An empirical analysis of the association between the use of executive support systems and perceived organizational competitiveness

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Abstract

A synthesis of management control theory suggests four major categories of use for management information: (1) score keeping, (2) improving individual understanding, (3) focusing organizational attention and learning, and (4) legitimizing decisions. A field study was undertaken to determine if these uses form a robust typology for classifying executive use of management information, and how useful each is perceived to be in enabling organizations’ competitiveness. The results of the study indicate that different uses have substantively different effects on perceptions of whether or not competitiveness is enabled. The study lends credence to the position that control and power, to a large extent, drive the perceptions of benefits associated with using management information in organizations. © 1998 Elsevier Science Ltd. All rights reserved.

Several theories and taxonomies have been developed to explain why managers use accounting, control and management information. Using such information to provide feedback on performance is perhaps its most renowned purpose. Inspired by cybernetic imagery (Weiner, 1948), measurement and feedback have been lauded as key to many organizational improvement approaches. Measurement of performance is fundamental to both system thinking (Churchman, 1956) and the systems approach (Armstrong, 1985). Juran (1988) discusses the importance of “sensors” to measure quality in order to improve it. Process reengineering also includes the measurement of performance as a core tenet (Davenport, 1993). The predominant role of providing feedback notwithstanding, there are several other uses for accounting, control and management information in organizational settings.

Simon et al. (1954) identified three types of questions that accounting information is used to answer: score keeping questions such as “How am I doing?”, attention-directing questions such as “What problems should I look into?”, and problem solving questions such as “Of the several ways of doing the job, which is the best?” Burchell et al. (1980) put forward an alternative taxonomy. They described information and accounting systems as having the potential to be, not only answer and learning machines, but also ammunition and rationalization for decision making.

The political purposes to which these uses of information allude have received considerable...
attention. For example, Feldman and March (1981) support the notions of ammunition and rationalization in their description of information as signal and symbol. Markus and Pfeffer (1983) provide evidence that the uses to which management information systems are put relate to the acquisition or exercise of power: setting direction, altering performance, and conferring legitimacy.

While many anecdotes and case studies support these various uses, little is known about which of them, in the eyes of the people who use the information, make a difference to organizational performance and whether or not they are all undertaken. The study described here addresses these issues. It investigates how differing uses of the information provided to senior managers in executive support systems (ESS) are related to the perceived ability of the systems to enable improvements in competitiveness resulting from that use. The specific research questions pursued in this study are:

1. What are the uses to which ESS information is put?
2. How are these uses related to the system’s usefulness for improving competitiveness?

Executive support systems (ESS) were chosen as the information vehicle to study for several reasons. First, it is difficult to arrive at a precise definition of what constitutes management information, or information for that matter (Davenport, 1993). By focusing on a particular delivery mechanism, subjects did not have to confront this lack of clarity; what constituted information was obvious in the ESS context. Second, the espoused aim that most managers have for using information is to improve organizational effectiveness, performance and profitability in some way. However, because of the many interrelated factors that contribute to results, it is difficult to attribute a direct causal relation between the use of information and indicators of organizational performance such as profits or sales growth. By focusing on a particular technology, it is possible to ask about the perceived impact of the specific information provided by the technology, rather than the impact of information generally. Third, while information is important to managers at all organizational levels, monitoring information about their organizations and environments is one of the main roles of executives (Mintzberg, 1973). Executive support systems provide a way to study senior managers explicitly. Finally, although executive support systems have been used in organizations for more than a decade (Rockart & Treacy, 1982), they are still viewed as high-risk (Watson & Frolick, 1993), and little is known about what differentiates the successes from the failures. This research was structured to provide some insight into this issue.

The major drawbacks of investigating executive support systems as a surrogate for accounting, control and management information are, of course, the constraints they place on how information can and will be used, and the limitations they put on the type of information made available.

Executive support systems are flexible tools that provide broad and deep information support and analytic capability for a wide range of executive decisions (Houdeshel & Watson, 1987; Rockart & De Long, 1988). They are designed to make the information contained in the lower-level systems in the organization available in a form that is easy to access, easy to use, and germane to decision making (Stevenson, 1994). In addition, they provide executives with access to external information such as news, regulations, and competitive analyses (Young & Watson, 1995). The data can come from a variety of sources including transaction processing systems, manufacturing control systems, financial reporting systems, commercial information sources, text files, and manual data collection. Information contained in ESS varies by organization and runs the gamut from finance, marketing and sales, human resources, and manufacturing or operations, to external competitive benchmarks of various types.

The reasons why and ways that executive information systems are used are as varied as the executives who use them. Depending on functionality and inclination, ESS may be used for performance monitoring, “what-if” analyses, trend spotting, problem identification and resolution, and generally keeping up to date. Some executives use their systems every day, or even several times a day, to stay abreast of current developments,
typically viewing a consistent set of predefined reports. Some executives define new reports as the issues they face change and develop. Some use their ESS to scan broadly across a wide variety of information. Still others use them sporadically when they require a specific piece of information (Matthews & Shoebridge, 1992).

Watson et al. (1991) conceptualize ESS as including support for communications, data analysis, and office organization. In this research, the domain of interest was narrower, in that it was restricted to the accounting, management, and control information that was provided by the ESS. Communications and office support tools such as spreadsheets, word processing, electronic mail, and calendaring were excluded.

The remainder of this paper provides background on a typology of management information uses appropriate to executive support systems, describes empirical research that investigated how these uses are related to perceptions of competitiveness resulting from the systems, discusses the implications of the results, and describes avenues for future research.

1. Previous research

Boland (1979) defines control as the process of creating, sustaining and changing organizational order. Any kind of information that supports these activities could legitimately be considered control information. For purposes of this research then, the differences among management information, accounting information, and control information are a matter of semantics. They all help to create, sustain or change organizational order. Hence, control theory encompasses control, decision making and strategy, and provides an appropriate base from which to investigate the information-related uses of executive support systems.

The most narrow definition of management control systems relegates their role to providing feedback, in other words, enabling managers to compare results to expectations and to manage by exception (Simons, 1991; Green & Welsh, 1988). As mentioned above, Simon et al. (1954) found that control went beyond providing feedback and included score keeping, attention directing, and problem solving. However, they determined that it was not possible to distinguish between score keeping and attention directing, since variances that were found when score keeping was being undertaken caused managers to redirect their attention.

Until relatively recently, there appeared to be general agreement that score keeping and problem solving are the activities relevant to the controllership of an organization (Birnberg et al., 1983). Simons (1991, 1994) extended the notion of control systems, however, when he found that executives sometimes use systems to proactively focus other people’s attention and learning, thereby shaping the formation of new strategies. This clearly fits into the use of information for purposes of exercising power put forward by Markus and Pfeffer (1983). It also fits with Burchell et al.’s (1980) notion of information as ammunition to promote a particular point of view.

Bower (1970) puts forward the notion that analyses justify decisions rather than guide them. Burchell et al. (1980) also discuss the use of information for purposes of rationalization, in their words, “seeking to legitimize and justify actions that already have been decided upon”. Markus and Pfeffer’s (1983) “conferring legitimacy” seems to be referring to a component of legitimization as well, although it depends on whether the information is used to give permission or to provide proof. In the former case, the information is used not to justify but to direct. Feldman and March (1981) note that people demand and collect a great deal of information that frequently has little relevance to decisions that have yet to be made. Rather, it is used to justify the decisions that have already been made.

Combining these ideas leads to a typology of management information uses consisting of:

1. score keeping,
2. problem solving,
3. focusing organizational attention and learning, and
4. legitimizing decisions.

This typology dovetails with Mintzberg’s (1973) monitoring function. He identifies four reasons that executives undertake monitoring. They
monitor to detect changes, identify problems and opportunities, build up knowledge about their milieux, and to determine when information must be disseminated and decisions must be made. Detecting change corresponds to score keeping. Identifying problems and opportunities and making decisions are ways to direct attention, disseminating information can be either directing attention or legitimizing previous decisions, and building up knowledge corresponds to problem solving.

According to Walls et al. (1992), management information systems are based on theories of accounting control, and decision support systems have decision making and choice as a theoretical foundation. However, executive support systems have no strong theoretical base beyond a notion of enhancing executive effectiveness in identifying and diagnosing strategic problems and opportunities. Given the broad scope of control and the pervasiveness of power and politics in the use of information, it seems that control theory can be used as a theoretical basis for investigating executive support systems.

1.1. Control theory and executive support systems

Much of the ESS literature provides descriptions of the benefits of ESS along various dimensions, but little of it focuses specifically on what the systems are used for. However, the concrete uses that are described in the literature do fit into the typology suggested above.

Based on interviews with ESS users in thirty companies, Rockart and DeLong (1988) propose four ways in which an ESS can be successful (ranked from most to least valuable):

1. It changes or enhances the way the executive thinks about the business—in other words, it improves the manager’s mental model of the firm.
2. It provides the executive with better planning and control capabilities.
3. It leverages the manager’s time, allowing the company to take better advantage of the executive’s experience, expertise, and perspective.
4. It educates the executive about the use and potential of information technologies (p. 38).

Rockart and DeLong (1988) go on to describe attributes leading to the potential for ESS to improve mental models that show a remarkable similarity to Simon et al.’s (1954) notions of problem solving, given that more than thirty years elapsed in the interim. Simon et al. (1954) found that “further development of staff and facilities for special studies is a more promising direction than elaboration of periodic accounting reports” (p. 3), principally because executives dislike having voluminous accounting reports sent to them every month when their need is for a particular piece of information at a particular time. According to Rockart and DeLong, ESS can improve mental models when they provide improved access to external data, the ability to combine data from multiple sources, data presented in more meaningful formats, improved analytic and modelling capabilities, the ability to surface and test assumptions about the business, and off-hours data access. These attributes allow executives to undertake personalized analyses and obtain the particular piece of information they need at the particular time they need it.

Millet and Mawhinney (1990) list focusing organizational attention; operations monitoring; and analysis, conceptualization, and consumption of information as the primary uses of ESS—which, with the exception of legitimizing decisions, corresponds directly to the management information use typology. Mohan et al. (1990) describe how ESS can be used to implicitly and explicitly impact the focus of the organization and its measurement system, lending further support to Simons’ (1991) findings.

The support for the management information use typology in both the accounting and executive...
support system literatures encouraged the pursuit of research to investigate the relationship between the uses in the typology and perceptions of executive support system success. Table 1 summarizes the literature sources supporting each component.

A fundamental issue facing all researchers who investigate information systems is the selection of a dependent construct to measure system success (Keen, 1981; Srinivasan, 1985). The ultimate aim of most systems is to improve organizational effectiveness, performance and profitability. However, because of the many confounding factors, alternate explanations, and time lags associated with these concepts, researchers are forced to use surrogate measures. In this research, managers’ perceptions of the usefulness of the ESS for improving competitiveness is employed as a surrogate for its actual impact on competitiveness. This approach to measurement assumes that perceptions form the basis of behaviours (Volkart, 1951; Ajzen & Fishbein, 1980; Goldman, 1986). What managers believe as real, is real or becomes real as a result of the actions they take to support their belief. Geringer and Hebert (1991) provide empirical support for this assumption.

Although there are no empirical studies specifically relating the uses of ESS information to perceptions of competitiveness, there is some evidence of the nature of the relationships between management information and competitiveness in previous research. This evidence enables the development of a hypothesis about the relation to perceptions of competitiveness for each of the management information uses in the typology as follows:

### 1.1.1. Score keeping

Score keeping is usually a standardized process that evolves over long periods of time in an organization. It is characterized by consistency between time periods so that comparisons are easy to make. Typically, organizations respond to standardized reporting such as this in routinized ways (Cyert & March, 1963). In fact, there is a substantial literature indicating that score keeping limits organizational performance precisely because of its routine nature. For example, Argyris and Schön (1978) discuss its limits in terms of single- and double-loop learning. Score keeping is first-order feedback and can result in nothing more than single-loop learning. Comparisons of operating results to expectations and competitors’ performance lead to operating variances and corrective action at best. At worst, they lead to discussions frequently centering around such unproductive topics as the believability of the numbers and why things are not better—and result in very little action. Score keeping typically results in rigidity and often slows or inhibits substantive change (Hedberg & Jonsson, 1978). There is evidence from both Simon et al. (1954) and Rockart and DeLong (1988) that problem solving produces greater organizational benefits than does score keeping. Hence, it would seem that score keeping is either unrelated or negatively related to competitiveness, leading to Hypothesis 1.

H1: Score keeping will not be positively related to the usefulness of ESS for enabling competitiveness.

<table>
<thead>
<tr>
<th>Table 1</th>
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<tbody>
<tr>
<td><strong>Literature supporting the management information use typology</strong></td>
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<td><strong>Use</strong></td>
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</table>
1.1.2. Problem solving

As mentioned above, the work of both Simon et al. (1954) and Rockart and DeLong (1988) points to the organizational benefits of information to support problem solving. However, there are also drawbacks. Information systems may limit viewpoints to those that are obvious from the data that they make available. If the information is too focused, strategies may be too narrow-minded (Argyris, 1977; Hedberg & Jonsson, 1978; March, 1987). If it is too broad or too flexible, it may reduce the ability to uncover the salient facts, whatever those might be (Ackoff, 1967; Simon, 1977). Nevertheless, it is unlikely that most executives would be sufficiently reflective to recognize these pitfalls (Mintzberg, 1973; Kotter, 1982). As such, Hypothesis 2 is as follows:

H2: Problem solving will be positively related to the usefulness of ESS for enabling competitiveness.

1.1.3. Focusing attention

Boland (1979) indicates that activities that define issue legitimacy and shape the resolution of issues hold the key to control. Similarly, Markus and Pfeffer (1983) find that systems are perceived as more successful if they are consistent with other sources of power in the organization, leading to the third hypothesis:

H3: Focusing attention will be positively related to the usefulness of ESS for enabling competitiveness.

1.1.4. Legitimizing decisions

Feldman and March (1981) take the position that legitimacy may be a relevant attribute of effective decisions in some organizations. If actions will only be taken if they have been legitimized, organizations become dependent on information that can provide legitimacy to forestall inertia. In addition, Alter (1977) reports that justifying a decision that has already been made is a major reason for using a decision support system.1 Hence:

H4: Legitimizing decisions will be positively related to the usefulness of ESS for enabling competitiveness.

2. The study

The study consisted of three parts: a series of interviews to ensure that the components of the management information use typology were a relevant and exhaustive list of types of information use as embodied in ESS, the development of scales to measure the four components, and a large scale survey to determine their relationship to the usefulness of the ESS for enabling competitiveness.

2.1. Interviews

Interviews were undertaken with thirty-six executives in seven companies in order to ensure that the proposed typology of management information use typology were a relevant and exhaustive list of types of information use as embodied in ESS, the development of scales to measure the four components, and a large scale survey to determine their relationship to the usefulness of the ESS for enabling competitiveness.

Interviews were undertaken with thirty-six executives in seven companies in order to ensure that the proposed typology of management information use typology were a relevant and exhaustive list of types of information use as embodied in ESS, the development of scales to measure the four components, and a large scale survey to determine their relationship to the usefulness of the ESS for enabling competitiveness.

Potential sites were identified by asking vendors and consultants to provide names of organizations with successful systems. Seven organizations’ ESS were studied in detail. Two of the seven were among the top ten financial institutions in Canada. Four others were among the top three companies in their respective markets. The remaining company was a large government service. Each interview lasted from forty-five to ninety minutes and was taped for subsequent analysis. Twenty-nine interviews were conducted in person and seven by telephone. The mean age of the respondents was forty-seven, and the median number of layers to the president was one. In four of the seven organizations, the executive with the most seniority participated in the research. The mean tenure in the company was 15.8 years and the mean tenure in the job was 4.2 years. The respondents had a wide range of system usage varying from no use at all to 3.5 hours per day.

1 Silver (1991) provides justification for considering executive support systems to be a subset of the category of systems called decision support systems.
The interview transcripts were analyzed in two steps, following Reich and Benbasat (1990). In the first step, the interview data were transcribed onto worksheets. Each comment made by an executive was classified as relating to his or her general approach to information, characteristics of ESS use, individual impact, or organizational impact. The interview transcripts were coded according to whether or not the themes under investigation were present, rather than how often they were raised (Berelson, 1954). In the second step, these summaries were interpreted to determine the absence or presence of the four use categories.

Score keeping came through clearly as a major use of ESS. Examples of relevant comments include the following:

I can get a view of the status of things that I know are percolating.
I track how we're doing against budget.
I can now look at our results for the whole country, by region, by group and by department, every day.

The notion of problem solving did not surface explicitly. Instead, executives spoke of developing interpretations, raising curiosity, drawing new insights, and sparking ideas. Hence, a more appropriate label seemed to be “improving understanding,” as suggested by Rockart and DeLong (1988), and more closely aligned with Mintzberg’s (1973) notion of building up knowledge about the milieu.

Focusing attention happened in two ways: as a conscious activity undertaken by executives, and as a byproduct of having one place to look for information. Comments supporting the former included:

We're structuring it around our strategic initiatives.
We are defining this vocabulary.
X can direct the company to focus on things, this whole profitability thing, for example.
The way I drive it (the use of the executive support system) is by questions...so this is part of the process of learning.
Because of the ESS they’re (his subordinates) communicating back with vocabulary, with ways of looking at things that are just like I like to look at the total business.
I am completely convinced from our own internal experiences that if you put it in the ESS, it has a higher impact than if you deliver it any other way.

A typical comment relating to focus as a byproduct was:

And the other thing that it does is provide one voice of what the final figures are as opposed to each person generating their own numbers in a slightly different format. …Everyone is dealing with the same rules.

Legitimizing decisions appeared in the interviews in terms of providing comfort rather than ammunition. Many executives spoke of the fact that the system often was used to confirm or deny their own previously held beliefs. One executive said that he used the system to check against his prior expectations. Another said the system gave him a warm feeling or made him grouchy, depending on what the numbers told him.

A few of the comments executives made were difficult to classify. These included answering the boss’s questions, keeping current on external news, and getting up-to-date. These could be construed as activities relating to keeping score (perhaps the boss’s score), legitimizing decisions or points of view, or improving understanding, depending on the context in which the activity was undertaken. Hence, it seemed important to clearly differentiate among these three uses in the survey questions.

The interviews also provided insight into the competitive benefits that the ESS provided the organizations. For the most part, these revolved around speed and flexibility.

2.2. Scale development

The first seven steps of Churchill’s (1979) paradigm for developing measures were followed in order to develop reliable and valid scales for the constructs under investigation. First, an initial list of items for each construct, based on the literature and the interview transcripts, was developed. A
sorting exercise was then undertaken to determine if the items had face and discriminant validity. The items were put onto cards, one item per card, and randomly shuffled. Five academic colleagues were independently asked to sort them into groups that “made sense.” Any items that were incomprehensible or did not fit were to be kept separate. Five more colleagues were each provided with the same stack of items as well as the names of the constructs they were intended to represent. These sorters were asked to group the items into the constructs as they felt appropriate, and once again, to hold aside incomprehensible items and misfits. There were no major differences between the groupings created by the sorters who had construct names and those who did not.

The results of the sorting exercise were used to select scale items as follows: any item that was not included in the correct construct at least seventy percent of the time was discarded. If an item was included in the wrong construct more than once, it was also discarded. Finally, any item that did not end up where the researcher had predicted it would was discarded.

A pilot survey consisting of the items that survived was then developed. Questions were asked using 7 point Likert scales. Anchors for the score keeping and improving understanding scales were “never” and “regularly.” Anchors for the focusing attention and improving competitiveness scales were “strongly disagree” and “strongly agree.” Anchors for the legitimizing scale were “to no extent” and “to a great extent.”

Pilot data collection was undertaken by asking the interview participants to complete the preliminary survey instrument. The rationale for asking them was that they were committed to the project and would be willing to help test an instrument and provide detailed feedback. Each of the thirty-six users who had been interviewed in the first phase was sent a letter outlining the purpose of the pilot and a copy of the pilot questionnaire. Thirty surveys were returned for a response rate of 83%.

Measure purification was undertaken by computing Cronbach’s alphas for all the constructs, and inspecting their correlation matrices. The specific questions for items that performed poorly were then reviewed and discussed with colleagues and survey participants. Changes were made as appropriate, and the revised constructs were used in the main survey instrument. (The Appendix contains the final survey items.) In addition to these constructs, several demographic items were collected via single questions.

2.3. The survey

As with the interviews, contacts were made with ESS software vendors and consultants to obtain the names of companies with ESS. In addition, the researcher obtained a mailing list from an ESS conference organizer. In contrast to the interviews, no attempt was made to find successful ESS. Fifty-two organizations were contacted about participation in the survey. Of these, six did not have ESS, ten had systems that were still in development, six had dismantled their ESS, nine could not commit to sufficient participation, and three indicated that timing was poor. Eighteen organizations agreed to participate. They came from six industry groups: two from natural resources, four from transportation and communications, six from financial services, two from the food industry, two from manufacturing, and two from the public sector. Three organizations were based in the United States, eight in Ontario, four in Eastern Canada, and three in Western Canada. The mean number of employees was 11,000, and only two organizations had less than 1,500 employees.

The ESS ranged in age from six months to four years, with a mean age of 2.3 years. They had a range of nine to two hundred users with a mean of seventy-one. Four systems were implemented using Comshare’s Commander, two using Pilot’s Command Center, two using Pilot’s Lightship, and the remainder using other software products or in-house development. Impetus for development came from three sources: senior line management (3), the information systems group (8), and finance and accounting groups (7).

Six hundred and twelve surveys were sent out, and four hundred and fifteen people replied for a response rate of 67.8%. Of the non-respondents, thirty-six provided reasons for why they were not appropriate respondents, six indicated they were
too busy, and twelve were not interested. Seventeen of the completed questionnaires had a large number of missing values, leaving three hundred and forty-four usable responses.\(^2\)

Non-response bias was tested by comparing the responses of those people who returned the questionnaire without a reminder (74.3%) and those who returned the questionnaire after receiving a reminder letter (25.7%). Unpaired \(t\)-tests were used to compare the group means to each other. Prior to comparing the responses, homogeneity of variance was tested. Three variables failed this test (yesterday’s use, company tenure, and job tenure), so separate variance estimates were calculated for their \(t\)-values. The results indicated that there were no differences between the group means of early and late respondents for daily ESS use, perceptions of use and competitiveness, layers to the president, age, and the three variables mentioned above. Hence, it was assumed that non-response bias was not a problem.

The mean age of the respondents was forty-three, and the median number of layers to the president was two. The mean tenure in the company was 14.3 years, and the mean tenure in the job was 3.9 years. The respondents had a wide range of system use varying from no use to six hours per day. The mean daily use was 0.62 hours with a standard deviation of 0.71.

Partial least squares analysis (PLS) was used to test the relative strengths of the information uses. PLS has been used in a number of studies in various disciplines such as marketing (Barclay, 1986), organizational behaviour (Howell & Higgins, 1990), and MIS (Compeau & Higgins, 1995; Rivard & Huff, 1988). It is a theory-based approach to conceptualization that has been designed to integrate theory and data, and hence, provides a better platform than traditional multivariate techniques from which to construct and verify theory (Fornell, 1982). When analyzed using PLS, theory and data take meaning from each other. Hence, the reliability and validity of the constructs can be verified in light of the theory’s nomological network and assessed simultaneously with the estimation of the relationships among the constructs.

PLS is an appropriate technique to use in a theory development situation such as this research (Barclay et al., 1995). Its purpose is to find the highest prediction accuracy possible. Because of its flexibility, PLS provides a powerful way to understand the interaction between theory and data. In addition, PLS has minimal data assumptions. No specific distributions are required and there are no assumptions about the independence of observations. Finally, small samples work well in PLS. Because PLS is a regression-based technique, it requires ten cases for each variable in the most complex multiple regression. (The most complex multiple regression is the dependent construct with the greatest number of paths leading to it.) PLS uses ordinary least squares to minimize the residual variance and estimate case values. Because of its foundations in regression, PLS can make use of many standard statistical significance tests. Although goodness of fit tests are not available, the number of iterations required to converge on a solution does provide an indication of how well the model fits the data. In this research, the convergence took only three iterations.

Jack-knifing is used to test the statistical significance of the relationships in the model (Fornell & Barclay, 1983). Sub-samples of the total data set are formed by omitting a small proportion of cases each time. PLS is executed against each sub-sample, and the resulting distribution of the path and loading co-efficients is used to determine standard errors and \(t\)-values.

Although the measurement and structural parameters are estimated together, a PLS model is analyzed and interpreted in two stages: (1) the assessment of the reliability and validity of the measurement model, and (2) the assessment of the structural model. This sequence ensures that the constructs’ measures are valid and reliable before attempting to draw conclusions regarding the relationships among the constructs themselves (Barclay et al., 1995). Hence, the results of the research will be discussed in two parts: the quality of the construct measurement, and the strength of the relationships under investigation.

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\(^2\) Listwise deletion of cases was employed when a visual inspection of the surveys with missing values indicated that in almost all cases, an entire scale, rather than a single item had not been coded.
2.3.1. Measurement

As a first step, individual reliabilities for the constructs under investigation were assessed. The initial factor structure was checked to see if more than half of the observed variance of each variable was explained by the construct it measured (Carmines & Zeller, 1979), and if the variables loaded more on the constructs they represented than on the other constructs under investigation. Only one item loaded poorly: OC6-has little impact on our competitiveness. It was dropped from further analyses. Table 2 shows the resulting measurement model’s factor structure.

Reliability was assessed using the measure of internal consistency developed by Fornell and Larcker (1982). Convergent validity was assessed by ensuring that items had high loadings, as already discussed, and by inspecting the average variance extracted for each construct. Table 3 shows these measures as well as the means and standard deviations for the constructs.

The constructs appeared to be reliable as they all had measures of internal consistency well above Nunally’s (1978) cutoff of 0.8 for basic research. Convergent validity was also acceptable. The lowest average variance extracted was focusing attention at 0.702 indicating that 70.2% of the average variance in the manifest variables was shared in the construct.

As discussed above, in addition to assessing discriminant validity by ensuring that all items loaded more highly on their associated construct than on any other, the square root of the average variance extracted for each construct was compared to the correlations between it and the other constructs under investigation. In all cases, the square root of the average variance extracted was greater than the correlations between constructs.

Table 2
Measurement model factor structure

<table>
<thead>
<tr>
<th></th>
<th>Score keeping</th>
<th>Improving understanding</th>
<th>Focusing attention</th>
<th>Legitimizing decisions</th>
<th>Enabling competitiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK1</td>
<td>0.921</td>
<td>0.574</td>
<td>0.465</td>
<td>0.584</td>
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<td>SK3</td>
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<td>0.452</td>
<td>0.638</td>
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<td>SK4</td>
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<td>0.464</td>
<td>0.631</td>
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<td>IU1</td>
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<tr>
<td>IU2</td>
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<td>0.908</td>
<td>0.349</td>
<td>0.602</td>
<td>0.434</td>
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<td>FA1</td>
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<td>0.875</td>
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<td>0.842</td>
<td>0.548</td>
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<td>0.339</td>
<td>0.720</td>
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<tr>
<td>FA5</td>
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<td>0.336</td>
<td>0.827</td>
<td>0.494</td>
<td>0.424</td>
</tr>
<tr>
<td>LD1</td>
<td>0.510</td>
<td>0.501</td>
<td>0.537</td>
<td>0.840</td>
<td>0.474</td>
</tr>
<tr>
<td>LD2</td>
<td>0.608</td>
<td>0.647</td>
<td>0.471</td>
<td>0.890</td>
<td>0.464</td>
</tr>
<tr>
<td>LD3</td>
<td>0.579</td>
<td>0.599</td>
<td>0.485</td>
<td>0.874</td>
<td>0.443</td>
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<tr>
<td>LD4</td>
<td>0.535</td>
<td>0.566</td>
<td>0.560</td>
<td>0.912</td>
<td>0.473</td>
</tr>
<tr>
<td>LD5</td>
<td>0.628</td>
<td>0.664</td>
<td>0.491</td>
<td>0.890</td>
<td>0.460</td>
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<td>LD6</td>
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<td>0.626</td>
<td>0.518</td>
<td>0.894</td>
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<td>LD7</td>
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<td>0.616</td>
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<td>0.644</td>
<td>0.492</td>
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<tr>
<td>OC1</td>
<td>0.246</td>
<td>0.373</td>
<td>0.516</td>
<td>0.463</td>
<td>0.883</td>
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<td>OC2</td>
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<td>0.479</td>
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<td>0.337</td>
<td>0.522</td>
<td>0.450</td>
<td>0.928</td>
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<tr>
<td>OC4</td>
<td>0.210</td>
<td>0.332</td>
<td>0.483</td>
<td>0.438</td>
<td>0.930</td>
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<tr>
<td>OC5</td>
<td>0.351</td>
<td>0.408</td>
<td>0.603</td>
<td>0.542</td>
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</tbody>
</table>
indicating that all the constructs exhibited discriminant validity in this context. Table 4 shows the results of this analysis.

In summary, the tests of reliability, and convergent and discriminant validity showed that the construct measurement was sound.

2.3.2. Strengths of relationships

Once the reliability and validity of the constructs were established, the relationships among them were assessed in terms of path strengths and variance explained (Fig. 1). Together, the information uses had high predictive power. They accounted for 42% of the variance in enabling competitiveness. The strongest path led from focusing attention at 0.45. This was followed by the path from legitimizing decisions to improving competitiveness at 0.30. The path between improving understanding and improving competitiveness was 0.17. The path between score keeping and the dependent construct was −0.25. As mentioned above, jack-knifing was used to test the statistical significance of the paths. All of them were significant at $p \leq 0.001$.

3. Discussion

The findings of this study answer the research questions posed at the outset. First, ESS information uses can be clustered into four types: (1) score keeping, (2) improving individual understanding, (3) focusing organizational attention and learning, and (4) legitimizing decisions. Second, all four hypotheses relating types of information use and usefulness of the ESS for enabling competitiveness were supported. Focusing organizational attention seems to be the use that is most strongly related to perceptions of competitive performance improvements resulting from the ESS, followed by legitimizing decisions. Improving understanding is less strongly related. Finally, executives indicated that score keeping may not enable competitiveness. Each of these findings will be discussed in turn.

3.1. Focusing attention

The results underline executives’ understanding of the fact that management systems can shape their organizations. It seems that information can

---

Table 3
Construct reliability and convergent validity

<table>
<thead>
<tr>
<th>Construct</th>
<th>Internal consistency</th>
<th>Variance extracted</th>
<th>Construct mean(a)</th>
<th>Construct standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score keeping</td>
<td>0.966</td>
<td>0.875</td>
<td>4.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Improving understanding</td>
<td>0.946</td>
<td>0.746</td>
<td>3.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Focusing attention</td>
<td>0.921</td>
<td>0.702</td>
<td>4.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Legitimizing decisions</td>
<td>0.888</td>
<td>0.788</td>
<td>4.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Enabling competiveness</td>
<td>0.956</td>
<td>0.813</td>
<td>4.0</td>
<td>1.3</td>
</tr>
</tbody>
</table>

\(a\) Based on a linear aggregation of the scale items.

---

Table 4
Correlations between constructs

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>1. Score keeping</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2. Improving understanding</td>
<td>0.65</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Focusing attention</td>
<td>0.48</td>
<td>0.42</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Legitimizing decisions</td>
<td>0.66</td>
<td>0.69</td>
<td>0.60</td>
<td>0.88</td>
<td></td>
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<tr>
<td>5. Enabling competiveness</td>
<td>0.27</td>
<td>0.41</td>
<td>0.58</td>
<td>0.53</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Note: Diagonal elements are the square roots of the average variance extracted and off-diagonal elements in the lower half of the table are correlations between constructs.
affect what an organization focuses on, and that those effects are associated with perceptions of competitiveness. Managers are cognizant of the power that technology has to shape agendas and legitimate where attention is directed. The question that remains, however, is whether this power will objectively result in improvements in competitiveness, or whether the benefits ascribed to the system are really a transference of the benefits that individuals secure when their power and control are strengthened through the use of the technology. Armstrong and Collopy (1996) provide illustrations of the danger of focusing attention inappropriately. On a more positive note, as long as the direction is appropriate, making sure everyone in the organization is pointing that way should tend to reduce fractious and unproductive behaviour and improve performance.

The importance of focusing attention also has implications for those who are developing ESS. For an ESS to have a focusing influence on the organization, it would seem that many more people in the organization than those in the executive suite need to have access. Five of the ESS in the survey had more than one hundred users. Not all were executives. Do these organizations hold the key to success? Are there hazards associated with using an ESS to direct the organization’s attention? The way that ESS are constructed and used can assist executives in either empowering or controlling their organizations. It can dictate whether the organization will focus on tactical improvements to existing strategies or will respond creatively to environmental opportunities and threats. Is there a risk that organizational attention will be limited to those factors that seem important to the person in charge?

3.2. Legitimizing decisions

The strong relationship between legitimizing decisions and enabling competitiveness shows, not only that managers use information to justify their decisions, but that they believe doing so enables their organization’s competitiveness. This finding provides some indication of the energy that managers expend on justifying and legitimizing. While this energy may be required to make things happen, the underlying issue is whether this is a worthwhile use of information or just an inevitable one.

3.3. Improving understanding

While not as strongly related to perceptions of competitiveness as focusing organizational attention or legitimizing decisions, improving understanding also seems to be a worthy use of management and control information. One difficulty with improving understanding is the effort that is required to undertake this sort of activity. Exploration is more painful and uncertain than exploitation (March, 1991). Perhaps this is a reason for the weaker relationship. Another possibility is that improving understanding has no direct relationship to control and power. Managers are perhaps not as convinced as they profess that improving their understanding is key to competitiveness.

3.4. Score keeping

Score keeping was negatively related to enabling competitiveness. Why then, do executives continue to engage in this activity? Why also is it such a fundamental component of improvement initiatives? One explanation is that score keeping is probably one of the easiest management information and control system applications to develop. Another is that management information and
control systems are often championed by executives with systems, finance, or accounting responsibility. In many organizations, score keeping is the raison d’être for these departments. A third possibility is that the score keeping that is feasible using technology such as an executive support system is not as finely tuned as that required in improvement initiatives. For example, Davenport (1993) describes the difficulty associated with finding measures for the less concrete activities typically associated with management at senior levels in organizations. Finally, score keeping may be undertaken because it always has been.

The high quality of informants in this study lends credence to these results. In total, twenty-five ESS in twenty-five different organizations were investigated. More significant however, are the user respondents. Three hundred eighty users participated in the research. On average, they were less than two levels away from the president of their respective organizations. Only a handful were more than three levels away.

3.5. Limitations and future research

A limitation of this study relates to organization bias, and therefore, external validity. While attempts were made in the survey phase to include organizations with ESS of varying quality, it seems likely that organizations that are unhappy with their systems would be less prone to participating in research of this nature. Hence, the sample of ESS probably contains a larger proportion of “good” systems than is the case in the population of all ESS. A second limitation relates to common method variance and same source bias. The research relied on user perceptions and one principal method to elicit information. Because perceptions of usefulness for enabling competitiveness were not at arms length from perceptions of the way the information in the ESS was used, it is possible that the dependent construct is a characteristic of the system rather than an outcome from using it. However, the consistency between the hypotheses and findings provides confidence in the results. Future research could improve the precision of this measure. In addition, other dependent variables meriting investigation might include performance (individual, unit, or organizational; absolute vs. relative), learning and satisfaction.

A third limitation relates to the nature of ESS. The negative relationships between ESS’ usefulness for enabling competitiveness and scorekeeping and the strong relationships between focusing attention and enabling competitiveness could be the result of an interaction between the information system in use (i.e. ESS) and how it is best used. Other information systems may demonstrate different relationships (e.g. routine monthly reports may show a strong relationship to improving competitiveness).

This study opens several additional avenues for future research in addition to those mentioned above. Perhaps the most pressing is the need to understand the linkages among the four uses of information. Is it possible to focus organizational attention in any other way than by keeping score? How is legitimization undertaken? Is there any link to improved understanding of a particular situation? A second avenue for research relates to the potential to direct the type of use to which information is put. For example, is there any way to encourage one type of information use and discourage another? Which particular attributes of information or technology foster each of the information uses, or is type of information use dependent on the individual using it? Third, research could be undertaken to better understand the relationships between types of information use, performance and other important factors such as environmental uncertainty, task uncertainty/interdependence, competition and strategy. Fourth, do these findings hold in other information settings, or are they limited to the information uses to which ESS are put? Finally, and possibly most importantly, do perceptions of usefulness and consequent actions result in improvement in actual outcomes?

The way the current study has been constructed, it is possible that a manager claims that the ESS is useful for improving competitiveness but the company he or she works for faces other problems.

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Footnote: Fifteen of the eighteen ESS in the survey were initiated by one of these departments; there is no reason to believe that this is any different than the population of ESS at large.
(e.g. poor products, poor distribution channels) that make it uncompetitive and overwhelm any positive contributions of the ESS. Future research could attempt to untangle these interrelated causes and their effects to determine the net impact of ESS.

4. Conclusion

It seems that control and power, to a large extent, drive perceptions of the benefits associated with using information in organizations. It also seems that organizations should proceed cautiously when developing systems to provide access to information. If the systems are to be used only to automate score keeping, they are not likely to be perceived as particularly successful. If they enable improved understanding, decision legitimation, or the ability to focus the organization’s attention, their prognosis is much better. We should perhaps now turn our attention to whether or not these uses are inevitable, valuable, and can or should be modified, not only in relation to ESS, but also to accounting, management and control information generally.

Appendix:

Improving understanding

How often do you use the ESS to...
IU1...dig behind the numbers.
IU2...build scenarios
IU3...model potential outcomes
IU4...analyze results
IU5...delve more deeply into issues.
IU6...explore options.

FA1...ties the organization together.
FA2...enables the organization to focus on common issues.
FA3...enables the organization to focus on our critical success factors.
FA4...has developed a vocabulary in the organization.
FA5...provides a common view of the organization.

Score keeping

How often do you use the ESS to...
SK1...track progress towards goals.
SK2...review key measures.
SK3...monitor results.
SK4...compare outcomes to expectations.

Legitimizing decisions

To what extent does the ESS enable you to...
LD1...confirm your understanding of the business.
LD2...justify decisions.
LD3...verify assumptions.
LD4...maintain your perspectives.
LD5...support your actions.
LD6...reinforce your beliefs.
LD7...stay close to the business.
LD8...increase your focus.
LD9...validate your point of view.

Enabling competitiveness

The ESS...
OC1...enables us to keep up with the competition.
OC2...enables us to surpass the competition.
OC3...makes the organization more flexible than the competition.
OC4...enables the organization to move faster than the competition.
OC5...enables the organization to perform better overall.
OC6...has little impact on our competitiveness.

References


