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Content characteristics of formal information technology strategy as implementation predictors in Norwegian organisations

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Abstract

The need for improved implementation of information technology strategy has been emphasised in both empirical and prescriptive research studies. In this study, ten content characteristics of formal information technology strategy are identified from the research literature as potential implementation predictors. These are descriptions of: i) resources needed for the implementation; ii) user involvement during the implementation; iii) analyses of the organisation; iv) anticipated changes in the environment; v) solutions to potential resistance during the implementation; vi) information technology to be implemented; vii) projects' relevance to the business plan; viii) responsibility for the implementation; ix) management support for the implementation; and x) clearity of the documentation. The survey was conducted in Norway whereupon the return of 471 completed questionnaires resulted in a satisfactory response rate of 43%. Formal IT strategy was reported in 40% of these organisations. The two significant predictors in the testing of hypotheses proved to be description of responsibility for the implementation and description of user involvement during the implementation. Suggestions for further research are concerned with adding richness by searching for other explanations of IT strategy implementation beyond characteristics of the plan itself and including contingency variables.

Keywords: management of information technology, formal information technology strategy, implementation predictors, content characteristics, survey research, Norway.

1. Introduction

The need for improved implementation of strategic IS plans has been emphasised in both empirical (Earl, 1993; Lederer and Mendelow, 1993; Lederer and Sethi, 1988, 1992; Premkumar and King, 1994a) and prescriptive studies (Galliers, 1994a; Lederer and Salmela, 1996; Lederer and Sethi, 1996). These studies show that implementation is important for four reasons. Firstly, the failure to carry out the strategic IS plan can cause lost opportunities, duplicated efforts, incompatible systems, and wasted resources (Lederer and Salmela, 1996). Secondly, the extent to which strategic IS planning meets its objectives is determined by implementation (Earl, 1993; Lederer and Sethi, 1996). Further, the lack of implementation leaves firms dissatisfied with and reluctant to continue their strategic IS planning (Galliers, 1994a; Lederer and Sethi, 1988, 1992; Premkumar and King, 1994a). Finally, the lack of implementation creates problems establishing and maintaining priorities in future strategic IS planning (Lederer and Mendelow, 1993).

The intent of this paper is to add to the body of empirical implementation research by evaluating the plan implementation link suggested by Lederer and Salmela (1996). The research question is presented in the next scetion, followed by review of research literature on implemenation problems and implementation definitions, research model, research hypotheses and research method. Finally, research results are provided and discussed.

2. Research Question

The theory of strategic information systems planning (SISP) by Lederer and Salmela (1996) contains a link between plan and implementation suggesting that a more useful (comprehensive) IS plan produces greater plan implementation. This link inspired the following research question: "What content characteristics of formal IT strategy predict the extent of plan implementation?" IT strategy is defined as a plan comprised of projects for application of information technology to assist an organisation in realising its goals. The term plan refers to a written document, according to Mintzberg (1994), who suggests that when the word planning is used, the understanding should be that of formal planning. In this research, the terms strategic IS plan (Lederer and Sethi, 1996) and IT strategy (Galliers, 1993) are treated as synonyms. The research question was initially based on the following two observations:

- Organisations engage in strategic IS planning. Galliers (1994), Finnegan et al. (1997) and Kearney (1990) found that 75 percent, 76 percent and 80 percent respectively of those surveyed had a strategic IS plan. However, as discussed later in this article, the survey in this research was conducted in Norway where the organisations are smaller than those in previous studies, leading to a potential expectation that there would be a lower percentage of organisations with a formal IT strategy. For example, in an Australian survey, the number of respondent organisations that claimed to undertake strategic IS planning ranged from 58% in large organisations to 29% in medium-sized organisations and 19% in small organisations (Falconer and Hodgett, 1997).
- Strategic IS plans are not implemented very extensively. Lederer and Sethi (1988) found that only twenty-four percent of the projects in the strategic IS plans had been initiated after more than two years of the implementation horizon had elapsed. In a study of four Norwegian organisations, approximately forty-two percent of the projects in the formal IT strategy had been implemented after five years (Gottschalk, 1995a). Ward and Griffiths (1996, p.97) found that "despite a belief in its importance, in the past decade many organisations have developed perfectly sound IS strategies that have been left to gather dust, or have been implemented in a half-hearted manner". Taylor (1997, p.336), too, found that "all too often strategies remain 'on the page' and are not implemented".

Content characteristics of formal IT strategy as implementation predictors is an important research topic for two main reasons. Firstly, there is a lack of empirical work which is of major concern to researchers (Lederer and Salmela, 1996). Empirical research focusing specifically on the implementation of strategic information systems plans is relatively sparse; empirical research has only included implementation as one of several issues in strategic IS planning research (Lederer and Sethi, 1996). Secondly, the strategic information systems plan is one of the main concerns of IS practitioners today (Watson et al., 1997). In a survey conducted by Stephens et al. (1995), eighty percent of the chief information officers (CIOs) reported that they had responsibility for IT strategy. The documentation process is, however, challenging for CIOs both because it is a time consuming effort to write the IT strategy (Gottschalk, 1995b), and because the plan contents chosen by the CIO may themselves influence the extent of plan implementation (Lederer and Salmela, 1996).

3. Literature Review

Lederer and Salmela (1996) have developed a theory of strategic information systems planning which contributes to helping researchers study SISP and present their findings in an organised, comprehensive, efficient, and meaningful manner. The theory consists of an input-process-output model, seven constructs, six causal relationships and six hypotheses. The input-process-output model provides the initial bases for the theory. The seven constructs are i) the external environment, ii) the internal environment, iii) planning resources, iv) the planning process, v) the strategic information systems plan, vi) the implementation of the strategic information systems plan, and vii) the alignment of the strategic information systems plan with the organisation's business plan. These seven constructs exhibit causal relationships among each other demonstrated by hypotheses. For this research on the implementation of strategic IS plans, the most important relationship in the theory is the effect of the plan on its implementation. In their discussion of this effect, Lederer and Salmela (1996) refer to research by authors such as Earl (1993), Lederer and Gardiner (1992), Lederer and Mendelow (1993), Lederer and Sethi (1988), Premkumar and King (1994b), and Raghunathan and King (1988).

3.1 Research Literature on Implementation Problems

Though there exists an extensive range of literature on strategic information technology planning (e.g., Lederer and Mendelow, 1993; Raghunathan and Raghunathan, 1994) and on information technology implementation (e.g., Alavi and Joachimsthaier, 1992; Gill, 1996), specific literature on plan implementation has been relatively sparse. While the literature on strategic information technology planning treats implementation only as one of many phases, the literature on information technology implementation lacks the gestalt perspective which is needed when plan implementation is to be studied. Furthermore, much of the reviewed research literature consists mainly of theory (e.g., Joshi, 1991), often lacking empirical evidence. For the testing of the plan implementation link in the theory of strategic information systems planning suggested by Lederer and Salmela (1996), it was nevertheless possible to identify existing literature as listed in table 1. The thirty-five organisational practices derived from the six research studies analysed constitute a comprehensive list of practices for the implementation of IT strategy.

Table 1: Practices influencing IT Strategy Implementation

Earl (1993): Implementation Problems
E1 Resources were not made available
E2 Management was hesitant
E3 Technological constraints arose
E4 Organisational resistance emerged
Galliers (1994a): Implementation Barriers
G1 Difficulty of recruiting
G2 Nature of business
G3 Measuring benefits
G4 User education resources
G5 Existing IT investments
G6 Political conflicts
G7 Middle management attitudes
G8 Senior management attitudes
G9 Telecommunications issues
G10 Technology lagging behind needs
G11 Doubts about benefits

Table 1: Practices influencing IT Strategy Implementation

Lederer and Salmela (1996): Effect of Plan on Implementation S1 Contents of the plan S2 Relevance of proposed projects in the plan to organisational goals S3 Sections of the plan S4 Clarity and analysis of presentation of the plan
Lederer and Sethi (1992): Implementation Problems L1 Difficult to secure top management commitment L2 Final planning output documentation not very useful L3 Planning methodology fails to consider implementation L4 Implementing the projects requires more analysis L5 Planning methodology requires too much top management involvement L6 Output of planning is not in accordance with management expectations
Lederer and Sethi (1996): Prescriptions for SISP X1 Prepare migration plan X2 Identify actions to adopt plan X3 Identify resources for new tools X4 Avoid/dampen resistance X5 Specify actions for architecture X6 Identify bases of resistance
Premkumar and King (1994a): Implementation Mechanisms P1 Monitoring system to review implementation and provide feedback P2 Resource mobilisation for implementation P3 User involvement in implementation P4 Top management monitoring of implementation

In this reseach, the thirty-five organisational practices were reduced to a set of ten predictors as listed in table 2.

Table 2: Implementation Predictors derived from Organisational Practices

Practices	**Predictors**	**Measurement**
E1 Resources were not made available G1 Difficulty of recruiting P2 Resource mobilisation for implementation X3 Identify resources for new tools	Resources	Multiple item scale by Lee (1995)
G4 User education resources P3 User involvement in implementation	Users	Multiple item scale by Chan (1992)
G5 Existing IT investments L3 Planning methodology fails to consider implementation L4 Implementing the projects requires more analysis X5 Specify actions for architecture	Analysis	Multiple item scale by Segars (1994)
Gilbert (1993), Salmela (1996), Teo (1994)	Environment	Multiple item scale by Segars (1994)

Table 2: Implementation Predictors derived from Organisational Practices

Practices	Predictors	Measurement
E4 Organisational resistance emerged G6 Political conflicts X4 Avoid/dampen resistance X6 Identify bases of resistance	Resistance	Multiple item scale by Lee (1995)
E3 Technological constraints arose G9 Telecommuncations issues G10 Technology lagging behind needs	Technology	Items from Teo, 1994; Lederer and Sethi, 1992; Byrd et al., 1995; Salmela, 1996
G2 Nature of business G3 Measuring benefits G11 Doubts about benefits S2 Relevance of proposed projects in the plan to organisational goals L6 Output of planning is not in accordance with management expectations	Relevance	Items from Teo, 1994; Lederer and Sethi, 1992; Segars, 1994; Chan and Huff, 1994; Hann and Weber, 1996
P1 Monitoring system to review implementation and provide feedback X1 Prepare migration plan X2 Identify actions to adopt plan	Responsibility	Ideas from Olsen, 1995; Ward et al., 1996; Gottschalk, 1995, and pilot tests
E2 Management was hesitant G7 Middle management attitudes G8 Senior management attitudes L1 Difficult to secure top management commitment L5 Planning methodology requires too much top management involvement P4 Top management monitoring of implementation	Management	Items from Lee, 1995; Jarvenpaa and Ives, 1991; Segars, 1994; Premkumar and King, 1994
S1 Contents of the plan S3 Sections of the plan S4 Clarity and analysis of presentation of the plan L2 Final planning output documentation not very useful	Presentation	Ideas from Lederer and Salmela, 1996; Hussey, 1996

3.1.1 Research Literature on Definition of Implementation

There is a need as such in this research to define implementation and dimensions thereof. According to Montealegre (1994), the term implementation is given a variety of meanings in the literature. According to Nutt (1986), implementation is a procedure directed by a manager to install planned change in an organisation. According to Klein and Sorra (1996), implementation is the process of gaining targeted organisational members' appropriate and committed use of an innovation. In table 3, the reviewed research literature on implementation is listed according to their particular definition of implementation. The first references in the table represent definitions where implementation is completed at an early stage, while those that follow represent definitions where implementation is completed at a later stage. The numbers may, therefore, represent a scale of stages at which authors place their defini-

tion of implementation. Some authors find implementation to be completed when change is occurring, while others find it continues until intended benefits have been realised.

Table 3: Stages of Implementation Completion

Stage	Implementation completed when:	Reference
1	System is installed	Lucas (1981)
2	System is put to use	Brancheau, Schuster and March (1989)
3	Programs are adopted	Baier, March and Saetren (1986)
4	Organisation acts on new priorities	Floyd and Wooldridge (1992
5	Changes are installed	Nutt (1986, 1995)
6	Not abandoned or expensively overhauled	Markus (1983)
7	Adoption has occurred	Lucas, Walton and Ginzberg (1988)
8	Innovation is adopted and used	Leonard-Barton and Deschamps (1988)
9	Systems are installed and used	Srinivasan and Davis (1987)
10	Change is accepted	Baronas and Louis (1988)
11	Systems are accepted	Ginzberg (1980)
12	Innovation is accepted and used	Alavi and Henderson (1981)
13	Systems are accepted and used	Bradley and Hauser (1995)
14	Control rests with users	Alter and Ginzberg (1978)
15	Change process completed	Joshi (1991)
16	Committed use occurs	Klein and Sorra (1996)
17	Post-application phase is consolidated	Rhodes and Wield (1985)
18	Satisfaction with system is achieved	Griffith and Northcraft (1996)
19	Intended benefits are realised	Alavi and Joachimsthaier (1992)

The purpose for using the stages in table 3 is not to defend a certain rank order of the authors along the axis of implementation completion; the purpose is rather to indicate that the authors have different opinions about when implementation is considered completed. The dimensions of IT strategy implementation may be summarised as illustrated in table 4. The purpose of the table is to develop alternative measures of IT strategy implementation.

Table 4: Dimensions of IT Strategy Implementation

Time / Detail	**Installed (Earl, 1993)**	**Completed (Lederer and Salmela, 1996)**	**Benefits (Premkumar and King, 1994a)**
Plan		**3**	**4**
Project	**2**	**1**	
System			

In table 4, there are two dimensions of IT strategy implementation: the time dimension and the detail dimension. The time dimension is the implementation stage derived from table 3, where the two extreme stages of implemented are "installed" and "benefits", while the middle stage is "completed". Benefits may be considered as the effect of the changes; that is, the difference between the current and proposed way that work is done (Ward et al., 1996). The detail dimension refers to the implementation content which may be the whole plan, one or more projects in the plan, or one or more systems in one project. Implementation content thus refers to a plan consisting of one or several projects (Bryson and Bromiley, 1993; Falconer and Hodgett, 1997; Shoval and Giladi, 1996), and a project consisting of one or several systems. The term project is defined as the means by which the organisation's technological, organisational, and external assets are mobilised and transformed (Williams, 1992, p.36): "Projects, or initiatives as termed in this study, then, are the vehicles through which an organization's competitive and technology strategies are operationalized into organizational outputs". For, according to Gupta and Raghunathan (1989, p.786), "the ultimate success of systems planning depends on the success of the individual projects covered by the plan". Both the time dimension and the detail dimension may certainly be challenged. The detail dimension, for example, may in an organisation be such that a large system is broken down into several projects, and a project may itself consist of several phases or stages (Pinto and Prescott, 1988). The main purpose of table 4, however, is to develop a definition and measures of implementation suitable for this research. As such, IT strategy implementation is here defined as *the process of completing the projects for application of information technology to assist an organisation in realising its goals.* As such, the column "completed" is essential for this research.

Implementation is measured in four different ways in this research based on the two dimensions of time and detail discussed above. The first plan implementation measurement (#1 in table 4) is concerned with completion of projects in the plan which were to be completed to date. The second plan implementation measurement (#2 in table 4) is concerned with completion of projects in the plan which are expected to be completed, or at least installed, by the end of the implementation horizon. The third implementation measurement (#3) measures completion of the whole plan, while the fourth IT strategy implementation measurement (#4) is concerned with improved organisational performance from plan implementation. According to Ward and Griffiths (1996, p.102), the impact of an IT strategy implementation is not instantaneous; "it may, in fact take some time - two or more years - between embarking on strategic IS/IT planning for the first time and demonstrating any consequent impact on business practices and results". The operationalisation of these alternative measurements of the dependent variable implementation is listed in table 5.

Table 5: Four Potential Measurements of the Implementation

Construct	**Measurement of Construct**
1 Implementation rate to date (Lederer and Sethi, 1988)	Divide projects actually implemented to date by projects scheduled to be implemented to date
2 Implementation rate to end (Lederer and Sethi, 1988)	Divide projects actually implemented to date by projects in the IT strategy and divide by percent of expired time horizon
3 Implementation extent (Bryson and Bromiley, 1993; Coolbaugh, 1993; Ginzberg, 1981, 1981b; Salmela, 1996; Ward et al., 1996; 1993; Williams, 1992)	IT strategy has been implemented as planned IT strategy implementation has been completed on time IT strategy implementation has been completed within budget IT strategy implementation has been completed as expected IT strategy implementation has achieved the desired results Deviations from the IT strategy have occurred during implementation You are satisfied with the IT strategy implementation

Table 5: Four Potential Measurements of the Implementation

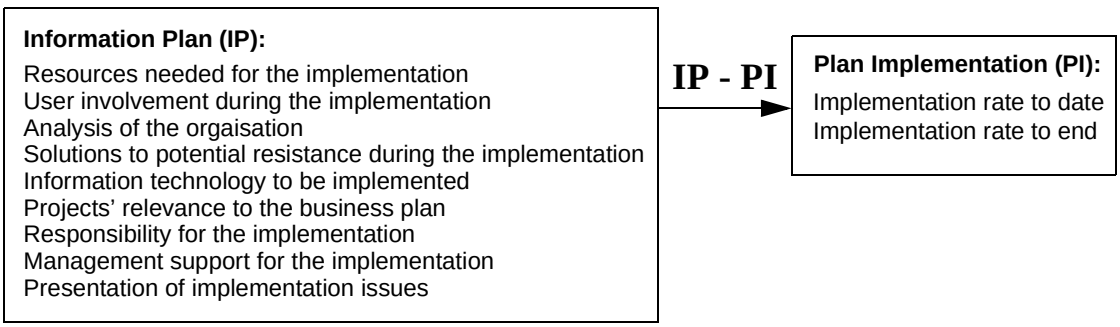
Construct	Measurement of Construct
4 Contribution to organisational performance (Scale adopted from Teo, 1994, p.121, Alpha=0.87; one item added from Segars, 1994, p.154)	Contribute to improved organisational performance Contribute to increased Return on Investment (ROI) Contribute to increased market share of products/services Contribute to improved internal efficiency of operations Contribute to increased annual sales revenue Contribute to increased customer satisfaction Contribute to alignment of IT with business needs

3.2 Research Model and Hypotheses

Ten predictor constructs were listed in table 2, while four alternative implementation constructs were listed in table 5. To organise the research according to the theory of Lederer and Salmela (1996), a causal relationship between predictor constructs and implementation constructs is proposed in the research model as illustrated in figure 1. For each of the ten predictors, one hypothesis was formulated stating that the greater the extent of description of the content characteristic, the greater the extent of plan implementation.

The ten constructs in table 2 are used in this research as the basis for the research hypotheses to follow. Each hypothesis is formulated to reflect the focus on characteristics of the plan itself. For example, the eighth hypothesis is related to management support. The hypothesis does not treat the extent of management support as such; the hypothesis, rather, addresses the extent of description of management support in the plan. The following ten hypotheses represent a specification of the general hypothesis by Lederer and Salmela (1996) who claim that a more useful (comprehensive) information plan produces greater plan implementation. The operationalisation of each construct is listed later in table 6 in the next section.

Figure 1: Research Model



Hypothesis 1: *The greater the extent of description of resources needed for the implementation, the greater the extent of plan implementation.*

One reason for lack of implementation is that resources are not made available (Earl, 1993). The answer to the simple implementation question "Can it be done?" (Hussey, 1996, p.19) is dependent on competence and resources; telecommunication resource issues may, among others, represent implementation barriers (Galliers, 1994a). It is important to identify the resources and actions needed to implement new applications development and maintenance tools (Lederer and Sethi, 1996). Resource mobilisation for implementation is an effective implementation mechanism to secure quality of implementation (Premkumar and King, 1994a). An important resource issue in the field of SISP is the difficulty of

recruiting IS specialists (Galliers, 1994a) and defining their role in projects (Bashein, 1995; Markus and Benjamin, 1996).

Hypothesis 2: *The greater the extent of description of user involvement during the implementation, the greater the extent of plan implementation.*

Both resources for and extensive performance of user training are necessary to secure implementation of SIS plans (Galliers, 1994a; Whang, 1992). Education, training and other implementation activities are generally viewed as outside the IS role, in part because formal authority for training usually is assigned elsewhere (Markus and Benjamin, 1996). Training may consist of both formal and informal training: according to Ellis (1994), formal training consists of long-term as well as short-term instruction received through seminars, classes, conventions, and private lessons, while informal training consists of on-the-job training received from co-workers and supervisors as the need arises.

Hypothesis 3: *The greater the extent of description of analyses of the organisation, the greater the extent of plan implementation.*

Sometimes implementation of the projects requires more analysis; lack of analysis, therefore, represents an implementation problem (Lederer and Sethi, 1992). The clarity and analysis of presentation of the plan have an effect on implementation (Lederer and Salmela, 1996). Analysis is important since "attention to the present and future gives direction to change" (Brown and Eisenhardt, 1997, p.30). Existing IT investments may as well represent an implementation barrier (Galliers, 1994a), requiring analysis of the existing IT investments in combination with the suggested new IT investments. According to Salmela (1996, p.35), the analyses made within information systems planning constitute the core of IS planning activities: "the quality of the planning process is best evaluated in terms of the extent of detailed analysis of the various facets of planning".

Hypothesis 4: *The greater the extent of description of anticipated changes in the external environment, the greater the extent of plan implementation.*

Gilbert (1993, p.296) found that "environmental turbulence" was one of two dominant constructs when developing a contingent theory of information technology planning. Planners seldom have full certainty about the content, timing or direction of changes in the external environment, and "this creates additional demands for IS planning" (Salmela, 1996, p.63). Environmental conditions influence strategic change (Rajagopalan and Spreitzer, 1996). To test a strategy, Hussey (1996, pp 18-19) suggests the following points to help this process: "Has it considered competitors and the industry structure? Does it match the realities of the market? Is it consistent with environmental forces?"

Hypothesis 5: *The greater the extent of description of solutions to potential resistance during the implementation, the greater the extent of plan implementation.*

According to Cespedes and Piercy (1996, p.4614), "resistance to change by individuals and groups in organizations is a well-documented and analysed topic". Organisational resistance to IT strategy implementation often emerges (Earl, 1993; Keen, 1981; Marakas and Hornik, 1996), since "new IT always has generated resistance and today's rapidly changing IT is no exception" (Benamati et al., 1997, p.281). There may as well be political conflicts in organisations which play a role (Galliers, 1994a; Markus, 1983). "Resistance is often people's reaction to the change agents, not necessarily to the change itself" (Markus and Benjamin, 1996, p.392). As Lau and Woodman (1995) conclude, resistance to change is dependent on many factors including locus of control which refers to people's beliefs concerning the source of control over events affecting them.

Hypothesis 6: *The greater the extent of description of information technology to be implemented, the greater the extent of plan implementation.*

While hypothesis 1 deals with resources needed during implementation, including information technology, hypothesis 6 addresses information technology to be permanently installed to support infrastructure (Byrd et al., 1995) as well as applications after implementation. Sometimes technological constraints arise (Earl, 1993) which may be caused by technology lagging behind needs (Galliers, 1994a). One prescription for successful strategic IS planning is to specify actions needed to implement the proposed architecture (Lederer

and Sethi, 1996); evidence from a study conducted by Osborn (1992) emphasised that information infrastructure is not enough unless data access issues can be resolved.

Hypothesis 7: *The greater the extent of description of projects' relevance to the business plan, the greater the extent of plan implementation.*

The nature of the business will determine a framework for the usefulness of the plan (Galliers, 1994a). It is often difficult to measure benefits (Shoval and Giladi, 1996), and doubts about benefits may arise (Galliers, 1994a). It is important that the proposed projects in the plan be relevant to organisational goals (Das et al., 1991; Hoffer et al., 1989; King and Teo, 1994; Lederer and Mendelow, 1987; Lederer and Salmela, 1996). IT management decision-making strategies should align with business strategies (Boynton et al., 1992; Lederer and Mendelow, 1989; Mentzas, 1997; Simonsen, 1997), as well as impact business strategies (Ward and Griffiths, 1996). According to Calhoun and Lederer (1990, p.1), a prerequisite is "sufficient communication of the business plan to IS management".

Hypothesis 8: *The greater the extent of description of responsibility for the implementation, the greater the extent of plan implementation.*

During implementation, the frames of implementers - the frames of those responsible for the introduction of the technology to prospective users - will influence the extent of implementation (Griffith and Northcraft, 1996). Most IS units do not have responsibility for key organisational results (Markus and Benjamin, 1996): "line managers are increasingly assuming responsibility for planning, building, and running information systems that affect their operation" (Boynton et al., 1992, p.32). Further, the plan should identify the IT department's necessary actions to expedite adoption of the plan (Lederer and Sethi, 1996). Finally, a monitoring system to review implementation and provide feedback is an effective implementation mechanism (Coolbaugh, 1993; Premkumar and King, 1994a).

Hypothesis 9: *The greater the extent of description of management support for the implementation, the greater the extent of plan implementation.*

According to Shanks (1997, p.86), "management support is widely recognised as an important factor in the implementation of information systems". Management may be hesitant about implementing the IT strategy, hence representing an implementation problem in itself (Earl, 1993); as Hambrick et al. (1993, p.401) pont out, some top executives are "committed to the status quo". Both middle and senior management attitudes towards implementation are important influences on the extent of plan implementation (Galliers, 1994a; Raghunathan and Raghunathan, 1990). Nonetheless, it may be difficult to secure top management commitment for implementation (Lederer and Sethi, 1992), commitment being defined as acceptance of plan values and willingness to exert effort on its behalf (Lau and Woodman, 1995).

Hypothesis 10: *The greater the extent of a clear description of implementation issues, the greater the extent of plan implementation.*

The output of the strategic information systems planning process is the IT strategy. This plan is again input into the implementation process. According to Hussey (1996, p.15), the plan is "a communication medium and an aid to implementation ... The preferred situation is when the strategy is sound and the plan that describes this is clear, concise, yet comprehensive". The contents of the plan vary depending on the processes carried out during planning; organisations which carry out a subset of recommended steps in SISP will have a more limited plan.

4. Research Method

The choice of research method is to be regarded not as a set of problems to be solved, but rather a set of dilemmas to be lived with (McGrath, 1982; Pettigrew, 1993). For example, a sample survey represents a choice of research method dealing effectively with population generalisability, but does so by buying relatively low levels of precision and realism of context. This research is concerned with implementation predictors which require a quantitative

method to produce quantitative descriptions of the predictors (Pinsonneault and Kraemer, 1993). Survey research is appropriate when research and theory are beyond early stages and small sample size and generalisation of results are major concerns (Premkumar and King, 1994a). The literature review (Gottschalk, 1997a, 1997b; Gottschalk and Lederer, 1997) provides evidence that research and theory in the field of IT strategy are beyond early stages. Furthermore, this research is concerned with generalisability of research results which requires a large sample size and a large number of variables, subjected to rigorous statistical analysis. Given the researcher's own experience in the area, both as a CIO and a CEO (Gottschalk, 1995a, 1995b), which provided some ad hoc historical data to aid the research, a survey approach was selected for this research.

Five related issues must be addressed regarding the population sample studied. First, the organisation is the level of the unit from which observations were obtained. Second, original data was collected by the researcher. Third, the population of cases had to be determined; given the context of the research and its focus on IT strategy implementation, organisations with experience in IT strategy in Norway were identified as suitable target population for this research. Fourth, a sample of these organisations was studied. The sample consisted of corporate members of the Norwegian Computing Society which has been active in the area of strategic information technology planning for many years. Fifth, a final important issue to be addressed is the selection of informants in the organisations. The decision to use the CIOs as informants in this research finds support in previous research conducted by Stephens et al. (1995), Earl (1993), Sabherwal and King (1995), and Teo and King (1997). In a survey conducted by Stephens et al. (1995), eighty percent of the CIOs said that they had responsibility for IT strategy. Earl (1993) interviewed stakeholders in his survey. The IS director or IS strategic planner was interviewed first, followed by the CEO or general manager, and finally a senior line or user manager. His research results show no significant differences between stakeholder sets. Sabherwal and King (1995) decided to use the CIOs as informants because of their ability to answer questions related to IT strategy. According to Teo and King (1997), the use of a single key informant avoids the problem of potential perceptual differences between key informants.

Table 6: Items for Measurement of Implementation Predictor Constructs

Construct	Measurement of Construct	Alpha
Resources needed for the implementation Lee, 1995, alpha = 0.68	Financial resources needed for implementation Technical abilities needed for implementation Human resources needed for implementation Project team time needed for implementation External consultants needed for implementation (new) A "project champion" needed for the implementation (new)	87
User involvement during implementation Chan, 1992, alpha = 0.82	Degree of systems-related training received by information systems users Users' understanding of systems' functional and technical features Users' participation in systems projects Users' involvement in the operation of information systems Participation in the ongoing development of information systems Users' support for the implementation (new)	86

Table 6: Items for Measurement of Implementation Predictor Constructs

Construct	Measurement of Construct	Alpha
Analyses of the organisation Segars, 1994, alpha = 0.86	Information needs of organisational sub-units How the organisation actually operates A "blueprint" which structures organisational processes Changing organisational procedures New ideas to reengineer business processes through IT Dispersion of data and applications throughout the firm Organisation of the IT function (new)	.87
Anticipated changes in the external environment Segars, 1994, alpha = 0.82	Anticipated changes in competitors' behaviour Anticipated changes in suppliers' behaviour Anticipated changes in customers' behaviour Anticipated changes in information technology Anticipated changes in government regulations (new) Anticipated changes in the economy (new)	.83
Solutions to potential resistance during the implementation Lee, 1995, alpha = 0.64	Solutions to resistance caused by job security Solutions to resistance caused by change in position Solutions to potential resistance caused by new skills requirements Solutions to potential resistance caused by scepticism of results Solutions to potential resistance caused by a unit's interests Solutions to potential resistance caused by our customers	.93
Information technology to be implemented New	Hardware to be implemented Communications technology to be implemented Databases to be implemented Applications software to be implemented Operating systems to be implemented A data architecture for the organisation	.89
Projects' relevance to the business plan New	Projects in accordance with the expectations of management Organisational goals for the projects Benefits of the projects to the organisation Projects that contribute to new business opportunities Competitive advantage from IT Strategic applications of IT	.88
Responsibility for the implementation New	Responsibility for the implementation on time Responsibility for the implementation within budget Responsibility for the implementation with intended benefits Responsibility for the stepwise implementation of large projects Responsibility for the implementation of high priority projects Responsibility for short-term benefits from initial projects Personnel rewards from successful implementation	.91
Management support for the implementation New	Management expectations of the implementation Management participation in the implementation Management monitoring of the implementation Management knowledge about the implementation Management time needed for the implementation Management enthusiasm for the implementation	.93

Table 6: Items for Measurement of Implementation Predictor Constructs

Construct	Measurement of Construct	Alpha
Clear presentation of implementation issues New	Evaluation of progress clearly Change management clearly A list of projects clearly A schedule for the implementation clearly Alignment of IT strategy with business strategy clearly	.83

1108 questionnaires were mailed to CIOs of member organisations of the Norwegian Computing Society. 471 questionnaires were returned, providing a satisfactory response rate of 43%. Out of 470 subjects, 190 subjects (40%) confirmed that they had a written IT strategy and provided information on content characteristics. Ten content characteristics of formal information technology strategy were measured in the questionnaire through sixty-two items as listed in table 6.

5. Significant Implementation Predictors

The return of 471 completed questionnaires resulted in a satisfactory response rate of 43%; however, formal IT strategy was reported in only 40% of these organisations. Formal IT strategy was defined as "a written plan comprised of projects for application of information technology to assist an organisation in realising its goals", while IT strategy implementation was defined as "the process of completing the projects". The implementation extent scale (#3 in table 5) was found to be the most suitable measure for this construct, and, based on the collected survey data, all ten hypotheses were tested in this research. The Cronbach alphas (reliability) for all multiple item scales were between 0.73 and 0.93 as listed in table 6. Cronbach alpha for the dependent variable implementation extent (#3 in table 5) was 0.79. The starting point for hypothesis testing is a null hypothesis of no relationship between the two variables being examined (Bryman and Cramer, 1997). The hypothesis testing was carried out using multiple regression analysis (Hair et al., 1998).

However, the issues of collinearity and multicollinearity have to be addressed first. Both collinearity and multicollinearity could represent data problems in this research. Collinearity is the expression for the relationship between two independent variables (Hair et al., 1998). A means of identifying collinearity is an examination of the correlation matrix for the independent variables. The presence of high correlation (generally those of 0.90 and above) is the first indication of substantial collinearity (Hair et al., 1998). Ten independent variables are measured using multiple item scales in this research. Table 7 below lists correlation coefficients between these variables. The correlation coefficient indicates the strength of the association between the variables. A correlation coefficient is considered significant if the p-value is less than 0.05.

Table 7: Correlation Matrix for Predictor Variables

	Res	Users.	Anal.	Chan.	Resis.	IT.	Relev.	Resp.	Mana.	Issues.
Resources		.531**	.386**	.359**	.403**	.333**	.454**	.564**	.505**	.470**
Users			.413**	.265**	.356**	.283**	.414**	.400**	.510**	.423**
Analyses				.544**	.560**	.234**	.517**	.380*	.631**	.529**

Table 7: Correlation Matrix for Predictor Variables

	Res	**Users.**	**Anal.**	**Chan.**	**Resis.**	**IT.**	**Relev.**	**Resp.**	**Mana.**	**Issues.**
Changes					.588**	.230**	.350**	.333*	.502**	.386**
Resistance						.251**	.319**	.474**	.598**	.434**
IT							.411**	.293**	.282**	.160*
Relevance								.588**	.518**	.505**
Responsibility									.630**	.560**
Management										.621**
Issues										

Note: The statistical significance of the correlation coefficient is ** for p<.01 and * for p<.05.

There is significant correlation between all the independent variables as listed in table 7 above. Out of 45 correlations, 18 have a correlation coefficient larger than 0.5. The highest correlation (0.631) is between analyses and management. There are no high correlations of 0.90 or above. Bryman and Cramer (1997, p.257) suggest 0.80 instead of 0.90 as the threshold: “The Pearson’s r between each pair of independent variables should not exceed 0.80; otherwise the independent variables that show a relationship at or in excess of 0.80 may be suspected of exhibiting multicollinearity”. The highest coefficient correlation in this research, however, is 0.631 which is below the cut-off of 0.80 for the collinearity problem. Multicollinearity is the expression for the relationship between more than two independent variables (Hair et al., 1998), that is, one of the independent variables is a linear combination of other independent variables. The tolerance value is a common measure for assessing multicollinearity. Tolerance is the amount of variability of the selected independent variable not explained by the other independent variables. A common cut-off threshold is a tolerance value of 0.10, which corresponds to a multiple correlation of 0.95 (Hair et al., 1998). A variable with very low tolerance contributes little information to a model and can cause computational problems. To investigate this potential multicollinearity problem, stepwise linear regression was applied. The multiple correlation coefficients were 0.69 for resources, 0.60 for users, 0.74 for analyses, 0.65 for changes, 0.72 for resistance, 0.50 for technology, 0.72 for relevance, 0.73 for responsibility, 0.79 for management and 0.69 for document issues. These multiple correlation coefficients are high, but they do not represent multicollinearity problems since they are all below 0.95. Another measure for assessing multicollinearity is the variance inflation factor (VIF). Any variables with a VIF value above 5.3 would be correlated more than 0.90 (Hair et al., 1998). The highest VIF value in the sample is 2.3. Hence, collinearity and multicollinearity do not represent data problems in this research.

All observations with missing values were excluded, reducing the sample from 190 to 151 valid cases, to make research results obtained using multiple regression comparable with research results obtained using structural equation modelling (Gottschalk, 1998). Table

8 lists the results of multiple regression analysis between the ten independent variables and the dependent variable implementation. The R-square is the coefficient of determination which is a measure of the proportion of the variance of the dependent variable about its mean that is explained by the independent, or predictor variables (Hair et al., 1998). The Beta coefficient is the standardised regression coefficient which allows for a direct comparison between coefficients as to their relative explanatory power of the dependent variable (Hair et al., 1998). The test statistic t is of importance for hypothesis testing: if the calculated t exceeds critical t, then the null hypothesis is rejected (Churchill, 1995). The significance of the calculated t exceeding critical t is measured by the p-value. A p-value of less than 0.05 is considered significant.

Table 8: Multiple Regression Analysis between Implementation and Predictors

Content characteristics as implementation predictors	**Full regression Beta**	**Full regression t-test**	**Stepwise regression Beta**	**Stepwise regression t-test**
Resources	.078	.766		
Users	.158	1.665	.233	2.892**
Analyses	.019	.170		
Changes	.138	1.407		
Resistance	.065	.628		
IT	.015	.173		
Relevance	.048	.449		
Responsibility	.189	1.672	.298	3.692**
Management	-.071	-.599		
Issues	.145	1.408		

Note: The statistical significance of the t-values is ** for p<.01and * for p<.05.

The full multiple regression equation with all ten independent variables explains 19% of the variation in implementation, that is, the adjusted R-square is 0.19. The F-value of 4.505 is significant at $p < 0.001$, indicating that the null hypothesis is rejected and that there is a significant relationship between content characteristics and IT strategy implementation. However, none of the content characteristics are significant implementation predictors.

Stepwise multiple regression is a method of selecting variables for inclusion in the regression model that starts by selecting the best predictor of the dependent variable. It is an objective method for selecting variables that maximises the prediction with the smallest number of variables employed (Hair et al., 1998). When stepwise regression was applied, two of the ten predictors have significant coefficients in the multiple regression equation. Firstly, the description of responsibility for the implementation was associated with the highest explanatory power since it achieved the highest Beta coefficient. Next, the description of user involvement during the implementation proved to be the other significant predictor. The adjusted R-square of the stepwise model is 0.19. None of the remaining eight potential predictors is significant.

Responsibility was the first hypothesis to be supported in this research: the greater the extent of description of responsibility for the implementation, the greater the extent of

plan implementation (H8). Implementation participants must accept responsibility (Markus and Benjamin, 1996), responsibility is a positive duty, and tasks should be assigned to specific individuals. As listed in the appendix, responsibility was measured by responsibility for implementation on time, responsibility for implementation within budget, responsibility for implementation with intended benefits (Ward et al., 1996), responsibility for stepwise implementation of large projects, responsibility for implementation of high priority projects (Gottschalk, 1995a), responsibility for short-term benefits from initial projects, and personnel rewards from successful implementation.

User involvement was the second hypothesis to be supported in this research: the greater the extent of description of user involvement during the implementation, the greater the extent of plan implementation (H2). User involvement during the implementation is the engagement of people who will employ the technology and the systems after the implementation. As listed in the appendix, user involvement was measured by a multiple item scale adopted from Chan (1992).

6. Discussion

Though there exists an extensive range of literature on strategic information systems planning (e.g., Lederer and Mendelow, 1993; Raghunathan and Raghunathan, 1994) and on information systems implementation (e.g., Alavi and Joachimsthaier, 1992; Gill, 1996), specific literature on plan implementation has been relatively sparse. While the literature on strategic information systems planning treats implementation only as one of many phases, the literature on information systems implementation lacks the gestalt perspective which is needed when plan implementation is to be studied. Furthermore, much of the reviewed research literature consists mainly of theory, often lacking empirical evidence. It was nevertheless possible to apply existing literature to the specific issue in question: what content characteristics of formal IT strategy predict the extent of plan implementation? Research revealed that description of responsibility for the implementation and description of user involvement during the implementation are the content characteristics of formal IT strategy of significance as implementation predictors. As the IT management literature seems to have no definition of implementation at all, and the implementation management literature seems to disagree on the definition without actually discussing it, one of the major contributions of this research may prove to be the implementation extent definition based on the gestalt view developed and measured by a multiple item scale.

The evidence presented in this paper leads to the belief that there is a relationship between plan and implementation as suggested by Lederer and Salmela (1996) in their theory of strategic information systems planning. However, all of the statistical models developed and tested in this research provide limited explanation of the variation in implementation. The multiple regression analysis resulted in an adjusted R-square of 0.19 which implies that 81% of the variation in the implementation is unexplained by the theory. Hence, there must be other - possibly more important - influences on plan implementation.

The three main suggestions for future research are concerned with weaknesses of the presented research. Firstly, the research model suggested a connection between implementation of an IT strategy and the content of the strategy. Previous research has identified, as table 1 indicates, that much more complicated causal relationships might exist. Secondly, the importance of various implementation predictors may vary depending on contingency issues such as organisation size, implementation horizon and environmental turbulence (Salmela, 1996). Finally, future research may widen the focus by including both factors and processes in both the planning phase and the implementation phase (Mintzberg, 1994; Van de Ven and Poole, 1995).

An important practical contribution can be derived from the conducted research. In practice, the CIO is often responsible for the IT strategy process, as well as the IT strategy topics and the IT strategy plan (Gottschalk, 1995a; Stephens et al., 1995). When the CIO

sits down to produce the formal IT strategy, this research provides clear priority on what to include in the plan document to increase the likelihood of its implementation. Description of responsibility for the implementation is important. Responsibility description should include responsibility for implementation on time, within budget, intended benefits, stepwise implementation of large projects, high priority projects and short-term benefits from initial projects. Description of user involvement during the implementation is the other important factor. User involvement description should include user training, understanding, participation, operation, development and support.

7. References

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