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Enterprise resource planning systems, strategic enterprise management systems and management accounting

A Danish study

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Abstract

Purpose – The purpose of this paper is to contribute to the body of knowledge about to what extent integrated information systems, such as ERP and SEM systems, affect the ability to solve different management accounting tasks.

Design/methodology/approach – The relationship between IIS and management accounting practices was investigated quantitatively. A total of 349 responses were collected using a survey, and the data were analysed using linear regression models.

Findings – Analyses indicate that ERP systems support the data collection and the organisational breadth of management accounting better than SEM systems. SEM systems, on the other hand, seem to be better at supporting reporting and analysis. In addition, modern management accounting techniques involving the use of non-financial data are better supported by an SEM system. This indicates that different management accounting tasks are supported by different parts of the IIS.

Research limitations/implications – The study applies the methods of quantitative research. Thus, the internal validity is threatened. Conducting in-depth studies might be able to reduce this possible shortcoming.

Practical implications – On the basis of the findings, there is a need to consider the potential of closer integration of ERP and SEM systems in order to solve management accounting tasks.

Originality/value – This paper adds to the limited body of knowledge about the relationship between IIS and management accounting practices.

Keywords Information management, Manufacturing resource planning, Management accounting, Denmark, Quantitative methods

Paper type Research paper



Introduction

Information technology has evolved quickly and has brought about many changes in recent decades. In the 1990s, companies started purchasing enterprise resource planning (ERP) systems, which are characterised by the integration of several business

Journal of Enterprise Information
Management
Vol. 19 No. 1, 2006
pp. 50-66
© Emerald Group Publishing Limited
1741-0398
DOI 10.1108/17410390610636878

The authors would like to thank the two anonymous referees for their valuable suggestions. They would also like to thank participants and the three anonymous referees at the 1st International Conference on Enterprise Systems and Accounting for their comments and suggestions to a previous version of the paper. All comments and suggestions have been fruitful for us in our endeavour to enhance the quality of the paper.

functions, sharing one database and by being real-time (Davenport, 1998, 2000). Today, 94.8 per cent of the top 500 companies in Denmark have an ERP system (Møller *et al.*, 2003). Recent development has focused on web-enabling the ERP systems and making them inter-organisational (Shields, 2001; Davenport and Brooks, 2004). Finally, an increasing interest in analytic applications such as strategic enterprise management (SEM) systems and business intelligence software is now in evidence (Dragoon, 2003).

In the last two decades, management accounting techniques have been developed alongside developments in information technology. This was partly initiated by Kaplan (1984) and Johnson and Kaplan (1987) who state that management accounting techniques have become obsolete, as they have not developed in conjunction with business requirements and technology.

Several researchers claim that a prerequisite for change in management accounting practices and for getting most new management accounting techniques to work in companies seems to be coupling them with information technology (Hitt and Newing, 1995; Classe, 1998; O'Donnell and David, 2000). In spite of the possibilities for change in management accounting practices that evolved with the development of integrated information systems (IIS), research shows that ERP systems have only a limited impact on management accounting practices (Fahy and Lynch, 1999; Granlund and Malmi, 2002; Scapens and Jazayeri, 2003). These observations make it seem relevant to explore whether Danish companies in general have the same experiences with ERP system's effects on management accounting practices, and secondly, whether implementation of business intelligence software and SEM systems will lead to observations and conclusions that are different from what is observed with ERP systems.

The paper is organised as follows: the next section of this paper is a review of the ERP and SEM literature that forms the basis of the hypotheses developed (Yin, 1994; Luft and Shields, 2003). The literature review provides the foundation for developing the measuring instrument and designing the data collection. Data are analysed with reference to the literature. Finally, results are discussed and conclusions drawn.

Literature review and development of hypotheses

Differences and similarities between ERP and SEM systems

The term "integrated information systems" is used by several authors (Bhatt, 1995; Booth *et al.*, 2000; Wall, 2003) in reference to a system of integrated, real-time systems that share common data. In this paper, the term "integrated information system" (IIS) will be used to refer to a system of systems including both transaction-oriented ERP systems and analysis-oriented SEM systems (see definition below). It does not include, for example, spreadsheets when they are not an integrated part of the system. However, applications like Cognos and Hyperion (Clark, 1997; Classe, 1998; Dragoon, 2003) are included, as they conform to the demands of formal integration and being real time.

As can be seen in Figure 1, ERP systems typically operate at the transactional level (Hyvönen, 2003) while SEM systems operate at the strategic level (Fahy and Millea, 2001; Brignall and Ballantine, 2004).

ERP systems are modular systems based on a client/server technology. The ERP systems are comprehensive, functionally as well as institutionally, and they interface with external systems. Data are stored in a single database, which eliminates redundancy and the need to update data in several different subsystems (Davenport, 1998).

While the focus of ERP systems is on the operational and tactical level, Fahy (2000) argues that they lack comprehensive reporting and analysis functionalities at the strategic level. In turn, SEM systems in combination with a data warehouse are focused on the tactical and strategic level. Brignall and Ballantine (2004) describe an SEM system as a system that is built on an ERP system; that relies on data warehousing tools; that has a range of integrated applications such as planning and simulation; that has both an internal and an external focus; and finally, that supports strategic decision making.

The suppliers of SEM systems include SAP, Oracle and Hyperion. One example of an SEM system is SAP SEM (SAP, 2004b). SAP SEM is a suite containing modules of business planning and simulation, business consolidation, strategy management, performance measurement and stakeholder relationship management.

The business planning and simulation module supports the task of budgeting. This module acknowledges the user-friendliness of MS Excel and the user interface is built around MS Excel. The strategy management module is a balanced scorecard module with the functionality for drilling down and connecting measures in, for example, a strategy map.

SAP SEM does not contain any data and is merely an application shell. A data warehouse (e.g. SAP's business information warehouse (SAP BW) (SAP, 2004a) is needed for data storage. All modules of the suite store data in the same database. For example, the budget data from the business planning and simulation module are also reported in the strategy management module.

The range of SEM systems is not limited to suites including all modules such as those supplied by the major ERP vendors and thus also includes products from, for example, Cognos and QPR. These latter products are so-called best-of-breed (BoB) products that focus on supporting tasks such as consolidation, activity-based costing, the balanced scorecard, performance management, shareholder value management and budgeting. While BoB products are normally not a suite with an integrated user interface, they still make use of the same data as the rest of the SEM applications. Consolidation takes place among the BoB products and develops towards more fully integrated SEM suites (the first level of integration). Thus, two levels of integration seem to exist:

- (1) full integration, including the integration of the user interface; and
- (2) integration involving individual systems using the same data.

The impact of ERP and SEM systems on management accounting practices

When exploring the relationship between IIS and management accounting, it is important, according to March and Smith (1995) and Mauldin and Ruchala (1999), to

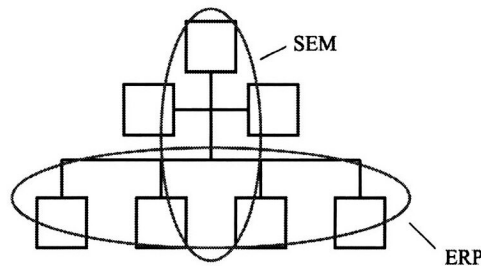


Figure 1.
ERP systems, SEM
systems and the
organisation

identify the nature of the tasks to which the IIS is applied. According to Brignall and Ballantine (2004) ERP systems and SEM systems address separate business tasks, and it is important to distinguish between those two kinds of systems when investigating how they impact the use of management accounting and control techniques in practice; in this paper referred to as “management accounting practices” (Chenhall and Langfield-Smith, 1998a; Booth *et al.*, 2000).

It should be noted that the ERP and SEM systems as such are not expected directly to change management accounting practices (Scapens and Jazayeri, 2003). The impact of ERP and SEM systems are to be understood in the light of their ability to foster or inhibit change in management accounting (Granlund, 2001). It is this feature of altering the possibilities for change that is the crux of this paper.

Among the most common motives for implementing an ERP system have been the year 2000 issue, development of business processes, lack of accuracy and slowness of previous systems, the euro currency and reduction in the number of different systems (Davenport, 1998; Brady *et al.*, 2001; Hyvönen, 2003). Thus, companies seem to focus mainly on the technical functionality of the ERP system and to a lesser extent on how the system supports different control and business decisions. Seen from a management accounting perspective it is important to gain more insight into how ERP and SEM systems support management accounting practices and how they may change these practices.

Studies on the impact of ERP systems on management accounting practices have been conducted (Fahy and Lynch, 1999; Booth *et al.*, 2000; Granlund and Malmi, 2002; Scapens and Jazayeri, 2003).

Fahy and Lynch (1999) find that ERP systems led to significant improvements in data gathering but that the systems have had an ambiguous impact on the more strategic decision support in the organisations. When they carried out their study, spreadsheets were still used in the companies for meeting the flexible information needs required by managers facing complex decisions. Booth *et al.* (2000) make similar observations. They conclude that ERP systems seem to be useful for transaction processing while they are less suited for reporting and decision support in general. Their results also show that there was no significant tendency towards a higher adoption of modern management accounting practices among ERP adopters than among non-adopters. This indicates that ERP systems do not seem to enable changes in management accounting practices.

In a study on the effects of ERP systems on management accounting in ten Finnish companies, Granlund and Malmi (2002) find that companies that have integrated their cost accounting into the ERP system had simply transferred the costing principles from the existing system to the new system. The rest of the companies used spreadsheets or standalone software without formal integration with the ERP system, mainly because they lacked the capacity to invest the amount of time and effort necessary to implement even a plain vanilla solution of the ERP system. In eight out of ten of the cases, activity-based costing (ABC) was applied in parts of the organisations, but this was – with one exception – accomplished outside the ERP system. The main argument for not integrating ABC with the ERP system was that the existing version of the ERP system was considered too complex for that purpose.

When looking at the implications on performance measurement systems like the balanced scorecard (BSC) it is observed that they are implemented outside the ERP system even if the ERP system delivers some of the data to the BSC. Granlund and

Malmi (2002) conclude that the ERP system does not seem to play a major role for these performance measurement systems so far. The effects of ERP systems on budgeting also seem to be limited. Even though some of the companies prepare their budgets within the ERP system, according to Granlund and Malmi (2002) interpretation, the motives for preparing budgets in separate systems are related to their functionality and quality. Their conclusion that the introduction of ERP systems does not seem to have much impact on changing management accounting practices is in line with Scapens and Jazayeri (2003) observations.

When making suggestions for further research, Granlund and Malmi emphasise the emergence of SEM systems:

The introduction of so-called SEM modules may provoke companies to adopt methods that they have not used earlier (Granlund and Malmi, 2002, p. 315).

Some research has been conducted on SEM systems. The findings of the CIMA SEM Round Table indicate that SEM is used for supporting decision making (Gould, 2003), but there is still a lack of empirical evidence related to the impact of these systems on management accounting practices. While empirical findings are few, promising descriptions of SEM systems are numerous. It is argued that the functionality of the SEM systems can help the organisation improve the strategy process (Gould, 2003). However, techniques such as activity-based costing and the balanced scorecard are not implemented in practice with the support of SEM suites (e.g. SAP SEM) but by BoB products or spreadsheets (Fahy and Millea, 2001; Gould, 2003). Therefore, research on the support of strategic enterprise management should not limit itself to SEM suites, as BoB products can also be an integrated part of the information system with today's technologies.

Synthesis on literature review and development of hypotheses

Three dimensions of the relationship between IIS and management accounting practices appear from the literature review above.

First, ERP and SEM systems seem to have different impacts on management accounting practices. While the relationship between ERP systems and management accounting practices to some extent has been explored, this is not the case with regard to the relationship between SEM systems and management accounting practices. Therefore, it seems relevant to investigate this latter relationship, which is the primary purpose of this article.

Second, the literature review reveals that when investigating the relationship between IIS and management accounting practices it seems relevant to apply a task focus on management accounting. In this article we have thus been inspired primarily by the research conducted by Booth *et al.* (2000). They have classified the tasks into processing, reporting and decision support. In order to translate those tasks for use in a Danish context, processing is translated to data collection (Madsen, 1963, p. 8), reporting is retained and decision support is divided into analysis, which is ex post oriented, and budgeting, which is ex ante oriented. The task of data collection consists of, for example, the data recording in the general ledger as well as collection and recording of non-financial data. The reporting tasks include the making of profit and loss statements and several kinds of segmented profitability reporting, but reporting on non-financial data (e.g. the use of the balanced scorecard) is also included. Analysis

is based on historical data and can be performed on a continuous as well as an *ad hoc* basis. Finally, budgeting concerns, for example, the collection of budgets from different departments within the company.

Third, IIS seems to have two different kinds of impact on how and to what extent these management accounting tasks are solved in practice. First, one type of impact concerns how the functionality of the IIS can support current management accounting tasks in practice as investigated by Booth *et al.* (2000). Since SEM systems add to the functionality of the IIS it can be argued that SEM adopters are more satisfied with the support of the IIS than are non-SEM adopters. Second, it may also be argued that the introduction of an SEM system might enable change in management accounting practices.

On the basis of this synthesis two hypotheses are set forth:

- H1. Current management accounting tasks are better supported by an IIS with an SEM system than an IIS without an SEM system.
- H2. With an SEM system, the way management accounting tasks are carried out is more likely to change.

The hypotheses express a unidirectional relationship between SEM systems and management accounting. Although it could be relevant to explore a bidirectional relationship (Luft and Shields, 2003), a unidirectional relationship is more likely to exist, as it appears that IIS's are difficult to change (Granlund and Malmi, 2002).

Research method

Sample selection and survey development

In order to ensure construct validity and reliability, emphasis was placed on developing a short but comprehensive survey. The survey went through a pilot test and a face value test (Modell, 2003).

The survey was administered to 3,000 companies comprising a major part of Danish companies with more than 50 employees. Responses were received from 401 companies, of which 349 had an IIS corresponding to our definition.

The survey was addressed to the CFO. Of the respondents, 84 per cent had an accounting background, which is comparable to the survey of Chenhall and Langfield-Smith (1998b). Responses from accountants and non-accountants were compared, and no indications of bias could be established.

External validity was tested for according to company size, legal type and industry. The conclusion is that external validity cannot be rejected with regard to these variables. Non-response bias was also tested for; the result was that no non-response bias exists (only two sub-questions have different means).

Measurement of constructs

Data were collected to measure the constructs contained in the two research hypotheses: IIS and management accounting practices. In order to compare the impact of SEM systems to other systems, it was necessary to collect information on both ERP and SEM systems.

One of the main questions asked concerned which ERP and SEM modules had been implemented in the organisation. The list of ERP and SEM modules is derived from Davenport (1998) and material from SAP, Oracle and Microsoft Business Solutions. The degree of implementation was measured on a five-point Likert scale ranging from

“No, implementation is not planned” to “Is implemented and further developed”. The measurement scale used spans a wider range of phases than traditional phase models, which typically start with the initiation of an implementation project and end with the successful infusion of the new technology (Rajagopal, 2002). Scapens and Jazayeri (2003) find that functionality and features of the ERP system change with usage, and consequently it is necessary to apply a wider view of the implementation process (Parr and Shanks, 2000; Willis and Willis-Brown, 2002).

To get from the detailed level of data collection to the construct level, a factor analysis was applied. Missing values were replaced by calculated means before the factor analysis was performed (Little, 1992; Nicolaou, 2003). In order to determine whether the data was appropriate for factor analysis, the Kaiser-Meyer-Olkin measure was calculated to be between 0.82 and 0.87, which is satisfactory (Sharma, 1996). Varimax rotation was used in order to make individual items load on only one factor (Sharma, 1996). Items that loaded > 0.50 on single factors were retained in the analysis (Chenhall and Langfield-Smith, 1998b). The selection of the number of factors was based on the eigen-value-greater-than-one rule and scree plots.

The factor analysis generated two constructs for IIS's that account for 49.1 per cent of the variance. The first factor is an ERP systems factor and the second factor, an SEM systems factor. This matches the constructs of the hypotheses. Details of factors and loadings are provided in the appendix. The reliability of the constructs was tested using Cronbach's alpha coefficient (Cronbach, 1984). The coefficients are 0.72 and 0.85. Both constructs therefore exhibited satisfactory levels of convergent validity and reliability (Nunally, 1978).

A five-point Likert scale from “Not at all”/“Completely disagree” to “To a very large extent”/“Agree completely” was used to measure the management accounting construct. A factor analysis was performed on the entire set of management accounting questions. The procedure described above was followed. A KMO of 0.87 was calculated, and six factors were found: Organisational breadth in management accounting ($\alpha = 0.85$); reporting and analysis ($\alpha = 0.79$); non-financial, external and *ad hoc* management accounting ($\alpha = 0.80$); budgeting ($\alpha = 0.79$); data collection ($\alpha = 0.72$); and allocation of costs ($\alpha = 0.72$). The constructs found to a great extent match the disaggregation into tasks. Further, a decomposition of management accounting practices into traditional versus modern management accounting (Bjørnenak and Olson, 1999) also seems to be a result of the factor analysis. Three traditional management accounting tasks were identified between which reporting and analysis are collapsed. Modern management accounting consists of two factors: Non-financial, external and *ad hoc* management accounting, and allocation of costs. Traditional management accounting is contained within the task factors. A sixth and new construct was identified: Organisational breadth of management accounting.

The support of management accounting practices derived from the IIS was measured by prioritisation of management accounting tasks and satisfaction with the support of the IIS with regard to the individual task, and the extent of exploitation of the IIS and support from IIS. In the analysis, the first group of items is used to identify critical areas within the four tasks, while the second group of items is collapsed using factor analysis. Two factors were identified using no rotation: General fit ($\alpha = 0.84$) and fit in budgeting ($\alpha = 0.80$). Only the first factor will be used in the analysis.

In addition to the statistical tests of validity and reliability, a focus group interview was performed and the results were fed back to respondents (Modell, 2003). The interview gave no reason to question the validity and reliability of the data material.

Measurement of change

As it seemed problematic to ask the respondents about their historic actions (Yin, 1994, p. 85), respondents were not asked about their management accounting practices prior to the implementation of an IIS. Instead, "change" in this paper is measured by comparing different cases with different IIS's (the "treatment") and accompanying management accounting practices (a "separate-sample pretest-posttest design" without the pretest; Campbell and Stanley, 1963, p. 53). Even though the same case is not measured before and after the "treatment", the different cases can be compared and conclusions about the relationship between IIS and management accounting practices can be drawn if other explanatory variables are controlled for (Campbell and Stanley, 1963, p. 36).

Data analysis

H1. Current management accounting tasks are better supported by an IIS with an SEM system than an IIS without an SEM system

The data material used for testing *H1* consists of two parts. The first part deals with the satisfaction with the support of different management accounting tasks derived from the IIS: Data collection, reporting, analysis and budgeting, and the priority of the same four management accounting tasks. The second part deals with the conjunction of IIS and management accounting.

Figure 2 illustrates the differences between the satisfaction that SEM adopters and non-SEM adopters feel with the IIS (the *y*-axis) and their prioritisation of management accounting tasks (the *x*-axis). When the respondents prioritise a management accounting task to a higher degree than it is supported by the IIS, a misfit seems to exist. Such a situation exists when large circles are found in the lower right corner of each diagram. It is also relevant to consider the diagonal of the diagrams. Especially the diagrams regarding budgeting show that SEM adopters have a better fit between satisfaction and prioritisation than non-SEM adopters (diagonals are more populated and the lower right corner less populated). The same holds true for reporting and analysis. A slightly different situation exists for data collection, where non-SEM adopters are quite predominant on the diagonal compared to SEM adopters. Chi-square tests show that significant differences exist between all four pairs of two-way tables. On the basis of these findings *H1* is confirmed.

Another way of testing the hypothesis is to look at whether the IIS supports management accounting tasks and whether the functionality of the IIS is exploited. Table I summarises the coefficients between ERP and SEM systems and the factor for exploitation/support. The coefficients are calculated using regression analysis. The method of ordinary least squares is used. The factor for exploitation/support is the dependent variable. Company size and company type (service, manufacturing and trade) are controlled for. A significantly more positive relationship exists between SEM systems and exploitation/support than between ERP systems and exploitation/support.

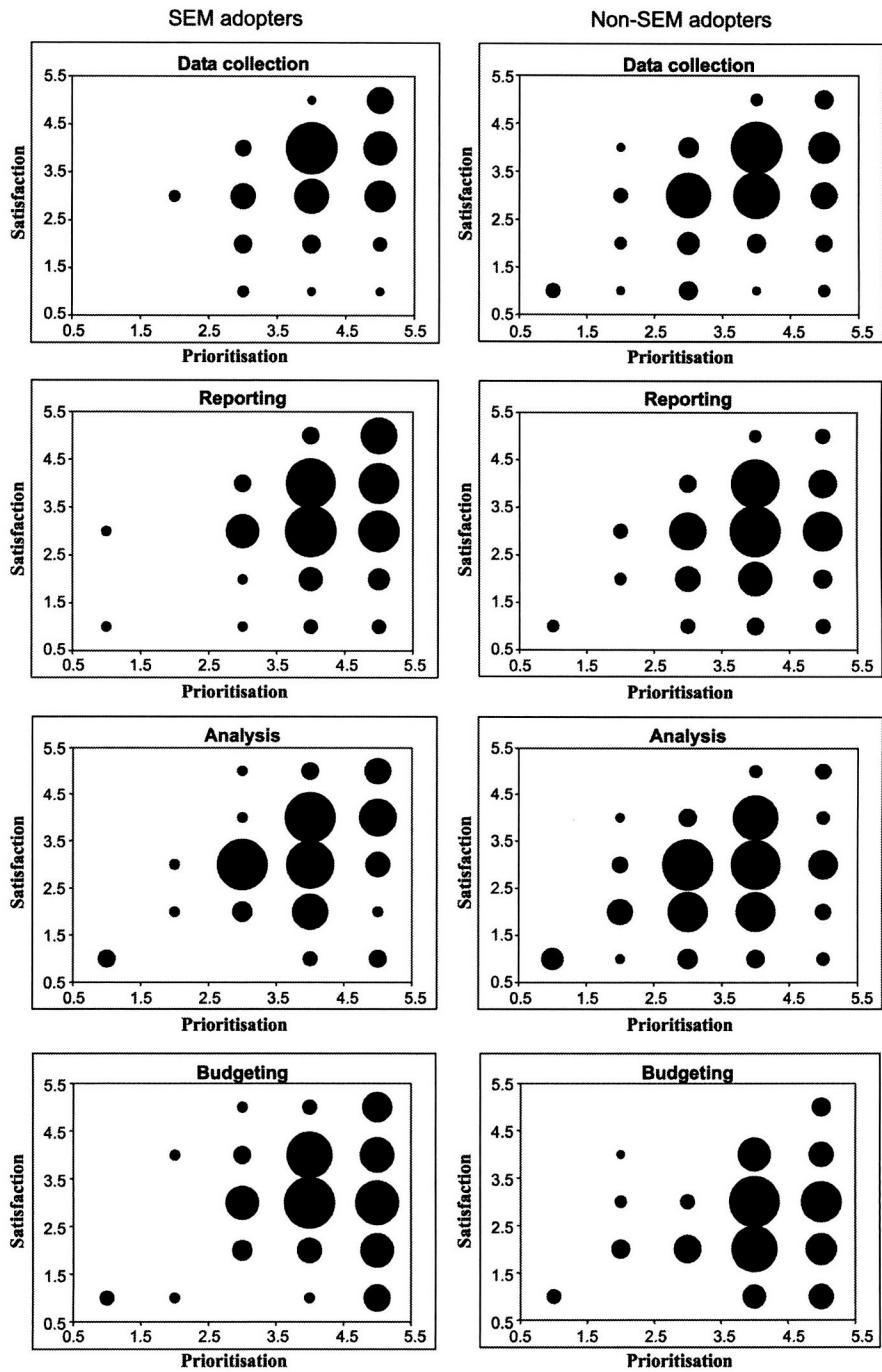


Figure 2. Satisfaction with the support of the IIS (*y*-axis) and priority of management accounting tasks (*x*-axis) – SEM adopters vs. non-SEM adopters

Based on the two different analyses of the support of management accounting derived from IIS, it can be concluded that *H1* is supported, and that SEM systems are better at supporting management accounting tasks than are ERP systems.

H2. With an SEM system, management accounting practices are more likely to change
The analysis of the relationship between SEM systems and management accounting practices is based on the factors developed above. Several regression analyses are performed, as the dependent variable (management accounting practices) consists of several constructs. Differences in coefficients of ERP and SEM systems are tested by means of a *t*-test (Aczel and Sounderpandian, 2002).

In order to ensure that the measurement of the impact of ERP systems is consistent with that of SEM systems, coefficients of the SEM systems are compared to the coefficients of the ERP systems. *T*-tests show that all coefficients are significantly different between ERP and SEM systems. See Table II.

This demonstrates that there is a positive and significant relationship between SEM systems and organisational breadth of management accounting, reporting and analysis, non-financial, external and *ad hoc* management accounting, and allocation of costs, whereas there is a positive, but not significant, relationship between SEM systems and budgeting and collection of data. The significant correlation coefficients range from 0.200 to 0.394.

SEM systems are a lever for change of modern management accounting as measured by the factors non-financial, external and *ad hoc* management accounting, and allocation of costs (extensive use of a multiplicity of cost drivers). It is demonstrated that both modern management accounting variables have a significant

	Exploitation of IIS and support from IIS
ERP systems	0.195*
SEM systems	0.347*
SEM better than ERP	+

Note: * Relationship is significant at the 0.01 level (two-tailed)

Table I.
Regression coefficients –
the match between
ERP/SEM and
management accounting

	Non-financial, external and <i>ad hoc</i> management accounting	Allocation of costs	Data collection	Reporting and analysis	Budgeting	Organisational breadth
ERP systems	0.024	0.033	0.095*	0.093*	0.047	0.329**
SEM systems	0.394**	0.261**	0.046	0.200**	0.073	0.211**
SEM better than ERP	+	+	-	+	+	-

Notes: * Relationship is significant at the 0.1 level (two-tailed); ** Relationship is significant at the 0.01 level (two-tailed)

Table II.
Regression coefficients –
the found impact of ERP
and SEM systems on
management accounting
practices

relationship with SEM systems while no significant relationship is found with ERP systems.

Traditional management accounting is analysed in conjunction with data collection, reporting and analysis, and budgeting. Data collection is positively and significantly related to ERP systems, while no significant relationship exists to SEM systems. ERP systems thus to a greater extent than SEM systems enable change in data collection. SEM systems are positively related to reporting and analysis, while no significant relationship is found between ERP systems and reporting and analysis. Implementing an SEM system thus forms the basis for developing reporting and analysis. The coefficients of ERP and SEM systems and budgeting are not significant, but a t-test shows that the relationship with SEM systems is significantly more positive than the relationship with ERP systems.

With regard to organisational breadth of management accounting, it is demonstrated that ERP systems have a significantly more positive coefficient than do SEM systems. Both systems, however, have a positive relationship to organisational breadth of management accounting.

Though a misfit between the constructs of the hypotheses and the data material is found, it is concluded that *H2* is confirmed.

Discussion

On the basis of previous research and the findings of this study we conclude that we are witnessing a development in the understanding of the IIS. We no longer expect ERP systems to have a major impact on management accounting practices, as only data collection is significantly related to ERP systems. Based on the question raised by Granlund and Malmi (2002, p. 315) as to whether SEM systems will induce companies to change the logic of their accounting and control practices, it seems relevant to study the impact of SEM systems as companies have entered into the second phase of the IIS (Willis and Willis-Brown, 2002).

The analysis of the relationship between SEM systems and budgeting reveals that there is a non-significant relationship between those two constructs. During the focus group interview, problems with the budgeting process were emphasised. Some companies were using a spreadsheet solution (which is outside the IIS as the budgets are not automatically loaded back into the central database), while others had invested in SEM systems such as SAP SEM and Cognos. The findings of the survey might be an indication that companies are just getting around to revising the budgeting process at this moment. Further research is needed to uncover this contradictory finding.

Fahy and Lynch (1999) and Fahy (2000) find that ERP systems have a negative impact on strategic management accounting. They argue that in order for SEM systems to be enablers for change in strategic management accounting, the SEM system must be implemented in conjunction with a wider perspective on strategic enterprise management. Strategic management accounting is defined by its external focus (Bromwich, 1990), the emphasis on the use of non-financial metrics (Kaplan and Norton, 1992, 1996), and the use of differentiated periods (Bjørnenak and Olson, 1999), which are characteristics measured by the survey. The conclusions of Fahy and Lynch (1999) are supported by the survey results as no significant relationship between non-financial, external and *ad hoc* management accounting, and allocation of costs and ERP systems is found. The significantly positive relationships between SEM systems and non-financial,

external and *ad hoc* management accounting, and allocation of costs indicate that companies match the implementation of a SEM system with a change in the management accounting practices. Whether coefficients of 0.261 and 0.394 are high enough to imply application of a wider perspective on strategic enterprise management cannot be determined through this survey material, and further investigation is required.

As is the case of most research, this paper is also subject to limitations. First, there are a number of explanatory variables not included in the study. Throughout this paper, it has been taken for granted that the IIS is the independent variable and that management accounting practices are the dependent variable. However, it could be argued that both constructs could be influenced by a factor that could be called “sophistication of management”, which means the extent to which the management focuses on and applies the appropriate management techniques.

The degree of sophistication impacts both the comprehensiveness of IIS and management accounting, and thus “sophistication of management” might be a supplementary enabler for change in management accounting. Other explanatory variables may also be relevant. Further, while company size and company type are controlled for, no environmental variables are controlled for.

Second, statistically significant relationships do not necessarily imply causation, and thus internal validity is threatened. This quantitative study can advantageously be supplemented by qualitative studies in order to validate the causality claims.

Third, as change in management accounting practices is not measured within each case, internal validity is further threatened. Again, qualitative studies such as longitudinal case studies can overcome this limitation.

Conclusions

One of the main conclusions from the literature review is that ERP systems have only a limited impact on management accounting practices. Booth *et al.* (2000) find that ERP systems are powerful tools with regard to transaction processing, whereas reporting and decision-making are not well supported by the systems. This finding matches recent communication from software vendors including SAP and Oracle stating that ERP systems are built for transactional management while SEM systems are built for management at a more strategic level.

The findings of this study confirm previous research as they demonstrate the fact that ERP systems have no significant relationship to reporting and analysis, budgeting, non-financial, external and *ad hoc* management accounting, and allocation of costs. However, a significant and positive relationship is found between ERP systems and data collection and organisational breadth of management accounting. It is confirmed that ERP systems are powerful tools with regard to transaction processing and integration of the organisation, as data collection can be considered a proxy for transaction processing, and organisational breadth of management accounting a proxy for integration. ERP systems are also related to exploitation of and support from IIS, which indicates that ERP systems have the capability of supporting current management accounting practices. This conclusion supports the claim that having an ERP system is still better than having no ERP system with regard to the support of the existing management accounting tasks.

It is indicated that SEM adopters are satisfied to a larger extent than non-SEM adopters with the support of their IIS to the data collection, reporting, analysis and budgeting tasks.

The respondents seem to be more satisfied with the IIS when an SEM system is an integrated part of it. It can also be concluded that the comprehensiveness of the SEM system has a significantly higher relationship to exploitation of and support from the IIS than do ERP systems. These conclusions verify the statements of the major software vendors and confirm the hypothesis that a better match is seen between SEM systems and management accounting than between ERP systems and management accounting.

With regard to the impact of SEM systems on changes of management accounting practices, it is implied that SEM systems are better than ERP systems at supporting changes in reporting and analysis, non-financial, external and *ad hoc* management accounting, and allocation of costs. With the implementation of an SEM system, changes in management accounting practices and particularly strategic enterprise management practices are anticipated (Fahy, 2000; Fahy and Millea, 2001; Gould, 2003). On the basis of the findings of this survey, the existence of such a relationship cannot be rejected.

ERP and SEM systems are complementary systems: ERP systems seem to be the primary enablers of change in data collection and organisational breadth of management accounting, while SEM systems seem to be the primary enablers of change in reporting and analysis, budgeting, non-financial, external and *ad hoc* management accounting, and allocation of costs.

ERP systems have been around for some time, and some research has been conducted on the topic. The adoption of SEM systems is a contemporary issue lacking scrutiny of management accounting academics. The present study shows that the distinction between ERP and SEM systems is of major importance, as they represent different systems for different management accounting tasks. The findings reported in this paper are based on a quantitative study, which would benefit from being supplemented by in-depth case studies. Academics and practitioners alike are encouraged to make contributions to the further research needed into SEM systems and management accounting.

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Appendix. Factor analysis and Cronbach statistics for items within each factor
See Tables AI-AIII.

Integrated information systems (KMO = 0.82)	Factors	
	1	2
<i>IIS1 – ERP systems ($\alpha = 0.85$)</i>		
Group of modules: sales, distribution, CRM	0.750	0.132
Group of modules: production, logistics	0.862	0.152
Group of modules: finance	0.848	0.140
Group of modules: other: e-business, vertical solutions etc.	0.785	0.115
<i>IIS2 – SEM systems ($\alpha = 0.72$)</i>		
Data warehouse	0.038	0.622
Activity-based costing	0.073	0.569
Performance measurement/balanced scorecard	0.108	0.667
Executive portal	0.084	0.545
Data mining	0.109	0.606
Planning and simulation	0.156	0.666
Consolidation	0.167	0.580

Table AI.

Management accounting practices (KMO = 0.87)	Factors					
	1	2	3	4	5	6
<i>MA1 – Organisational breadth ($\alpha = 0.85$)</i>						
Extent of dimensions of data collection	0.719	0.180	0.072	0.021	0.122	0.254
Extent of departments collecting data	0.817	0.146	0.106	0.090	0.070	0.033
Extent of dimensions of reporting	0.689	0.161	0.071	0.131	0.223	0.205
Extent of departments generating reports	0.747	0.289	0.038	0.078	0.232	0.000
Extent of departments budgeting	0.728	-0.051	0.180	0.099	0.069	0.019
<i>MA2 – Reporting and analysis ($\alpha = 0.79$)</i>						
<i>Ad hoc reporting</i>						
The user designs the reports himself	0.184	0.756	0.109	-0.010	-0.002	-0.007
The report is delivered to the screen	0.081	0.649	0.044	0.162	0.060	-0.131
Use of drill down	0.182	0.713	0.153	0.068	0.077	-0.007
Use of simulations and forecasts	0.027	0.615	0.184	0.097	0.227	0.218
Use of IIS in strategic management accounting	0.059	0.448	0.295	0.196	0.211	0.302
<i>MA3 – Non-financial, external and ad hoc management accounting ($\alpha = 0.80$)</i>						
Collection of non-financial, qualitative data	0.103	0.608	0.265	0.175	0.050	0.264
Collection of external data	0.083	0.174	0.742	0.081	0.118	0.101
Collection of data <i>ad hoc</i>	0.073	0.069	0.738	0.078	0.190	0.024
Reporting of non-financial data	0.101	0.295	0.625	0.026	0.006	-0.076
Budgeting on non-financial, qualitative metrics	0.162	0.121	0.732	0.162	-0.026	0.186
<i>MA4 – Budgeting ($\alpha = 0.79$)</i>						
Budgeting on non-financial, quantitative metrics	0.047	0.131	0.557	0.354	0.114	0.265
Sales are budgeted as units \times unit price	0.160	0.106	0.339	0.558	-0.080	0.227
Costs are budgeted as units \times unit price	0.111	0.155	0.094	0.876	0.143	0.060
<i>MA5 – Data collection ($\alpha = 0.72$)</i>						
Extent of hierarchy of dimensions	0.117	0.157	0.155	0.834	0.196	0.086
Registration of quantities (kg etc.)	0.194	0.389	0.115	0.031	0.477	0.227
Registration of unit price	0.138	0.191	0.032	0.280	0.675	-0.006
Calculated amounts are posted	0.360	0.104	0.053	0.082	0.747	-0.020
<i>MA6 – Allocation of costs ($\alpha = 0.72$)</i>						
Allocation of fixed costs to cost objects	0.088	-0.019	0.211	-0.018	0.669	0.292
Extent of cost drivers used for cost allocation	0.154	0.070	0.047	0.133	0.053	0.808
	0.153	0.043	0.199	0.110	0.194	0.758

Table AII.

Table AIII.

	Factors	
	1	2
Exploitation of IIS and support of management accounting by IIS (KMO = 0.84)		
<i>Fit1 - In general ($\alpha = 0.84$)</i>		
Extent of use of IIS for data collection	0.592	-0.373
Exploitation of IIS for data collection	0.715	-0.201
Extent of use of IIS for reporting	0.708	-0.289
Exploitation of IIS for reporting	0.800	-0.171
Extent of use of IIS for analysis	0.778	-0.063
Exploitation of IIS for analysis	0.785	-0.038
Extent of use of IIS for budgeting	0.554	0.702
Exploitation of IIS for budgeting	0.569	0.697
<i>Fit2 - Budgeting ($\alpha = 0.80$)</i>		
Extent of use of IIS for budgeting	0.554	0.702
Exploitation of IIS for budgeting	0.569	0.697

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