs

> We do not hypothesize any effect for this category of problem. An IS plan best suited to a strategic organization should address all the problem items included within this category.

As with the overall measures of resource, process, and planning problems, the metrics for each of the 11 problem categories were calculated as the average of the scores in each item in the category (see Table 7).

For both sets of hypotheses, note that we are assuming the strategic impact of existing systems and the strategic impact of proposed systems have additive effects on the levels of planning problems experienced. McFarlan et al. (1983) do not argue for a multiplicative effect, nor can we educe a theoretical argument for why one should occur.

## DATA ANALYSIS AND RESULTS

Table 8 shows descriptive data for the independent and dependent measures. Note that the distribution for some dependent measures is right-skewed. Some measures also have kurtosis values that reflect their distribution is not normal. In this light, we initially applied a logarithmic transformation (base 10) to restore normality. Because the results for the untransformed data are basically the same as those for the transformed data, however, in the interests of simplicity we present only the results for the untransformed data below.

Tables 2, 3, and 4 show the mean and standard deviation for the individual items on the three questionnaires measuring the different types of planning problems.

**Table 8:** Descriptive statistics for independent and dependent variables.

| Variable | Range | Experimental | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Standard Deviation | Skew | Kurtosis | Mean | Standard Deviation | Skew | Kurtosis |
| Operational Dependence | 1 - 3 | 1.973 | 0.294 | 0.742 | -0.070 | 1.921 | 0.249 | -0.556 | 0.157 |
| Application Development Portfolio | 0.714-3.071 | 1.998 | 0.435 | -0.430 | -0.342 | 1.785 | 0.336 | 0.226 | -0.520 |
| Resource-Related Problems | 1 - 5 | 1.973 | 0.532 | 0.374 | -0.632 | 2.017 | 0.550 | 0.783 | 0.300 |
| Process-Related Problems | 1 - 5 | 1.704 | 0.497 | 0.515 | -0.850 | 1.938 | 0.659 | 1.153 | 1.150 |
| Output-Related Problems | 1 - 5 | 1.893 | 0.653 | 1.208 | 1.191 | 1.994 | 0.677 | 1.483 | 3.021 |
| Resource-Costs | 1 - 5 | 1.935 | 0.674 | 0.832 | 0.382 | 1.886 | 0.767 | 0.847 | -0.181 |
| Resource-Competence | 1 - 5 | 2.074 | 0.893 | 0.430 | -1.006 | 2.197 | 0.935 | 0.352 | -0.933 |
| Resource-Guidance | 1 - 5 | 2.090 | 0.671 | 0.252 | -0.579 | 1.871 | 0.783 | 1.585 | 3.803 |
| Resource-Support | 1 - 5 | 1.840 | 0.849 | 1.137 | 0.993 | 2.303 | 0.890 | 0.652 | -2.52 |
| Process-Scope | 1 - 5 | 1.869 | 0.631 | 0.420 | -1.095 | 2.123 | 0.810 | 1.226 | 1.351 |
| Process-Involvement (TM) | 1 - 5 | 1.130 | 0.328 | 3.032 | 9.459 | 1.568 | 0.623 | 0.646 | -0.693 |
| Process-Involvement (TL) | 1 - 5 | 1.938 | 0.937 | 0.863 | 0.137 | 1.955 | 0.910 | 0.592 | -0.913 |
| Process-Rigidity | 1 - 5 | 2.037 | 10.091 | 1.012 | 0.430 | 2.182 | 1.259 | 0.971 | 0.070 |
| Output-Value | 1 - 5 | 1.683 | 0.689 | 1.486 | 1.951 | 1.864 | 0.613 | 1.155 | 0.954 |
| Output-Infrastructure | 1 - 5 | 2.026 | 0.729 | 1.115 | 0.683 | 2.040 | 0.842 | 2.052 | 4.956 |
| Output-Implementation | 1 - 5 | 2.048 | 0.697 | 0.610 | 0.045 | 2.155 | 0.846 | 0.633 | 0.028 |

Note: For the operational dependence and application development portfolio instruments, higher values mean existing and future systems are more critical to the organization. For all other measures, lower values mean that fewer problems have been experienced.

The items in each table have been ordered using the mean score in decreasing severity of problem for the experimental group participants. For the experimental group, the Cronbach alpha reliability coefficients for the resource, process, and output questionnaires were .82, .82, and .94. The corresponding coefficients for the control group were .85, .84, and .90. Thus, the questionnaires have adequate reliability.

To test all hypotheses, we fitted the following general linear model to our data:

$$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_1X_3 + b_5X_2X_3 + e,$$

where

$Y_i$ = different diffusion-related or localization-related dependent measures,

$X_1$ = importance of existing systems according to operational dependence questionnaire,

$X_2$ = importance of future systems according to application development portfolio questionnaire,

$X_3$ = two-level categorical variable indicating whether participant is a member of the experimental group or the control group,

$X_1X_3$ = interaction term between importance of existing systems and experimental/control group membership, and

$X_2X_3$ = interaction term between importance of future systems and experimental/control group membership.

In light of our hypotheses, we hoped both interaction terms in our model would be significant. Basically we were seeking to show the level of diffusion-related measures or localization-related measures changes across the level of importance of existing systems and the level of importance of future systems only for the experimental group.

## Diffusion Hypotheses

Contrary to our expectations, for none of the three overall measures of problems were the interaction terms in our statistical model significant. Thus, Hypotheses 1 and 2 are not supported. For the overall measure of output problems, however, the main effect for the application development portfolio variable was significant ($F$=5.60; $df$=1,42; $p$=.02). As the importance of future systems increases, the level of output problems decreases.

As a follow-up procedure, we fitted general linear models separately for the experimental group and the control group. Surprisingly, the results provide some support for our hypotheses. For the experimental group, consistent with our hypotheses the levels of process problems ($t$= 2.96; $df$=24; $p$<.01) and output problems ($t$=–3.37; $df$=24; $p$<.01) decrease as the importance of future systems increases. For the control group, however, no significant results were obtained. In other words, consistent with our hypotheses, the level of planning problems did not vary as a function of the strategic importance of an organization's existing and future systems, providing the organization was allowed to choose its own planning methodology.

This difference between the two groups should have been reflected in significant interaction terms in the first three models we fitted. As best we can determine, a lack of statistical power seems to be undermining the significance of our tests.

Unfortunately, we cannot obviate this problem by expanding the experimental group's size because we have exhausted our population. Furthermore, in the case of the control group, we would be forced to enlist the assistance of governmental organizations in other Australian states. We would then introduce other sources of error variation because of differences in governmental organizations among the states.

## Localization Hypotheses

Contrary to our expectations, for none of the four resource dependent measures (costs, competence, guidance, and support) were the interaction terms in our statistical model significant. Nevertheless, significant main effects were obtained in relation to group for the competence measure ($F$=4.42; $df$=1,43; $p$=.04) and the importance of existing systems for the guidance measure ($F$=4.18; $df$=1,43; $p$<.05). Somewhat consistent with our expectations, the experimental group experienced a higher level of competence-related problems. Contrary to our expectations, however, the level of guidance-related problems decreased as the importance of existing systems increased in both the experimental and control groups.

As with the overall measures, we again analyzed the experimental group and control group data separately for the four resource-related measures. Two effects were significant: fewer cost-related problems ($t$=–2.65; $df$=24; $p$=.01) were experienced by the experimental group as the importance of existing systems increased; and fewer competence-related problems ($t$=–2.12; $df$=19; $p$<.05) were experienced by the control group as the importance of future systems increased.

For the four localization-related measures pertaining to process problems (scope/relevance, involvement—too much, involvement—too little, rigidity), as predicted, there were no significant interaction effects for the scope/relevance and involvement—too little measures, neither were there significant main effects. Contrary to our expectations, however, for neither the involvement—too much nor the rigidity dependent measures were the interaction terms significant. The main effects for these two dependent measures also were not significant. When separate analyses were undertaken of the experimental group and the control group data, however, one effect was significant. For the experimental group, the level of scope/relevance problems decreased as the importance of future systems increased ($t$=–3.66; $df$=24; $p$<.01).

For the three localization-related measures pertaining to output problems (value, infrastructure, implementation), recall that we predicted that no interaction effects would occur for any of these measures. The results confirm our predictions. There was a significant main effect, however, for the importance of future systems across all three measures (value: $F$=6.73; $df$=1,43; $p$=.01; infrastructure: $F$=8.17; $df$=1,43; $p$<.01; implementation: $F$=4.49; $df$=1,43; $p$=.04). When the experimental group and control group data were analyzed separately, however, it is clear that the main effect in the combined data is primarily a manifestation of a main effect in the experimental group data. As the strategic importance of future systems increases among the experimental group participants, they experience fewer value problems ($t$=–2.48; $df$=24; $p$=.02), infrastructure problems ($t$=–3.55; $df$=24; $p$<.01), and implementation problems ($t$=–2.77; $df$=24; $p$=.01). For the control group, however, the main effect for the strategic importance of future systems was not significant for any of the three measures.

## DISCUSSION OF RESULTS

In terms of the diffusion hypotheses, our results are equivocal. When the experimental group and control group data were analyzed as a single set, we found no support for Hypotheses 1 and 2. We did find support, however, for a relationship between the level of importance of future systems and the level of output problems experienced. Specifically, as future systems became more important, the level of output problems experienced decreased.

When we analyzed the experimental group and control group data separately, however, we found some support for Hypothesis 1. If we are correct in arguing that the experimental group agencies used an approach to information systems planning best suited to strategic organizations, the results show the levels of process and output problems decreased as the importance of future systems increased. No such relationships, however, were evident in the control group data. In short, we have a modicum of support for our arguments that the experimental group should have experienced more process-related and output-related planning problems because some had been forced to use an incongruent IS planning approach.

Our tests of the localization hypotheses addressed the question of whether the problems experienced spread or remain confined to specific areas. Recall, we obtained no significant main or interaction effects for the overall resource problem measure. When we analyzed the data for the four localized resource measures, however, we obtained four significant main effects. At this time, we cannot provide a meaningful interpretation of these four main effects. Thus, we conclude that there is little compelling evidence of some Queensland agencies having experienced resource problems because they were forced to use an incongruent information systems planning approach.

For the four localized process measures, recall that we found no significant effects for either the combined data and only one main effect for the separate experimental group data in terms of scope/relevance problems. On the other hand, we found a significant main effect for the experimental group data in relation to the overall measure of process problems. We see this result as supporting our diffusion arguments. Overall, the experimental group seems to have experienced sufficient process problems for the importance of future systems to have produced a significant effect, but most specific process problems were not severe enough to produce a significant effect.

For the three localized output measures, recall that we found a significant main effect for the importance of future systems in the combined experimental group and control group data. Separate analyses of the experimental group data and control group data showed this effect primarily reflected a relationship in the experimental group data. For two reasons we believe this result supports our diffusion arguments rather than our localization arguments. First, the effect is significant for all three localized output problem measures. Thus, it appears to have generalized across a wide range of output problems that the participants could encounter. Second, because of the nature of the localized output problem measures, recall that we argued above that none would be impacted by the imposition of an incongruent IS planning approach on the experimental group. Indeed, we argued that the imposed planning approach should have mitigated these problems for all experimental group participants.

The results are contrary to our arguments, therefore, and they suggest that the experimental group in fact experienced widely diffused output-related problems in the IS planning activities they undertook.

In summary, our results are mixed. Nevertheless, in our view, two main themes emerge. First, there is some evidence that the experimental group experienced process-related problems and output-related problems because they were required to use an information systems planning approach not suited to their needs. Nonetheless, surprisingly we found no evidence of resource-related problems, which was the area we thought most difficulties would arise. Second, there is some evidence to support a view that incongruent information systems planning approaches undermine planning activities generally rather than causing problems in specific areas. In this regard, their problematical effects are diffused rather than localized.

## LIMITATIONS OF THE RESEARCH

Our study is subject to certain limitations, which we briefly examine below in terms of four sets of validity threats.

### External Validity

We perceive three threats to the external validity of our results. First, we did not choose a random sample of participants. In the case of the experimental group, we took advantage of a research opportunity that was presented to us. If we had not used this experimental group, we would have faced the more difficult task of measuring the level of congruence between each participant's IS planning approach and their position within the strategic grid. We then would have had to relate this level of congruence to the IS planning problems they experienced. In the case of the control group, we had to rely on another party to select our prospective participants.

Second, external validity is also limited because we asked only some of the stakeholders in the information systems planning process about the problems experienced. Earl's (1993) research suggests that different stakeholders in the information systems planning process may have different perceptions of the levels of problems experienced.

Third, our study is confined to public sector organizations. The results for private sector organizations may be different because, for example, IS planning might be more critical in terms of their survival in the marketplace (Caudle et al., 1991). Nonetheless, state governments in Australia are representative of those in most Western democracies, especially those based on English traditions. Thus, our results may generalize to many other public sector organizations.

### Internal Validity

We have two concerns about the internal validity of our research. First, as we pointed out above, differences between the perceived levels of planning problems experienced by the experimental group and the control group could reflect learning effects. The experimental group had to deal with a new IS planning methodology. At least some of the experimental group's planning problems may reflect learning phenomena rather than incongruities between the IS planning approach used and

their position within the strategic grid. Participants in the control group, on the other hand, presumably were more experienced with the planning methodologies they used.

Second, in our tests of the diffusion hypotheses, recall that we found an effect for the level of process and output problems experienced by the experimental group. Contrary to our expectations, however, no effect was found for the level of resource problems experienced by the experimental group. Recall, also, that the level of process and output problems experienced by an agency was assessed by the IPB consultants. The level of resource problems experienced, however, was assessed by an agency representative. Perhaps our failure to find an effect for resource problems reflects "evaluation apprehension" (see Cook & Campbell, 1979, p. 67). Given the pressure on agencies to perform well in terms of the new planning process they had to follow, agency representatives may not have been willing to indicate the full extent of the problems their organizations were experiencing.

## Construct Validity

We have three concerns about construct validity in our research. First, to the best of our knowledge, little research has been done to validate the operational dependence and application development portfolio instruments contained in McFarlan et al. (1983). Until this validation research is undertaken, measuring organizations according to these dimensions remains problematical.

Second, even though we used Lederer and Sethi's (1988) research as the basis for developing the three instruments that measure resource problems, process problems, and output problems, we have concerns about the accuracy of their assignment of specific items (problems) to the three problem categories. For example, one of their resource problems is: "The methodology makes inappropriate assumptions about organization size." In our view, this item would be better classified as a process problem. Subsequent to the conduct of our empirical work, Lederer and Sethi (1991) reported they had factor analyzed their three instruments with a view to identifying underlying constructs and assessing construct validity. In our opinion, however, given the number of variables they factor analyzed, they have insufficient data for their results to be deemed robust. Moreover, the unidimensionality of their instruments has not been established (Segars, 1994). In short, more work needs to be done before reliance can be placed on the construct validity of these instruments.

Third, the problems we measured in this research are a function of the instruments we used which, in turn, are based upon explicit or implicit theories about the nature of and sources of information systems planning problems. IS planning theories, however, are still in their infancy. Better theories might cause us to view the world differently, and in this light, we might focus on different phenomena as a manifestation of IS planning problems.

## Statistical Conclusion Validity

We have five concerns about the statistical conclusion validity of our research. First, if our number of respondents had been larger, we would have had greater statistical power.

Second, given the somewhat different ways in which our instruments were administered in the experimental group and the control group, we may have inflated

our error variance and decreased our chances of identifying differences between the two groups.

Third, particularly in relation to the localization hypotheses, we undertook a large number of related statistical tests. Thus, we run a higher risk of making a Type-I error than our *p*-values indicate.

Fourth, the respondents in our experimental and control groups were not selected randomly, nor were they assigned randomly to the experimental and control groups. Thus, we have a quasi-experiment—an experiment involving nonequivalent groups (Cook & Campbell, 1979). The statistical tests we use, therefore, are likely to be more biased and less powerful than tests undertaken with randomly selected participants and randomly formed groups. Like all quasi-experiments, we run the risk that differences between the groups prior to administration of the treatment may confound the results. For this reason, we used a number of covariates to try to control for any pretreatment differences that might have impacted the results (see Cook & Campbell, pp. 153-174). Recall, however, that none of the covariates were significant in the statistical analyses we undertook. In this regard, there is some evidence to suggest the two groups were similar in spite of our inability to use randomization procedures.

Fifth, our dependent measures were highly correlated. For the experimental group, the Pearson correlation coefficient between the level of resource problems and the level of process problems is .279, between the level of resource problems and the level of output problems is .466, and between the level of process problems and the level of output problems is .873. For the control group, the corresponding correlation coefficients are .819, .632, and .759. It is difficult to interpret the results for each category of problem, given that problems in one category may simply manifest problems in another category. In this regard, we reiterate our call for better measurement instruments (and better theory) in this area.

## CONCLUSIONS

From the viewpoint of information systems planning practice, we believe our research has provided some support for the usefulness of McFarlan et al.'s (1983) strategic-grid model as a means of identifying IS planning approaches that are incongruent with the needs of an organization. We also believe there is some evidence to support the proposition that the effects of incongruent IS planning approaches will generalize across IS planning activities and not be confined to those activities in which the effects of the incongruencies seem most likely to occur. We stress the equivocal nature of our results, however, and the tentative nature of our conclusions.

We believe our research also makes contributions to both information systems planning theory and research method. Using Nelson and Winter's (1982) evolutionary theory of economic change and Cohen and Levinthal's (1990) theory of absorptive capacity, we have sought to explain why organizations should use an IS planning approach that is congruent with their needs (as determined by the strategic-grid model). We also pointed out some of the conditions that must hold under different empirical approaches to testing the strategic-grid model if the results are to be valid.

From the viewpoint of information systems planning research, we see five avenues for further work. First, more extensive empirical testing of existing contingency models of IS planning needs to be undertaken. The results of our tests of one model

are tentative and limited in scope, but nevertheless, they are encouraging. Second, new theoretical models need to be developed to account for the wide range of IS planning behaviors we observe. For example, we need models to explain and predict how the specific contents of IS plans might vary across organizations. In this regard, contingency models such as those proposed by Sambamurthy, Venkataraman, and DeSanctis (1993) and Hann and Weber (1996) suggest a rich array of planning phenomena that might be investigated. Third, improved instruments must be developed so that the characteristics of organizations, IS planning approaches, and IS planning behaviors can be better measured. Our results highlight some of the problems surrounding existing instruments. Fourth, the relationship between IS planning behaviors and the broader issue of organizational effectiveness needs to be studied. For example, reduced IS planning problems may not necessarily lead to more effective IS plans. Some level of problems may be beneficial as a means of eliciting better plans. Fifth, more research needs to be undertaken on learning phenomena associated with IS planning. For example, we could investigate whether problems that might arise when organizations use incongruent IS planning approaches are transient or whether, with experience, organizational effectiveness is robust across multiple IS planning approaches. In light of our tentative results, we also might investigate whether planning problems diffuse and undermine a wide range of planning activities or whether they can be localized. In this regard, longitudinal studies that examine the dynamics of IS planning behaviors are sorely needed. [Received: August 12, 1994. Accepted: March 1, 1996.]

## REFERENCES

Atkinson, R.A., & Montgomery, J. (1990). Reshaping IS strategic planning. *Journal of Information Systems Management*, *7*(Fall), 9-17.

Benbasat, I., Dexter, A.S., Drury, D.H., & Goldstein, R.C. (1984). A critique of the stage hypothesis: Theory and empirical evidence. *Communications of the ACM*, *27*(5), 476-485.

Bowman, B., Davis, G.B., & Wetherbe, J.C. (1983). Three stage model of MIS planning. *Information & Management*, *6*, 11-25.

Boynton, A.C., & Zmud, R.W. (1987). Information technology planning in the 1990's: Directions for practice and research. *MIS Quarterly*, *11*(1), 59-71.

Broadbent, M., Hansell, A., Lloyd, P., & Dampney, C.N. (1992). Managing information systems in Australia and New Zealand: Requirements for the 1990s. *Australian Computer Journal*, *24*(1), 1-11.

Byrd, T.A., Sambamurthy, V., & Zmud, R.W. (1995). An examination of IT planning in a large, diversified public organization. *Decision Sciences*, *26*(1), 49-73.

Cash, J.I., McFarlan, F.W., McKenney, J.L., & Applegate, L.M. (1992). *Corporate information systems management: Text and cases* (3rd ed.). Homewood, IL: Irwin, Inc.

Caudle, S.L., Gorr, W. L., & Newcomer, K.E. (1991). Key information systems management issues for the public sector. *MIS Quarterly*, *15*(2), 171-188.

Clark, T.D. (1992). Corporate systems management: An overview and research perspective. *Communications of the ACM*, *35*(2), 61-75.

Cohen, W.M., & Levinthal, D.A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*, 128-152.

Cook, T.D., & Campbell, D.T. (1979). *Quasi-experimentation: Design & analysis issues for field settings*. Chicago: Rand McNally.

Drury, D.H. (1983). An empirical assessment of the stages of DP growth. *MIS Quarterly, 7*(2), 59-70.

Earl, M.J. (1989). *Management strategies for information technology*. Hertfordshire: Prentice-Hall, UK.

Earl, M.J. (1993). Experiences in strategic information systems planning. *MIS Quarterly, 17*(1), 1-24.

Galliers, R.D. (1987). Information systems planning in the United Kingdom and Australia: A comparison of current practice. In P. Zorkorczy, (Ed.), *Oxford surveys in information technology* (vol. 4). Oxford: Oxford University Press, 223-255.

Goodhue, D.L., Kirsch, L.J., Quillard, J.A., & Wybo, M.D. (1992). Strategic data planning: Lessons from the field. *MIS Quarterly, 16*(1), 11-34.

Hackathorn, R.D., & Karimi, J. (1988). A framework for comparing information engineering methods. *MIS Quarterly, 12*(2), 203-220.

Hann, J., & Weber, R. (1996). Information systems planning: A model and empirical tests. *Management Science, 42*(July), 1043-1064.

Information Technology Review Committee. (1990). *Information technology review: Final report*. Brisbane: Queensland Government.

IPB. (1991a). *Guidelines for agency information strategic planning*. Brisbane: Information Policy Board.

IPB. (1991b). *Guidelines for agency information technology operational planning*. Brisbane: Information Policy Board.

Ives, B., & Learmonth, G. (1984). The information system as a competitive weapon. *Communications of the ACM, 27*(12), 1193-1201.

King, J.L., & Kraemer, K.L. (1984). Evolution in organizational information systems: An assessment of Nolan's stage model. *Communications of the ACM, 27*(5), 466-475.

Kriebel, C.H. (1989). Understanding the strategic investment in information technology. In K.C. Laudon & J.A. Turner (Eds.), *Information technology and management strategy*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Lederer, A.L., & Gardiner, V. (1992). Strategic information systems planning: The method/1 approach. *Information Systems Management, 9*(3), 13-20.

Lederer, A.L., & Mendelow, A.L. (1986). Issues in information systems planning. *Information and Management, 10*(5), 245-254.

Lederer, A.L., & Sethi, V. (1988). The implementation of strategic information systems planning methodologies. *MIS Quarterly, 12*(3), 445-461.

Lederer, A.L., & Sethi, V. (1991). Critical dimensions of information systems planning. *Decision Sciences, 22*(1), 104-119.

Lucas, H.C., & Sutton, J.A. (1977). The stage hypothesis and the s-curve: Some contradictory evidence. *Communications of the ACM, 20*(4), 254-259.

McFarlan, F.W., McKenney, J.L., & Pyburn, R. (1983). The information archipelago—Plotting a course. *Harvard Business Review*, *61*(1), 145-156.

McLean, E.R., & Soden, J.V. (1977). *Strategic planning for MIS*. New York: John Wiley & Sons.

Moynihan, T. (1990). What chief executives and senior managers want from their IT departments. *MIS Quarterly*, *14*(1), 15-25.

Nelson, R.R., & Winter, S.G. (1982). *An evolutionary theory of economic change*. Cambridge, Mass: Harvard University Press.

Niederman, F., Brancheau, J.C., & Wetherbe, J.C. (1991). Information systems management issues for the 1990s. *MIS Quarterly*, *15*(4), 475-500.

Nolan, R.L. (1973). Managing the computer resource: A stage hypothesis. *Communications of the ACM*, *16*(7), 399-405.

Nolan, R.L. (1979). Managing the crises in data processing. *Harvard Business Review*, *57*(2), 115-126.

Parker, M.M., & Benson, R.J. (1989). Enterprisewide information management: State-of-the-art strategic planning. *Journal of Information Systems Management*, 14-23.

Pyburn, P.J. (1983). Linking the MIS plan with corporate strategy. *MIS Quarterly*, *7*(2), 1-14.

Raghunathan, B., & Raghunathan, T.S. (1990). Planning implications of the information systems strategic grid. *Decision Sciences*, 21(2), 287-300.

Sambamurthy, V., Venkataraman, S., & DeSanctis, G. (1993). The design of information technology planning systems for varying organizational contexts. *European Journal of Information Systems*, *2*(1), 23-35.

Segars, A.H. (1994). Scale development in information systems research: A paradigm incorporating unidimensionality and its assessment. In J.I. DeGross, S.L. Huff & M.C. Munro (Eds.), *Proceedings of the Fifteenth International Conference on Information Systems*, Vancouver, B.C., 1-12.

Sullivan, C., Jr. (1985). Systems planning in the information age. *Sloan Management Review*, *26*(Winter), 3-12.

Watson, R.T. (1989). Key issues in information systems management: An Australian perspective—1988. *Australian Computer Journal*, *21*(2), 118-129.

Zmud, R.W. (1988). Building relationships throughout the corporate entity. In J.J. Elam, M.J. Ginzberg, P.G.W. Keen, R.W. Zmud, & S.S. Jimenez (Eds.), *Transforming the IS organization*. Washington, D.C.: ICIT Press, 55-82.