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Doctoral Thesis

Management accounting and integrated information systems: How to exploit the potential for management accounting of information technology

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Anders Rom

Management accounting and
integrated information systems

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How to exploit the potential for management
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How to exploit the potential for management
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CBS / Copenhagen Business School

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Anders Rom

Frederiksberg, February 2008

Chapter 1. Introduction

1.1 Motivation and purpose

1.1.1 From management accounting theory to practice: information systems as an explanatory variable

A lag seems to exist between management accounting techniques and management accounting practices of organisations (Bjørnenak, 1997a). The accounting lag exists in spite of the interaction taking place between academia and practice in terms of researchers conducting field studies and management accountants attending research-based courses before and during their careers in practice.

If the purpose of research in management accounting is to help companies improve management accounting practices, an understanding of what facilitates and what are barriers to the implementation of management accounting techniques is needed. Research on the accounting lag commenced in the 1980s (Ashton *et al.*, 1995). This research has for example resulted in investigations of how the relationship between conventional wisdom, research and practice can be understood (e.g. Bjørnenak, 1997a) and the diffusion of management accounting techniques (e.g. Bjørnenak, 1997b).

Several researchers claim that a prerequisite 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). Granlund (2001) studied management accounting change in a Finnish company. He identified a force field (Lewin, 1947) of facilitators and barriers consisting of economic, institutional, and human factors. Granlund (2001) identified advanced information technology as an economic facilitator of change.

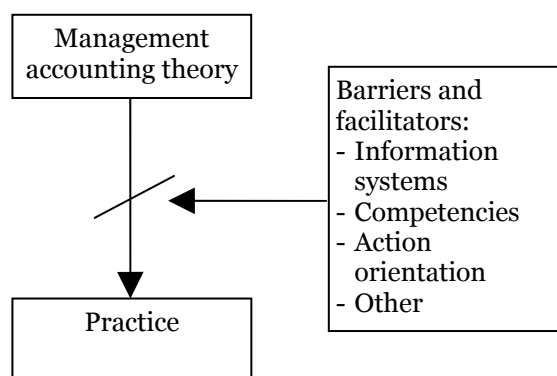
To Kaplan (1990) information systems are a facilitator as well. In his four-stage model, the development of costing systems is closely linked with information systems. In the fourth phase, the

organisation has an integrated cost system that facilitates different costing situations.

Information systems can also represent a barrier in that information systems and enterprise resource planning (ERP) systems in particular (Davenport, 1998) can be hard to change whereby management accounting cannot necessarily always be supported by the information system. Thus, information systems probably should be located on the list of facilitators as well as that of barriers.

Information technology has evolved quickly. In the 1990s, companies started purchasing ERP systems which are characterised by the integration of several business functions, sharing one database and by being real-time (Davenport, 1998, 2000). Today, 94.8% 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). These developments in information systems make it seem relevant to explore how information systems simultaneously constitute a facilitator and a barrier in relation to implementation of management accounting theory. This is illustrated in Figure I.

Figure I. Management accounting theory, practice and information systems



A difference exists between how companies theoretically should be able to make use of information systems to facilitate management

accounting and how companies are actually making use of information systems. Implementation of an ERP system is a complex task; and a study by Granlund and Malmi (2002) indicates that the complexity of ERP systems prevents companies from redesigning their management accounting. Rather, they prefer to implement their traditional management accounting in the ERP system in order to reduce complexity. Furthermore, a recurring argument for implementing ERP systems was the year 2000 problem that legacy systems were not expected to overcome. Thus, most organisations have other motives than implementing new management accounting techniques or revising existing ones when implementing new information systems.

An interview with an SAP consultant revealed that companies that have implemented an ERP system primarily make use of the ERP system for handling daily transactions, statutory reporting and simple internal reporting. No management accounting innovations (Bjørnenak and Olson, 1999) are implemented alongside implementation of an ERP system. Likewise, the financial manager of a company that has implemented Oracle Applications 11i says that focus was on ERP system functionalities at operational and tactical level. Later, when these things are in place, focus will be redirected to more managerial and strategic uses of the ERP system.

From the two interviews referred to above and research by for example Granlund and Malmi (2002), it seems that much unexploited potential of information systems exists. When taking a closer look at the researched relationship between management accounting and information systems, it is seen that the findings reported above are limited to ERP systems. Granlund and Malmi (2002) find that for example the balanced scorecard is implemented outside the ERP system. When scanning the market for BSC software, several non-ERP systems appear such as Corporater BSC and strategic enterprise management systems from SAP, Hyperion and Cognos. Should we expect ERP systems to be the primary facilitator of management accounting? Would it not be appropriate and rewarding to broaden our focus to include non-ERP systems as well when looking for information systems that support management accounting? Would we still experience limited support of management accounting practices if we asked companies about how information systems in general (as opposed to ERP systems in particular) support management accounting? It seems to be relevant

to broaden the scope of information systems; and when doing so, an unexplored field is revealed.

1.1.2 Purpose

The purpose of the current research project is derived from the above motivation. A research gap seems to exist with regard to how management accounting is supported by different information systems. Therefore, it is the purpose of this research project to develop an understanding of the relationship between management accounting and information systems where information systems are not limited to ERP systems. There seems to be potential for companies to make better use of information systems when performing or changing management accounting activities. This research project will try to uncover how information systems can offer support for management accounting and how they can be exploited.

1.2 Research paradigm

The research paradigm of the research project is the subject of this section. Several levels of methodology and method exist (Miles and Huberman, 1994; Mingers, 2001; Silverman, 2001; Ryan *et al.*, 2002). The distinction between and use of the terms methodology and method is ambiguous throughout the literature. Leonard-Barton (1990) and Silverman (2001) define methodology as selection of cases, methods for data collection and different types of data analysis, while they define method as specific techniques such as tests for significance, interview and observation. These two definitions are opposed to those of Ryan *et al.* (2002) who define methodology at a higher level of abstraction. Methodology is about the identification of the ontological and epistemological standing that impacts the research process. When using the term method, they write about types of case studies and selection of those. Further, Ryan *et al.* (2002) write that the case study as a method can be applied under different methodological orientations. Jick (1979), Birnberg *et al.* (1990) and Yin (1994) use the term method in a way similar to that of Ryan *et al.* (2002). Using the term methodology with reference to the research paradigm and the term method with

reference to for example the case study method seems to be the most widespread use of the terms within the literature of management accounting (e.g. Birnberg *et al.*, 1990; Modell, 2003) and integrated information systems (e.g. Mingers and Brocklesby, 1997). The definitions by Ryan *et al.* (2002) and Yin (1994) will be applied.

This section will discuss the paradigmatic standpoint of this research project. Chapter 3 and sections 4.2 and 5.2 contain a discussion of the methods applied. Methodology and method are separated since methodology needs to be considered before conducting a literature review (methodology among other things impact whether and to what extent a literature review is needed) while identification of a proper research method requires the existence of research questions, which will be developed on the basis of the literature review.

Any research is contingent upon the research paradigm applied and it is important to the researcher himself as well as to the reader of this thesis to know under which paradigm this piece of research has been conducted (Puxty, 1993). A framework of research paradigms has been developed by Burrell and Morgan (1979). A number of management accounting researchers (e.g. Hopper and Powell, 1985; Orlikowski and Baroudi, 1991; Laughlin, 1995; Brignall and Ballantine, 2004) build their discussions of methodology on this framework. Reading these publications, which build upon the framework by Burrell and Morgan (1979), it seems as if the framework has the power to support the discussion of the more fundamental choices that researchers make regarding the perspective from which the researched object or subject is approached. Although, the framework by Burrell and Morgan (1979) is extensively used, the incommensurability of methodologies is questioned (e.g. Orlikowski and Baroudi, 1991). Seeing the methodologies as complementarities rather than substitutes seems to be a more appropriate view. Nevertheless, the dimensions identified by Burrell and Morgan (1979) are still relevant, since the individual researcher cannot easily apply different paradigms as the paradigm is a rather personal characteristic of the researcher (Orlikowski and Baroudi, 1991).

The research paradigms of Burrell and Morgan (1979) vary along two dimensions. These are objectivity versus subjectivity and regulation versus radical change. Furthermore, the concepts of ontology, epistemology and the human nature are part of the identification of the paradigmatic standing (Hopper and Powell, 1985, p. 431).

It is the purpose of this research project to develop an understanding of the relationship between management accounting and information systems so that companies can make better use of information systems. The choice of paradigmatic standing will have this purpose as a reference point, since the selection of the most appropriate research methodology depends on the phenomenon being researched (Ryan *et al.*, 2002, p. 35).

When reviewing management accounting and information systems literature, it is seen that the discussions regarding methodology and method are, to a large extent, the same. Thus, the fact that this research project draws on two different research areas does not create problems when drawing on the two distinct areas in one research project.

1.2.1 Ontology, epistemology and the human nature

Ontology is about the nature of reality. The ontological assumption can be put on a continuum from reality as a concrete structure to reality as a projection of human imagination (Ryan *et al.*, 2002, p. 36). Information systems can be described in a technical language, and information systems have a set of characteristics that are independent of the company and the people using the system (e.g. an ERP system is modular, it contains real-time data and data come from different parts of the organisation). This implies that reality is independent of subjects. But it is not a closed system (Scott, 1998), as the information system and management accounting are dependent upon the context in which they operate. Furthermore, we are not operating with a fixed structure as things are expected to change.

Epistemology is about how knowledge is acquired and how it can be communicated (Hopper and Powell, 1985; Ryan *et al.*, 2002, p. 11). At one end of the continuum, knowledge is gained through observation, knowledge is cumulative and knowledge is transferable. At the other end of the continuum, knowledge is highly dependent on the subject that experiences things. With a purpose to understand in order to help companies improve, an epistemological standpoint of knowledge as something transferable is taken. Knowledge is dependent on the context and the subject, but knowledge can be made explicit and transferred (Nonaka, 1994).

Human nature refers to whether human behaviour is determined by the external environment or whether the behaviour of humans is unpredictable due to the autonomy of human beings (Hopper and Powell, 1985). The belief in the causal relationship claiming that companies will make better use of information systems if they understand how they can support management accounting, implies that human beings to some extent are predictable and rational of nature. Rationality is here defined as behaviour that is optimal in the pursuit of certain goals (according to Webster's online dictionary, www.websters-online-dictionary.org). But it is important to underscore that different kinds of rationales exist since goals can be pursued in many different ways. Salancik and Pfeffer write that "the term "rationalise" refers to any situation in which a person's action is described with reference to some supporting reason or cause" (1978, p. 231). Some specific behaviour might seem irrational from one theoretical standpoint but quite rational when applying another theory. Thus, one might argue that rationality is dependent upon the level of understanding of the researched phenomenon. That is, if the phenomenon is well described and understood from a range of different perspectives, certain behaviour can be explained by the existing theories. Thus, a broader range of behaviours seem rational as theories explaining behaviour are developed. With this research project, it is the aim to add to the body of knowledge and thus increase the domain of rationality. With this aim, the research project rests on the assumption that human behaviour to some extent is predictable and determined.

1.2.2 Objectivity versus subjectivity and regulation versus radical change

The three dimensions of ontology, epistemology and human nature are by Burrell and Morgan (1979) collapsed into one dimension of objectivity versus subjectivity since strong relationships exist between the three dimensions (Hopper and Powell, 1985). This research project is positioned in that end of the continuum closest to the objectivity extremity. Although believing in an objective reality, it is acknowledged that information systems do not exist independently of human beings. The information system has in itself no value unless it is able to have an effect on the behaviour of the organisation. This acknowledgement and awareness draws the methodology of the

research project away from the extremity of objectivity. To the research project this means that collection of data on for example number of ERP system modules implemented is supplemented with data on managers' use of and attitudes towards information systems. On the other hand, this research project will not dwell on projections of the human imagination in relation to management accounting and information systems. Thus, how the balanced scorecard is translated from a textbook technique into management in action will not be in focus.

The methodological framework of Burrell and Morgan (1979) has a second dimension that distinguishes between society as being held together by regulation, order and stability and society as being split by division of interest, conflicts and the unequal distribution of power (Hopper and Powell, 1985). In this research project, management accounting and information systems are considered tools for maintaining order in the organisation. Through better support from information systems, the management accounting of the organisation can be improved. Thus, in this research project management accounting and information systems are considered techniques for maintaining order. It is not questioned whether order and increased visibility are at the advantage of employers or employees or whether the implementation of an information system for the support of management accounting is initiated by managers or by employees.

1.2.3 Identification of a fixed research paradigm versus multi-methodology

Based on the discussion of the two dimensions of objectivity versus subjectivity and regulation versus radical change, the paradigm of the present research project is situated in the functionalist paradigm. Within the functionalist paradigm a number of schools exist (Hopper and Powell, 1985; Puxty, 1993). Among those we find the systems theory. One of the characteristics of the systems theory is that the field of management accounting is enriched by incorporating other fields of research. And that is what this research project is basically all about: combining the fields of management accounting and information systems research. This is to some extent similar to the contingency stream of management accounting research where for

example organisation and strategy theory are coupled with management accounting.

On the basis of the discussion of ontology, epistemology and human nature, the paradigm employed by this research project can be categorised as middle-range thinking as described by Laughlin: “This approach recognizes a material reality distinct from our interpretations while at the same time does not dismiss the inevitable perceptive bias in models of understanding” (1995, p. 81). The middle-range thinking breaks up with the fixed boxes of schools and paradigms.

Taking it one step further, the request for research employing multiple paradigms comes into mind (Orlikowski and Baroudi, 1991; Mingers and Brocklesby, 1997; Mingers, 2001; Brignall and Ballantine, 2004). The paradigms and schools represent different perspectives on the researched object. A fuller understanding of the relationship between management accounting and information systems can be achieved if multiple perspectives are employed. While multi-methodology should be strived for, the researcher has certain interests and predispositions that inevitably will lead to the choice of a primary perspective that is compatible with these interests and predispositions (Orlikowski and Baroudi, 1991). On the basis hereof, this research project will take its offset in systems theory within the functionalist paradigm.

1.2.4 Level of prior theorisation

To Yin “[...] theory development as part of the design phase is essential” (1994, p. 27). Theory development prior to the conduct of data collection is what distinguishes case studies from ethnography. With knowledge of the body of knowledge to which you want to contribute, you are able to identify gaps in theory that need investigation. Some degree of prior theorisation helps the researcher sharpen the research questions (Eisenhardt, 1989). When turning to literature that applies the quantitative research method, the need for prior theorisation seems to be even more outspoken since it hardly is possible to construct a survey instrument without knowledge of the constructs that you want to measure.

On the other hand, while advantages of some degree of prior theorisation exist, one must be careful not to let the literature

reviewed and the frameworks developed *a priori* limit the data collection and openness to new constructs and relationships (Dyer and Wilkins, 1991). Approaching the field (be it using qualitative or quantitative research methods) with a toolbox of constructs and expected relationships may blind the researcher so that unexpected phenomena are not captured.

Approaching the field with a *tabula rasa* or a well-developed set of hypotheses seems to be two ends of a continuum. Laughlin (1995) argue in favour of a middle-range approach where the better of the two extremes are taken advantage of. According to the middle-range approach, 'skeletal' theories are theories that are incomplete but yet they have some stability. 'Skeletal' generalisations are possible and we might have some broad understanding of the relationships. This broad understanding of relationships is provided by a literature review.

Whether the researcher should approach the field with a *tabula rasa* or with a well-conducted literature review and framework development is not an independent variable. It is tightly connected to the research methodology discussed above. Knowledge was regarded as being cumulative; and it is possible to transfer knowledge between subjects. But still, some knowledge may be dependent on the context and not easily transferred. A middle-range stance leaning towards knowledge being transferable defines the epistemology of this research project. The real world is external to the subject, and, thus, all does not depend on the eyes that are watching. But it is acknowledged that something depends on the eyes that are watching. On the basis hereof, a literature review is conducted. But the literature review and framework development will only result in a skeleton since the field of management accounting and information systems is an emerging and not fully exploited field of research.

1.3 Thesis structure and content

This section finalises Chapter 1, which contained the motivation and purpose of the research project. In addition hereto, the paradigmatic standing was discussed.

From a predominantly objective perspective, a literature review is needed in order to ensure that the present research project is a progression of prior research. Thus, a literature review of research on

management accounting and information systems is reported in Chapter 2. The chapter opens with an account of the method of the literature review. The recommendations for conducting a literature review by Webster and Watson (2002) are to a large extent followed. Definitions of the key variables of management accounting and information systems are discussed in section 2.3 in order to set the boundaries of the literature review. Sections 2.4 and 2.5 represent a mutual dependency in that section 2.4 develops a theoretical framework on the basis of prior research while section 2.5 presents and discusses prior research structured according to the theoretical framework. On the basis of the literature review, research gaps are identified and the research questions of this research project are identified.

When research questions are identified, it is time for identifying the appropriate research method. This is done in Chapter 3. The chapter only contains an initial identification of the research method and the research approach of the individual research questions as well as discussions of validity and reliability where triangulation across research questions is one theme among several. Discussions of details of research method and research design are located in connection to the three studies answering the three research questions, which is much in the same way that the method of the literature review is discussed in connection to the literature review.

Chapter 4 and Chapter 5 report on the two empirical studies. A survey on management accounting and information systems is reported in Chapter 4 and a case study of Danish Broadcasting Corporation is reported in Chapter 5. The two empirical studies are reported using similar structures. Each chapter begins with an introduction where the research question is re-stated and briefly discussed. The next section of each chapter contains the research method. Hereafter, a description of the subject of analysis is presented. With regard to the survey, it is described in terms of descriptive statistics while description is equal to company presentations with regard to the case study. Both chapters contain an analysis of the empirical material. The methods of analysis differ from one study to the other dependent on the overall research method and research approach. The findings are then discussed in relation to existing theory as presented in the literature review. The chapters finalise with a brief summary and introduction to the next chapter.

The thesis concludes with a cross-study discussion where the findings of the two studies are discussed in relation to each other and in relation to existing literature. The results of the research project are wrapped up in a conclusion. Finally, avenues for future research are discussed.

Chapter 2. Literature review

2.1 Introduction

It is the purpose of the present research project to investigate the relationship between management accounting and information systems. Although it is a research area in which not much research has been conducted and calls for further research are numerous (e.g. Hunton, 2002; Granlund and Mouritsen, 2003; Chapman, 2005), some research exists. It is the purpose of this chapter to review this literature.

The method of the literature review is discussed in section 2.2. Key concepts of research in management accounting and information systems are defined in section 2.3. The theoretical framework synthesising research within the field of interest is developed in section 2.4. The literature review of section 2.5 is centred on concepts and their relationships, and within each relationship i) the theoretical logic is discussed, ii) research findings are reported and iii) applied research methods and paradigms are identified. In section 2.6 directions for future research are suggested. Finally, in section 2.7 I identify the research questions that will be investigated in this thesis.

2.2 The method of the literature review

2.2.1 Identifying relevant literature

In order to identify all relevant literature within the topic of management accounting and information systems, the recommendations by Webster and Watson (2002) were followed. The literature search includes the following steps:

1. Keyword search using the database called Business Source Complete
2. Review of relevant journals

3. Review of relevant conferences
4. Review of references of publications identified in step 1, 2 and 3 (going backward)
5. Identification of publications citing the key publications (going forward)

It is the purpose of the literature review to identify theories and concepts within the research field of management accounting and information systems. Thus, saturation of the publication search was reached when new publications did not seem to add new theories or concepts (Webster and Watson, 2002). Therefore, not all publications on the topic of management accounting and information systems are included in the literature review.

Several methods for retrieval of relevant literature are used. The purpose of the method triangulation was to ensure that no relevant publication was overlooked during the literature search. The triangulation of search methods seemed to be fruitful as new publications were found during each step. Each of the methods is now described in turn.

2.2.1.1 Keyword search

The database of Business Source Complete is the search engine most often used at the Copenhagen Business School (CBS) Library. The database contains approximately 7,600 journals, company profiles and country reports. On the basis hereof, this database was selected for the keyword search.

The search was restricted with regard to publication type in that only academic journals were included. Doing this, publication types such as business journals and books were excluded. Arguments for this delimitation are that the quality of academic journals is considered higher than business journals and newspapers. Books are excluded as they to a large extent represent research that previously has been published in article format (e.g. Davenport, 1998 (article) and 2000 (book)). Important books and monographs are captured by following the references of found articles (search method number 4). Finally, the delimitation with regard to publication type ensures that a manageable list in terms of number of publications is produced. That

a manageable number of publications are provided is important since the review of a large number of publications tends to lower the quality of the scan.

The second dimension of delimitation was the year of publication. The search was delimited to the years 1998 – 2005 (the literature review was updated the last time in 2005). Although the topic of management accounting and integrated information systems is not a new one (Chapman, 2005), the emphasis will naturally be on recent types of technologies such as ERP and SEM systems. These systems gained foothold in business in the mid-1990s; and especially the entry of the new millennium brought with it high activity with regard to implementation of ERP systems. Since research seems to be lagging behind the development in business, most research on the topic is conducted after 1998. Relevant articles published prior to 1998 were captured by the review of references. Furthermore, also the delimitation with regard to year of publication results in a manageable number of publications.

Finally but most importantly, the possibility to restrict the search to a set of keywords was used. Combinations of keywords regarding management accounting and information systems respectively were entered into the 'search for' string. Keywords regarding management accounting include 'management accounting', 'management control', 'performance measurement', 'cost accounting', 'balanced scorecard', 'BSC', 'activity-based costing' and 'ABC'. Keywords regarding information systems include 'enterprise resource planning', 'ERP', 'strategic enterprise management', 'SEM', 'information system', 'best-of-breed', 'business intelligence', 'management accounting system' and 'enterprise system'. By including the keyword 'information system', the terms 'integrated information system', 'management information system', 'accounting information system' and 'executive information system' were captured. The number of searches run equalled the number of keywords regarding management accounting multiplied by number of keywords regarding information systems.

When the database returned the list of found publications, the publication titles were scanned. The large number of documents did not allow for reading all the abstracts. Publications were not excluded on the basis of research methodology or method. Publications were only selected if they had some relation to both management

accounting and information systems. Otherwise, the number of publications would have been very large.

In most cases, an electronic copy of the publication was available and it was then stored on the laptop computer. The remaining publications were obtained with the help of the librarians of the CBS Library. These publications were scanned and then stored on the laptop computer.

Finally, in order to reduce the number of publications that the keyword search resulted in, the abstracts were read.

2.2.1.2 Review of relevant journals

The second search method applied was the review of relevant journals. The list of relevant journals was identified from the publications found using the previous search method. The quality of read publications was used as an indicator of which journals to comprehensively review. The review of the journals was delimited to the years 1998 – 2005. Forthcoming articles available on the journal websites were also scanned. The reviewed journals include accounting journals, accounting information systems journals, information systems journals and management journals. See the list of journals reviewed in appendix 1.

An alternative way of identifying journals for review would be to identify the journals by reviewing previous literature reviews or publications identifying journals within management accounting and information systems. While literature on accounting information systems (AIS) has been reviewed (e.g. Poston and Grabski, 1999, 2000) and AIS outlets have been identified (e.g. Harper and Cerullo, 1992; Arnold, 1993; Baldwin *et al.*, 2000) these lists of journals are relevant to AIS research and to a lesser extent to research within management accounting and information systems. If such lists of journals were relied on in this literature, review publications in for example *Accounting, Organizations and Society* (e.g. Quattrone and Hopper, 2005), *European Accounting Review* (e.g. Hyvönen, 2003) and *Journal of Enterprise Information Management* (e.g. Spathis and Ananiadis, 2005) would not have been identified.

Relevant publications were identified on the basis of their title. The list of publications was further reduced by reading the abstracts.

2.2.1.3 Review of relevant conferences

A number of relevant conferences are regularly arranged at which papers on management accounting and information systems are presented. These conferences are 'Annual Congress of European Accounting Association', 'Annual Meeting of American Accounting Association', 'European Conference on Accounting Information Systems', 'New Directions in Management Accounting', 'Workshop on Performance Measurement and Management Control', 'Global Management Accounting Research Symposium', 'Manufacturing Accounting Research Conference', 'International Research Symposium on Accounting Information Systems', 'Asia/Pacific Research Symposium on Accounting Information Systems' and 'International Conference on Enterprise Systems and Accounting'.

Not all conferences make the presented papers publicly available, but conferences where papers or at least a program with the title of the papers are publicly available are reviewed. Only the last conference is reviewed. The argument for this is that high quality conference papers are succeeded by journal articles (e.g. Booth *et al.*, 2000a (conference paper) and 2000b (journal article)), and they will be captured by the four other search methods applied.

2.2.1.4 Review of references of publications (going backward)

During the reading of the publications that were identified during step 1, 2 and 3 described above, all relevant references were pursued. The pursuit of references was not delimited by publication type or publication year. Thus, this search method resulted in a number of older publications as well as monographs.

Abstracts were read in order to reduce the number of publications identified using the search method.

2.2.1.5 Identification of publications citing the key publications (going forward)

Using ISI Web of Knowledge (www.isiwebofknowledge.com) (the electronic version of the Social Sciences Citation Index), I searched

for publications referring to the key publications identified during steps 1, 2 and 3 described above. While this search method seems promising like the others, it has one major weakness. Only a limited number of journals and no conference proceedings are included in ISI Web of Knowledge. Thus, I was not able to conduct an exhaustive 'going forward' search. But a search was conducted on the key publications that could be found on ISI Web of Knowledge.

2.2.2 Reading, analysing and reporting the publications

The literature review is concept-centric rather than author-centric (Webster and Watson, 2002) or paradigm-centric (Burrell and Morgan, 1979; Hopper and Powell, 1985; Puxty, 1993; Ryan *et al.*, 2002). In order to identify concepts within the literature on management accounting and information systems, notes were taken on the key concepts and their relationships when reading the publications.

A theoretical framework will be developed. This will be done by analysing the existing frameworks' ability to embrace all existing research within management accounting and information systems. A new theoretical framework, that extends the existing ones, will be developed. The literature will be reviewed with reference to the theoretical framework. To the extent that concepts and relationships are empirically investigated, the findings will be reported. Suggestions for further research will be supplied for concepts and relationships that lack empirical investigation.

2.3 Definitions of key variables

Like Foster and Young (1997) and Williams and Seaman (2002) this research will start with a definition of key concepts (management accounting and information systems). The definition guides the development of a theoretical framework, the literature review and the identification of research questions of the research project.

2.3.1 Management accounting

2.3.1.1 Definition of management accounting

In order to define management accounting, definitions were sought for in management accounting textbooks and institutes of management accounting (Chartered Institute of Management Accountants (CIMA) and Institute of Management Accountants (IMA)). These are the places where one can expect to find definitions that have been through a thorough process of refinement.

Management accounting is by CIMA defined as “the process of identification, measurement, accumulation, analysis, preparation, interpretation, and communication of information (both financial and operating) used by management to plan, evaluate and control within an organisation and to assure use of and accountability for its resources” (2005). The definition by IMA is referred by Atkinson *et al.*: “The Institute of Management Accountants has defined management accounting as: a value-adding continuous improvement process of planning, designing, measuring, and operating both non-financial information systems and financial information systems that guides management action, motivates behaviour, and supports and creates the cultural values necessary to achieve an organization’s strategic, tactical, and operating objectives” (2004, p. 3).

The first textbook definition is supplied by Horngren *et al.* who define management accounting as follows: “Management accounting measures and reports financial information as well as other types of information that are intended primarily to assist managers in fulfilling the goals of the organisation” (2005, p. 5). Goal attainment is also crucial in the definition supplied by Worre in which management accounting is defined as “deliberate goal-oriented decisions, specifically in consideration of finances as goal element” (1991a, p. 6; translation of original text). Finally, Kaplan and Atkinson state that “management accounting systems provide information to assist managers in their planning and control activities. Management accounting activities include collecting, classifying, processing, analyzing, and reporting information to managers. [...] The scope of management accounting extends beyond traditional measures of the costs and revenues from the transactions that have already occurred to include also information on sales

backlogs, unit quantities, prices, demands on capacity resources, and extensive performance measures based on physical or non-financial measures” (1998, p. 1).

First, all five definitions put heavy weight on information. Information is not delimited to financial information as all five definitions explicitly state that management accounting is about financial as well as non-financial information. Thus, the type of information is not what delimits management accounting. Since management accounting is information-centric, fertilising research on management accounting with research on information systems seems promising.

Second, managers are external to management accounting. It is the role of management accounting to assist or guide managers. Managers use management accounting information to fulfil the goals of the organisation by for example planning and controlling activities.

Third, if managers and their actions are external to management accounting, so is management control. Management control (see e.g. Flamholtz *et al.*, 1985; Emmanuel *et al.*, 1995; Simons, 1995; Anthony and Govindarajan, 2003) is a broader concept that also embraces for example the design of the organisation.

Fourth, management accounting has a number of tasks in relation to assisting manager’s decision making (the tasks identified by Worre (1991a, pp. 6-12) differ from the tasks of the remaining definitions). The first task regards building up a database of information. This task includes the activities of measuring, collecting and classifying information. The second task is to analyse the information so that it is more easily used by managers. The third task is to report or communicate the information that has been collected and analysed.

The definitions supplied by all five sources seem to be very much in synch. In order to provide a comprehensive definition, management accounting is in this thesis defined as the collection, analysis and reporting of information in order to assist managers in reaching the goals of the organisation.

Management accounting is in the next four subsections broken down into four parts. By doing this, the multi-faceted features of management accounting are hopefully captured.

2.3.1.2 Tasks

Since tasks of management accounting are an essential part of the definition of management accounting, the framework should have a task focus. A task focus is also what March and Smith (1995) and Mauldin and Ruchala (1999) wish to bring into research on accounting information systems. Furthermore, research on the relationship between management accounting and information systems indicates that a distinction between different tasks is needed. Among others Booth *et al.* (2000a) find that ERP systems are effective with regard to transaction processing and less effective with regard to reporting and decision support. The tasks that will be used throughout this thesis are data collection, analysis and reporting following the definition of management accounting.

The present definition of management accounting tasks takes its departure in the literature on management accounting and information systems. As a consequence, the definitions of management accounting tasks put forth by Danish scholars in managerial economics (e.g. Madsen, 1963, pp. 18-20; Worre, 1991a, pp. 6-12) are different from the present definition.

2.3.1.3 Techniques

In order to produce information that can be reported to managers, a choice of what management accounting technique (by some authors also referred to as management accounting models; Bjørnenak and Olson, 1999) to apply must be made. How should customer profitability be calculated? What measures should be included when measuring the performance of departments or individual managers? What should a report to be used for cost control look like? Techniques such as activity-based costing (ABC), target costing, strategic management accounting, the balanced scorecard (BSC), contribution margin analysis and life cycle cost analysis are all well known examples of management accounting techniques.

Techniques vary with regard to a number of design characteristics. Cooper and Kaplan (1998) suggest that differences between operational control and activity-based costing be described according to overall purpose, cost of resources used, frequency of updating, measurement demands, scope of system, definitions of costs and cost

variability. Some of these design characteristics of management accounting techniques are relevant to cost accounting techniques only. Cooper and Kaplan (1998) use these design characteristics in an analysis of whether integration of cost systems is relevant to both operational control and activity-based costing (two management accounting techniques). Bjørnenak and Olson (1999) describe management accounting innovations (management accounting techniques that are perceived as new by the social system; Bradford and Kent, 1977) along the design characteristics called descriptive objects, causal variability factors, time, number and lifetime and user aspects. Within each of the five design characteristics, the authors identify how management accounting innovations differ from conventional management accounting techniques.

Since management accounting techniques are an important part of providing accounting information to managers, the theoretical framework should also have a focus on management accounting techniques.

2.3.1.4 Organisation of management accounting

Tasks and techniques do not provide management information themselves. The management accounting tasks must be delegated to people within the organisation. How tasks are dispersed throughout the organisation is an area within which research is conducted and also needed. The implementation of an ERP system seems to be able to open up new ways to disperse management accounting and control throughout the organisation (e.g. Lodh and Gaffikin, 2003; Quattrone and Hopper, 2005). The role of the accountant is an essential theme within research in management accounting and information systems.

2.3.1.5 Behaviour, use and perceptions in relation to management accounting

The behaviour, use and perceptions in relation to management accounting can be viewed from a functionalist as well as an interpretive perspective. From an interpretive point of view, management accounting is considered to be non-human actors that like human actors have the ability to play a role (actor-network

theory). Furthermore, management accounting goes through a translation process that is dependent on time and space (sociology of translation). Within the functionalist paradigm, the behavioural consequences of implementing new management accounting techniques are studied (e.g. Bhimani and Pigott, 1992) as well as how accounting information systems are used (e.g. Birnberg *et al.*, 1983). From an AIS perspective, behaviour is studied in relation to for example carrying out different management accounting tasks with the support of an information system (Rose, 2002).

2.3.2 Information systems

2.3.2.1 Definition of information systems

The study of information systems in a business setting is a relatively extensive discipline. Information systems are many, and many terms are used. Sometimes the different terms cover different types of information systems. At other times, different terms cover the same type of information system. At yet other times, the one type of system is referred to by several different terms. Thus, the types of systems and terms seem to be overwhelming and a uniform taxonomy seems to be needed. In this section, information systems including their component parts and characteristics will be defined.

That information systems are able to deliver support for management accounting is not a new idea. On the other hand, it is argued that the first use of information systems was in relation to accounting (Brady *et al.*, 2001, p. 18; Shields, 2001, p. 3). It was the purpose of the first information systems to automate the processes of for example posting transactions to journals and sorting the transactions according to the chart of accounts of the general ledger. Regardless hereof, though, it seems as if research within management accounting and information systems is coming to live again.

What is new with regard to the support of information systems for management accounting is the advent of integrated information systems (IIS). Previously, each function within the organisation had its own information system that operated separated from the information systems of the other organisational functions (Davenport, 1998). The sales department had an information system

for keeping track of their sales activities, recording sales and developing sales forecasts. The manufacturing department had their own information system for production planning, and the accounting department had a third information system for keeping the accounts. This situation of information islands was the state of affairs up until the beginning of the 1990s. On the basis hereof, it seems relevant to focus on integrated rather than disintegrated information systems.

With the introduction and wide-spread adoption of the so-called enterprise resource planning (ERP) systems in the 1990s, new potentials of integrated information systems to support management accounting seem to have emerged. One of the major arguments for companies to replace old legacy systems with integrated ERP systems was the wish to avoid maintaining the same data in several different places (Hyvönen, 2003). This data redundancy was costly as for example the master data of products was to be maintained in the information system of the sales department as well as that of the production department (Davenport, 1998). Furthermore, the company did not always manage to keep all versions of the data up to date which caused decisions throughout the organisation to be made on basis of different data. Finally, the accounting department spent major parts of their time reconciling data that the department collected from the other departments of the organisation. The integrated information system has the potential to correct these inefficiencies.

ERP systems are not the only systems that have the potential to support management accounting. The balanced scorecard is for example implemented with software from for example Hyperion and QPR and budgeting is supported by software from Cognos (Fahy, 2001). Thus, other information systems than ERP systems should be included in the range of information systems that support management accounting. Following this line of argument, Shields (2001, p. 10) introduce the term 'extended enterprise system' (XES) that encompasses for example ERP systems, data warehouses as well as executive portals.

In order to underscore that the essential characteristic of the new information systems is that they are integrated, the term 'integrated information system' will be used. The term refers to a system of systems including both transaction-oriented ERP systems and analysis-oriented systems such as balanced scorecard and budgeting

applications such as those from Cognos and Hyperion (Clark, 1997; Classe, 1998; Dragoon, 2003), as they conform to the demands of formal integration and being real time. IIS does not include, for example, spreadsheets when they are not an integrated part of the system.

A defining characteristic of an IIS is that it to some extent is integrated. Booth *et al.* (2000a, p. 3, elaborating on Bhatt, 1995) identify three dimensions of integration: data integration, hard-/software integration and information integration. Data integration refers to the aforementioned characteristic of IISs that data are stored and maintained at only one place. Hard-/software integration is about network connectivity in that computers can communicate with one another. While data and hard-/software integration refer to the technical aspects of integration, information integration refers to the business aspects. Information integration is about the interchange of information between different departments, i.e. that technical integration is made use of in the business processes. In this thesis, the relationship between management accounting and IISs is looked into. When doing so, the concept of information integration belongs to the management accounting domain. Data integration and hard-/software integration remain as characteristic of IISs. One can argue that having one graphical user interface is not an absolute necessity as long as data are integrated. Thus, individual information systems are included within the definition of IIS as long as they integrate to the remaining IIS at the data level.

Other defining characteristics of an IIS are that they operate on a real-time basis, that they are comprehensive functionally as well as institutionally and that they are based on client/server technology. IISs are not necessarily modular as an IIS can consist of one information system with several modules or of several individual systems that are integrated at the data level. The support for management accounting is found in several different parts of an information system. As Gelinis *et al.* put it: “So it is that historically an IS incorporated a separate accounting information system (AIS), a specialized subsystem of the IS. The purpose of this separate AIS was to collect, process, and report information related to the financial aspects of business events. [...] However, given the integrated nature of information systems today, we seldom can distinguish an AIS that is separate from the IS” (2005, p. 15). Gelinis *et al.* (2005) refrain from defining the term ‘accounting information system’ since the AIS

is not any distinct system any longer. Following this, my definition of IIS is broader than just a focus on accounting information. But only IISs that support management accounting are subject to scrutiny of this thesis.

2.3.2.2 Characteristics

Some characteristics of integrated information systems were referred to when defining them. From the literature on integrated information systems, a number of characteristics are identified. While software can be described in terms of its general characteristics, focus in the thesis is on the characteristics of IISs of organisations. In this way SAP's ERP system might be broad in scope, but an individual implementation of SAP can be rather narrow if only few modules are implemented. The characteristics of IISs and their components are:

- Integration
- Transaction-orientation vs. analysis-orientation
- Flexibility
- Scope
- Functionality
- Complexity
- User-friendliness
- Ease of implementation

Apparent from the above discussion of IISs is the focus on integration (see e.g. Davenport, 1998; Booth *et al.*, 2000a). Previously, ERP systems vendors focused on developing applications supporting all business needs. Today, they focus on providing a system that can be integrated with almost any other system (see Gelinias *et al.* (2005, p. 45) on enterprise application integration (EAI); e.g. the focus on the .net technology by Microsoft).

Information systems can focus on transactions (as in an account's receivable module where track is kept of transactions with customers) or of analyses (such as data mining). Transaction-

oriented information systems handle many transactions, and typically it is important that data contain high validity. Analysis-oriented information systems care less about the validity of data and focus on aggregated data.

The characteristic of flexibility refers to the extent to which the IIS component can be configured to match the needs of an organisation. Flexibility is needed when the information system is set up for the first time because ways of doing business should be supported by the system and not *vice versa* (Davenport, 1998). When the system is up and running, flexibility is about the ongoing adjustment of the system to match the changing nature of the business.

Scope is about the breadth of the information system. ERP systems can be considered broad-scope systems while best-of-breed (BoB) systems are narrower in scope (Hyvönen, 2003). In addition to measuring scope at the information system level, scope can also be measured with regard to the scope of the IIS within a given organisation. A broad-scope information system can be used quite narrowly within a specific organisation.

Functionality is about the depth of the system. Best-of-breed systems tend to have good functionality as they are niche applications. Some years ago, the ERP systems lacked functionality in some specific areas, but ERP systems are closing the gap to best-of-breed systems.

Complexity seems to be another important characteristic (see e.g. Granlund and Malmi, 2002). Although related, complexity is distinct from functionality in that an information system with a lot of functionality does not need to be complex. Complexity is about the structure of the system. Are great skills and extensive training needed to operate the system?

The negative impact of complexity can be reduced by designing the information system so that it is user-friendly. User-friendliness is among other things about layout of the graphical user interfaces. Is it intuitive and can non-expert users find their way around?

The level of effort needed to implement an information system differs from system to system. Implementation of an ERP system is a major undertaking that can take several years (Davenport, 1998). At the other end of the scale is a narrow-scope best-of-breed system that the organisation can almost implement themselves without any assistance from consultants. Thus, a way of measuring ease of

implementation is to investigate the relationship between license costs and costs of consultants and own employees.

An alternative list of characteristics of the AIS is supplied by Gordon and Miller (1976). What is characteristic of this list is that it contains elements such as valuation methods and performance evaluation. Such elements belong to the management accounting side of the relationship between management accounting and the IIS. Again it is underscored that this thesis tries to separate management accounting and integrated information systems in order to better analyse their interrelationship. Another point is that when looking at the list by Gordon and Miller (1976), the use of terms such as AIS and management accounting systems (MAS) differ from author to author and from research stream to research stream. Research on MAS is not necessarily research on integrated information systems and management accounting in the sense that this thesis represents.

2.3.2.3 Components

Following the definition of IIS, an IIS consists of several subsystems (be they modules within one single software package or be they a number of individual systems that are integrated). Using the eight characteristics of IISs, groups of IIS components seem to exist. These are transaction-oriented information systems and analysis-oriented information systems. Using the characteristics identified above, these two groups of IIS components will now be discussed in turn.

One subsystem of the IIS is the aforementioned ERP system. Research on management accounting and information systems has primarily considered this part of the IIS. A number of definitions of ERP systems is offered by different researchers (e.g. Davenport, 1998; Booth *et al.*, 2000a; Maccarrone, 2000; Granlund and Malmi, 2002; Spathis and Constantinides, 2004). What is common to these definitions of ERP is:

- Integration
- Process orientation
- Share common data
- Produce real-time data

- Module-based
- Support all functions within an organisation
- Use client/server technology
- Are built on an integrated data warehouse
- Configuration-based as opposed to standard or custom-built

The probably best known ERP systems vendor is SAP AG which was established back in 1972 by a number of systems analysts from IBM (Brady *et al.*, 2001, p. 21). The current version of their ERP system is mySAP ERP 2005 which, in contrast to the previous version called R/2, is based on a three-tier technology. mySAP ERP 2005 consists like other ERP systems (e.g. Oracle Applications 11i and Microsoft Business Solutions (MBS) Dynamics AX) of a number of modules. Among these modules are sales and distribution, materials management, production planning, human resources, general ledger, controlling and projects. This list is not exhaustive, and the modules may have different names from vendor to vendor. In addition to these core modules of the ERP system, more advanced modules such as SCM, CRM and e-procurement are added (Wieder *et al.*, 2004). These latter modules are also operating at the transactional level, but they offer functionalities not offered by the core modules of the ERP system. Furthermore, many ERP systems vendors offer so-called industry solutions. An industry solution is a pre-configured (at least to some extent) version of the ERP system. All modules are available to all customers, but when buying an industry solution you avoid some of the work in relation to module selection and configuration (Brady *et al.*, 2001, p. 25).

ERP systems are also referred to as transaction-oriented information systems. Their focus is on the operational and tactical levels. ERP systems are good at handling transactions (Booth *et al.*, 2000a; Granlund and Malmi, 2002; Hyvönen, 2003) such as order entry and registration of vendor invoices. They are also good at compiling a production plan on the basis of sales forecasts, bills of materials and capacity availability. While ERP systems are almost all-encompassing, there might be niches that ERP systems do not support. Furthermore, since ERP systems are almost all-encompassing, their depth or functionality is not always as large as

their scope. Thus, to the group of transaction-oriented information systems belong also best-of-breed systems such as route planners for the transportation industry. Trucks, truck drivers and orders are stored in the ERP system, but the route planning system is a separate piece of software (see Moriarty (1999) and Hyvönen (2003) for a discussion of ERP and BoB systems).

Fahy (2000) argues that ERP systems lack comprehensive reporting and analysis functionalities at the strategic level. Fortunately, other systems focus on reporting and analysis. These systems will be referred to as analysis-oriented information systems. To stay in the world of SAP, an example of such a system is the strategic enterprise management (SEM) suite by SAP. Brignall and Ballantine (2004) define an SEM system as a system that is built on an ERP system that 1) relies on data warehousing tools, 2) has a range of integrated applications such as planning and simulation, 3) has both an internal and an external focus; and finally 4) supports strategic decision-making.

The definition of SEM supplied by Gould is slightly different. He writes: "[...] a working definition could be: An approach to strategic management which focuses on creating and sustaining shareholder value through the integrated use of best practice modelling and analysis techniques, technologies, and processes in support of better decision making" (2003, p. 6). What is characteristic of this definition is that SEM includes processes as well as technologies. Thus, an SEM system is not just the information system but a wider system of technologies, techniques and processes. Likewise, Romney and Steinbart (2000, p. 2) define an AIS as consisting of people, procedures and information technology, and Dechow and Mouritsen (2005) distinguish between ERP as a technology and ERP as a system. While the focus in this thesis is on the relationship between management accounting and integrated information systems, these definitions of SEM, ERP and AIS are not workable in this context.

The modules of SAP's SEM system are Business Planning and Simulation, Business Consolidation, Strategy Management, Performance Measurement and Stakeholder Relationship Management (SAP, 2004b). The Business Planning and Simulation module supports the task of budgeting. This module acknowledges the user-friendliness of Microsoft (MS) Excel and the user interface is built around MS Excel. The Strategy Management module is a

balanced scorecard module with the functionality of 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.

Analysis-oriented suites are also offered by the other major ERP vendors such as Oracle. The range of SEM systems is not limited to systems supplied by the major ERP vendors and thus also includes suites from Cognos and Hyperion, as they conform to the demands of true integration and real time (Clark, 1997; Classe, 1998; Dragoon, 2003; Brignall and Ballantine, 2004). The analysis-oriented suites from for example Cognos and Hyperion are also module-based.

Finally, the analysis-oriented part of the IIS can consist of products that focus on only one management accounting technique. An example of this is the balanced scorecard software called Corporater BSC. Thus, the analysis-oriented information systems can in addition to an SEM suite consist of a number of BoB systems that focus on supporting individual techniques such as consolidation, activity-based costing, the balanced scorecard, performance management, shareholder value management and budgeting. While BoB systems are usually not a suite with an integrated user interface (software integration), they still make use of the same data (data integration) as the rest of the analysis-oriented information systems. Consolidation takes place among the BoB products and develops towards more fully integrated SEM suites.

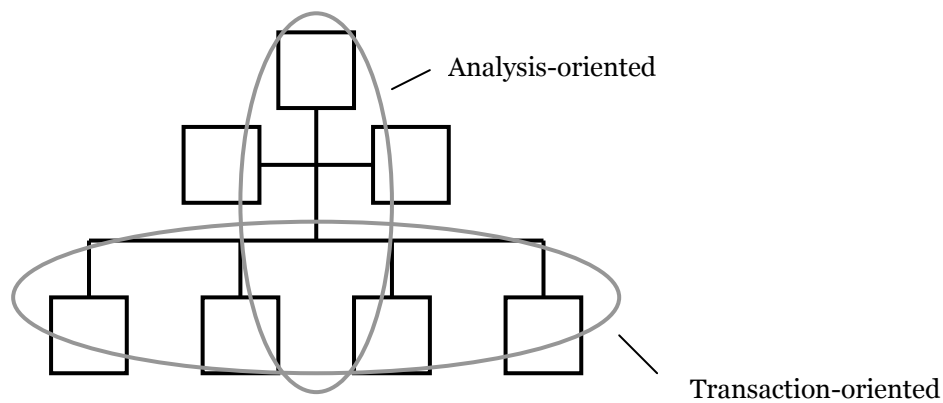
The two groups of components of the IIS can have different degrees of integration. Table I describes transaction-oriented and analysis-oriented information systems that are both available as suites or best-of-breed applications.

Table I. The two groups of components of the IIS along the dimension of integration

	Transaction-oriented information systems	Analysis-oriented information systems
Suites	ERP systems such as mySAP ERP 2005 and Oracle Applications 11i.	SEM systems such as SAP SEM and Hyperion System 9.
Best-of-breed	For example specialty software for route planning such as that from Transvision or CRM software from Siebel/Oracle.	For example Corporater BSC. Other examples of systems in this category are dedicated query tools, ABC systems, business intelligence systems and executive information systems.

Figure II illustrates how transaction-oriented information systems typically operate at the transactional level (Hyvönen, 2003), while analysis-oriented information systems typically operate at the strategic level (Fahy and Millea, 2001; Brignall and Ballantine, 2004).

Figure II. Transaction-oriented information systems, analysis-oriented information systems and the organisation



2.3.3 The definitions set the boundaries of the literature review

The boundaries of the literature review are defined by the definitions of management accounting and IIS given above. Literature that deals with the relationship between management accounting and IIS is included in the literature review, while the remaining literature is not. Though this sounds very easy, it has sometimes been hard to decide whether a certain publication should be included or not. An example of such a publication is Dunk (2004). He investigates the impact of customer profiling, competitive advantage and quality of information systems information on the use of product life cycle cost analysis. The study was excluded from the literature review since it obviously deals with management accounting but not directly with IIS.

Another example of an excluded publication is that by Hunton and Gibson (1999) in which they investigate whether users produce more inputs to the systems development process when they work alone or when they work in groups. The IIS is represented in the study but content of management accounting is very limited.

2.4 Development of a theoretical framework

The purposes of the framework to be developed in this chapter are several. Most importantly, the framework should provide a tool for mapping current research so that research gaps can be identified. On the basis of identified research gaps, directions for future research can be identified and the research questions of this research project can be developed.

A second purpose is to develop a framework that can guide researchers investigating management accounting and IIS. The framework should be exhaustive so that all aspects of the relationship between management accounting and IIS are included. This second purpose is rather descriptive by nature. Third, the framework should be usable for people designing management accounting systems and IISs in practice. By using the framework, practitioners should be able to design a better management accounting and integrated information system than would otherwise be the case. This third purpose is normative by nature.

2.4.1 Discussion of existing frameworks

As the purpose of the framework needed in the current situation is to be able to map all existing and future research within management accounting and IIS, the criteria function of the framework is to encompass the aspects of management accounting and IIS as identified in the definitions section above. Furthermore, the variables that in different ways impact the relationship between management accounting and IIS must also be included. Finally, the framework should also be independent of the research paradigm in that research within all paradigms should be includable.

Existing frameworks on management accounting and IIS do not seem to be able to fulfil the primary purpose of a framework stated above and score high on all dimensions of the criteria function. Most management accounting and control frameworks (e.g. those by Flamholtz *et al.* (1985) and Simons (1995)) do not explicitly incorporate the IIS. The same goes with regard to frameworks within information systems research (e.g. Dehning and Richardson (2002) and DeLone and McLean (2003)) as they do not explicitly incorporate management accounting.

Some frameworks exist that deal with both management accounting and IIS. An example of such a framework is that by Mauldin and Ruchala. Their framework is task focused: “A primary result of this paper is the proposition that an AIS research model should be reoriented around a task focus” (1999, p. 318). This is in accordance with March and Smith who write that “technologies are often developed in response to specific task requirements using practical reasoning and experiential knowledge” (1995, p. 252). The framework by Mauldin and Ruchala (1999) is centred on four organising principles: i) task focus, ii) design process, iii) contingency factors and iv) task performance. As such tasks could be management accounting tasks as well as tasks in a production department, the focus on management accounting does not seem to be strong enough.

That task characteristics impact task performance is also the theme of the framework developed by Dehning and Richardson (2002) (see also Barua *et al.* (1995) and DeLone and McLean (1992, 2003) who develop comparable frameworks). While their framework as such does not include management accounting, it has a clear logic that

could be used in some form in the framework that will be developed. The main content of their framework is that information technology impacts on business processes that in turn impact on firm performance. Thus, the impact of information technology on firm performance goes through business processes. In addition hereto, a direct impact of information technology on firm performance is also depicted. A number of contextual factors are expected to moderate the relationships. All relationships of their framework are unidirectional. Unidirectionality is a limitation since firm performance can impact on investments in IT as well. Furthermore, the suggested measurement of variables is primarily delimited to what is available from archival data. A strong feature of the framework is that the major impact of information technology (as measured by e.g. spending) on firm performance (as measured by e.g. ROA and market share) goes through the business processes (as measured by e.g. inventory turnover). Information technology must lead to some change in business processes before the real benefits of information technology are reaped.

A third and final framework to be discussed is that by Hartmann and Vaassen (2003). The purpose of their paper is to develop a framework of management control that suits contemporary organisations that are characterised by for example mass customisation, ambiguous tasks and flexibility. They propose a framework composed of an information domain, a communication domain and a business domain. Accounting information systems are expected unidirectionally to impact on the communication domain (which is composed of management accounting and internal control). The communication domain is then expected to impact on the business domain, which in turn impacts on organisational performance. As with the previously discussed frameworks, this framework also includes performance. A strength of this framework is that it explicitly incorporates management accounting. What is a shortcoming is that all relationships are expected to be unidirectional, which is unlikely the case in real life. The unidirectionality excludes much research within the interpretive paradigm. Furthermore, the framework puts heavy emphasis on knowledge management.

While these three frameworks each have their strengths and weaknesses, none of them seem to fulfil the purposes of a framework identified above. In Table II, the criteria function is depicted in the

first column. The analyses of the frameworks are summarised according to the criteria.

Table II. Evaluation of existing theoretical frameworks

Evaluation criteria	Mauldin and Ruchala (1999)	Dehning and Richardson (2002)	Hartmann and Vaassen (2003)
Management accounting tasks	Included	Not included	Management accounting in general is included.
Management accounting techniques	Not included	Not included	Management accounting in general is included.
Organisation of management accounting	Not included	Not included	Management accounting in general is included.
Behaviour, use and perceptions	Not included	Not included	Management accounting in general is included.
IIS components	To some extent	IT spending, strategy and capability	A broad distinction between IS and AIS
IIS characteristics	To some extent	IT spending, strategy and capability	Not included
Context variables	Organisational and cognitive factors	Several, for example industry, size and financial health	Several, for example culture, actions and beliefs
Output variables	Task performance	Firm performance as measured by accounting and market measures.	Organisational performance
Independent of research paradigm	Primarily functionalistic since most relationships are unidirectional and	Primarily functionalistic since relationships are unidirectional and there is no	Primarily functionalistic since relationships are unidirectional and there is no

Evaluation criteria	Mauldin and Ruchala (1999)	Dehning and Richardson (2002)	Hartmann and Vaassen (2003)
	no room for perceptions.	room for perceptions.	room for perceptions.

Each of the existing frameworks have some strengths that will be included in a new framework that better illustrates the relationship between management accounting and the IIS including context (mediating and moderating) and outcome variables.

2.4.2 Development of a new framework

Taking departure in the strengths of existing frameworks, the concepts and their interrelationships needed for a satisfactory framework will be identified.

The first two concepts are management accounting and IIS. Both terms were defined and discussed in detail in the definitions section above. While existing frameworks to a lesser extent recognise the multiplicity of components of the IIS and the different characteristics of these components, the new framework includes a breakdown of IIS into components and characteristics. Different components and different characteristics seem to have explanatory power in the literature reviewed (e.g. Hyvönen (2003) on BoB vs. ERP systems and Wieder *et al.* (2004) on ERP vs. SCM systems).

Management accounting is divided in tasks, techniques, organisation and behaviour, use and perceptions. Literature investigates the relationship between ERP systems and different aspects of management accounting (to provide some examples: Granlund and Malmi (2002) investigate techniques, Booth *et al.* (2000a) investigate tasks, Quattrone and Hopper (2005) investigate organisation of management accounting while Dechow and Mouritsen (2005) investigate the use, perceptions and enactment of ERP systems). From a functionalistic and normative perspective the focus on tasks (Mauldin and Ruchala, 1999) is natural since tasks should define the techniques (you do not use activity-based costing for operational control (Kaplan, 1988)). The solution of tasks should be organised in some optimal manner, and the use of management

accounting techniques and information systems should support the solution of tasks.

The relationship between management accounting and IIS is bidirectional. Major parts of the research on the relationship are unidirectional and it is expected that the IIS impacts or supports management accounting. Granlund and Malmi (2002) argue that the IIS is more likely to impact management accounting than the other way around, since ERP systems are hard to change once they are configured (Davenport, 1998). The impact of management accounting on IIS may have a longer time horizon since changes to the IIS are not easily carried out. Luft and Shields (2003) argue that when deciding for a direction of the unidirectional arrow, one should choose the direction that manifests itself first. But this is not a valid argument for delimiting research to that of unidirectionality.

Several variables mediate or moderate the relationship between management accounting and IIS. Especially literature within contingency theory offers several variables including perceived environmental uncertainty (PEU) (Chong and Chong, 1997), strategy (Gerdin and Greve, 2004), bureaucratisation (Gordon and Miller, 1976), task complexity (van der Veecken and Wouters, 2002) and resources such as skills of employees (Gordon and Miller, 1976). While contingency variables gain considerable attention from the contingency literature, other streams of research consider contingency or context variables as well. This is for example the case of institutional theory where the impact of external organisations such as consultants is investigated (Ansari and Euske, 1987). The context variables can be many, and it is not the purpose of the framework to put forth an exhaustive list of such variables.

Context variables are mediating variables when for example the IIS causes some change in the strategy. The IIS may enable the company to pursue a strategy of JIT production. The change in strategy may in turn cause a change in management accounting. This is very likely since the purpose of management accounting is to produce information for for example evaluation of the success of strategies (Horngren *et al.*, 2005, p. 5).

Context variables can also be moderating variables. This is for example the case of tasks that require action-centred skills. In this situation, transaction-oriented components of the IIS are able to support the management accounting carried out by lower-level

mangers. In case of tasks that require analytical skills, a business intelligence system may support higher-level managers better (van der Veeken and Wouters, 2002).

Context variables can both impact on and be impacted on by management accounting and IIS. Furthermore, the relationship need not be linear.

A stream of research is particularly interested in the role of power and politics (e.g. Bariff and Galbraith, 1978; Markus and Pfeffer, 1983; Skærbæk, 1998; Abernethy and Vagnoni, 2004). The IIS has the ability to shift power bases. When implementing a performance monitoring system, power might be shifted to top management. Organisational members may be aware of this and may try to influence the implementation project so that the shifting of power is minimised. Furthermore, management accounting or the IIS can also be used for legitimising actions (DiMaggio and Powell, 1983; Ansari and Euske, 1987).

Though not directly a part of the relationship between management accounting and IIS, the performance variable is included in all of the above reviewed frameworks. Especially in the information systems and accounting information systems literature, a relatively large stream of research investigates the performance effects of investments in IT (e.g. Dos Santos *et al.*, 1993; Hayes *et al.*, 2001; Poston and Grabski, 2001; Hunton *et al.*, 2003). Performance is measured along a number of variables. In the early literature performance was almost only measured on share prices and financial metrics available from archival databases. Recent research now advocates and applies a more sophisticated approach to performance measurement by including leading and lagging indicators (e.g. DeLone and McLean, 2003) or by measuring performance according to the balanced scorecard (e.g. Kennerley and Neely, 2001; Wieder *et al.*, 2004). The construct of performance can even be extended to such an extent that the management accounting construct is included as a leading indicator. Thus, management accounting can in some studies be considered as the driver of performance and in other studies as a part of the performance measure as a leading indicator.

Performance is like the other variables of the framework included with a bidirectional relationship. It seems obvious to consider performance as an outcome variable. But performance can also be an explanatory variable. A hypothesis could be that higher performing

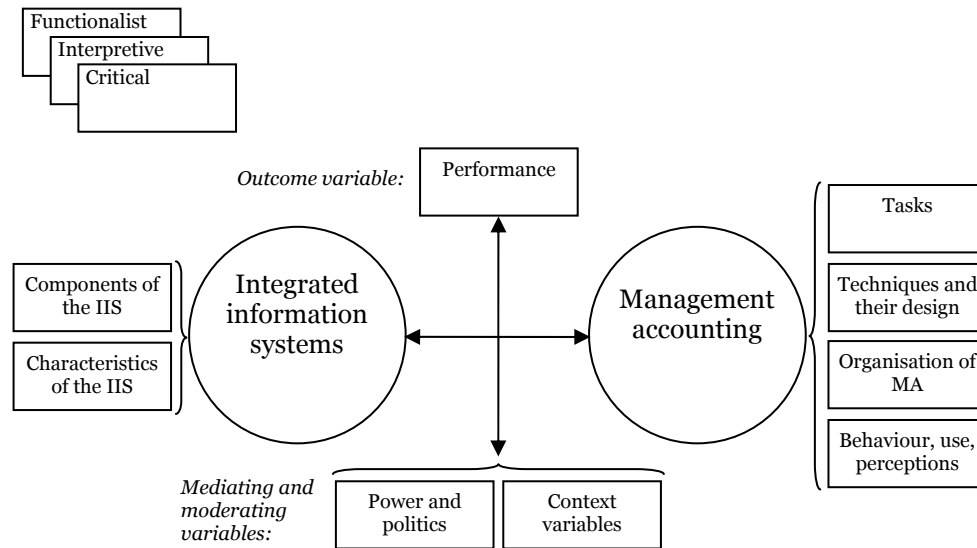
organisations have better possibilities for turning investments in IIS to improvements in management accounting as contribution of for example human resources is necessary for turning an ERP implementation project into a success. In this case, performance would be part of the context variables (Umble *et al.*, 2003).

Finally, the framework is independent of research paradigm (e.g. Burrell and Morgan, 1979; Hopper and Powell, 1985; Puxty, 1993; Ryan *et al.*, 2002). This means that the constructs and their interrelationships can be researched from a functionalist, interpretive as well as a critical research paradigm. The different paradigms ascribe different characteristics to constructs and relationships. What is characteristic of the interpretive paradigm is that the IIS is considered an actor (see e.g. Dechow and Mouritsen (2005) building on Latour (1987) among others) in the sense that the ERP system of the organisations studied made some kinds of management accounting feasible while others were not feasible. Research within the functionalist paradigm treats the constructs as objects that can be influenced by humans. Relationships are discoverable. Within the critical paradigm the goodness of IIS is questioned (e.g. Dillard and Yuthas, 2002; Dillard *et al.*, 2005). Under this paradigm, the IIS is a tool for capitalism to strengthen the control over employees and resources. The power construct is quite often in play when the critical paradigm is applied. But the power construct can also be studied from a contingency view within the functionalist paradigm.

The theoretical framework that is the result of analyses of current frameworks, definitions of management accounting and IIS and an extensive search for researched constructs within management accounting and IIS is presented in Figure III.

Figure III. A theoretical framework for research on management accounting and the IIS

Perspectives on the relationship between management accounting and the IIS:



As the primary purpose of the framework is to provide a tool for mapping current research so that research gaps can be identified, it is critical to its success that all research can be mapped to the framework. This test will be carried out below as literature on management accounting and the IIS will be reviewed with reference to the framework. On the basis of the review, directions for future research will be identified.

2.5 Literature review: the findings

2.5.1 The relationship between IIS and management accounting tasks

2.5.1.1 The logic of the relationship

Traditionally, relationships are explored in which the IIS is the independent variable and management accounting tasks the

dependent variable. The arguments for this are the same as the ones presented in section 2.5.2.1. A relationship where the IIS is the dependent variable would also be relevant to investigate. One could expect that as the design of for example management accounting reports changes (e.g. change of dimensions) then so must the IIS. Against this argument goes that especially ERP system are said to be difficult to change (Davenport, 1998).

2.5.1.2 *The findings*

This section deals with research on the relationship between IIS and management accounting tasks. Management accounting tasks were defined above as activities that are typically performed regardless of the management accounting technique applied. Data collection, reporting and analysis are all activities performed whether working with activity-based costing, balanced scorecard or traditional financial reporting.

Booth *et al.* (2000a) decompose management accounting into the tasks of transaction processing, reporting and decision support. Analysing responses on a questionnaire survey, they find that ERP systems are effective with regard to transaction processing and less effective with regard to reporting and decision support. Similarly, Fahy and Lynch applying the field study method find that “[...] while ERP systems improve the supply of transaction data for strategic management accounting activities they typically cause significant damage to existing decision support capability of the firm” (1999, p. 1). Thus, they argue that not only do ERP systems not support decision support, but they even damage the existing decision support capability. The argument behind this finding is that companies focus on the transactional part of management accounting tasks, which are the tasks that ERP systems primarily support. This takes focus away from strategic decision making. Also, reports are not changed even though one should expect an improvement of the quality of reports with the vast amounts of data and the computing power of ERP systems.

Likewise, Dechow and Mouritsen find that the ERP system is good for transaction processing but not for reporting. For reporting the case company uses SAS. One informant says: “[...] management information has become secondary to the operational” (2005, p. 721).

Several authors (e.g. Fahy and Lynch, 1999; Granlund and Malmi, 2002) argue that the missing development of reports can best be explained from an institutionalist point of view (Giddens, 1984). Current reports are an institutionalised part of the organisation. Managers have an established pattern of monitoring through reports and making decisions on the basis of the reports. The old reports seem to perfectly fit the needs.

But it is not all bad. Fahy and Lynch (1999) also find that implementation of an ERP system leads to better information and more streamlined financial processes. In this vein “ERP-systems are considered to be an important data source for most of the new accounting practises, but not an incentive for their adoption” (Booth *et al.*, 2000a, p. II). Furthermore, Spathis and Ananiadis (2005) also find that the flexibility of information provision has increased.

A rather interesting point is made by Malmi (2001) who finds that companies adopting the balanced scorecard (a management accounting technique) prefer to collect data manually. Usually, one should think that automation is the better and manual tasks the worse. But this is not necessarily always the case. The findings provided by Malmi (2001) seem to be confirming the hypothesis put forth by Kaplan (1990) that companies must pass through a phase of disintegration before they move on to integration.

All of the above findings regard the ERP system. But as discussed in section 2.3.2, the ERP system is only one among several components of the IIS. A distinction is made between suites and BoB systems. Hyvönen (2003) investigates the different relationships between ERP vs. BoB systems and management accounting. He finds that no difference exists between ERP and BoB systems with regard to collection of data.

2.5.1.3 Research method and paradigm

Research on the relationship between IIS and management accounting tasks is primarily conducted using the survey method. To this a couple of studies applying the field study method can be added. In-depth case studies are missing. Characteristic of quantitative studies is that primarily unidirectional relationships are researched. This is also the case of the current literature. All surveys are treating management accounting tasks as the dependent variable and the ERP

system as the independent variable. It need not necessarily be so. The frequency, dimensions and detail of data collected might change the IIS.

The reviewed literature on this part of the field is primarily conducted from a functionalist perspective.

2.5.2 The relationship between IIS and management accounting techniques

2.5.2.1 The logic of the relationship

At first sight, the logic of the relationship between IIS and management accounting techniques seems quite straightforward. Back in 1987, Johnsson and Kaplan (1987) called for research that to a much larger extent was relevant to the business community. Following that call, management accounting techniques such as activity-based costing and the balanced scorecard were developed. Despite the availability of innovative management accounting techniques, not all companies seem to adopt them (see e.g. Chenhall and Langfield-Smith, 1998). Obviously, barriers of adoption seem to exist, and IISs could be one of those barriers.

With the advent of more advanced information systems one should expect that management accounting innovations (Bjørnenak and Olson, 1999) could now be implemented. Behind this reasoning lies a unidirectional relationship where the IIS is expected to impact or support change in management accounting techniques. Most publications on the most popular component of the IIS, the ERP system, state that ERP systems are difficult to change (e.g. Davenport, 1998). This is so with regard to the implementation phase where companies are urged to consider the appropriateness of adopting the same business processes as their competitors (Davenport, 1998). This also goes with regard to the post-implementation phase where the initial configuration cannot be changed, and as a consequence companies have to live with their failures (e.g. Dechow and Mouritsen, 2005). That IISs are hard to change is one of the arguments for a unidirectional relationship going from IIS to management accounting (Granlund and Malmi, 2002).

The relationship need not be unidirectional and it would be relevant to explore a bidirectional relationship (Luft and Shields, 2003). In the implementation phase or even before that, management accounting techniques can change the IIS. The IIS consists of a number of components; and the components implemented probably is an outcome of the management accounting techniques that the organisation needs support for. When the implementation phase is over and users are getting accustomed to the IIS, they may try to change it in small portions just like a controlled experiment. Thus, a bidirectional relationship is likely to exist.

2.5.2.2 The four-stage model of cost systems design

One of the arguments of the ‘relevance lost’ debate is that management accounting is suffering from the precedence of financial accounting (Kaplan, 1988). Since it is mandatory to prepare the financial accounts, these accounts are also used for managerial purposes by many companies. This brings with it problems for the quality of management accounting since for example allocation of fixed costs to products on the basis of for example machine hours is not appropriate when performing operational control or product costing (Cooper and Kaplan, 1998). Taking departure in this finding, Kaplan (1988) argues that one cost system is not enough. Organisations need a system for each purpose. The same system cannot provide information for financial accounting, operational control and product cost measurement. The characteristics of these management accounting techniques are different along a number of dimensions (allocations, frequency, precision, scope etc.).

Kaplan experienced that readers of his 1988-article were not fond of the idea of having several different information systems: “[...] executives want any cost system improvements made for managerial purposes to become part of a single official system” (1990, p. 22). Kaplan (1990) proposes a four-stage model of cost systems design in which the information system must pass through a phase of disintegration before it finally can be integrated. Kaplan warns organisations against skipping the third phase in which each management accounting technique has its own information system. In the third phase, management accountants and IS specialists do the pilot testing. Once through that phase – but not before – it is recommended to integrate the IIS. Cooper and Kaplan (1998) repeat

the message that although integrated cost systems might seem attractive, their potential dangers must be acknowledged.

Where are we today, 15 years after the development of the four-stage model? Are we home safe in phase four where integrated information systems offer support for different management accounting techniques? Or have organisations not even passed stage two where financial accounting precedes management accounting? Empirical evidence indicates that organisations are still struggling with disintegrated information systems. Malmi (2001) and Granlund and Malmi (2002) report that balanced scorecards are maintained in separate spreadsheet systems or specialised software. Quite often data are entered manually into the systems. Hyvönen (2003) finds that financial departments prefer a BoB system, which is an example of a stage three system. These findings could indicate that companies are still in the third phase. Companies might have tried to skip the third phase. With the first wave of ERP systems, they were said to be able to fulfil the entire need for an enterprise system. So, some companies may have tried to integrate it all in the ERP system, thereby skipping phase three and going directly to phase four.

Although ‘integration’ is the characteristic of ERP systems most widely referred to, “the level of system integration can be said to be a continuum” (Granlund and Malmi, 2002, p. 304). The most recent implementations of balanced scorecards using specialised software are integrated with regard to data. This is an inherent feature of SAP’s SEM suite (SAP, 2004b) in which data are collected from SAP’s own business information warehouse (SAP, 2004a), which in turn is integrated with the database of the ERP system. Thus, the IIS seems to be moving towards phase four of integrated cost systems. But it is another kind of integration than that of the ERP system being the entire enterprise’s system. The four-stage model seems to be able to explain the development of IISs in relation to management accounting techniques.

The directionality of the four-stage model seems to be one of unidirectionality where management accounting techniques are the independent variable. From phase one to phase four management accounting techniques are developed from arbitrary allocation of costs to allocation of costs in some cost systems and not in others. The IIS is expected to develop from one system supporting primarily financial accounting via several disintegrated information systems to

an integrated cost system (the IIS). The development of management accounting techniques seems to drive the development of the IIS. The IIS and the management accounting techniques are not independent of one another. Thus, the publications of Kaplan (1988, 1990) and Cooper and Kaplan (1998) do not treat the IIS and the management accounting techniques as separate systems.

2.5.2.3 The relationship between ERP systems and management accounting techniques

While the four-stage model has only been subject to theorising, some empirical evidence has been collected on the relationship between ERP systems and management accounting techniques. The majority of research on the relationship between IIS and management accounting techniques has focused on ERP systems. This is not surprising as the ERP systems is the largest technological advancement of the 1990s.

A case study conducted by Scapens and Jazayeri indicates that the management accounting techniques used are not changed significantly. One of the reasons for this is given by a plant leader who says that “we wanted what we had before” (2003, p. 216). This argument for lack of change is also given by Granlund and Malmi (2002) who find that previous principles were simply transferred into the ERP system. Granlund and Malmi (2002) state that ERP systems might have a stabilising effect on management accounting practice, which is an argument from institutional theory (DiMaggio and Powell, 1983).

Management accounting techniques used by organisations prior to the implementation of an ERP system are not changed. In addition hereto, new, more sophisticated management accounting techniques are not adopted using the ERP system (Granlund and Malmi, 2002; Scapens and Jazayeri, 2003). Similarly, Fahy and Lynch (1999) find that no new performance metrics are implemented.

While the above mentioned authors find no impacts of ERP systems on management accounting techniques, Spathis and Constantinides (2004) find some. 26 usable survey responses indicate that responding companies increased the use of non-financial performance measures and profitability analyses when the ERP system was implemented. Although the authors state that these are

minor changes, they are not necessarily so in the context of the rest of the research findings that indicate that no changes have occurred. But one must be careful giving too much influence to this study since it has some major flaws. First, with only 26 responses it must be very hard to find statistically significant relationships, and significance tests are not reported at all in the article. Thus, the found relationships may just be due to random variance in the data material. Second, the list of modules included in the survey instrument does seem to be complete as for example the often-used module of sales and distribution is not on the list. Finally, more than half of the respondents work in the information department; and this seems to be an inappropriate group to ask questions about the effects of ERP systems on management accounting.

Spathis and Ananiadis (2005) also investigate the Greek setting. They examine 43 survey responses from users of an ERP system within one university. They find that after implementation of the ERP system the financial statements are better and they more effectively exploit the assets. The authors write that there exists a large difference between the previous and the new system. This factor may be an important explanatory variable to explain the findings that contradict the findings from other European countries that no major changes in management accounting techniques are found.

What is important to note is that although Granlund and Malmi (2002) and Malmi (2001) report that ABC and BSC are not implemented using the ERP system, they are not saying that management accounting techniques such as ABC and BSC are not implemented at all. Rather, they find that ABC and BSC are maintained outside the ERP system. These management accounting innovations are operated in separate systems such as spreadsheet systems or specialised software. Specialised software for ABC and BSC are considered more user-friendly and flexible regarding analysis and reporting. Furthermore, Granlund and Malmi (2002) argue that ABC is operated outside the ERP system since the ERP system is too complex. Similarly, Maccarrone (2000) find that reporting tools are outside the ERP system.

Thus, the conclusion that the introduction of ERP systems has not led to changes in management accounting techniques – be they innovative or conventional – seems not to be applicable to other components of the IIS. Furthermore, the companies seem

purposefully to disregard ERP systems for support of new management accounting techniques. Malmi (2001) finds that companies prefer starting out with BSC in a manual mode where they can probe the applicability of the BSC and experiment with it.

Granlund and Malmi (2002) ask whether the missing impact is due to a time lag or whether it is a permanent outcome. The findings of Malmi (2001) could indicate that companies would integrate their BSCs with the ERP system when they are finished probing its applicability and when they are past the phase of pilot testing. This would also be in line with the four-stage model (Kaplan, 1990) where different management accounting techniques are operated in different systems before they are integrated in the fourth phase. On the other hand, it seems more likely the case that for example BSCs will never be supported by the ERP system since it is found to be too complex, and specialised software are found to be more user-friendly and flexible. This argument questions whether companies will ever move to the fourth phase of the four-stage model (Kaplan, 1990).

The most commonly investigated relationship is a unidirectional one in which the ERP system is the explanatory variable (e.g. Granlund and Malmi, 2002). But Scapens and Jazayeri (2003) question the real impact of the ERP system. They find that the changes that took place were not brought about by the ERP system, since the changes were on their way regardless of the ERP implementation. On the basis hereof, they conclude that ERP systems are not the driver of management accounting change. It sounds reasonable that it would be to give too much credit to ERP systems to state that they themselves drive changes in management accounting techniques. But on the other hand, it still seems likely that ERP systems and other parts of the IIS can facilitate management accounting techniques.

2.5.2.4 The relationship between non-ERP systems and management accounting techniques

Section 2.5.2.3 investigated the relationship between the relatively well-known ERP systems and management accounting techniques. Most research within the area of management accounting and integrated information systems has been conducted on these ERP systems. But there is more to IIS than ERP systems as discussed in section 2.3.2 where the IIS and its components were defined. This

section takes a look at research on the relationship between non-ERP systems and management accounting techniques. Examples of such non-ERP systems are strategic enterprise management suites and best-of-breed systems. For more technical details on SEM suites and BoB systems please refer to SAP (2004a, 2004b) and Moriarty (1999) respectively.

The review of the literature on non-ERP systems will actually take departure in the literature on ERP systems. Granlund and Malmi, who primarily studied the relationship between ERP systems and management accounting techniques and the management accountant's work, write that "the introduction of so-called SEM modules may provoke companies to adopt methods that they have not used earlier" (2002, p. 315). In addition hereto, they and also Malmi (2001) write that for example activity-based costing and the balanced scorecard are maintained outside the ERP system in either spreadsheet systems or in specialised software. The reasons for the widespread use of non-ERP systems are that they are user-friendly and flexible with regard to analysis and reporting. Analysis and reporting belong to the category of management accounting tasks as discussed in section 2.3.1.2 above. Thus, the fact that software is good at supporting the management accounting tasks seems to have an effect on the relationship between IIS and management accounting techniques.

Expanding on these preliminary findings, Granlund and Malmi ask: "[...] as SEM packages start to be a part of a normal ERPS offering, will this induce companies to change the logic of their accounting and control practices?" (2002, p. 315).

In similar vein as Granlund and Malmi (2002), Fahy and Millea (2001) find that activity-based costing and shareholder value analysis are not supported by the ERP system. Rather, companies seem to rely on spreadsheets and BoB software for modelling as done with activity-based costing. Fahy and Millea (2001) seem to define SEM by referring to Granlund and Malmi (2002). Fahy and Millea write that "SEM is not a technological issue but is instead about integrating best practices in the key strategic management processes of planning, decision making, execution and review to maximise stakeholder returns" (2001, p. 11). That is also the message of Fahy (2000) and Gould (2003). But definitions that mix integrated information

systems and management accounting are not useful in this research project that aims at investigating their interrelationship.

Neither of the above mentioned studies report impact-full studies on the relationship between SEM suites and management accounting techniques. Rather, the studies seem to be reporting hunches and indications.

This seems not to be the case with Hyvönen (2003) that reports on a study on the use of ERP vs. BoB systems. First of all, Hyvönen makes clear that “companies without an ERP system still integrate their systems using conventional best of breed (BoB) or standalone system components of standard package and/or custom software” (2003, p. 156). This is very well in line with the argument that information systems need not be fully integrated in order to support management accounting techniques. Integration at the data level seems to be enough (Cooper and Kaplan, 1998; Granlund and Malmi, 2002). Thus, the case for BoB systems is made.

Hyvönen (2003) finds that financial departments are implementing BoB systems while other departments (primarily the IT department) are implementing ERP systems. The author also finds that the ERP adopters have more problems with budgeting than BoB adopters. This seems to support the indications of Granlund and Malmi (2002) who find that Hyperion to a large extent is used for budgeting.

On the other hand, Hyvönen (2003) does not find any significant differences between BoB and ERP adopters with regard to adoption of management accounting innovations. That is, although there seems to be a relationship between BoB software and budgeting, which can be considered a conventional management accounting technique, there does not seem to be a relationship between BoB software and management accounting innovations. This is contradicting the indications reported by Granlund and Malmi (2002) that activity-based costing and the balanced scorecard are implemented using specialised software.

To sum up, it is hypothesised that SEM systems and BoB systems might have a relationship with management accounting innovations since these techniques are found to be implemented using non-ERP systems (Fahy and Millea, 2001; Granlund and Malmi, 2002). On the other hand, a non-significant relationship is reported by Hyvönen (2003). In addition to that, we must conclude that research within non-ERP systems and management accounting techniques is scarce,

the research that is conducted also seems to be inconsistent in its findings.

2.5.2.5 *Design science and REA*

A major stream of research within AIS research deals with the modelling of accounting information systems. Several modelling techniques exist within the information systems literature (e.g. entity-relationship diagram, flowcharts and data flow diagrams). While these modelling techniques can be used when modelling accounting information systems (see e.g. Gelinas *et al.*, 2005), they are not particular to the AIS domain and therefore not part of the literature reviewed here. But the modelling technique called REA modelling is particular to the AIS domain.

A REA model maps resources, events and agents. The modelling technique was first described by McCarthy (1979, 1982) and later developed by an exclusive group of researchers (see a review of the REA literature in David *et al.*, 2002). Among the extensions to resources, events and agents are locations (Denna *et al.*, 1993), tasks (Geerts and McCarthy, 1997) and commitments (Geerts and McCarthy, 2002). In order to test the scope and applicability of the REA model, O'Leary (2004) investigates the relationship between REA and SAP. He finds that there are substantial similarities but also some compromises in SAP. He also finds that the REA model in many situations is underspecified.

What is characteristic of the events that are supported by the REA model is that they are almost exclusively at the transactional level. Not much REA literature deals with provision of information for decision making.

As can be seen, design science is a quite normative research stream. Models are built to improve upon practice (David *et al.*, 2002). When models are built, their feasibility is tested by implementing them in practice. Some discussion goes on whether design science is to be considered proper research. The line between researching novel extensions to the REA model, verifying it and reproducing it is a very fine one. David *et al.* identify three characteristics that must be included in design science in order to make it research. These are i) that the research must be truly novel, ii) that the problem addressed

is difficult and iii) there is not already a proof of concept or of feasibility (2002, p. 4).

Design science is at the same time a field of research and a research method. Design science as a research method resembles that of the constructive research approach (CRA) (e.g. Kasanen *et al.*, 1993; Labro and Tuomela, 2003; Lukka, 2003). Thus, the research conducted is primarily applying an analytic method of building the models. The part of design science that is not dealing with the use and perception of the REA modelling technique is within the functionalist paradigm.

2.5.2.6 Research method and paradigm

Research on IIS and management accounting techniques is primarily conducted from a functionalist point of view. Although Granlund and Malmi (2002) apply the institutional theory, they find that primarily economic factors seem to be able to explain the findings. Thus, their arguments end up fitting neatly with functionalist research.

The research methods applied are diverse. A variety of research methods are employed in order to investigate the relationship between ERP systems and management accounting techniques. The method used most often is the field study method (Fahy and Lynch, 1999; Maccarrone, 2000; Malmi, 2001; Granlund and Malmi, 2002). What is characteristic of these studies is that relatively few interviews are conducted with a larger number of companies. In this way, the findings are bound to one specific setting. The depth of field studies is very different from that of longitudinal case studies as for example that conducted by Scapens and Jazayeri (2003). Two of the studies (Spathis and Constantinides, 2004; Spathis and Ananiadis, 2005) apply the survey method. Publications on the four-stage model are theorisations without explicit use of empirics. The triangulation of research methods is good. But more in-depth case studies and large-scale survey seem to be needed.

A variety of research methods are also employed in research on SEM systems. On the other hand, most of the research on ERP systems applies the survey or field study methods. With regard to research on REA modelling, this is primarily conducted using analytical research methods. But also interventionist research methods (the design science) are applied when the models are tested.

2.5.3 The relationship between IIS and the role of the accountant and the organisation of management accounting

20 years ago management accounting was carried out by management accountants. Management accounting was a centralised task and management information was at the custody of the management accountants. Management accountants were carrying out bean-counting tasks far away from the factory floor (Friedman and Lyne, 1997; Burns and Baldvinsdottir, 2005). This seems no longer to be the case. Now management accounting as a set of tasks to be carried out and management accountants are two separate entities. Management accounting can be carried out by general managers as well as management accountants, and management accountants can carry out management accounting tasks as well as for example general management tasks and tasks in relation to maintaining the IIS.

2.5.3.1 The logic of the relationship

To what extent the development of the IIS is driving this change or whether the change would have happened without the advent of information systems such as the ERP system is the question. A second question is if the change in the relationship between management accounting and the management accountant has had an impact on the IIS. The first question deals with whether the IIS is an explanatory variable to the observed change in the organisation of management accounting and the second question deals with whether the impact goes the other way around where the change in the relationship between management accounting and the management accountant has an impact on the IIS.

A bidirectional relationship would seem plausible. But in literature and in practice it does not seem to be the case that the change of the relationship between management accounting and the management accountant has come from the blue sky. Thus, a bidirectional relationship in which the IIS drives the change in the relationship between management accounting and the management accountant is expected.

2.5.3.2 Findings: the role of the management accountant

The saying 'from bean counter to business analyst' seems to have something to it. Several authors find that the role of the management accountant has changed. Granlund and Malmi (2002) and Quattrone and Hopper (2001) find that the management accountant is now performing more business-oriented tasks. Lodh and Gaffikin (2003) write that multidisciplinary knowledge is needed as a management accountant and Scapens and Jazayeri (2003) find that routine jobs are eliminated and that management accountants are getting a wider role. Thus, it seems to be a general finding that management accountants are getting involved in general management by acting as business consultants. But this change does not seem to have happened only recently. Stambaugh and Carpenter write before the massive adoption of ERP systems that "computer systems and advanced modelling techniques are reducing the need for accountants as processors for learning machines" (1992, p. 61). Thus, it is not ERP systems in particular that drives the change. Other parts of the IIS also have an effect.

Management accountants are also getting a new role in relation to the IIS. Caglio writes that "ERP systems certainly provide accountants with powerful modalities of structuration" (2003, p. 146). Management accountants can choose to take charge of the IIS or they can leave it for someone else. The future role and status of the management accountant is dependent on this choice. Other professional groups such as IS professionals are also interested in taking charge of the IIS (Sangster, 1996). Being in charge of the systems providing information is a power base (Bariff and Galbraith, 1978; Markus and Pfeffer, 1983).

To sum up, it is found that the introduction of ERP systems leads to new, hybrid positions (Caglio, 2003). Management accountants are now carrying out tasks of business consulting and IIS maintenance in addition to the tasks of management accounting. Also, it is found that proactivity of the management accountant is important if he wants to define his future role himself. But the management accountant should also be aware that taking charge of the IIS leads to a high pressure since many people are dependent on the IIS working properly (Caglio, 2003).

2.5.3.3 Findings: the organisation of management accounting

Management accounting at a more transactional level is also carried out by non-accountants. The ERP system has many in-built routines that for example automatically update the ledgers when data are entered in other parts of the system. Today, shop floor workers initiate postings to the stock and payables accounts when they key in a goods returns notice (Quattrone and Hopper, 2001). A large number of such situations can be mentioned. Management accounting has become a dispersed activity.

The IIS is able to distribute information throughout the organisation. In this way line managers are supplied with accounting knowledge. They know their own spend and budgets (Caglio, 2003; Scapens and Jazayeri, 2003). Thus, control is decentralised. Quattrone and Hopper (2001, 2005) even go as far as to argue that everyone can choose to exert control. Supporting this argument, Dechow and Mouritsen find that management control is now an activity that is integrated with commercial management: “Some ERP configurations even may work to separate management accounting practices from financial reporting” (2005, p. 727).

2.5.3.4 Research method and paradigm

The reviewed publications primarily apply the case study method. Some studies apply the field study method (e.g. Granlund and Malmi, 2002). The survey method has not been applied at all.

The role of management accountants and the dispersion of management accounting have been studied from a variety of research paradigms. Granlund and Malmi (2002) and Scapens and Jazayeri (2003) make use of institutional theory (DiMaggio and Powell, 1983; Burn and Scapens, 2000). Caglio (2003) draws on structuration theory (Giddens, 1976, 1979, 1984) and a large number of researchers (Quattrone and Hopper, 2001, 2005; Lodh and Gaffikin, 2003; Dechow and Mouritsen, 2005) draw on actor-network theory also known as sociology of translation (e.g. Callon, 1981, 1986, 1991; Latour, 1987, 1991, 1999; Law, 1997, 2000). Hence, research within this topic is primarily conducted from an interpretive perspective.

2.5.4 The relationship between IIS and behaviour, use and perceptions

2.5.4.1 The logic of the relationship

Behaviour, use and perceptions are important aspects of management accounting. If implementation of an IIS or adoption of management accounting innovations do not lead to change in behaviour and use, implementations and adoptions are of no use. As den Hertog and Wielinga put it: “The factual use of the system is the basic link between the system’s design and its effectiveness” (1992, p. 126). While tasks, techniques and organisation to some extent can be designed and controlled (at least from a functionalist perspective), use can only be so to a limited extent. You may train employees and give them instructions but their behaviour and use are at their discretion. Behaviour, use and perceptions may transform the other parts of management accounting from what was intended to what it becomes. Thus, a bidirectional relationship is expected in that IIS may impact on behaviour, use and perceptions, but those three may also impact on the IIS.

Literature on behaviour, use and perception in relation to management accounting and IIS seem advantageously to be split in two parts. The first is the study of behaviour and use from primarily a functionalist perspective. The second part is the study of perceptions from primarily an interpretive perspective. The two parts are reviewed in turn.

2.5.4.2 Findings: behaviour and use in relation to management accounting and IIS

The challenge of unlearning common practice was the subject of a study by Hedberg and Jönsson (1978). Hedberg and Jönsson (1978) argue that information systems have a stabilising potential, which is also indicated by Granlund and Malmi (2002). With a stabilising system, double-loop learning is inhibited (Argyris and Schon, 1978). Rather, the IIS should be designed to provide early warning signals. An experiment is set up in which a new IIS with good query and reporting facilities is implemented. Bank professionals, that on a daily basis work with tasks that the new IIS supports, are included as

well as students without any experience with the task. The authors found that students got many new insights. But the authors also found that after some time the students also settled with a small number of standard reports. The stabilising effect is confirmed.

The issue raised by Hedberg and Jönsson (1978) is very relevant to ERP systems. Are they able to provide early warning or are they merely stabilisers? Research provides several indications that ERP systems and probably also IISs in general have a stabilising effect. An interviewee of the case study conducted by Scapens and Jazayeri says: “We want exactly the same thing in SAP as we had before” (2003, p. 216).

Burchell *et al.* (1980) identify four roles of accounting (management accounting systems as an answer machine, learning machine, ammunition machine and a rationalisation machine). These four roles are by Ansari and Euske (1987) used to evaluate the use of an IIS. The four roles are coupled with three research perspectives. The authors argue that when accounting is used as an answer or learning machine, we have a case of rational choice. When accounting plays the role of an ammunition machine, an IIS is used in a socio-political sense. And finally when accounting plays the role of a rationalisation machine, the IIS is used with an institutional purpose. A military organisation in which a head quarter induces a reporting system onto a subsidiary is studied. The authors find that the information system is not used for rational choice. Decisions are made on the basis of other systems or non-accounting data. Rather, the information system was used by the head quarter to exercise power and by the subsidiary for legitimacy.

Although it is relevant to explore the use of an IIS using a taxonomy of three theoretical perspectives, it seems at bit rash to conclude that IISs are used for legitimising purposes. If Ansari and Euske (1987) had investigated the use of the system that the subsidiary had themselves chosen for decision-making support, the authors would probably not have found that the system was not used according to the rational perspective. It would probably be more reasonable to conclude that IISs are used for different purposes and thereby adopt a view of commensurability rather than one of incommensurability.

Jönsson and Grönlund (1988) investigate the use of accounting information in a manufacturing company. In particular they investigate how accounting information helps work teams do

continuous improvement. The company needed to be able to fully exploit technology by adopting new technology in order to offer competitive prices to the one customer it was sub-contracting for. Therefore the company needed to unlearn the Tayloristic management philosophy that it was so good at. Jönsson and Grönlund (1988) discuss the use of behaviour-oriented vs. output-oriented control (Ouchi, 1979). Jönsson and Grönlund argue that “the triggering information will be on output, while search and problem solving will again focus on causal information” (1988, p. 520). The authors set up an experiment where some teams get information systems that they use for improvements in a very interactive way. The supply of non-financial operating data is found to be of great support to the lower-level managers. Finally, the argument that one cost system is not enough (Kaplan, 1988) is put forward.

Integrated information systems are used differently dependent on managerial level. van der Veeken and Wouters (2002) investigate the use of an IIS in a road building company. The use of accounting information is studied at different managerial levels. The authors find that the use varies significantly between the management levels. Site foremen hardly use accounting information when it is only amounts. Site foremen have close contact to the actions at the site and they are dissatisfied with accounting information: it is too late and not reliable. From the daily involvement they already know the financial results. The site foremen report that either financial reports confirm their expectations or if not it often turns out that they are wrong.

With higher-level managers the case was another. Output-oriented information on costs and budgets is used at this management level. Accounting information seems to be able to support the analyses made at higher levels. The authors conclude that output-oriented accounting numbers are usable when analysis-oriented skills are used (as also found by Jönsson and Grönlund, 1988) while non-financial operating data are needed when action-centred skills are used. This finding matches the hypothesis put forth by Kaplan (1988) that one cost system is not enough.

A well-established stream of research exists within the AIS literature that investigates behavioural issues in relation to accounting information systems (Sutton and Arnold, 2002). This stream of

research investigates the impact of IT on individuals, organisations and society. It is questioned whether behavioural AIS research is AIS research at all since the accounting content is very limited.

An example of behavioural AIS research is a study carried out by Arnold *et al.* (2004) on the use and effect of intelligent decision aids. Building on the theory of technology dominance (Arnold and Sutton, 1998) the authors find that smart machines must be operated by smart people. If the user is inexperienced, he will be negatively impacted by the system. Furthermore, he will not learn by experience.

2.5.4.3 Findings: perceptions and translations in relation to management accounting and the IIS

Functionalist research treats management accounting and IIS as entities that can be designed. This does not harmonise with an interpretive view in which humans are not put above the IIS. Rather, they are treated symmetrically (Lowe, 2001; Dechow and Mouritsen, 2005). An organisation consists of human as well as non-human actors (Lodh and Gaffikin, 2003). Applying actor-network theory Lodh and Gaffikin (2003) experience that the new SAP system as well as the existing systems presented alternatives that battled for influence. Lowe (2001) finds that human actors make relations to non-human actors. This is for example the case when the ability to manoeuvre the IIS constitutes power.

What is also characteristic of research on management accounting and IIS applying the actor-network theory is that ERP systems are not said to automatically integrate, centralise or control (e.g. Dechow and Mouritsen, 2005; Quattrone and Hopper, 2005). Actors can make of an ERP system almost whatever they want. Quattrone and Hopper (2005) describe how one company used the ERP system to collapse the distance between the controller and the controlled. Another organisation used the ERP system to maintain the distance between head quarter and subsidiaries, which was of importance to them. Thus, the ability of an ERP system to define integration, control *et cetera* depends on the situation and how the ERP system is brought in play. Furthermore, the system itself is also found to be able to point out what management accounting looks like in an organisation (Dechow and Mouritsen, 2005).

Actor-network theory also brings with it an alternative view on change. Quattrone and Hopper (2001) argue that the notion of ‘drift’ should replace that of ‘change’. To judge whether an organisation has changed is not self-evident but requires choice of criteria.

Research applying the actor-network theory is able to shed light on aspects of the relationship between management accounting and IIS that are not seen from a functionalist perspective.

Another perspective on management accounting and IIS is provided by for example Dillard *et al.* (2005). Using a critical framework they analyse the role of ERP systems in reinforcing the instrumental rationality. According to the authors, instrumental rationality reduces human actions to abstract representations. Dillard *et al.* write that “ERPs are capable of accentuating and accelerating the conditions that lead to the abdication of moral responsibility” (2005, p. 118).

Dillard *et al.* (2005) move beyond merely criticising the ideology of ERP systems. They move on to suggest that ERP systems should be a facilitator of social change. Although today ERP systems are a capitalist tool, it can be a tool for an alternative ideology as well.

2.5.4.4 Research method and paradigm

Two (at least) research streams seem to investigate the relationship between IIS and management accounting behaviour, use and perceptions. The first research stream has a functionalist perspective and primarily applies the case study method. The second research stream that has an interpretive and critical perspective exclusively applies the case study method.

2.5.5 The effects on and of performance

2.5.5.1 The logic of the relationship

Whether investments in management accounting and IIS have an effect on performance is certainly of interest. A better IIS together with improved management accounting is expected to bring with it

better firm performance which in turn should also have an effect on market value. This is the most commonly researched relationship.

Performance might have an effect on the relationship between management accounting and IIS as well. One could expect that high-performing organisations have a better basis for implementing IIS components and making use of them by developing the management accounting. But this relationship belongs to section 2.5.7 that discusses context variables in relation to management accounting and IIS. Thus, this section only considers a unidirectional relationship.

2.5.5.2 Findings

A distinctive stream of research deals with the question of performance effects of information systems in general and of IIS and management accounting in particular. Back in the early 1990s researchers could not find a significantly positive relationship between investments in IT and performance measured by either firm performance or market value. This is referred to as the productivity paradox (Brynjolfsson, 1993). One explanation given for the phenomenon that investments in IT have no impact on performance is that the expenditures of the IT investments offset the gains. But as time went by, research findings began to indicate that investments in IT had a positive effect on performance after all. Dos Santos *et al.* (1993) find that innovation IT investments lead to a positive market response. In 2001 it is found that capital markets place value on ERP implementations (Hayes *et al.*, 2001), but at the same time Poston and Grabski (2001) find that ERP implementations have no effect on firm performance. A couple of years later, Hunton *et al.* (2003) find that non-ERP adopters experience decreasing firm performance while ERP adopters do not. Following these findings, the question turned from one of whether investments in IT have a positive impact on performance to a question of when and why there is a performance effect (Dehning and Richardson, 2002). A literature review on studies using archival data and accounting or market measures of firm performance is conducted by Dehning and Richardson (2002).

The relationship between investments in IT and performance seems to be passing through a lot of variables left unmeasured. The

hypothesis that investments in IT have a positive effect on performance is a joint hypothesis. A change in business processes is expected to take place in order for investments in IT to have an effect. Thus, business processes must be included as an intermediate variable. Another way of viewing business processes is to consider them as leading indicators of performance while measures such as ROE are lagging indicators of performance. Inclusion of leading and lagging indicators or an intermediate variable is done in frameworks developed by for example Barua *et al.* (1995), Dehning and Richardson (2002) and DeLone and McLean (1992, 2003). Management accounting is one example of a business process or a leading indicator.

Kennerley and Neely (2001) investigate the performance effects of an SAP implementation at a manufacturing company in which a case study is conducted. They build a framework with inspiration from the framework by DeLone and McLean (1992) and the balanced scorecard (Kaplan and Norton, 1992). They find that changes have taken place in that for example excessive inventory levels are identified. Furthermore, planning is improved, but no financial impact is identified. It appears that actions have not yet been taken to reduce the excessive inventory levels. A time lag seems to exist between implementation of the ERP system, identification of opportunities for improvement, carrying out actions to exploit the opportunities and, finally, identification of improved financial performance. Their study makes a valuable contribution to research in that it applies the case study method and measures performance along multiple measures.

Another study, that measures leading and lagging indicators of performance, is the one conducted by Wieder *et al.* (2004). They use the balanced scorecard to identify leading and lagging indicators. On the basis hereof, a number of financial as well as non-financial indicators are found. Whether organisations have adopted ERP or not is found to have no effect on any leading or lagging measure of performance. More detailed ERP variables are needed. Much against what could be expected, findings indicate that ERP system characteristics have an impact on financial indicators but not on non-financial indicators.

Wieder *et al.* (2004) add an important contribution to the research on performance effects in that they include complementary software

as an explanatory variable. Until now almost all research on the relationship between management accounting and IIS has only considered ERP systems. This seems to be a major limitation. Wieder *et al.* (2004) consider the effect of including SCM software in the IIS. They find significantly positive effects of SCM software adoption on supply chain indicators. Wieder *et al.* “expect that future research on performance impacts of enterprise systems will move from a single-system approach (e.g. ERPS) to a multi-system approach” (2004, p. 40). This is a very important statement in relation to the IIS components variable of the theoretical framework underlying this literature review.

Not much research is conducted where management accounting is included as an intermediate variable between investments in IT and performance. The literature on performance effects of investments in IT primarily uses archival data and these do not include information on the management accounting of organisations. When intermediate variables are included they are included as measures of for example inventory turnover (e.g. Barua *et al.*, 1995) and user satisfaction (e.g. Kennerley and Neely, 2001). No studies that examine the relationship between management accounting, IIS and performance could be identified.

2.5.5.3 Research method and paradigm

Most research on the performance effects of investments in IT applies a quantitative method on the basis of either archival or survey data. A few studies apply the case study method. All studies are conducted within the functionalist paradigm. The studies belong to the strong tradition of AIS research.

2.5.6 Power as a moderating or mediating variable

2.5.6.1 The logic of the relationship

Several studies indicate that power has a legitimate place in the theoretical framework. den Hertog and Wielinga (1992) argue that the impact of control systems depend on power relations among other things. Power is not considered a primary variable of the

research framework but it deserves a place as a moderating or mediating variable. As a moderating variable, power changes the effect that the independent variable has on the dependent variable (Luft and Shields, 2003). One example of such a relationship is the case where the IIS has an effect on management accounting since people in charge of the IIS implementation are very powerful. Power can also be considered an intermediate variable when for example implementation of a new IIS changes power relations (e.g. more power to employees as opposed to managers), which in turn changes management accounting (e.g. management accounting becomes decentralised). Power can both be the independent and the dependent variable.

2.5.6.2 Findings

Information is a source of power as it is needed for decision-making (Bariff and Galbraith, 1978). Thus, when changes are made to systems that produce information, power relations may be affected. But it is not always the case that IIS implementations will change power relations. This is the case when the new IIS matches the current social structure, culture and values and thus does not bring with it any alterations.

The IIS also has the potential to change or conflict with social structure, culture and values. Then some parties will resist the implementation while others will support it (Markus and Pfeffer, 1983). Implementation of an IIS may have several and even opposing effects. Bariff and Galbraith (1978) argue that power will be shifted downwards as the monopoly of top management with regard to information is reduced. On the other hand, that subordinates lose the possibility of smoothing data will upwardly shift power. Thus, the effects of and on power relations seem to be highly context dependent.

Abernethy and Vagnoni (2004) conduct an archival study on the relationship between formal and informal power and AIS use. They find that physicians with formal power use AIS to a greater extent. Furthermore, top management used the newly implemented system for monitoring. Use of AIS is found to have a positive effect on cost consciousness, but the cost consciousness is hampered if people have informal power. Here, power is an explanatory variable of AIS use.

This directionality is opposed to that studied by Bariff and Galbraith (1978) and Markus and Pfeffer (1983) where the IIS is affecting power.

From an interpretive perspective power is also ascribed significance. Skærbæk (1998) proposes a framework for analysing IS and power. He proposes that one must look at i) the content of the IIS (hardware, software etc.), ii) the social context (social relations, infrastructure and history) and iii) political elements (relations between interests, conflicts and power). Using this framework, he analyses a governmental accounting information system. He finds that the accounting directorate forces the departments to use a certain accounting information system that the departments find unsatisfactory by using power. The national auditors support the accounting directorate. The departments do not have the power needed to choose another system against the interest of the accounting directorate and the national auditors.

Lowe (2001) states that power is ascribed to accounting technologies. The IIS provides a base for power. Accountants have the opportunity to master the IIS by gaining knowledge of how it works (Caglio, 2003). Doing this, accountants may gain power. But the implications of an IIS implementation on power relations cannot be predicted *per se*. Power relations depend on how the actors make use of the IIS.

2.5.6.3 Research method and paradigm

Power is primarily studied using the case study method. This is especially the case with the interpretive studies. With regard to the functionalist studies, theoretical reasoning and archival studies are conducted.

2.5.7 Context variables as moderating or mediating variables

2.5.7.1 The logic of the relationship

The context variables are not among the primary variables of the framework. The focus is on management accounting and the IIS.

Although these two variables are the main variables of the framework, they do not exist in a vacuum. Several context variables bring with them important insights into the relationship between management accounting and IIS.

2.5.7.2 Context variables used and their impact

Analysis of context variables is not reserved for contingency theory, but contingency theory is particularly interested in context variables and thus this section will build heavily on contingency studies.

The level of environmental change is a context variable in the study by Hedberg and Jönsson (1978). They argue that it is particularly important to organisations in unstable environments that the information system be able to supply managers with destabilising information. This is important since inertia is a threat to survival of organisations in unstable environments, and information systems tend to be stabilisers.

Jönsson and Grönlund (1988) also investigate the use of information systems in a changing environment. The organisation studied is a subcontracting company faced with a high pressure for learning and adoption of the newest production technology. Like van der Veeken and Wouters (2002), the authors look into the use of an information system by lower-level and higher-level managers. They argue that the IIS should serve needs of both lower- and higher-level managers. Lower-level managers are found to be able to make most use of non-financial information. Non-financial information supports continuous monitoring of the processes, it supports further investigations of inefficiencies and, furthermore, it supports the process of implementing new production technology.

Bureaucratic vs. organic environments and simple vs. complex tasks are studied by den Hertog and Wielinga (1992). The study is conducted within a number of engineering workshops within one manufacturing company. The authors find that the information system fitted the best to the workshop with a complex organisation and simple tasks. Furthermore, they find that the implementation of a vertical information system does not fit well with a strategy of autonomy for peripheral units. These two strategies for dealing with increasing complexity and uncertainty do not seem to go well together.

van der Veecken and Wouters (2002) introduce a key concept of action-centred vs. analytical skills. Action-centred skills are used by lower-level managers such as the site foremen. On the other hand, analytical skills are employed by higher-level managers when analysing the accounting numbers of several projects. The authors find that financial accounting numbers are not of much use when action-centred skills are employed. Rather, number of bricks is easier to manage than costs of bricks used (van der Veecken and Wouters, 2002, p. 364). The opposite seems to be the case when analytical skills are used. Higher-level managers are using financial numbers. But still, knowledge of the details of the individual projects is needed in order to fully understand the financial numbers.

In the study by Hunton *et al.* (2003) company size and financial health is included in their quantitative model where firm performance is dependent on ERP adoption, company size and financial health. The authors find that for larger firms, financial health negatively affects performance. The relationship is the opposite for smaller firms in which financial health positively affects performance. With these findings it is argued that firms must be of a certain size in order to be able to handle an ERP implementation project.

Only to a relatively small extent do the publications reviewed explicitly study context variables of the relationship between management accounting and IIS. Other studies include context variables as control variables without reporting explicitly on them. Only studies that report on the effects of context variables are analysed here. Much research remains to be conducted on the context variables.

2.5.7.3 Research method and paradigm

Research, which includes context variables and report on their effect, applies quantitative as well as qualitative methods.

2.6 Directions for future research

The theoretical framework developed in section 2.4 has now been used for mapping current research within management accounting

and IIS. In this section the framework together with the review of current research will be used to identify directions for future research. Not all concepts and relationships of the framework have been explored, and selected gaps are discussed in this section. Although several opportunities for future research exist they are not all analysed here.

2.6.1 Analysis-oriented information systems and management accounting tasks and techniques

Unfortunately, it is characteristic of current literature to focus, to a large extent, on ERP systems only. Not much research has been conducted on other components of the IIS. This seems opaque since research on the relationship between ERP systems and management accounting tasks and techniques respectively does not find strong relationships between management accounting and IIS. Several of these studies even argue that analysis-oriented systems such as SEM systems and specialised software seem to be better able to support management accounting (see e.g. Malmi, 2001; Granlund and Malmi, 2002).

Fortunately, some research is appearing that looks at other components of the IIS than ERP systems (e.g. Fahy and Millea, 2001; Hyvönen, 2003). But much more research is needed. Especially, an opportunity for future research exists within the relationship between specialised software and management accounting tasks and techniques. Examples of such software are ABC, BSC or query software. Much indicates that this kind of research will gain important new insights since management accounting obviously is carried out using such software (e.g. Malmi, 2001).

Survey as well as case study methods can be applied. The two research methods offer different strengths; and application of both research methods would strengthen the validity of research.

2.6.2 The promise and peril of integration

Integration seems to be the key characteristic of the IIS. The more integration seems to be the better. But contemporary research indicates that this is not necessarily the case. Case studies such as the

ones conducted by Scapens and Jazayeri (2003) and Dechow and Mouritsen (2005) report that ERP systems bring with them such a high degree of integration that it is almost too much. Furthermore, from a functionalist point of view, it is argued that integration must not be strived for at the sacrifice of management accounting (Kaplan, 1990). According to the four-stage model, information systems that are not fully integrated can actually be better at supporting management accounting in a pilot phase than fully integrated information systems. Finally, research on ERP systems and management accounting techniques finds that companies choose lower degrees of integration when they implement for example the balanced scorecard using specialised software (Malmi, 2001).

Data integration can also be studied more narrowly. Kaplan (1990) argues that at present information produced for financial accounting purposes is used for management accounting purposes as well. Rather, Kaplan (1990) would prefer if management accounting was the primary vehicle for cost allocations and that financial accounting then in turn used these calculations for inventory valuation as an example. In this structure, data for management and financial accounting are integrated.

An information system can be integrated along some dimensions. Booth *et al.* (2000a) identify three dimensions of integration: data integration, hard-/software integration and information integration. Furthermore, Granlund and Malmi (2002) state that level of integration is a continuum. Building on these first indications that integration is not valuable *per se*, much research can be conducted on the optimal level of integration. Is integration along all dimensions of integration needed? Contingency theory can be applied to study the situations in which different kinds of integration are optimal. Actor-network theory would be an appropriate base for studying the role of integration in a specific setting.

2.6.3 Management accounting, the IIS and performance

No piece of research was identified that studied the relationship between management accounting, the IIS and firm performance. Several frameworks in which business processes intermediate the relationship between investments in IT and performance are proposed (e.g. Barua *et al.*, 1995; Dehning and Richardson, 2002).

Although not a primary business process, management accounting can be considered one of the business processes. Does better management accounting lead to improvements in firm performance? How does better management accounting impact firm performance? Under what circumstances? Inclusion of management accounting as an intermediate variable would enrich the research stream on performance effects.

In particular research that applies the case study method is missing, since the application of this research method would be better able to uncover the many intermediate variables between investments in IT and firm performance. The joint hypothesis needs to be split in smaller parts (Dehning and Richardson, 2002).

2.6.4 IIS and management accounting design and use in a functionalist perspective

An in-depth understanding of the relationship between IIS and design of management accounting techniques and their use is missing. Studies on the relationship between IIS and management accounting techniques have mostly applied survey or field study methods. Only few case studies applying a functionalist perspective have been conducted (e.g. Jönsson and Grönlund, 1988; van der Veeken and Wouters, 2002).

More research on the specific design considerations is needed. How are the IIS and management accounting techniques designed in practice? What limitations of the IIS or the management accounting techniques do practitioners experience? How do practitioners circumvent these limitations?

Similarly, more research on the use of the IIS and management accounting techniques is needed. The insights from Jönsson and Grönlund (1988) and van der Veeken and Wouters (2002) are valuable, but much more research like that is needed.

2.6.5 Contingency research where management accounting and IIS are separated

Many publications that investigate the concept of management accounting systems from a contingency perspective were read but not

reported in the literature review (e.g. Libby and Waterhouse, 1996; Bouwens and Abernethy, 2000; Gerdin, 2005). The reason for the exclusion was that MAS research collapses management accounting and IIS. Thus, the relationship between management accounting and IIS is not explored. MAS research brings with it a host of relevant context variables and well-designed quantitative research methods. Contingency theory is not particularly strong in the topic of management accounting and IIS. Bringing context variables and research method into the research field would certainly enrich it.

2.6.6 Organisation of management accounting

Today management accounting is conducted by a host of different people from business managers to shop floor personnel. That these new groups of people possess insights into the techniques of management accounting can be questioned. This leads to two opportunities for future research. First, from a functionalist perspective, research is needed on what skills non-management accountants need and what happens to the design and use of management accounting techniques when shop floor personnel is posting in the general ledger and business managers are doing budget revisions.

Second, the role of management accounting as a management technology is likely to change. From the perspective of actor-network theory, management accounting and IIS are now taking on new meanings. While not much research has been conducted on the organisation of management accounting from a functionalist perspective, some research has been conducted that applies the theory of actor-networks.

2.7 Research questions of this research project

Section 2.6 presents a number of directions for future research. As directions for future research they are all candidates for further investigation. But not all directions for further research will be investigated in this research project. Rather, this research project will investigate the relationship between analysis-oriented information systems and management accounting (see section 2.6.1). Existing literature on the relationship between transaction-oriented

information systems (e.g. ERP systems) and management accounting indicates that management accounting to a lesser extent is supported by transaction-oriented information systems alone. Granlund and Malmi (2002, p. 315) among others direct the attention to SEM systems, which is an example of an analysis-oriented information system, that might be better at supporting management accounting.

The support of an information system can take many forms. In this research project the focus is on the more technical aspect of support. Therefore, support refers to the capability of information systems through its technical features to make a certain design and use of management accounting possible. One example of this is whether an organisation is able to post financial transactions and later on prepare income statements along a product dimension where a hierarchy of products exists (shoes vs. bags, women's shoes vs. men's shoes, men's casual shoes vs. men's business shoes etc.). Not all ERP systems support dimensions with hierarchies. This was an example from the design side of management accounting. From the use side an example is how a balanced scorecard application supports the dialogue between the senior manager and his managers that are responsible for performance as managed by a balanced scorecard.

Before digging deeper into the relationship between analysis-oriented information systems and management accounting, it seems necessary first to investigate whether at all analysis-oriented information systems are better at supporting management accounting than are transaction-oriented information systems. This leads us to the first research question:

RQ 1: Are analysis-oriented information systems better than transaction-oriented information systems at supporting the management accounting tasks of data collection, reporting, analysis and budgeting?

The first research question deals with the support of analysis-oriented components of the IIS to management accounting tasks (the research opportunity identified in section 2.6.1). Current literature primarily deals with the support of ERP systems (an example of a transaction-oriented information system) to management accounting tasks. In order to match current literature, both transaction-oriented

and analysis-oriented information systems are included in the research question. Since RQ1 is an extension of existing research on the relationship between transaction-oriented information systems and management accounting (see e.g. Booth *et al.*, 2000a) it is possible to develop a set of hypotheses.

The hypothesis is that transaction-oriented information systems are better at supporting data collection than are analysis-oriented information systems. In practice, an example of the support of an ERP system could be whether working with hierarchies of products is possible cf. above. On the other hand, a set of hypotheses states that analysis-oriented information systems are better than transaction-oriented information systems at supporting reporting, analysis and budgeting. An operationalisation of these hypotheses could for example be to what extent the information system allows one department upstream the value chain to forecast future activities on the basis of the activities of a department downstream the value chain. The hypotheses will be developed in Chapter 4. If the hypotheses are confirmed, a large space of research opportunities within analysis-oriented information systems opens.

If analysis-oriented information systems are found to have the ability to better facilitate design and use in relation to management accounting than are transaction-oriented information systems, it would be relevant to dig deeper into how analysis-oriented information systems are actually designed and used to support management accounting (see the direction for future research identified in section 2.6.4). The second research question is phrased as follows:

RQ 2: How is the design and use of a management accounting innovation supported by an analysis-oriented information system?

The second research question focuses on management accounting innovations as opposed to conventional management accounting techniques in order to focus on management accounting techniques that by existing literature are expected to gain particular support from analysis-oriented information systems or that are found to be supported outside the ERP system (Granlund and Malmi, 2002).

The two research questions are closely related to each other. The first research question investigates whether analysis-oriented information systems are better at supporting management accounting than are transaction-oriented information systems. This is investigated first since deeper investigation of the relationship can seem without reason if analysis-oriented information systems are no different from transaction-oriented information systems with regard to their support of management accounting. If analysis-oriented information systems are found to support management accounting to a larger extent than are transaction-oriented information systems, answering the second research question will try to uncover how (as opposed to whether) analysis-oriented information systems support management accounting. Thus, RQ2 is to a large extent dependent on the answer of RQ1.

Another difference between the two research questions regards the level of analysis. The two research questions complement each other since RQ1 operates at the organisational level in order to investigate whether analysis-oriented information systems generally are found to be able to support management accounting whereas RQ2 operates at the level of individuals in order to uncover how analysis-oriented information systems facilitate management accounting.

The research project inscribes itself in the academic discussion in which Kaplan (1990), Booth *et al.* (2000a), Fahy and Millea (2001), Granlund and Malmi (2002), Hyvönen (2003), Brignall and Ballantine (2004), Spathis and Constantinides (2004) and Spathis and Ananiadis (2005) participate. This is the stream of research that applies a functionalist perspective.

2.8 Summary and introduction to the next chapter

In chapter 2 literature on management accounting and IIS was reviewed. The review was organised according to a framework developed with the purpose of providing a comprehensive overview of research on management accounting and IIS. On the basis of the framework and the literature review, a number of directions for future research were identified. Among these directions this research project will close research gaps with regard to analysis-oriented components of the IIS. This research will extend current research by investigating the relationship between analysis-oriented systems and

management accounting tasks, techniques and use. First, the overall relationship between analysis-oriented information systems and management accounting tasks will be investigated. Second, how an analysis-oriented custom-developed information system supports a balanced scorecard will be investigated. Doing this, the relationship between analysis-oriented information systems and management accounting tasks, techniques and use is explored.

The next chapter will identify the research method that is best applied when answering the two research questions.

Chapter 3. Research method

In this chapter the relevant research methods will be identified. The choice of research method is dependent upon the type of research question, the extent of control the researcher has over actual behavioural events and the degree of contemporarity (Yin, 1994, p. 4). Also, the methodology of the research project as discussed in section 1.2 has some influence on the choice of methods.

The research questions are in section 2.7 derived from research opportunities identified in the literature review and the overriding purpose of the research project as discussed in section 1.1.2. On the basis of the purpose and the literature review, research questions was developed in such a way that answering the research questions will make possible the fulfilment of the purpose of this research project.

While the appropriate research methods and approaches will be identified and briefly discussed in this chapter, the detailed discussion of the research method and design of the individual studies are reported in the two chapters where the studies are reported and the two research questions answered (more specifically in sections 4.2 and 5.2 respectively). The reason for not going on with the details is that they advantageously can be presented in close connection to the other treatments (e.g. tests and analyses) of the data material.

3.1 The research method of research question 1

The first research question was stated as follows:

RQ 1: Are analysis-oriented information systems better than transaction-oriented information systems at supporting the management accounting tasks of data collection, reporting, analysis and budgeting?

While some research has been conducted on the relationship between transaction-oriented components of the IIS and management

accounting tasks (e.g. Booth *et al.*, 2000a), no research has investigated whether analysis-oriented components of the IIS support management accounting tasks. On the basis of knowledge of characteristics of analysis-oriented vs. transaction-oriented components of the IIS together with knowledge of previous research (as presented in Chapter 2), a set of hypotheses can be developed. Thus, the answer of RQ1 takes on a hypothesis-testing nature.

Since the research question is at a higher level of abstraction and it is of the “What”-type, a quantitative method seems to be appropriate (Birnberg *et al.*, 1990; Yin, 1994, p. 6). Thus, data will be collected through a measurement instrument administered to the respondent via mail and e-mail. Generalisability of a quantitative study rests on whether the sample is large enough to identify relationships and whether the sample is representative compared to the population. The former issue will be dealt with by administering the measurement instrument to a major part of the population. A large sample increases the likelihood that the sample will be representative, and representativity is tested on a number of dimensions.

The data material will be prepared for analysis (e.g. identification of outliers and testing for validity and reliability) and subsequently analysed using statistical techniques such as descriptive statistics, regression analysis, principal components analysis and factor analysis.

The completion of a quantitative study is to a large extent characterised by being serial as opposed to iterative. First, a theoretical framework and hypotheses are developed. Second, data collection is designed and carried out. Third, data are cleaned up and tested, and fourth, analyses are carried out. If one during the analysis phase should realise that the measurement instrument should have included a certain question, it is too late. You cannot go back to the respondents and ask them to answer an additional question. This characteristic of being serial differs from the characteristic of the case study method. Further method details of the survey are provided in section 4.2.

3.2 The research method of research question 2

While the survey method is good at uncovering relationships at a high abstraction level, it is not particularly good at uncovering the relationships at a deeper level. This is among other things due to the problems of internal validity within empirical research (Birnberg *et al.*, 1990). The second research question operates at a level that demands in-depth knowledge:

With research question 2 a management accounting innovation is investigated. Furthermore, focus is solely on analysis-oriented information systems. Research question 2 is stated as follows:

RQ 2: How is the design and use of a management accounting innovation supported by an analysis-oriented information system?

The research question requests an understanding at a relatively deep level of the relationship between management accounting practices and analysis-oriented information systems. Research question 1 applying the survey method will supply a general understanding of the relationship in question. But the survey study will only find out whether there is a relationship between analysis-oriented information systems and management accounting. According to the literature review, no studies have investigated the relationship between management accounting innovations and analysis-oriented information systems in depth. Therefore, the study will be exploratory in nature.

While RQ1 involves only a few variables, several variables are included in RQ2. With RQ2 knowledge of what the relationship between management accounting and IIS looks like rather than if a relationship exists is sought for. Thus, while RQ1 has a hypothesis testing character, the second research question has an exploratory character. A room for uncovering of variables not previously captured must exist when RQ2 is answered.

In order to achieve a thorough understanding of how a management accounting technique is supported by an analysis-oriented information system, rich data collection from a company setting is needed.

Johnson and Kaplan (1987) requested research that to a higher degree complies with the needs of companies. Furthermore, Hopwood (1983), alongside Kaplan's (1984) request for more relevant management accounting research, requests studies in management accounting that are more grounded in its context. A grounding of research in management accounting was needed and "[...] management accounting is, in the end, a practical field where theory without pragmatic implications is empty" (Kasanen *et al.*, 1993, p. 262). The request came from researchers with different paradigmatic convictions as the references show. RQ2 seems to be of a character that responds to these requests.

Case study research seems to be the appropriate method to apply when answering such an in-depth research question (Yin, 1994, p. 6). Furthermore, the case study method seems to be the right choice since the research question is of the "how" type and focus is on contemporary issues.

Case study research is in several instances mentioned in relation to interpretive research (e.g. Hopwood, 1983). While interpretive research especially profits from case studies, the research method is as much applicable to the functionalist stream of research (Falconer and Mackay, 1999; Ryan *et al.*, 2002, p. 147). For example, the degree of prior theorisation and the level of closure on the methods of investigation can vary (Laughlin, 1995), and this indicates that the method can fit different methodologies (see section 1.2 for a discussion of the research methodology applied in this research project).

Furthermore, Eisenhardt (1989) argues that the case study method is appropriate when researching areas that are not well known. When applying the case study method, I will be able to open up the black box that the quantitative method is not able to open.

Ryan *et al.* (2002, p. 143) identify five types of case studies. As the field of research is relatively unexplored, exploratory case studies seem to be appropriate. Exploratory case studies are particularly appropriate with regard to theory development and hypothesis generation. And the purpose of this research project is to generate theory on how management accounting is supported by integrated information systems.

Based on the above mentioned arguments, the case study method seems to be the appropriate research method to apply.

3.2.1 The research approach

Field research is by Burgstahler and Sundem (1989) defined as studies in which the researcher is involved with subjects and observes a real task (see also Ferreira and Merchant, 1992). Furthermore, Birnberg *et al.* write that “[...] field research occurs in natural settings that are not created for the sole or primary purpose of conducting research” (1990, p. 34). Several calls have been made for the application of field research (Ahrens and Dent, 1998), and field research, as being especially relevant in relation to exploration (Birnberg *et al.*, 1990), seems to be the appropriate way of digging deeper into how management accounting is supported by integrated information systems in real organisations.

With the approach taken, the researcher will not directly impact the research objects and subjects. In order to gather data, the researcher will for example conduct interviews and observe meetings. Doing this, the organisation will not be totally free of influence from the researcher since the mere presence of the researcher will influence the behaviour of individuals (McKinnon, 1988; Birnberg *et al.*, 1990).

3.2.2 Case selection

Within the quantitative research method the sample is selected so that the need for representativity is met. The quantitative research method applies statistical replication (Yin, 1994). With regard to case selection and replication in field research, one has to apply another notion. The notion of statistical replication makes no sense since the number of cases seldom gets large enough to be a base for generalisation. When building theories using case studies, it is the purpose of the cases to supply data material that covers the blind angles of the theory. Thus, theoretical sampling is applied when talking case studies (theoretical replication, Yin, 1994, p. 51; theoretical sampling, Eisenhardt, 1989, p. 537; Strauss and Corbin, 1996, p. 201; Silverman, 2001, p. 251). Cases are selected in a way that “[...] will maximize opportunities to discover variations among concepts and to densify categories in terms of their properties and dimensions” (Strauss and Corbin, 1996, p. 201).

The primary theoretical dimension of how management accounting is supported by an IIS is characteristics of the IIS (transaction-oriented vs. analysis-oriented information systems, scope, degree of integration etc. (see the full list of IIS characteristics in section 2.3.2 of the literature review)). Prior research has primarily investigated transaction-oriented information systems such as ERP systems. The literature review revealed that variety along the dimension of transaction-oriented vs. analysis-oriented information systems was needed for the advancement of research. On the dimension of conventional management accounting technique versus management accounting innovations (Bjørnenak and Olson, 1999), a management accounting innovation was chosen since this is where it is suggested that analysis-oriented information systems in particular support management accounting (see e.g. Granlund and Malmi, 2002).

In order to answer research question 2, access to an organisation using a management accounting innovation is needed. Access was granted by the Danish Broadcasting Corporation who uses the balanced scorecard in one of its directorates. The balanced scorecard is an example of a management accounting innovation (Bjørnenak and Olson, 1999). The balanced scorecard is presently supported by self-developed software. This software will during 2006 be replaced by standard BSC software. The self-developed as well as the standard BSC software are examples of analysis-oriented information systems. Differences exist with regard to for example functionality, integration with other information systems and user-friendliness.

The Danish Broadcasting Corporation is a large organisation. The company's IIS is large in scope. Further details of the Danish Broadcasting Corporation is provided in section 5.3.

3.3 Quality measures

In this section, issues of validity and reliability, that are present in any research project, will be discussed. The validity and reliability issues regard the data collection in the quantitative study and in the case study. A number of different strategies and tactics exist for the reduction of problems with regard to validity and reliability (McKinnon, 1988; Modell, 2003). These strategies and tactics work at the individual case/quantitative study level as well as on the higher level across research methods. This is one of the reasons why validity

and reliability are not discussed in relation to the research methods specifically.

McKinnon defines validity as “[...] the question of whether the researcher is studying the phenomenon she or he purports to be studying” (1988, p. 36). Three different types of validity can be identified (Birnberg *et al.*, 1990; Yin, 1994, p. 33; Abernethy *et al.*, 1999; Modell, 2003). These are internal validity¹, construct validity and external validity. Achieving high internal and construct validity is considered a prerequisite for external validity (Birnberg *et al.*, 1990; Modell, 2003).

The criterion of validity originates from the positivist tradition and the quantitative research method. Interpretivists argue that the external validity criteria is not relevant to them, since the personal interaction between the researcher and the studied is unique and thus, there exists no possibility that findings can be generalised to other groups, settings and times (Modell, 2003). The validity criteria remain when using case studies in functionalist studies. When the case study method fought for acceptance among researchers back in the 1980s, the proponents argued for the application of the validity criteria, which should make the case study method as scientific as the quantitative method (e.g. McKinnon, 1988). Since the quantitative and qualitative methods differ on several dimensions, one has to be careful when translating the definitions and remedies of validity from the quantitative to the qualitative research method (Ryan *et al.*, 2002, p. 155).

When considering the criteria of internal and construct validity, not all validity issues seem to be embraced. When conducting exploratory case studies, the researcher is looking for new constructs. In doing so a problem exists with regard to whether the researcher is able to identify all relevant constructs (Leonard-Barton, 1990). This is not covered by the concepts of construct or internal validity, and thus this kind of validity issue will be dealt with separately in the text below under the heading ‘Exploration validity’.

The issue of reliability regards whether the study can be repeated with the same results. Is the researcher obtaining data that can be

¹ Birnberg *et al.* (1990, p. 38) further divide internal validity in statistical validity dealing with the covariation among the variables and internal validity dealing with the effect of the independent variable on the dependent variable.

relied upon? Each of these five validity and reliability criteria are considered below.

3.3.1 Exploration validity

Exploration validity regards the extent to which all relevant constructs are identified. Exploration validity is not relevant to all research questions. As the name suggests, exploration validity is only an issue when the research question is exploratory in nature. This is not the case in research question 1 where the constructs are known when the research question is posed. It is not the purpose of research question 1 to uncover new constructs. On the other hand, it is the purpose of research question 2 to explore how management accounting is supported by information systems. The constructs subject to study are not defined up front, and it is important to the value of the study that all relevant constructs are uncovered. Thus, exploration validity is of concern in the case study.

Exploration validity is sought ensured in the study of the Danish Broadcasting Corporation through the use of several data sources (e.g. interviews, observation, archival records). In this way the researcher is exposed to many constructs. Furthermore, the case was approached with open-mindedness to ensure that no important constructs were disregarded. Finally, the researcher refrained from gaining closure too early in the research process by collecting data over several rounds.

3.3.2 Construct validity

Construct validity is about ensuring that consistency exists with regard to the construct and the phenomenon investigated (Birnberg *et al.*, 1990; Yin, 1994, pp. 34-35; Abernethy *et al.*, 1999; Modell, 2003). If differences exist between the construct and the processes *et cetera* in the company, any conclusions built on that construct will be invalid.

In the quantitative study, construct validity is tested for using Cronbach's alpha coefficient (Nicolaou, 2003). Several questions are asked regarding the same construct so that the phenomenon is approached through different angles. Furthermore, face value and

pilot tests are conducted when developing the measurement instrument in order to ensure that the questions are stated appropriately. Finally, the results of the study are fed back to the respondents through a focus group interview. The tests and description of the process of the quantitative study is further described in section 4.2.

With regard to the case study, data source and data type triangulation (interviews with different respondents and the collection of documents as well as conducting interviews) are employed. Furthermore, the researcher spent more time at the Danish Broadcasting Corporation than just during the interviews. Several full working days were spent at the desk in the accounting department that was supplied for the researcher. If the researcher spends a limited amount of time at the site, a risk exists that people in the company will present themselves in a better light in order to look good (McKinnon, 1988). When the researcher spends a considerable amount of time at the site, people will not be able to maintain the facades and the researcher will be confronted with the realities.

With regard to construct validity, method triangulation is mentioned as a remedy (Modell, 2005). But in this research project, the quantitative study and the case study are studying management accounting and integrated information systems at two different levels of abstraction. Thus, using the two research methods in this research project is not equal to applying method triangulation – at least not when considering the constructs as being on the two different levels of abstraction.

3.3.3 Internal validity

Whether the independent variables are really having an impact on the dependent variable (i.e. causal conclusions) is the concern of internal validity (Birnberg *et al.*, 1990; Yin, 1994, p. 35; Abernethy *et al.*, 1999; Modell, 2003). The quantitative method in particular is subject to critique with regard to the internal validity. That a statistical relationship exists does not necessarily mean that a real relationship exists. Covariance between two variables does not necessarily mean that they have an impact on one another. The covariance may be due to a third variable not included in the analysis. In order to ensure internal validity, control variables have been

included in the regression equations (Campbell and Stanley, 1963, p. 34).

When ensuring internal validity in the case study, the methods mentioned above in relation to construct validity is employed. That is for example the amount of time spent at the site. When being physically present when things happen, the researcher will be able to closely experience the relationships. Furthermore, internal (but also construct) validity is enhanced when findings are reported back to the companies, which is done during the interviews and during presentations of the findings.

3.3.4 External validity

External validity (also often referred to as generalisability) regards whether the findings of a study (whether a case study or a quantitative study) can be generalised across populations, contexts and time (Birnberg *et al.*, 1990; Yin, 1994, pp. 35-36; Abernethy *et al.*, 1999; Modell, 2003). External validity in the quantitative study is ensured by having a large sample and making sure that the distribution along a number of dimensions is alike in the sample and in the population. Furthermore, biases within the sample are tested for (e.g. non-response bias and bias of respondents being particularly positive towards the subject). In section 4.2.6 a number of such tests are conducted.

With regard to case study, one does not talk about statistical generalisability. Rather, the notion of theoretical and literal replication (Yin, 1994, p. 51) is used. The number of cases is far from being large enough to make statistical generalisation. When using a small number of case studies to make inferences on to other cases, it is important that the context of the cases studied be well described. On the basis of a well-described case, one can take departure in the case when trying to relate the findings to other cases.

3.3.5 Reliability

Data are not reliable if they “[...] are not independent of the “accidental circumstances” under which they were gathered” (McKinnon, 1988, p. 36). That is, the respondent or interviewee must

not have given an answer that is influenced by for example the bad weather. With regard to the quantitative method, this issue is dealt with when approaching the construct through several questions (the same way that construct validity is enhanced).

Biases may arise in the contact between the observer (whether participant or not) and the observed. When asking questions directly to people, the interviewer has to be aware of for example how the questions are phrased. Even the mere presence of the researcher might have the interviewee give answers that for example make the interviewee look better (McKinnon, 1988). The interview is an interpersonal drama (Fontana and Frey, 2000). The behaviour of the researcher is important for ensuring the reliability of data. The interviewee must feel comfortable when talking to the researcher. In all interviews, the interviewee was told that what was said would not be forwarded to anybody.

To these broadly described actions towards the reduction of validity and reliability problems are added a number of specific design choices. These are described in detail in sections 4.2 and 5.2.

3.4 A multi-method approach

This research project employs two different research methods: the survey method and the case study method. Doing this is not equal to applying two research paradigms. Thus, multi-method is not equal to multi-methodology. Positivist research can include different methods and for example the case study method is not for interpretivist studies only (Falconer and Mackay, 1999; Mingers, 2001). Falconer and Mackay (1999) group IS researchers in four groups. This research project and I as a researcher belong to the group of positivists who combine quantitative and qualitative methods from a positivist perspective.

The primary reason for combining two different research methods in this research project is that a general test of whether analysis-oriented information systems are better than transaction-oriented information systems at supporting management accounting is needed, which indicates the use of the survey method. On the other hand, research question 2 asks for a deeper understanding of how

analysis-oriented information systems support management accounting, which indicates the use of the case study method. Thus, the selection of research methods is driven by the research questions.

Combining research methods has advantages as well as disadvantages with advantages outweighing disadvantages when reading literature on multi-method research. Each research method has its weaknesses and strengths (see e.g. Gable, 1994, p. 114). Using more than one research method enables the researcher to cover for the weaknesses of using a single research method. One strength of the survey method is the external validity. On the other hand, survey methods are not particularly good at producing studies with high internal validity since correlation between two variables does not imply a causal relationship. This is also the case when investigating whether analysis-oriented information systems support management accounting. That the two constructs co-vary does not imply that the one causes the other. It could be a third construct that is impacting both analysis-oriented information systems and management accounting.

The weakness of internal validity is accounted for by the case study method where deep insight into the case company in question helps the researcher understand what the real drivers and outcomes are. Thus, a case study can supply the interpretation of statistical relationships (Jick, 1979).

A second advantage of applying several research methods is the robustness of results. In the same way that the robustness of results is tested within quantitative research by for example employing different statistical techniques (see section 4.4.2), the robustness of a research project can be tested by employing different research methods.

Against using multiple research methods speaks the fact that it can be hard for a single researcher to master several research methods in depth. Given the size and time frame of a PhD project, this type of research project seems suitable for employing several research methods.

Using the taxonomy of types of multi-method research designs by Mingers (2001, p. 252), this research project is using a sequential method mix in that methods are employed in sequence with results from one feeding into the later one. In this way, whether analysis-oriented information systems are better at supporting management

accounting than transaction-oriented information systems defines the point of departure of the case study.

Some researchers will regard this research design, where a quantitative study is preceding the case study, as the wrong way of organising the two research methods (see Modell, 2003). Typically, when it is recommended that the case study method be applied before the survey method, the two research methods deal with the same theory including level of abstraction. What is characterising research question 1 is that it operates at a high level of abstraction where a body of knowledge exists from which a theoretical framework and hypotheses can be developed. If such body of knowledge did not exist, it would be appropriate to begin with a case study. Research question 2 operates at a lower level of abstraction where the body of knowledge is relatively small. This calls for exploratory research, where the case study method is appropriate.

Triangulation is an often-used word in connection to multi-method research. According to Denzin, triangulation is “the combination of methodologies in the study of the same phenomenon” (1978, p. 291). Since the research questions do not study exactly the same phenomenon, it would not be proper to say that the research project makes use of method triangulation. At least, this is not so in a strict sense. On the other hand, if the phenomenon is the broader topic of analysis-oriented information systems’ support of management accounting, the application of multiple research methods is an instance of method triangulation.

3.5 Summary and introduction to the next chapter

This research project will investigate whether analysis-oriented information systems are better than transaction-oriented information systems at supporting management accounting and how they actually do so. Research question 1 will make use of the survey method, whereas research question 2 will make use of the case study method. The quantitative study is used for the identification of themes that need further scrutiny. Thus, the quantitative study is used for directing the in-depth studies. The combination of the two research methods enables the advantages of one research method to equalize the disadvantages of the other.

It is the purpose of the research project to develop an understanding of the support of information systems to management accounting. This understanding can afterwards be subject to testing by using the survey method. This next step is outside the scope of this research project.

The next two chapters will report on the two studies that answer the two research questions.

Chapter 4. A survey study on the relationship between management accounting tasks and the IIS

4.1 Introduction and development of hypotheses

It is the purpose of this chapter to investigate to what extent management accounting is supported by integrated information systems. Before trying to achieve a deep understanding, it is necessary to investigate to what extent transaction-oriented vs. analysis-oriented information systems support management accounting tasks. The literature review reported in Chapter 2 revealed that analysis-oriented information systems have almost been neglected in studies on the relationship between management accounting and integrated information systems. Therefore, it is important to examine whether analysis-oriented information systems are better at supporting management accounting than are transaction-oriented information systems before proceeding with the acquisition of a deep understanding. Before searching for a deep understanding it is necessary to know within what area this deep understanding should be gained. On the basis hereof, the first research question was stated as follows:

RQ 1: Are analysis-oriented information systems better than transaction-oriented information systems at supporting the management accounting tasks of data collection, reporting, analysis and budgeting?

Some research has been conducted on the support of ERP systems to management accounting while not much research has been conducted on the support of analysis-oriented information systems. This quantitative study will add to this limited knowledge of different kinds of information systems and their support of management accounting. That is, the contribution of this chapter is the uncovering

of how different kinds of information systems support the management accounting tasks of data collection, reporting, analysis and budgeting.

4.1.1 A theoretical framework

The literature was reviewed in Chapter 2 above. On the basis of this review a theoretical framework for the quantitative study was developed. In this section the part of the theoretical framework that is subject to scrutiny within this research question will be specified. The body of knowledge of the relationship between integrated information systems and management accounting tasks seems to have reached such a state that it is possible to develop a set of hypotheses that can be tested through an explanatory study.

Three sets of variables are included in the theoretical framework. These are control variables, management accounting tasks and the integrated information system. With regard to the control variables, the IIS and the management accounting tasks might vary with company size, company type, group unit vs. strategic business unit (SBU) and part of international group.

Company size is an often-used control variable (see e.g. Guilding, 1999; Bharadway, 2000). Studies on the relationship between company size and management accounting find that management accounting get more advanced the larger the company is. One example hereof is the finding by Guilding (1999) that competitor-focused accounting (an example of a management accounting innovation, Bjørnenak and Olson, 1999) is to a larger extent made use of in larger companies. In the study of integrated information systems and management accounting it seems relevant to include company size as a control variable since the scope of the IIS and the sophistication of management accounting can depend on company size.

There is in Danish management accounting research a strong tradition for distinguishing between manufacturing companies, trade companies and service companies (see e.g. Worre, 1991a). It is argued that for example profitability analysis differs between company types. For research on IIS and management accounting it seems relevant to include company type as a control variable. One important reason for this is that the number of modules of the ERP system may be larger

in manufacturing companies where production planning and material management modules are relevant while they are not that relevant to trade companies.

From contingency research on the relationship between contingency variables and management it is often seen that studies focus on strategic business units only (see e.g. Fisher and Govindarajan, 1993; Chong and Chong, 1997). This indicates that the management accounting of strategic business units is different from that of group units. This also seems to be the case with regard to the IIS where group units focus on consolidating the accounts of the subsidiaries while SBUs focus on their production and sales. Since this study does not focus on SBUs alone, it seems necessary to include a variable controlling for the differences in IIS and management accounting between SBUs and group units.

Finally, being part of an international group is included as control variable. From discussions with ERP system vendors such as Microsoft Business Solutions, it seems to be the case that some large Danish companies prefer to implement for example MBS Axapta throughout their subsidiaries throughout the world. The implication of this is that the ERP system called MBS Axapta, which originally is a Danish ERP system, gains market shares abroad through distribution via Danish companies with international representation. This also implies that the ERP system (and probably also the analysis-oriented information systems) of Danish companies might depend on whether the company is part of an international group or not. Therefore, a control variable regarding whether the organisation is part of an international group is added.

The literature review revealed that when investigating the relationship between management accounting and the IIS, it seems relevant to apply a task focus on management accounting. I have thus been inspired primarily by the research conducted by Booth *et al.* (2000a). 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 translated to analysis. Finally, budgeting, that has a central placing in the Danish literature on management accounting (e.g. Worre, 1978a, 1978b) as well as in practice, is added.

The first management accounting task is that of data collection. One dimension is the range or breadth of data collected. In this research project, data collection refers to the broad range of data that is included in management accounting. Thus, financial and non-financial data, quantitative and qualitative data, internal and external data and data collected on an ongoing basis and data collected ad hoc are all referred to when considering data collection. Another dimension regards the depth of data collection. Examples of depth of data collection are dimensions of financial data (department, product etc.) and the division of an amount in units and price per unit. When referring to for example more sophisticated data collection, I am referring to the extent to which breadth and depth of data collection are employed by the company.

The second management accounting task is that of reporting. To a large extent the data available define the capabilities of reporting. Thus, like data collection reporting is also about breadth and depth. Breadth of reporting refers to the diversity of measures that are reported. Thus, breadth of reporting includes for example financial versus non-financial data. Special attention has been given to non-financial data since management accounting innovations tend to include non-financial measures (Bjørnenak and Olson, 1999).

Depth of reporting refers to the complexity and completeness of the reports. One part of depth of reporting is the dimensions that for example profit-loss statements are prepared along. It is essential to the Danish management accounting tradition represented by Worre that cost allocations are not posted but calculated real time (indirect posting is avoided; Worre, 1991a, p. 32). Thus, reporting is also about cost allocation (i.e. the multiplicity of cost drivers used). In this research project it would also be relevant to consider IS aspects of reporting. Therefore, reporting also includes the design of reports and the medium through which they are delivered.

The third management accounting task is that of analysis. Analysis refers to the investigation of data by for example drill down analysis. While drill down analysis temporally is oriented towards the past, simulations and forecasts are oriented towards the future. Thus, past as well as future are analysed. Analysis is carried out in close connection to reports. Therefore, it is not surprising to see that reporting and analysis are collapsed by the factor analysis reporting below in section 4.2.5.4.

Finally, budgeting is also a management accounting task. Budgeting is about to what extent budgets are prepared on financial and non-financial as well as quantitative and qualitative items (just like targets for a diverse set of measures are set in a balanced scorecard). Budgeting is also about whether for example the budget for sales representatives is prepared on the basis of the expected number of products sold in contrast to merely last year's costs. Finally, budgeting is also about the organisational dispersion of the budgeting task to departments other than the accounting department.

The IIS is divided into transaction-oriented and analysis-oriented information systems as discussed in the literature review.

Causal models can be built in several different ways (Asher, 1983; Luft and Shields, 2003; Gerdin and Greve, 2004), and it is necessary to make the model explicit before proceeding.

The first relationship to be developed is the relationship between control variables and management accounting tasks and the integrated information system respectively. The control variables are not considered to be correlated with each other. That is, company size is not expected to co-vary with for example part of international group or not. These assumptions lead towards an additive model that can be illustrated in this way:

Figure IV. The relationship between control variables, management accounting tasks and the integrated information system

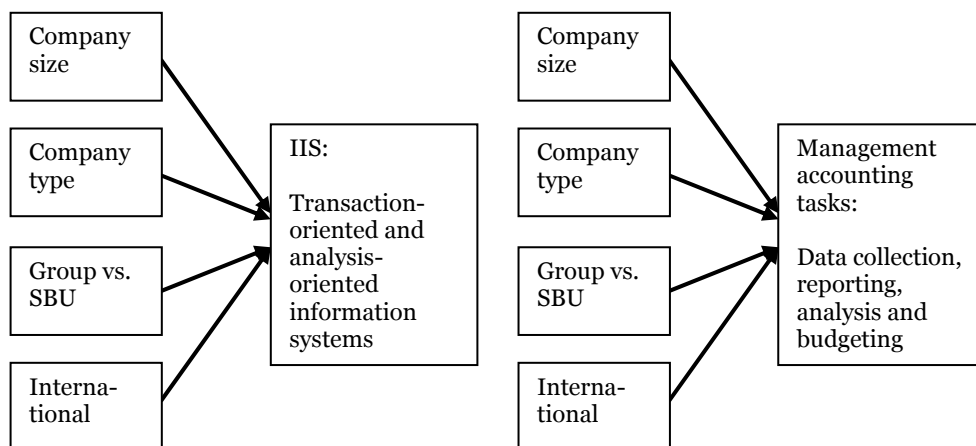


Figure IV illustrates the relationship between the individual control variables and the integrated information system (as divided in transaction-oriented and analysis-oriented information systems) and management accounting tasks respectively. Since the focus of the research question is on the support of the IIS to management accounting, I will not dig deeper into the relationship between the control variables and IIS and management accounting respectively. Therefore, although analysis and discussion of contextual relationships would be relevant, it is outside the scope of this research project.

The framework can be expanded with the relationship between management accounting tasks and the integrated information system. Decisions made with regard to the design of management accounting may have an impact on the design of the IIS. On the other hand, an IIS, which was not initially implemented for management accounting purposes, may lead to changes in management accounting when the users become aware of the possibilities.

This latter kind of impact is discussed by Quattrone and Hopper (2001). According to Quattrone and Hopper (2001), the notion of change can be questioned and the notion of drift may be a better way to look at change. The discussion about change versus drift refers to the two methodological paradigms of functionalism and interpretivism (Burrell and Morgan, 1979; Hopper and Powell, 1985). The notion of change is referred to by Quattrone and Hopper (2001) as something planned, while drift is something that is unplanned. This is much like the distinction between planned and emergent strategy (Mintzberg, 1994). The first relationship, where management accounting has an impact on the IIS, can be considered planned and in accordance with the functionalist paradigm. The notion of drift seems to be more appropriate for explaining the opposite relationship. I assume that an IIS is more necessary for carrying out management accounting tasks than management accounting tasks are necessary for an IIS, since an IIS supports several functional areas.

The time lag in the two relationships differs. A change in management accounting is assumed to have an impact on the IIS earlier than a change in the IIS will have an impact on management accounting (Luft and Shields, 2003). On the other hand, Granlund and Malmi (2002) argue that an ERP system (an example of a

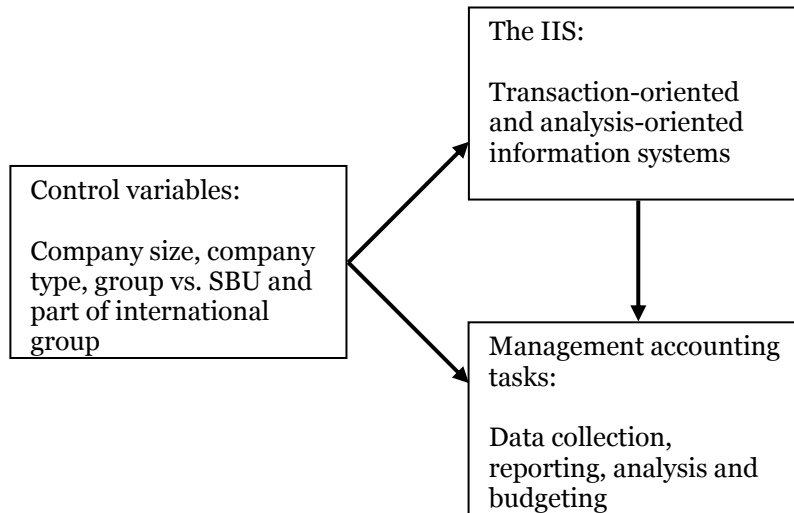
transaction-oriented information system) is hard to change when it is first implemented. Therefore, it is the ERP system that is the slowly changing variable, and management accounting that is the changing or dependent variable. But two objections can be made towards this argument. First, it can be argued that also management accounting can be hard to change (see e.g. Kasurinen, 2002 for an overview of potential change barriers). Second, the parts of the IIS that are expected to have the strongest relationship with management accounting are the analysis-oriented information systems which seem to be easier to redesign than the ERP system. At least this was the impression from the analysis of Corporater BSC (standard BSC software) in relation to the Danish Broadcasting Corporation (see the case study reported in Chapter 5).

It should be noted that the transaction-oriented and analysis-oriented information systems as such are not expected directly to change management accounting practices (Scapens and Jazayeri, 2003). The impact of transaction-oriented and analysis-oriented information 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 subject of scrutiny.

A unidirectional relationship, where the IIS is expected to support management accounting tasks, will be investigated in this chapter. This is so because, typically, integrated information systems are difficult to modify when they are first implemented (Davenport, 1998). Therefore, in the short to medium term, management accounting is expected to be designed on the basis of the premises of the IIS and not *vice versa*.

An arrow between management accounting tasks and the integrated information system can be added to Figure IV as done in Figure V.

Figure V. The relationship between control variables, management accounting tasks and the integrated information system



A unidirectional relationship is expected between management accounting tasks and the IIS, and the IIS is the independent variable, whereas management accounting tasks constitute the dependent variable.

4.1.2 The hypotheses

The hypotheses are developed on the basis of i) the literature reviewed in Chapter 2 and ii) deduction from the differences between transaction-oriented and analysis-oriented information systems.

The IIS is split in transaction-oriented and analysis-oriented information systems, and the literature review indicates that different impacts of those two kinds of systems seem to exist. Findings of for example Booth *et al.* (2000a) and Granlund and Malmi (2002) show that ERP systems, which are transaction-oriented information systems, seem to have some impact on transaction-oriented management accounting by for example efficient registration of large numbers of vouchers. This is well in accordance with the characteristics of ERP systems that are transaction-oriented and primarily support the operating core (Mintzberg, 1983, pp. 12-13) (see section 2.3.2). On the other hand, analysis-oriented information

systems (as the term suggests) are not expected to be particularly good at supporting transaction-oriented management accounting. This follows from the characteristics of analysis-oriented information systems.

On the basis of existing literature and the differences between transaction-oriented and analysis-oriented information systems, transaction-oriented information systems are expected to have a positive impact on data collection; and the hypothesis regarding the support of transaction-oriented information systems to data collection can be stated as follows:

H1a: Transaction-oriented information systems have a positive impact on data collection

In the previous section the content of data collection was discussed. Taking departure herein, the hypothesis can be translated into an expectation that organisations with a broader scope ERP system have more breadth (e.g. financial vs. non-financial data, quantitative vs. qualitative data, internal vs. external data) and depth (e.g. number of dimensions that data are collected along) than other organisations.

With regard to decision support and management accounting innovations such as activity-based costing and balanced scorecard, the situation seems to be another. Studies by for example Fahy and Lynch (1999), Booth *et al.* (2000a) and Granlund and Malmi (2002) conclude that the support of decision support and management accounting innovations is moderate. In continuation hereof and the appearance of SEM systems (an example of an analysis-oriented information system), Granlund and Malmi (2002) explicitly state that further research should look into SEM systems, since they might better support management accounting techniques such as the balanced scorecard than ERP systems. That existing literature points towards analysis-oriented information systems seems plausible when considering the differences in characteristics between transaction-oriented and analysis-oriented information systems. Transaction-oriented IS seems to focus on processing transactions and document masses, whereas analysis-oriented information systems focus on reporting and analysis. Furthermore, Wieder *et al.* (2004) find that supply chain management-software has explanatory power in

relation to supply chain KPIs. In other words, software dedicated to supply chain management is good at supporting supply chain management (that certainly sounds reasonable). Likewise, it should be expected that software focusing on management accounting (such as balanced scorecard-software) is good at supporting management accounting.

Following the above discussion, analysis-oriented information systems are expected to support the more decision-oriented aspects of management accounting (Fahy and Millea, 2001; Gould, 2003; Brignall and Ballantine, 2004). These are in terms of the present constructs reporting, analysis and budgeting. This leads to the following hypotheses:

- H1b: Analysis-oriented information systems have a positive impact on reporting.
- H1c: Analysis-oriented information systems have a positive impact on analysis.
- H1d: Analysis-oriented information systems have a positive impact on budgeting.

With regard to reporting, it is expected that organisations with a large-scope analysis-oriented information system to a larger extent prepare for example profit-and-loss statements along a number of dimensions, report non-financial data and prepare reports in a more flexible way (both in a temporal and in an organisational sense). Furthermore, organisations with a large-scope analysis-oriented information system are expected to a larger extent to do drill down analysis and make simulations and forecasts. Finally, that budgeting is supported by an analysis-oriented information system is expected to result in more extensive use of for example indirect budgeting of capacity costs (where number of future sales representatives is derived from number of expected products sold; Worre, 1991b, pp. 59-60). Also, it is expected that budgeting is more organisationally dispersed to a broader range of departments participating in the budgeting process.

What is as interesting as the absolute impacts of transaction-oriented and analysis-oriented information systems on management

accounting is to test the finding by for example Granlund and Malmi (2002) that reporting, analysis and budgeting are done outside the ERP system. Transaction-oriented information systems are expected to be better at supporting data collection than analysis-oriented information systems as data are primarily collected in the transaction-oriented information system. With the focus of transaction-oriented information systems on transaction processing (Booth *et al.*, 2000a) and the focus of analysis-oriented information systems on decision support (Fahy and Millea, 2001), one should expect analysis-oriented information systems to be the better at supporting reporting, analysis and budgeting. This can be summarised in the next four hypotheses:

- H2a: Transaction-oriented information systems have a larger impact on data collection than analysis-oriented information systems.
- H2b: Analysis-oriented information systems have a larger impact on reporting than transaction-oriented information systems.
- H2c: Analysis-oriented information systems have a larger impact on analysis than transaction-oriented information systems.
- H2d: Analysis-oriented information systems have a larger impact on budgeting than transaction-oriented information systems.

Operationalised, hypothesis H2a suggests that transaction-oriented information systems are better at supporting data collection in that broader and deeper data collection is more likely achieved with a transaction-oriented information system than with an analysis-oriented information system. On the other hand, companies that to a large extent prepare reports on several dimensions and make use of a multiplicity of cost drivers are expected to base this sophistication on analysis-oriented rather than transaction-oriented information systems. The same expectation goes with regard to the extent of drill down analysis, simulation and forecasting. Finally, budgeting along qualitative and non-financial measures and budgeting as an organisationally dispersed activity is expected to be best supported by an analysis-oriented information system.

4.2 Research method

The research method is dependent on the type of research question, control over behavioural variables and the degree of contemporarity (Yin, 1994, p. 4). The question is of the what-type, no control over behavioural variables is needed and contemporary events are in focus. A quantitative study is appropriate in a situation like this. This section will deal with the design of the quantitative study. Some general aspects of the quantitative research method were dealt with in Chapter 3.

4.2.1 The unit of analysis and the respondent

The unit of analysis is strategic business units or group functions. The research question regards the relationship between analysis-oriented information systems and management accounting tasks. The focus is on the design of management accounting and the integrated information system rather than on the behaviour of individuals.

When the unit of analysis is an entire organisation, you are confronted with the question about whom to ask (Luft and Shields, 2003, p. 196). You cannot ask the organisation itself as it consists of individuals. But when you ask individuals about the behaviour of the entire organisation, biases are introduced since the CFO might have other perceptions than the CIO. In order to avoid such biases, several people should be asked. But this is connected with logistical challenges, and the time and financial scope of this research project makes me limit the data collection to the financial manager of the organisation. Although this is a limitation of the study and might represent a source of bias, the financial manager typically has insight into both management accounting and IS matters (Caglio, 2003). Furthermore, the influence of different perceptions is limited as the questions of the survey instrument primarily deals with factual matters.

4.2.2 The population, the sample and administration of the survey instrument

The population consists of all Danish organisations that to some extent have implemented an IIS. Government authorities and non-profit organisations are included in the population. The limitation to Denmark is done due to resource constraints. The definition of the population is in accordance with the unit of analysis as identified in section 4.2.1.

Since analysis-oriented components of the IIS can take different shapes and since they are supplied by different vendors as well as developed in-house, it is not possible to find a register where all organisations having an IIS with an analysis-oriented component are registered. That would be possible if ERP systems were investigated, where vendors (e.g. SAP, Oracle and Microsoft Business Solutions) have customer lists. As a proxy for the true population, all Danish organisations with more than 50 employees are used. This operational population has a large intersection with the true population, since a Danish survey finds that 94.8% of the 500 largest Danish companies have an ERP system (Møller *et al.*, 2003). Several of these 94.8% of Danish companies might have an analysis-oriented component of their IIS.

Organisations with less than 50 employees are excluded from the population, because small organisations are not expected to have an IIS with an analysis-oriented component and because their management accounting typically differ from that of other organisations (e.g. Ask and Ax, 1992; Libby and Waterhouse, 1996; Lukka and Granlund, 1996; Hyvönen, 2003). In addition to the delimitation from small organisations, certain organisation types such as 'Administrative unit', 'Estate of deceased person', 'Branch office' and 'Faroese limited company' are excluded. Furthermore, all organisations with a Faroese or Greenland zip code are excluded.

Contact information of the operational population was collected from a database from 'Købmandsstandens Oplysningsbureau' called 'Web-direct' (www.web-direct.dk). This is a database containing all Danish organisations. The database is updated on an ongoing basis with input from public registers as well as direct contact to the organisations. The database search resulted in 4,533 organisations. The number of employees of the organisations was double-checked and the population was reduced to 4,490 organisations. When

referring to the population in the remaining part of the thesis it is this population that is referred to.

A sample of 3,000 organisations was chosen by random sampling (Aczel and Sounderpandian, 2002, pp. 214-215). Among these, 2,628 (87.6%) organisations had an e-mail address registered in the database. The survey instrument was administered to these organisations by an e-mail including a link to a website where the survey instrument was accessible. The remaining 372 (12.4%) organisations received the survey instrument by regular mail together with a postage-paid envelope. The 372 paper questionnaires were sent on November 30, 2003 and the electronic questionnaires were sent on December 5, 2003. The deadline of both dispatches was December 15, 2003. Paper reminders were sent on December 15, 2003 and electronic reminders were sent on December 16, 2003. Reception of completed questionnaires was ended on January 12, 2004, where a total of 401 responses were received. Among those 343 (85.5%) were collected electronically and 58 (14.5%) were collected postally. The response rate is 13.4%, which is low compared to Danish surveys where respondents for example are contacted by phone in advance of the dispatch. When comparing the absolute number of responses to that of other surveys (e.g. Spathis and Constantinides, 2004) it seems to be acceptable.

No reminder procedure by phone was carried out as the 401 responses were considered enough for the statistical analyses. The ratio of organisations in the sample with information about an e-mail address to organisations without is approximately the same as the ratio of electronic to postal responses. Emphasis was put on making the two data collection methods elapse in the same way.

A relatively large sample is chosen, and the external validity of the sample against the population has not been tested due to the size of the sample. Furthermore, the important external validity is the one where the responses are compared to the population. This latter issue as well as other validity and reliability issues are tested below.

4.2.3 Development of the measurement instrument and measurement of constructs

4.2.3.1 Measurement of the constructs

The IIS

The measurement instrument contains questions regarding transaction-oriented and analysis-oriented information systems and their modules. Transaction-oriented information systems can be ERP systems or best-of-breed systems (Hyvönen, 2003). Best-of-breed systems can be put together so that they cover the same functional areas as an entire ERP system, which is argued to cover the entire business. Therefore, the list of transaction-oriented modules was derived from Davenport (1998) and material from SAP, Oracle and Microsoft Business Solutions. The list of analysis-oriented applications is derived from Brignall and Ballantine (2004) and material from SAP (SAP, 2004b) and Oracle (www.oracle.com/applications/index.html). As the research project is delimited to integrated information systems, the respondent is asked only to consider the systems that are part of the IIS. The two lists of modules are supplemented with an 'Other' category. See the list of transaction-oriented and analysis-oriented modules in Table X on page 139.

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). This is expected to be applicable to other transaction-oriented information systems as well as analysis-oriented information systems. A 'Don't know' category was added to the scale so that the respondent feels that he is

answering the questionnaire even though he cannot answer all questions.

Management accounting tasks

The part of the measurement instrument collecting data on the four management accounting tasks was developed with inspiration from Booth *et al.* (2000a) that investigate the relationship between ERP systems and management accounting tasks and Hyvönen (2003) that investigates management accounting and ERP vs. best-of-breed.

Data collection is measured by 10 questionnaire items (questions C2 through C11). The questions regard to what extent a multiplicity of dimensions is used, different types of data (e.g. external) are collected and from what departments data are collected. See the measurement instrument in appendix 3.

Reporting is measured by the questions D2 through D9. The questions regard for example allocation of costs, the reporting of non-financial data and whether reports are generated on an *ad hoc* basis.

Questions D14 through D16 measures the management accounting task of analysis. The questions regard drill down analysis, simulation and forecasting. Strategic management accounting is included in order to include the strategic dimension (see Fahy and Lynch, 1999).

Budgeting is measured using six questions (E2 through E7). The questions regard the measures that budgets are prepared for (qualitative, unit price x price per unit), whether indirect budgeting is made use of (Worre, 1991b, pp. 59-60) and what departments participate in the budgeting process.

A five-point Likert scale from 'Not at all'/'Completely disagree' to 'To a very large extent'/'Completely agree' and a simple 'Yes'/'No' scale were used. A 'Don't know' category is included.

The assumption that data collection, reporting, analysis and budgeting are the most relevant constructs within management accounting tasks is tested using factor analysis in section 4.2.5.4 below.

Control variables

Four control variables are included in the theoretical framework. Company size is measured by number of employees. Company type is measured by three binary variables: manufacturing, trading and service. The respondent was allowed to mark several boxes. With regard to group versus SBU the respondent was asked to indicate whether he is located in a group unit or a strategic business unit. Finally, the respondent was asked to indicate whether the organisation was part of an international group. The four control variables were measured through self-evaluation. Number of employees is verified by comparison to the data of the companies' database.

4.2.3.2 The size of the questionnaire

In order to increase the response rate and to ensure construct validity and reliability, emphasis was placed on developing a short but comprehensive survey. The questionnaire consists of five pages. The scales are harmonised in order to make it easier for the respondent to answer the questions.

4.2.3.3 No anonymity but confidentiality

It is always important that the respondent feels confident answering a questionnaire. This is particularly relevant when collecting sensitive data. But sensitive data are not collected in this situation and the respondents were not guaranteed anonymity. All links to the survey website were supplied with a unique ID, and all paper questionnaires were coded. In this way, all responses can be merged with the data of the database and some questions can be left out of the questionnaire (e.g. industry). Furthermore, it made possible a reminder procedure, where respondents are not wrongly reminded.

While the responses are not anonymous they are treated with confidentiality. The responses are only analysed by me, the researcher, and no data are used for anything else but for research purposes. Only results based on groups larger than five are reported.

4.2.3.4 Ensuring validity and reliability

What is characteristic when doing quantitative research is that you do not have repeated access to the respondents, since the questionnaire is only sent out once. When the questionnaire is administered, there are no more opportunities for changing or adding questions. Therefore, it is important to consider the opportunities for ensuring high validity and reliability that can be employed before the responses are collected.

Construct validity is ensured by asking several questions within the individual topics. This data triangulation makes possible the tests of Cronbach's alpha and factor analyses. Furthermore, construct validity is ensured by avoiding heavy use of technical terms. Finally, the survey went through a pilot test and a face value test (Modell, 2003, 2005).

Internal validity is ensured by making sure that the two constructs, among which a relationship is looked for, are measured validly (construct validity), and that a theoretical framework lies behind the proposed relationship (Birnberg *et al.*, 1990). Therefore, the ways in which construct validity is ensured also help ensure internal validity.

External validity is ensured *ex ante* by selecting a large sample. The external validity could further be ensured by testing the external validity of the sample against the population, which, however, was considered unnecessary cf. section 4.2.2 above.

Reliability is about whether the respondent answers correctly and whether the data collection effort can be repeated with the same results. By stating several questions about the same topic, reliability can be ensured. Furthermore, reliability is ensured by making the respondent feel comfortable answering the questionnaire. This is ensured by promising confidentiality. Furthermore, the fact that Copenhagen Business School is the sender might also increase the comfort.

4.2.4 Cleaning up the data material

Among the 401 responses, 33 were totally empty or incomplete. These are left out of the data material. Furthermore, 19 responses are left out as those organisations do not have an IIS. For organisations to be included in the analysis, I decided that the organisation must

have a transaction-oriented information system or at least two modules of an analysis-oriented information system to some degree (at least 'implementation in progress'). Otherwise, the organisation cannot be considered having an integrated information system since the emphasis of most definitions of ERP systems or integrated information systems (including the one given in section 2.3.2.1 of this text) is on integration. The final number of usable responses is 349.

The remaining 349 responses were checked for outlying values as they can negatively impact the regression analyses (Aczel and Sounderpandian, 2002, p. 531). An outlier can be due to error or just due to a true but extreme value. Errors were tried corrected or otherwise removed. Extreme values were removed. But only the value of the field in question was removed and thus the entire response was retained.

4.2.5 Collapsing items into constructs

In section 4.2.3.1 it was described how the constructs were operationalised through a number of questionnaire items. In this section the items will be collapsed into constructs so that regression, correlation and other analyses can be conducted on this limited number of constructs.

4.2.5.1 Collapsing variables of dimensions and departments

The respondent was asked to indicate which dimensions are used for data collection and reporting and which departments are collecting data, reporting and budgeting. The respondent was asked to tick the relevant boxes resulting in a vast number of questionnaire items. These items are collapsed into five variables by using principal components analysis, which is a method for data reduction. Missing values were replaced by calculated means before the principal components analysis was performed (Little, 1992; Nicolaou, 2003). In order to determine whether the data were appropriate for principal components analysis, the Kaiser-Meyer-Olkin (KMO) measure was calculated to be between 0.708 and 0.773, which is satisfactory (Sharma, 1996, p. 116). Only one component was retained for each variable. The individual items all load high on their respective components. Those items that loaded >0.50 on the

components were retained in the analysis (Chenhall and Langfield-Smith, 1998). Construct validity and reliability are tested using the Cronbach's alpha statistic (α). The coefficients range from 0.637 to 0.751. All five constructs therefore exhibited satisfactory levels of construct validity and reliability (Nunally, 1978). Component loadings and other statistics of the components are reported in Table III.

Table III. Principal components loadings of dimension and department variables

Questionnaire items and principal components	Loadings
Number of dimensions of data collection (KMO=0.708, α =0.637, variance explained=41.9%)	
Revenues: Product/project	0.697
Revenues: Customer/customer group	0.620
Revenues: Market	0.572
Costs: Process/activity	0.618
Costs: Product/project	0.720
Number of departments collecting data (KMO=0.759, α =0.702, variance explained=41.5%)	
Purchasing	0.718
Production	0.650
Sales/marketing	0.687
R&D	0.629
Accounting	0.583
Other administrative functions	0.588
Number of dimensions of reporting (KMO=0.731, α =0.696, variance explained=40.8%)	
Department/function	0.597
Process/activity	0.608
Customer/customer group	0.680
Market	0.645

Questionnaire items and principal components	Loadings
Product/project	0.664
Person/manager	0.635
Number of departments generating reports (KMO=0.773, α =0.720, variance explained=43.1%)	
Purchasing	0.777
Production	0.720
Sales/marketing	0.715
R&D	0.635
Accounting (was included because of the high loading and it's centrality to the topic)	0.498
Other administrative functions	0.547
Number of departments participating in the budget process (KMO=0.768, α =0.751, variance explained=50.1%)	
Purchasing	0.826
Production	0.685
Sales/marketing	0.642
R&D	0.752
Other administrative functions	0.614

4.2.5.2 Four new variables: groups of modules of transaction-oriented information systems

The scope of the transaction-oriented information system was measured by number of modules of the transaction-oriented information system. A total of 19 different modules were available for ticking. These are collapsed into four module groups: Sales, distribution and CRM; Production and logistics; Finance; and Other. Principal components analysis with the same settings as above was used. KMO values, Cronbach's alpha coefficients, variance explained and component loadings are reported in Table IV.

Table IV. Principal components loadings of module groups

Questionnaire items and principal components	Loadings
Sales, distribution and CRM (KMO=0.500, α =0.491, variance explained=65.4%)	
Sales and distribution	0.808
CRM	0.808
Production and logistics (KMO=0.722, α =0.767, variance explained=51.2%)	
Production planning	0.800
Material management	0.785
Plant maintenance	0.642
Quality control	0.717
Supply chain management	0.632
Finance (KMO=0.690, α =0.597, variance explained=40.4%)	
Finance/general ledger	0.547
Controlling	0.695
Investment management	0.562
Cash flow and currency management	0.713
Group controlling	0.645
Other (KMO=0.694, α =0.572, variance explained=38.9%)	
Support for administrative tasks	0.725
Real estate management	0.548
Industry solutions	0.522
E-business	0.651
Work flow/document management	0.653

4.2.5.3 *The creation of composite variables of transaction-oriented and analysis-oriented information systems*

In continuation of the creation of module groups of transaction-oriented information systems, a single composite variable of the transaction-oriented information system is created. In addition, the modules of analysis-oriented information systems are collapsed into one composite variable. Again, principal components analysis is applied. Loadings *et cetera* are reported in Table V.

Table V. Principal components loadings of analysis-oriented and transaction-oriented information systems

Questionnaire items and principal components	Loadings
The transaction-oriented information system (KMO=0.712, α =0.734, variance explained=55.7%)	
Module group: Sales, distribution and CRM	0.736
Module group: Production and logistics	0.776
Module group: Finance	0.768
Module group: Other	0.703
The analysis-oriented information system (KMO=0.826, α =0.715, variance explained=38.3%)	
Data warehouse	0.609
Activity-based costing	0.569
Software for reporting financial as well as non-financial measures	0.674
Executive portal	0.549
Data mining	0.618
Planning and simulation	0.689
Consolidation	0.610

4.2.5.4 *Identification of factors of the management accounting variables and collapsing them*

As described in section 4.2.3.1 the items within management accounting were developed with inspiration from Booth *et al.* (2000a) and Hyvönen (2003). In this section it is described how

factor analysis is used for examining whether other management accounting constructs exist within the items. Therefore, exploratory factor analysis is used for identification of a number of underlying factors behind the many management accounting variables that the data set consists of. The factor analysis was carried out with a varimax rotation in order to optimise the diversity among the factors. Seven factors were found when using the criterion of eigenvalues greater than one (KMO=0.876, α =0.907, variance explained=50.8%). The factor loadings are reported in appendix 4. The seven factors and the variables loading onto them were analysed in order to extract a number of meaningful management accounting constructs. The seventh factor seemed to make no sense, and two variables loading on the first factor should rather belong to factors three and five respectively. On the basis of this theoretically inspired analysis, six factors were identified. Since two variables should be moved from one factor to another, the factor analysis was not used for creating the six final factors. Instead, principal components analysis was applied for this task. The principal components analyses were carried out as described above. The content of the six factors is analysed on the basis of the variables that make up the construct. In the remaining text the original four tasks will be referred to as 'tasks' whereas the identified six factors will be referred to as 'factors'.

Table VI. Principle components loadings of management accounting variables

Questionnaire items and principal components	Loadings
Organisational breadth of management accounting (KMO=0.701, α =0.790, variance explained=70.5%)	
Number of departments collecting data	0.853
Number of departments reporting	0.852
Number of departments participating in the budgeting process	0.813
Non-financial, external and ad hoc management accounting (KMO=0.780, α =0.798, variance explained=54.5%)	
Collection of non-financial, qualitative data	0.791
Collection of external data	0.746
Ad hoc collection of data	0.638

Questionnaire items and principal components	Loadings
Reporting non-financial data	0.805
Preparing budgets on non-financial, qualitative indicators	0.699
Reporting and analysis (KMO=0.812, α =0.794, variance explained=49.2%)	
Reports are generated ad hoc	0.706
The user is himself designing the reports	0.601
The reports are delivered to the screen rather than to paper	0.740
Electronic reports are analysed using drill down	0.724
Simulations and forecasts are done in the IIS	0.677
The IIS is used for strategic management accounting	0.749
Budgeting (KMO=0.695, α =0.778, variance explained=60.3%)	
Budgets are prepared on non-financial, quantitative indicators	0.649
Sales are budgeted as units x price per unit	0.893
Costs are budgeted as units x price per unit	0.873
The production department prepares budget on the basis of sales forecasts from the sales department	0.658
Data collection (KMO=0.756, α =0.748, variance explained=44.2%)	
Number of dimensions of data collection	0.549
The use of hierarchies on dimensions	0.680
Quantities are registered	0.729
Price per unit is registered	0.719
Calculated costs are posted	0.654
Non-financial, quantitative data are collected	0.638
Allocation of costs (KMO=0.500, α =0.717, variance explained=77.4%)	
Fixed costs are allocated to customer, products etc.	0.880
The allocation of costs are performed using a multiplicity of cost drivers	0.880

Organisational breadth of management accounting

This construct is about the extent to which different departments are participating in carrying out management accounting tasks such as data collection, reporting and budgeting. When examining the loadings, it is seen that all three variables load equally high on the component. To see this construct appear from the factor analysis was quite interesting. Other studies (e.g. Scapens and Jazayeri, 2003) report that the advent of ERP systems leads to a changing role of the general manager. With ERP systems, general managers review the performance of their organisation themselves rather than wait for the accounting reports. These findings are to some extent supported by the appearance of this construct.

Non-financial, external and ad hoc management accounting

This construct contains some of the characteristics of management accounting innovations (Bjørnenak and Olson, 1999). The collection of external and non-financial, qualitative data is part of the construct. So are the reporting and budgeting of the same types of data. Finally, external data collection is also included in the construct though it is loading the lowest.

Reporting and analysis

As the innovative aspects of reporting and analysis are contained within the construct of non-financial, external and ad hoc management accounting, what remains are the variables regarding what the interplay between management accounting tasks such as preparing reports and the IIS looks like. Thus, this construct contains the way in which reports are generated and analysis conducted in relation to the IIS. This is a construct that emphasises the relationship between management accounting and IIS.

Budgeting

This construct contains the conventional elements of budgeting such as whether budgets are prepared as number of units x price per unit (Worre, 1994, pp. 161-163). But also the issue of integration is

included in this construct, since the variable of whether the production department prepares their budgets on the basis of sales forecasts of the sales department is included.

Data collection

As with budgeting, this construct contains the conventional elements of data collection. These are the use of dimensions, collection of unit and price, collection of non-financial, quantitative data and so-called direct posting (Worre, 1994).

Allocation of costs

Two questions about whether fixed costs are allocated to cost objects and to what extent a multiplicity of cost drivers is used are contained within this construct. The number of questions asked in this area is not large enough to identify whether the company is making use of activity-based costing, full costing or contribution margin principle, which was not the purpose. Nevertheless, a high score on this construct indicates some degree of complexity in the cost allocation of the company.

4.2.6 Measurement of quality: validity and reliability

When data are cleaned for errors and new, composite variables are created, they must be tested for validity and reliability. These tests are carried out *ex post* to the data collection as opposed to the actions taken to ensure validity and reliability *ex ante*, which were described in section 4.2.3.4. Each type of validity and reliability is tested in turn. The six management accounting factors found using principal components analysis are also tested.

4.2.6.1 Construct validity

Construct validity refers to whether consistency exists with regard to the construct and the phenomenon investigated (Birnberg *et al.*, 1990; Abernethy *et al.*, 1999; Modell, 2003). If differences exist between the construct and the reality, any conclusions building on that construct will be invalid. Construct validity is tested in two ways.

First, consistency within both the different questionnaire items and the database data is tested. Second, it is tested whether answers from accountants deviate from those from non-accountants. In addition to the statistical tests, the results of the study are fed back to the respondents through a focus group interview.

Consistency within both the different questionnaire items and the database data (construct validity and reliability)

Several questions are asked regarding the same construct so that the phenomenon is approached from different angles, and construct validity is tested for by using Cronbach's alpha coefficient (Cronbach, 1984). This is the most common way of testing construct validity. This test also tests for reliability since the test cannot say whether deviations between different answers to the same question are due to bad translation of constructs (construct validity) or the respondent giving wrong information (reliability).

The following constructs are tested. Company size as measured by number of employees (between responses and database data), data collection, reporting and analysis, budgeting, non-financial, external and ad hoc management accounting, cost allocation and organisational breadth of management accounting. It does not make any sense to test for construct validity with regard to the transaction-oriented and analysis-oriented information systems, since the individual questions are independent of each other as they regard different modules. Thus, convergence in these questions is not expected.

Table VII. Test statistics for construct validity

Construct	Cronbach's alpha
Company size: number of employees (between responses and database data) (2 items)	0.804
Data collection (6 items)	0.748
Reporting and analysis (6 items)	0.794
Budgeting (4 items)	0.778
Non-financial, external and ad hoc management accounting (5 items)	0.798

Construct	Cronbach's alpha
Cost allocation (2 items)	0.717
Organisational breadth of management accounting (3 items)	0.790

The Cronbach's alpha coefficients range from 0.717 to 0.804, and the constructs therefore exhibit satisfactory levels of construct validity and reliability (Nunally, 1978).

The risk that non-competent persons respond to the questionnaire

A risk exists that persons without competence within the area of management accounting and integrated information systems are answering the questionnaire and are perhaps giving wrong answers as they do not understand the concepts or do not have the necessary insight. In order to test for this risk, the respondent was asked to indicate his occupation. An examination of the answers reveals that 84.2% of the respondents have an accounting background, which is comparable to the study by Chenhall and Langfield-Smith (1998). The remaining 15.8% of the responses are answered by for example account managers, CEOs, IS managers and project managers.

T-tests (the non-parametric test of Mann-Whitney is used when homogeneity of variance does not exist) on all variables, that are included in later analyses, indicate that differences between accountants and non-accountants exist on four variables. These are company type: service ($p=0.007$), number of employees ($p=0.003$), part of international group ($p=0.001$) and data collection ($p=0.044$). Non-accountants to a larger degree come from service companies, larger companies and companies that are not part of an international group. Finally, it is found that organisations, where non-accountants deliver the responses, tend to have lesser data collection.

While some differences exist between the answers from accountants and those from non-accountants, it is questionable whether a severe problem exists. The field of management accounting and IIS is characterised by the fact that new professions are entering as well as the role of the management accountants is changing (Caglio, 2003). Therefore, people not entitling themselves management accountants might have as much insight into the field as management accountants.

Consistency between questionnaire data and database data

Some data are collected using the survey instrument while other data are collected from the database. Questionnaire data and database data are connected using a unique identification number, which every electronic as well as paper-based questionnaire is supplied with. In order to make sure that this link is trustworthy, the consistency between questionnaire data and database data is tested by calculating the Cronbach's alpha coefficient of number of employees as per the respondent and the database. The value of the coefficient is 0.804 indicating that consistency exists. A Pearson correlation coefficient of 0.774 ($p < 0.000$) supports this finding. Based on these tests, the two data sets seem to be comparable.

4.2.6.2 Internal validity

Whether the independent variables are really having an impact on the dependent variable (i.e. causal conclusions) is the concern of internal validity (Birnberg *et al.*, 1990; Abernethy *et al.*, 1999; Modell, 2005). Internal validity is tested by for example reading the findings back to the respondents.

A focus group interview with seven respondents was conducted shortly after the collection of the data. The findings of the preliminary data analysis were presented and discussed. The discussions did not reveal any threats to the internal validity of the data.

A brief report containing a summary of the primary findings was given to the respondents who wanted to receive such a report. The receiver was asked to comment on the report if a need for doing so was felt. Only positive and confirmatory comments were received.

Based on these tests of internal validity, it can be concluded that internal validity of the data material is present.

In addition to explicitly testing validity, validity can be assured by applying sound theorising when developing the framework and the hypotheses to be tested.

4.2.6.3 External validity

External validity regards whether the findings of a study can be generalised across populations, contexts and time (Birnberg *et al.*, 1990; Abernethy *et al.*, 1999; Modell, 2005). External validity is tested by i) comparing demographic variables of respondents and non-respondents, ii) comparing the responses received first and the responses received last and iii) comparing the responses of panellists (supposedly positive participants) and non-panellists.

Comparison of the demographic variables of respondents and non-respondents

A number of control variables are included in the theoretical framework developed above. With regard to number of employees, information is available from both the population and the respondents. Furthermore, data on legal form and industry is available on the entire population from the database. The two latter variables are on a nominal scale, and a non-parametric test for correlation (the Spearman rank correlation coefficient) is used (Aczel and Sounderpandian, 2002, p. 702). The test for external validity tests the 349 valid responses against the population of 4,490 organisations. When analysing the test results, one has to keep in mind that the population is not the true population since organisations without an IIS is contained within the 4,490 organisations while the true population does not contain organisations without an IIS.

Number of employees

The non-parametric test of Mann-Whitney (homogeneity of variance does not exist) indicates that a difference exists with regard to the composition of company size in the population and in the responses ($p=0.000$). An analysis of the composition of company size among responding organisations and the population reveals that the organisations of the responses are larger than those of the population. The true population will probably not contain as many small organisations as the proxy population since small organisations to a lesser degree have an IIS. In non-completed responses from small organisations it is written that the survey is not relevant to the

company underscoring the difference between the proxy population and the true population.

As the true population is expected to consist of larger companies than the proxy population, the test results are not considered to lead to the conclusion that the data material does not contain external validity.

Legal form

No difference between the proxy population and the responses was found with regard to legal form. This was tested using Mann-Whitney and a significance level of 5%.

Industry

No difference was found between the proxy population and the responses with regard to industry.

Non-response bias

Responding organisations might be different from the remaining population. A risk exists that non-respondents would have answered differently than the respondents if they had answered. In order to remove this insecurity with regard to the external validity of the data material, the first responses and the last responses are compared. The late responses are used as a proxy for non-respondents.

The first 28 and the last 28 responses (8.0% each) were identified. The first 28 responses were received during the first 5 days while the last 28 responses were received during the last 21 days. All of the later responses were received after the deadline for returning the responses. On the basis of the two subgroups of the data set, means were compared using the t-test or the Mann-Whitney test in case of lacking variance homogeneity. All t-tests and Mann-Whitney tests indicate that no non-response bias exists in the data material.

The risk that only people positive towards the topic have answered the questionnaire

Yet a risk exists in that only people positive towards the topic of the relationship between management accounting and integrated

information systems might have answered the questionnaire (Cagwin and Bouwman, 2002). As I do not have the responses and attitudes towards the questionnaire of the non-respondents, the test will be carried out on the basis of a split of the data set along a variable indicating whether the respondent is interested in participating in future surveys. 131 respondents (=37.5%) want to participate in this panel. The responses of the panellists are compared to those of the remaining respondents using the same statistics as applied when testing for non-response bias. Results indicate that difference exists between panellists and non-panellists with regard to whether the organisation is part of an international group ($p=0.037$). Correlation analysis indicates that panellists to a lesser extent are part of an international group. This shortcoming of the data material is acknowledged but it is not considered to be a major problem since the difference only regards one variable.

4.2.6.4 Reliability

Data are not reliable if they “[...] are not independent of the “accidental circumstances” under which they were gathered” (McKinnon, 1988, p. 36). Reliability is tested by comparing the answers within related questions. This is the same way that construct validity is tested as the tests cannot say whether deviations between different answers to the same question are due to bad translation of constructs (construct validity) or the respondent giving wrong information (reliability). Therefore, the tests of reliability are carried out in section 4.2.6.1 above.

4.2.7 Testing the hypotheses

When constructs are in place it is possible to test the hypotheses. How this is done is the subject of this subsection. First, the issue of how to measure change is discussed. Then, a number of sections deal with the different relationships of the framework of section 4.1.1.

4.2.7.1 Measurement of change

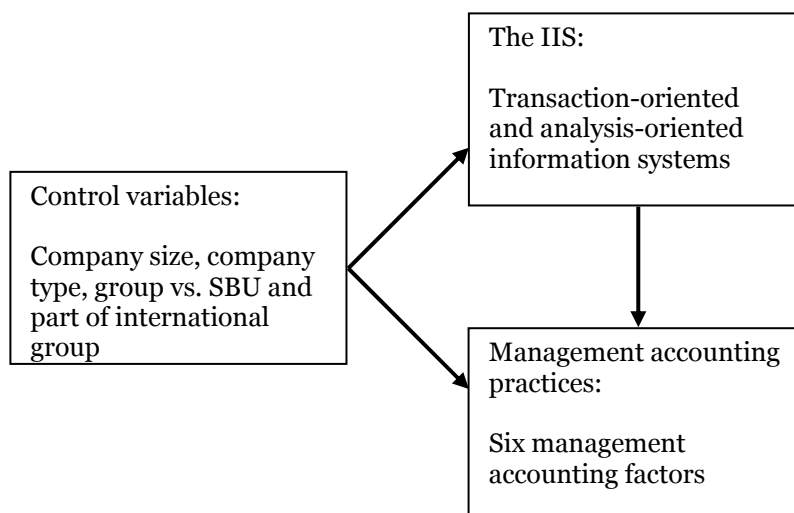
As it seems problematic to ask the respondents about their historic actions (Yin, 1994, p. 85), respondents are not asked about their past

management accounting practices as they were before the implementation of an IIS. Instead, ‘change’ is measured by comparing different cases with different IISs (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 the management accounting practices and the IIS can be drawn if other explanatory variables are controlled for (Campbell and Stanley, 1963, p. 36).

4.2.7.2 *The support of the IIS to management accounting factors*

As described in relation to the hypotheses developed in section 4.1.2, relationships are expected to exist between the IIS and management accounting factors. Multiple regression analysis seems appropriate for this task since the outcome variable is composed of several variables. The details of the use of multiple regression analysis are given below. The revised theoretical framework is reproduced in Figure VI.

Figure VI. The relationship between control variables, management accounting factors and the integrated information system



An equation can be identified that explains the management accounting factors respectively. The equation is depicted below:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_{3j} X_{3j} + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + R_u,$$

where

- Y_1 = Data collection
- Y_2 = Reporting and analysis
- Y_3 = Budgeting
- Y_4 = Non-financial, external and ad hoc management accounting
- Y_5 = Allocation of costs
- Y_6 = Organisational breadth in management accounting
- X_1 = Transaction-oriented information systems
- X_2 = Analysis-oriented information systems
- X_{3j} = Company type (1: trading, 2: service, 3: manufacturing)
- X_4 = Number of employees
- X_5 = Group unit vs. strategic business unit (1: Group, 2: SBU)
- X_6 = Part of an international group or not
- R_u = Error term

The notation of the figure and the equation is borrowed from Asher (1983).

The equation is analysed upon when answering the hypotheses regarding the support of IIS to management accounting tasks. It is the coefficients of the IIS (β_1 and β_2) that are of interest. A significance level of 5% is used. T-tests are made use of when testing the significance of independent variables.

When the impacts of transaction-oriented vs. analysis-oriented information systems are compared, coefficients of the same variable

but from two different regression analyses are compared. When testing for differences in the coefficient, t-tests are used.

4.2.7.3 Data analysis using multiple regression analysis

When carrying out multiple regression analysis, the method of ordinary least squares is employed (Aczel and Sounderpandian, 2002, p. 441) and the significance of the independent variables is tested using t-tests. A constant is included in the regression models to increase the variance explained, and missing values are replaced by the mean.

In order to justify the regression analyses a number of assumptions have to be fulfilled. Those assumptions regard the error term. These include (Asher, 1983, p. 26):

1. Data are on the interval level (a criterion for using Pearson product-moment correlations)
2. $E(\varepsilon)=0$
3. The variance of ε is constant for different values of X_i (homoscedasticity)
4. Pairs of error terms are uncorrelated (autocorrelation)
5. The independent variables and error term are uncorrelated
6. The error term is normally distributed (a criterion for the applicability of significance tests)

According to the first assumption, it is required that data be on the interval level. With regard to the variables created using principal components analysis (the variables of management accounting factors and the IIS) this is the case. Also the variable measuring company size is on the interval level. The measurement of company type, group unit or strategic business unit and part of international group is based on binary variables. But according to Asher “[...] in many situations, treating ordinal data as if they were interval poses no serious problems” (1983, p. 27).

Assumption number 2 is tested by saving the residual of the regression model and calculating the mean of that new variable. Whether the mean is significantly different from zero is tested by using a t-test (Aczel and Sounderpandian, 2002, p. 437), which is a parametric test.

Assumption number 3 is tested visually by examining plots of the error term against the independent variables. The cloud of dots should be equally distributed around zero (the assumed mean of the error term) with different values of X_i .

Assumption number 4 is tested using a Durbin-Watson test. While autocorrelation can exist at any one time lag, the Durbin-Watson test only tests for the existence of the first-order autocorrelation (Aczel and Sounderpandian, 2002, p. 577). Cases in which higher-order autocorrelation exists while no first-order autocorrelation exists are not common (Aczel and Sounderpandian, 2002, p. 579), and I therefore abstain from further testing of this assumption.

Assumption number 5 is tested using Pearson's product-moment correlations or Spearman's rank correlation coefficient, when the assumption of Pearson's product-moment correlations (normality) is not upheld (Aczel and Sounderpandian, 2002, p. 702).

Finally, assumption number 6 is tested visually by inspecting the normal probability plot.

On the basis of this comprehensive testing of the assumptions behind regression models, it can be concluded whether the regression coefficients are valid (assuming construct validity).

4.3 Descriptive statistics

4.3.1 Organisational characteristics

The control variables of the framework depicted in Figure VI are company size as measured by number of employees, company type, group vs. strategic business unit and whether the company is part of an international group. Descriptive statistics of each of these are presented here.

The distribution along company size is so that 60% of the responding organisations have less than 200 employees. Thus, responding companies are larger than the companies of the population and Danish companies in total (Danmarks Statistik, 2006). See the distribution of number of employees in Table VIII.

Table VIII. Number of employees in responding organisations

Number of employees	Frequency of valid responses
0-49	3.0%
50-99	26.9%
100-199	27.2%
200-499	23.4%
500-999	8.4%
1000-2499	6.0%
2500-4999	2.4%
5000-9999	1.2%
10000-	1.5%

Trading companies count for 26.1% of the cases while 49.0% are service companies and 44.7% manufacturing companies. The percentages do not sum to 100% since the respondent was given the opportunity of ticking several boxes as a response to this question (Andersen and Rohde, 2001, p. 41).

51.7% of the respondents are employed in a group unit while the remaining respondents are employed by strategic business units. 35.9% of the companies are part of an international group.

4.3.2 The integrated information system

To what extent transaction-oriented and analysis-oriented information systems and their modules are implemented in Danish organisations is described in this section. While Møller *et al.* (2003) investigate the presence of ERP systems in the largest organisations in Denmark, this study is investigating all organisations with more than 50 employees.

The first section of questions about the organisation's transaction-oriented information systems regards what ERP system the responding organisation has. The results are summarised in Table IX.

Table IX. ERP systems in Danish organisations

ERP systems	In percent of all valid responses (n=349) (Is implemented or Is implemented and further developed)
MBS Axapta, XAL, Attain, C5, Financials, Navision	42.4%
SAP R/2 or R/3	10.9%
Oracle Applications	3.4%
EDB-Gruppen Aspect/4	3.2%
Self-developed system	2.0%
Scala	1.5%
IFS	1.2%
SSA Global Baan	0.6%
PeopleSoft (now part of Oracle)	0.6%
Other	25.0%

Microsoft Business Solutions offers a range of ERP systems. MBS's product range has increased in size due to the acquisition of the products from formerly Damgaard and Navision among others. ERP systems from MBS are present in 42.4% of the responding organisations.

The Danish ERP system called Aspect/4 (developed by EDB Gruppen) is present with 11 implementations. Yet another medium-sized ERP system called Scala is represented with five implementations. The larger systems are also present in the Danish landscape as products from SAP are implemented in 38 or 10.9% of the responding organisations. Another 3.4% have Oracle Applications, two respondents have indicated implementation of Baan and other two respondents have an implementation of PeopleSoft. In total 84.2% of all responding organisations have an

ERP system. When including ERP systems under implementation, the total share of implementations increases to 91.4%.

Table X. ERP system modules in Danish organisations

ERP system modules	In percent of all valid responses (n=349) (Is implemented or Is implemented and further developed)
Finance	86.0%
Sales and distribution	54.7%
Controlling	43.3%
Materials management	35.3%
Project	33.5%
Production management	31.8%
Cash and currency management	27.8%
Group controlling	18.3%
Administrative routines	17.2%
Industry solutions	16.0%
Human resource management	14.6%
Document management	14.4%
Customer relationship management	14.3%
Quality control	14.3%
E-business	12.6%
Investment management	10.9%
Supply chain management	8.0%
Plant maintenance	5.8%
Real estate management	4.3%
Other	7.2%

When taking a closer look at the composition of modules in the implementations, it is seen that 86.0% of all respondents have implemented the finance module while 43.3% have implemented a controlling module, 27.8% a cash and currency management module, 18.3% a group controlling module (or 26.2% of responding

organisations that are a group unit) and 10.9% an investment management module. The basic financials module is thus to a large extent supplemented with other accounting modules. Second to the finance modules are the production and sales modules, among which a sales and distribution module is implemented in 54.7% and a production management module in 31.8% of the total responses. Of the responding organisations that are production companies, 57.7% have a production management module. Also the project module is quite prevalent as it is implemented in 33.5% of the responding organisations. While the aforementioned modules are quite prevalent, modules such as document management (14.4% of total responses) and real estate management (4.3% of total responses) are less frequent.

33.5% of all responding organisations have implemented or have implemented and further developed a data warehouse. To this can be added another 7.4% that are still in the implementation phase. The more frequent of the analysis-oriented information systems are software for reporting and analysis of financial as well as non-financial data (19.2% of total responses), planning and simulation (16.9%) and consolidation (15.5%). Less frequent is software for data mining (10.3%), activity-based costing (9.5%) and executive portal (4.6%).

Table XI. Modules of analysis-oriented information systems in Danish organisations

Modules of analysis-oriented information systems	In percent of all valid responses (n=349) (Is implemented or Is implemented and further developed)
Data warehouse	33.5%
Software for reporting and analysis of financial as well as non-financial data	19.2%
Planning and simulation	16.9%
Consolidation	15.5%
Data mining	10.3%
Activity-based costing	9.4%
Executive portal	4.6%

Modules of analysis-oriented information systems	In percent of all valid responses (n=349) (Is implemented or Is implemented and further developed)
Other	4.0%

When cross tabulating medium-sized (e.g. MBS Axapta) and large ERP systems (e.g. SAP R/3) against the data warehouse, it is seen that data warehouses are more frequent in organisations having large ERP systems. The same holds for the analysis-oriented information systems.

To summarise, the analysis of the frequencies shows that ERP systems are implemented in almost all responding organisations (which is the criterion for inclusion in the population), 33.5% have a data warehouse and approximately 20% have one or more analysis-oriented information systems. This adds to the picture on which data warehouses and other analysis-oriented information systems are built and perhaps regarded as advancements to ERP systems.

4.3.3 Management accounting factors

The purpose of this section is to describe the management accounting factors of the responding organisations in order to better understand what lies behind the term management accounting factors. All descriptive statistics are reported in Table XII.

Table XII. Descriptive statistics of management accounting factors

Variable	Mean (1: To a very low extent; 5: To a very large extent)	Standard deviation	Percent of valid respondent answering To a large extent or To a very large extent
Data collection			
Number of dimensions of data collection	n/a	n/a	60.0%

Variable	Mean (1: To a very low extent; 5: To a very large extent)	Standard deviation	Percent of valid respondent answering To a large extent or To a very large extent
(binary variable)			
The use of hierarchies on dimensions	3.59	1.288	59.4%
Quantities are registered	3.39	1.359	53.4%
Price per unit is registered	3.13	1.606	48.3%
Calculated costs are posted	2.80	1.340	30.1%
Non-financial, quantitative data are collected	2.63	1.370	29.3%
Reporting and analysis			
The reports are delivered to the screen rather than to paper	2.77	1.234	30.4%
Reports are generated ad hoc	2.74	1.202	27.2%
Electronic reports are analysed using drill down	2.58	1.303	26.1%
The IIS is used for strategic management accounting	2.63	1.158	21.7%
The user is himself designing the reports	2.35	1.105	14.6%
Simulations and forecasts are done in the IIS	2.15	1.140	13.6%
Budgeting			

Variable	Mean (1: To a very low extent; 5: To a very large extent)	Standard deviation	Percent of valid respondent answering To a large extent or To a very large extent
The production department prepares budget on the basis of sales forecasts from the sales department	2.48	1.442	27.8%
Sales are budgeted as units x price per unit	2.34	1.463	27.3%
Costs are budgeted as units x price per unit	2.15	1.319	18.8%
Budgets are prepared on non-financial, quantitative indicators	2.07	1.121	13.1%
Organisational breadth of management accounting (binary variables)			
Number of departments participating in the budgeting process	n/a	n/a	64.8%
Number of departments collecting data	n/a	n/a	55.1%
Number of departments reporting	n/a	n/a	49.5%
Non-financial, ad hoc and external management accounting			
Collection of non-financial, qualitative data	1.76	1.078	9.3%
Ad hoc collection of data	1.77	0.962	5.3%

Variable	Mean (1: To a very low extent; 5: To a very large extent)	Standard deviation	Percent of valid respondent answering To a large extent or To a very large extent
Reporting non-financial data	1.52	0.879	4.9%
Collection of external data	1.38	0.813	3.0%
Preparing budgets on non-financial, qualitative indicators	1.43	0.724	2.2%
Allocation of costs			
Fixed costs are allocated to customer, products etc.	2.45	1.202	21.1%
The allocation of costs is performed using a multiplicity of cost drivers	2.11	1.151	13.3%

4.3.3.1 Data collection

The construct of data collection as identified in section 4.2.5.4 contains six items, which will now be looked further into.

Revenues are registered along the dimensions of department (85.5% of total responses), product (78.3% of total responses), customer (73.9% of total responses) and market (53.4% of total responses). Costs are registered along the dimensions of department (95.5% of total responses), process (58.2% of total responses), product (75.4% of total responses) and responsible person (57.9% of total responses). Furthermore, 59.4% of the valid responses to a large extent or to a very large extent work with hierarchies on the dimensions and 53.4% split the amount in quantities and price per unit when registering revenues (48.3% with regard to costs). But only 29.3% of the valid responses are collecting non-financial, quantitative data (and only 9.3% collect non-financial, qualitative data, cf. below). Thus, the

organisations to a large extent have a very detailed set of data registered in their information system.

Only 30.1% of valid responses post calculated amounts. See also Table XII.

4.3.3.2 Reporting and analysis

It is seen from the analyses that only 27.2% of the valid responses say that reports are generated ad hoc to a large extent or to a very large extent, and only 14.6% design their own reports. Only 30.4% indicate that reports are delivered electronically rather than in paper to a large extent or to a very large extent, and only 26.1% are investigating the electronic reports by drilling down. Simulations and forecasts are done by 13.6% of the valid responses, and 21.7% are using the IIS for strategic management accounting.

4.3.3.3 Budgeting

While data to a large extent are collected with a high level of detail, this is to a lesser extent the case with regard to budgeting where 27.3% are budgeting sales as quantities times price per unit. Only 18.8% are having this level of detail with regard to the budgeted costs. Furthermore, only 13.1% are budgeting on non-financial, quantitative measures (only 2.2% prepare budgets on non-financial, qualitative measures, cf. below). 27.8% are having the production department preparing budgets on the basis of budgets from the sales department.

The frequencies indicate that while the responding organisations have a large degree of detail in their data collection, this does not seem to be the case with regard to budgeting.

4.3.3.4 Organisational breadth of management accounting

Management accounting is a discipline that relies on data from almost every part of the organisation. This is underscored by the figures showing that purchasing, production, sales and marketing and other administrative functions score relatively high with regard to where data are collected (ranging from 52.0% to 69.2%). Only data

from research and development are to a lesser extent collected (only 29.0% do that to a large or a very large extent). The accounting department is expectedly an important player (96.6%).

The high levels of participation from purchasing, production, sales and marketing and other administrative functions in carrying out the management accounting tasks are also prevalent with regard to reporting (between 47.5% and 64.2%) and budgeting (between 64.2% and 81.5%). The tendency of research and development and the accounting department is maintained.

4.3.3.5 Non-financial, ad hoc and external management accounting

With regard to non-financial, qualitative data it is seen that they are collected to a large or a very large extent in 9.3% of the valid responses and 2.2% are budgeting on these measures. But only 4.9% of the organisations are reporting on these data. External data are only collected by very few organisations (3.0%). Finally, it is seen that data primarily are collected on an ongoing basis since only 5.3% of the organisations collect data ad hoc to a large or very large extent.

4.3.3.6 Allocation of costs

A factor of allocation of costs was created. When analysing the underlying items, it is found that only 21.1% of the organisations allocate general and administrative expenses to cost objects such as customers and products. Approximately two thirds of organisations allocating general and administrative expenses or 13.3% of all organisations are carrying out the allocations using a multiplicity of cost drivers. While an indication of low allocation of costs is given, the data material is not suited for analysing the costing practices, which is not the purpose of this research project.

4.3.4 The IIS and management accounting of different organisations

Regression analysis is used for estimating the coefficients of equations 1 and 2 above. All coefficients and their p-values are

reported in appendices 3 and 5. Only relationships significant at a 5% level are reported in Table XIII.

Table XIII. Significant relationships between control variables and IIS and management accounting variables

Significant control variables	Management accounting and IIS variables	Standardised coefficients
Company size	Analysis-oriented information systems	0.205
Company type: Trade	Transaction-oriented information systems	0.195
	Analysis-oriented information systems	0.121
Company type: Service	Allocation of costs	0.154
Company type: Manufacturing	Data collection	0.156
	Budgeting	0.136
	Organisational breadth of management accounting	0.196
Group vs. SBU	Data collection	0.115
	Reporting and analysis	0.184
	Non-financial, external and ad hoc management accounting	0.179
Part of international group	Data collection	0.161

Company size as measured by number of employees has a significant relationship with analysis-oriented information systems.

Trading companies seem to have a more comprehensive IIS both as regards transaction-oriented and analysis-oriented information systems. No significant relationship with IIS is found for other company types.

Service companies are positively related to allocation of costs, while manufacturing companies are positively related to data collection, budgeting and organisational breadth of management accounting.

It is seen that strategic business units are more advanced in their management accounting in relation to data collection, reporting and

analysis, and non-financial, external and ad hoc management accounting, since regression coefficients are significant and positive.

Finally, a closer look at whether the company is part of an international group indicates that more international organisations have more comprehensive data collection.

4.4 Analysis

This section will explore the relationship between management accounting and the IIS as divided into transaction-oriented and analysis-oriented information systems. Management accounting is divided into the six factors identified in section 4.3.3 above. The hypotheses H1a through H1d will be tested using multiple regression analysis on the equation developed in section 4.2.7 above. Since the reporting and analysis were collapsed into one variable, the hypotheses H1b and H1c are tested simultaneously.

Control variables are included in the regression analyses. The coefficients of the regressions are summarised in Table XIV below. The coefficients of the control variables are not reported. Full details on the regression analyses are reported in appendix 5.

4.4.1 The support of the IIS to management accounting

Six regression analyses were carried out in order to test hypothesis 1 regarding the support of transaction-oriented vs. analysis-oriented information systems to four management accounting tasks. Reporting and analysis were collapsed into one variable with the factor analysis. Therefore, H1b and H1c are treated as one hypothesis.

Before drawing any conclusions with regard to the parameter estimates, all regressions went through the tests described in section 4.2.7.3. All but a few tests were passed. The Durbin-Watson test was inconclusive with regard to the IIS explaining allocation of costs (DW=1.606 where it should be above 1.78).

With regard to multicollinearity (Aczel and Sounderpandian, 2002, pp. 568-575), it was found that most independent variables correlate with each other to some extent. The correlation analysis focuses on correlations within the three variable groups: control variables,

management accounting variables and IIS variables. Inter-group correlations are expected due to the relationship between management accounting and IIS. Only two correlations exceeded 0.5 within the groups. In order to test whether multicollinearity is a problem, one variable within each set of correlating variables was removed and the regression rerun. The new parameter estimates do not differ much from the original ones, and it is concluded that the correlation between independent variables does not constitute a problem.

The parameter estimates of the six regressions are reported in Table XIV.

Table XIV. The impact of transaction-oriented and analysis-oriented information systems on management accounting

	Transacti on- oriented informati on systems	Analysis- oriented informati on systems	Analysis- oriented better than transactio n-oriented informatio n systems
Data collection	0.289***	0.178***	-
Reporting and analysis	0.200***	0.318***	+
Budgeting	0.206***	0.232***	+
Non-financial, external and ad hoc management accounting	0.173***	0.420***	+
Allocation of costs	0.125**	0.282***	+
Organisational breadth of management accounting	0.331***	0.225***	-

Notes:

* Relationship is significant at the 0.1 level (2-tailed)

** Relationship is significant at the 0.05 level (2-tailed)

*** Relationship is significant at the 0.01 level (2-tailed)

When calculating the impact of the IIS on management accounting factors, it is found that transaction-oriented as well as analysis-oriented information systems have a significantly positive impact on all six management accounting factors. This supports hypothesis H1a which states that transaction-oriented information systems have a significant impact on data collection. This means that companies with a large-scope transaction-oriented information system tend to collect a broader and a deeper range of data.

With regard to analysis-oriented information systems, it is found that they have a significantly positive impact on all management accounting factors. Thus, hypotheses H1b, H1c and H1d are also accepted.

When comparing the coefficients of transaction-oriented and analysis-oriented information systems using t-tests, it is found that transaction-oriented information systems are significantly better at supporting data collection while analysis-oriented information systems are better at supporting reporting and analysis and budgeting. Thus, all four hypotheses within H2 are confirmed.

With regard to the new management accounting factors (new compared to the four management accounting tasks), it is found that analysis-oriented information systems are better at supporting allocation of costs and non-financial, external and ad hoc management accounting. Transaction-oriented information systems are better than analysis-oriented information systems at supporting organisational breadth of management accounting in that companies with a large-scale transaction-oriented information system to a larger extent involve more departments in data collection, reporting and budgeting.

To sum up, it is seen that transaction-oriented as well as analysis-oriented information systems have a positive impact on management accounting with analysis-oriented information systems being a better support for all components of management accounting but data collection and organisational breadth of management accounting.

4.4.2 Robustness check: four management accounting tasks

In order to check the robustness of the findings, an alternative method for reconstructing management accounting was used. Rather than including all management accounting items in one large factor analysis as done above, the management accounting items were kept separate within the four management accounting tasks measured (data collection, reporting, analysis and budgeting). Principal components analysis was carried out on each of the four groups of items, and four new constructs were created for further analysis. The principal components analyses were carried out with the same settings as the previous analyses.

The six management accounting factors used in the previous analyses were replaced by the four management accounting tasks (the principal components). The regression analyses were rerun and Table XV reports the coefficients.

Table XV. The impact of transaction-oriented and analysis-oriented information systems on management accounting tasks

	Transaction-oriented information systems	Analysis-oriented information systems	Analysis-oriented better than transaction-oriented information systems
Data collection	0.313***	0.260***	-
Reporting	0.275***	0.379***	+
Analysis	0.170***	0.343***	+
Budgeting	0.221***	0.275***	+

Notes:

* Relationship is significant at the 0.1 level (2-tailed)

** Relationship is significant at the 0.05 level (2-tailed)

*** Relationship is significant at the 0.01 level (2-tailed)

When comparing Table XV, which is based on the four management accounting tasks, with Table XIV, which is based on the six management accounting factors, it is seen that the differences in all regression coefficients still are significant and positive. The standardised beta-values vary a bit between the two sets of analyses, but the conclusions are the same. This is also the case with regard to the comparison of transaction-oriented and analysis-oriented information systems where it is still found that transaction-oriented information systems are better at supporting data collection while analysis-oriented information systems are better at supporting reporting, analysis and budgeting.

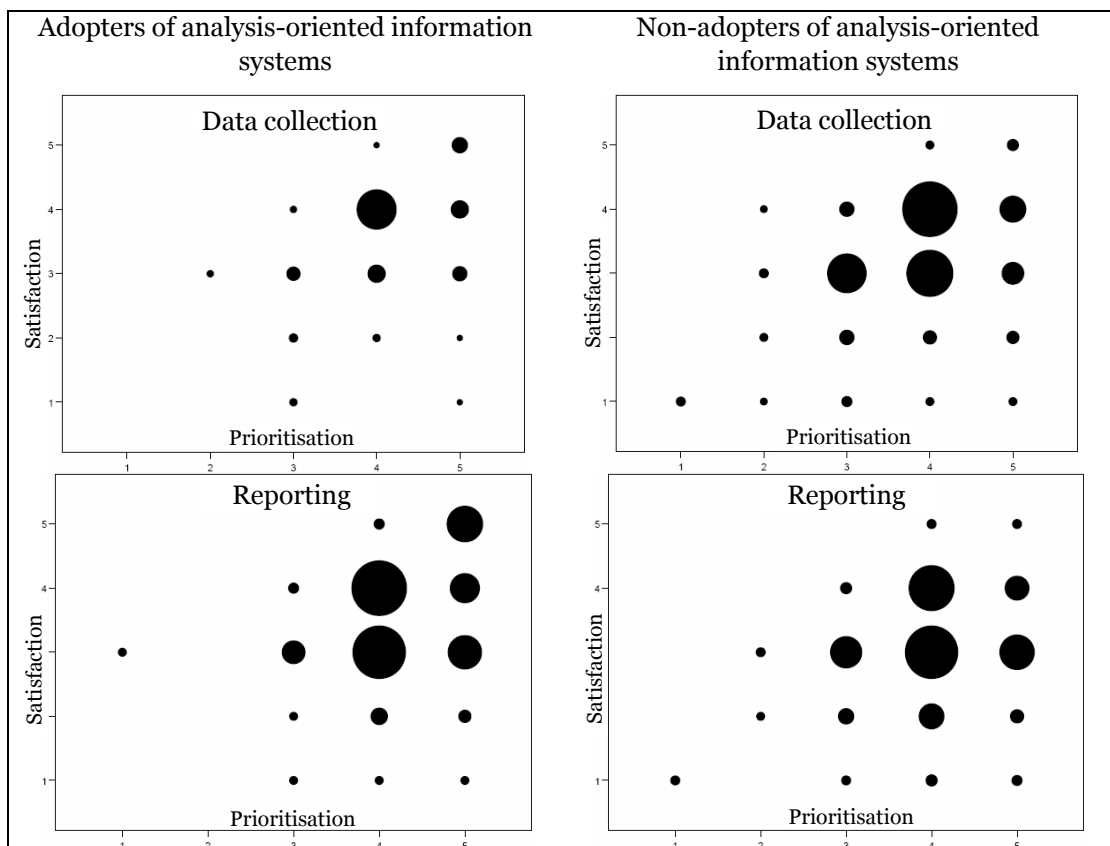
4.4.3 Robustness check: satisfaction vs. prioritisation

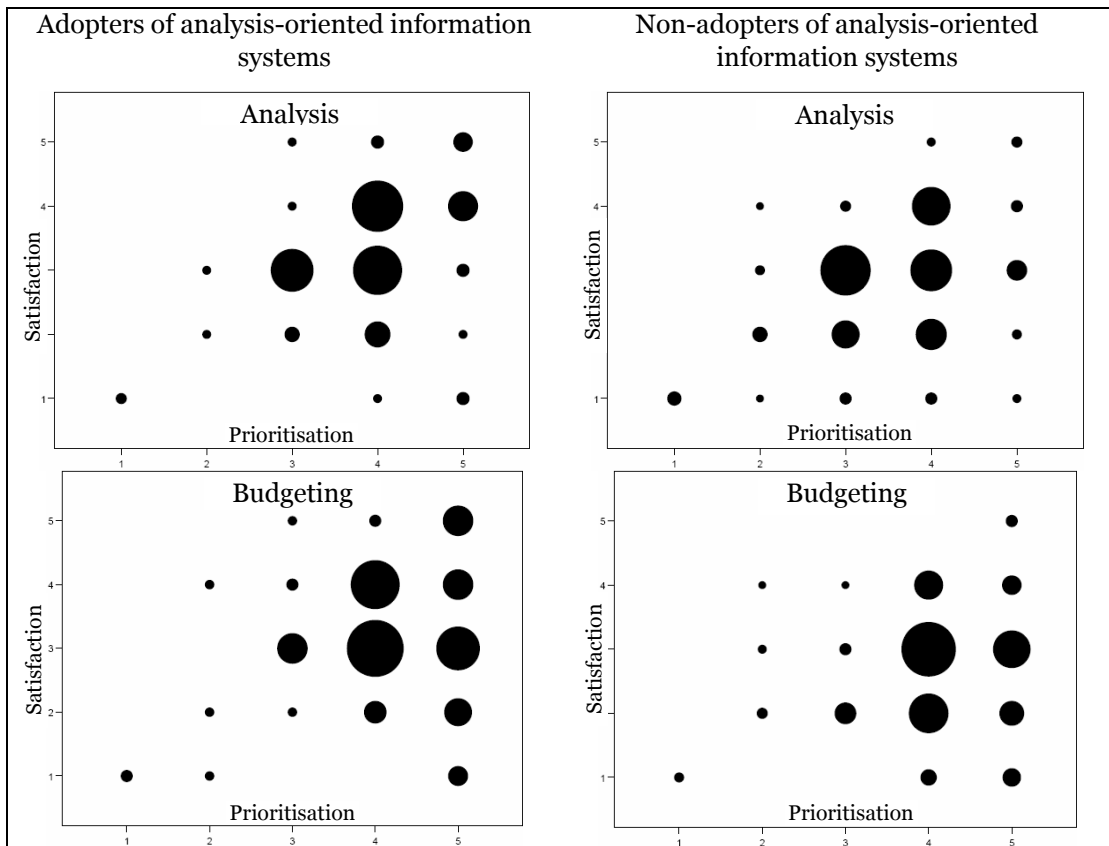
A second robustness check is carried out, which is slightly different from the two previous analyses. For each of the four management accounting tasks the respondent was asked to indicate prioritisation of management accounting tasks and satisfaction with the support of the IIS with regard to the individual task.

Prioritisation and satisfaction were measured along a five-point Likert scale from 'Not at all' to 'To a very large extent'. The data set was split in two according to whether or not the responding organisation has two or more components of an analysis-oriented information system (adopters of analysis-oriented information systems). Two-way tables were prepared with prioritisation along one dimension and satisfaction along another dimension. Such two-way tables were prepared for each management accounting task for adopters and non-adopters. Chi-square tests show that significant differences exist between all four pairs of two-way tables. This indicates that prioritisation and satisfaction with the support of the integrated information system in relation to each of four management accounting tasks differ between adopters and non-adopters of analysis-oriented information systems. Furthermore, t-tests (Mann-Whitney in case of lack of variance homogeneity) were used to test differences in the means. Significant differences exist across adoption with regard to all variables but prioritisation of budgeting. In all cases of management accounting tasks, satisfaction with the support of the IIS is significantly higher of adopters of analysis-oriented information systems. Similarly, in all cases but budgeting, prioritisation is significantly higher of adopters.

Figure VII illustrates the differences between the satisfaction that adopters and non-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 (Lämsiluoto, 2006). 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 adopters have a better fit between satisfaction and prioritisation than non-adopters (diagonals are relatively more populated and the lower right corner relatively less populated). The same is true for reporting, analysis and data collection.

Figure VII. Satisfaction with the support of the IIS (y-axis) and priority of management accounting tasks (x-axis)





The tests of the two-way tables, the means and visual inspection of Figure VII indicate that the relationship between prioritisation and satisfaction with reporting, analysis and budgeting is better with adopters of analysis-oriented information systems than with non-adopters. This supports the findings reported above that analysis-oriented information systems are better than transaction-oriented information systems at supporting reporting, analysis and budgeting. The statistics and diagrams show that this is also the case with regard to data collection. This can be explained by the fact that analysis-oriented information systems add to the data collection functionality of transaction-oriented information systems. Differences in means of satisfaction and prioritisation of management accounting tasks between adopters and non-adopters indicate that the difference is the lowest with regard to data collection.

4.5 Discussion

On the basis of previous research and the findings of this study, it can be concluded that we are witnessing a development in the understanding of the IIS. We no longer expect transaction-oriented information systems to be the only information systems supporting management accounting, since analysis-oriented information systems seem to provide better support than transaction-oriented information systems. Based on the question raised by Granlund and Malmi (2002, p. 315) as to whether strategic enterprise management systems (an example of an analysis-oriented information system) will induce companies to change the logic of their accounting and control practices, it seems relevant to study the impact of analysis-oriented information systems as companies have entered into the second phase of the IIS (Willis and Willis-Brown, 2002) where the ERP system is implemented and additional applications are added to the IIS.

4.5.1 The support of transaction-oriented information system to management accounting

One of the main conclusions from the literature review of Chapter 2 is that transaction-oriented information systems only to a limited extent support management accounting practices. Booth *et al.* (2000a) find that ERP systems are powerful tools with regard to transaction processing, whereas reporting and decision-making are not well supported by the ERP systems. This finding matches recent communication from software vendors including SAP and Oracle stating that ERP systems are built for transactional management whereas analysis-oriented information systems such as SEM systems are built for management at a more strategic level.

The findings of this study indicate that some support of transaction-oriented information systems for management accounting tasks can be found. It is confirmed that transaction-oriented information systems are powerful tools with regard to data collection in that transaction-oriented systems support data collection in its breadth (e.g. quantitative and qualitative data and internal and external data). But significantly positive impacts are also found on reporting, analysis and budgeting. These latter findings are juxtaposing the

findings of for example Fahy and Lynch (1999), Booth *et al.* (2000a) and Granlund and Malmi (2002) that indicate a limited support of transaction-oriented information systems for management accounting.

This change in the support of transaction-oriented information systems may be explained by the time that has passed since the other studies have been conducted (Granlund and Malmi, 2002). That is, a time lag may exist between the implementation of the transaction-oriented information system and the change in management accounting practices. The studies by Fahy and Lynch (1999), Booth *et al.* (2000a) and Granlund and Malmi (2002) were all conducted at the time when the focus of ERP system implementations was on fixing the year 2000 problem (Davenport, 1998). Scapens and Jazayeri (2003) argue that opportunities are opened up by the implementation of ERP systems. As companies get to learn the capabilities of the ERP system, they may consider changing their management accounting practices if it is found that new and better ways of carrying out management accounting is supported by the ERP system. Since the focus of the ERP system implementations around the millennium change was on fixing the year 2000 problem, it does not seem unrealistic to assume that it is the time that has passed since then that can explain that transaction-oriented information systems are not found to support management accounting.

4.5.2 The support of analysis-oriented information systems to management accounting

With regard to the support of analysis-oriented information systems for management accounting tasks, it is implied that analysis-oriented information systems are better than transaction-oriented information systems at supporting reporting, analysis and budgeting. This means that a sophisticated design of reporting (e.g. that the user himself designs reports), analysis (e.g. drill down analysis) and budgeting (e.g. the use of indirect budgeting) is better supported by an analysis-oriented information system compared to for example an ERP system. Granlund and Malmi (2002) and Brignall and Ballantine (2004) write that such a relationship might exist. On the basis of the findings of this survey, the existence of such a relationship cannot be rejected.

Transaction-oriented and analysis-oriented information systems are complementary systems since transaction-oriented information systems seem to be the primary enablers of change in data collection, while analysis-oriented information systems seem to be the primary enablers of change in reporting, analysis and budgeting. This implies that researchers and practitioners alike must include not only ERP systems when considering how to support management accounting with information systems. The argument can be put even stronger since analysis-oriented information systems even are found to provide better support for some tasks within management accounting. Thus, a full palette of transaction-oriented as well as analysis-oriented information systems must be considered when looking for information systems that can support management accounting.

4.5.3 Conventional management accounting vs. management accounting innovations

When conducting factor analysis on all management accounting variables, six management accounting factors emerged that to some extent distinguish between conventional management accounting and management accounting innovations (Bjørnenak and Olson, 1999).

Two factors emerged called non-financial, external and ad hoc management accounting and allocation of costs (extensive use of a multiplicity of cost drivers) respectively. The factor called non-financial, external and ad hoc management accounting includes, as the name implies, the data collection, reporting and budgeting of non-financial measures and the ad hoc dimensions of management accounting. The factor called allocation of costs includes measures of allocation of fixed costs to for example customers and products and the extent to which a multiplicity of cost drivers are used. The content of these factors is what describes management accounting innovations (Bjørnenak and Olson, 1999).

Conventional management accounting seems to be contained within the factors data collection, reporting and analysis and budgeting. Within these factors focus is on characteristics of conventional management accounting such as dimensions, the separation of

amounts in quantities and unit prices/costs and the ability to decompose the amounts using drill down analysis.

Fahy and Lynch (1999) and Fahy (2000) find that ERP systems have a negative impact on strategic management accounting. On the other hand, 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). It is argued 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, 1996a) and the use of differentiated periods (Bjørnenak and Olson, 1999), which are characteristics measured by the survey cf. above.

The conclusions of Fahy and Lynch (1999) are not supported by the survey results since positive and significant relationships between non-financial, external and ad hoc management accounting and allocation of costs and transaction-oriented information systems are found. This implies that companies implementing management accounting innovations have a broader-scope ERP system than other companies. Whether it is the broader-scope ERP system that supports the management accounting innovations of companies is up for discussion. The primary element of such a discussion is the internal validity of the relationship. From the literature on integrated information systems it can be learnt that analysis-oriented information systems build on transaction-oriented information systems (e.g. Shields, 2001, p. 10). This implies that companies with analysis-oriented information systems need transaction-oriented information systems. Based on this, it seems reasonable that companies using analysis-oriented information systems for the support of management accounting also have implemented a broader-scope ERP system. Thus, it is not necessarily the ERP system of companies that supports the management accounting innovations.

The significantly positive relationships between analysis-oriented information systems and non-financial, external and ad hoc management accounting and allocation of costs indicate that companies implement an analysis-oriented information system in

order to support management accounting innovations. Whether coefficients of 0.420 and 0.282 respectively are large enough to imply application of a wider perspective on strategic enterprise management cannot be determined through this survey material, and further investigation is required.

4.5.4 Limitations

As is the case with most research, this study is also subject to limitations. First, there are a number of explanatory variables not included in the study. It could be argued that management accounting as well as the IIS could be influenced by a factor that could be called 'sophistication of management', which refers to the extent to which the management team focuses on and applies the appropriate management techniques and information systems. The degree of sophistication has an effect on both the comprehensiveness of IIS and management accounting, and thus 'sophistication of management' might be a supplementary driver of more sophisticated management accounting. Other explanatory variables may also be relevant. Furthermore, 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 although the analyses and discussions are based on the literature review and a theoretical framework. This quantitative study can advantageously be supplemented by a qualitative study in order to validate the causality claims. This is done in the succeeding chapter.

Third, since the relationship between management accounting tasks and the components of the IIS is not measured within each case, internal validity is further threatened. Again, a qualitative study can overcome this limitation.

4.6 Summary and introduction to the next chapter

The primary research contribution of this chapter is the findings in relation to the extent to which analysis-oriented information systems support management accounting tasks. When comparing the relationship between management accounting tasks and transaction-

oriented and analysis-oriented information systems respectively, it is found that transaction-oriented information systems are better at supporting data collection while analysis-oriented information systems are better at supporting reporting, analysis and budgeting.

With regard to allocation of costs and non-financial, external and ad hoc management accounting, it was found that these aspects of management accounting are best supported by the analysis-oriented information system.

On the basis of these findings, it seems relevant not only to include ERP systems when investigating the relationship between management accounting and information systems. When investigating how an integrated information system can support management accounting, analysis-oriented components of the IIS must be considered as well as the transaction-oriented ERP systems.

It has been confirmed that analysis-oriented information systems complement transaction-oriented information systems in supporting management accounting. It would now be relevant to further investigate exactly how in detail an analysis-oriented information system supports management accounting now that it is confirmed that such information systems may be better at supporting management accounting than the often referred to ERP systems.

Chapter 5. The balanced scorecard of the Danish Broadcasting Corporation

5.1 Introduction

It is the purpose of this chapter to investigate how an analysis-oriented information system can support the balanced scorecard as a management accounting innovation and its design and use cf. research question 2 developed in section 2.7 and repeated here:

RQ 2: How is the design and use of a management accounting innovation supported by an analysis-oriented information system?

Survey results reported in Chapter 4 indicate that transaction-oriented and analysis-oriented components of the IIS support different tasks of management accounting. Of particular interest to research question 2 is the fact that the management accounting tasks of reporting, analysis and budgeting are best supported by an analysis-oriented component of the IIS. On the other hand, transaction-oriented components of the IIS are better at supporting data collection. A performance management technique such as the balanced scorecard involves all four management accounting tasks. With research question 2 the research project takes a closer look at the analysis-oriented information system and its support of a management accounting innovation. Research question 2 was chosen to focus on a management accounting innovation since prior research indicates that management accounting innovations in particular are implemented outside the ERP system (Granlund and Malmi, 2002; Brignall and Ballantine, 2004).

Research question 2 will be answered using the case study method as discussed in section 3.2. With the possibilities of the case study method of digging deeper, a bidirectional relationship between management accounting and integrated information systems will be

investigated, which complements the unidirectional relationship that was studied in Chapter 4.

The Danish Broadcasting Corporation (DBC) was chosen as case since it with its balanced scorecard implementation and IS support of it represents an interesting research site. In 2003, the company implemented the balanced scorecard, which is a management accounting innovation (Ittner and Larcker, 1998; Bjørnenak and Olson, 1999). During the case study period, the balanced scorecard of the DBC was still in the pilot phase since many experiences were still gained and many changes made. Thus, the BSC was implemented but still under development. That the different features of the BSC are implemented stepwise is quite common (Speckbacher *et al.*, 2003; Bedford *et al.*, 2006). The BSC was implemented in only one of five directorates but at the end of the case study period it was decided that the BSC should be implemented in the entire organisation; and thoughts on how to bring the BSC of the first department into a phase of consolidation and how an IIS could support a BSC of the entire organisation were done.

This was the setting in which an analysis-oriented information system supporting a management accounting innovation was studied. Although research question 2 is not specifically aimed at the balanced scorecard in particular, it soon turned out to be an examination of a BSC project (see e.g. Granlund, 2001). Thus, the BSC is merely an instantiation of a management accounting innovation although it is an interesting one to investigate.

The chapter is organised as follows. In section 5.2 the case study design will be presented. The case company and thereby the context (Pettigrew, 1987, p. 658) of the balanced scorecard of the DBC is presented in section 5.3. An introduction to the content and processes of the BSC is provided in section 5.4. The case of BSC in the DBC is analysed in section 5.5, and in section 5.6 the findings are discussed in relation to the literature reviewed. The case study is summarised and the next chapter introduced in the final section.

5.2 Research method

5.2.1 The approach to the company

The first contact was taken to the Danish Broadcasting Corporation back in spring 2001. Since then and until the start-up of the case study in June 2005, regular meetings were held with the manager of the accounting department. In this way an introductory knowledge of management accounting and its development in the DBC was gained.

Although the access to the company was negotiated with the financial manager, confidence was quickly gained with the CFO, the business development manager as well as other managers and employees.

5.2.2 Unit of analysis

It is important to define the unit of analysis before entering the field (Yin, 1994, p. 21). Otherwise, the data collection will be flawed and the analysis likewise. Management accounting is a dispersed activity involving a number of different roles. But as one cannot ask the company itself, the individuals of the company are going to be the data sources (Luft and Shields, 2003). Different persons have different attitudes and perspectives on the researched objects and subjects. Therefore, source triangulation (i.e. selection of several informants with different perspectives) will be applied in order to ensure the validity.

This case study has the organisation and especially the resources directorate of the Danish Broadcasting Corporation as its unit of analysis. Two departments within the organisation are chosen for investigation as discussed next.

5.2.3 What is studied?

Through ongoing contact with the manager of the accounting department within the resources directorate, it became apparent that the balanced scorecard implementation could serve the purpose of the case study of research question 2. At the time of the case study, the balanced scorecard was only implemented in one of the

directorates. Thus, this case study only deals with BSC in one of five directorates of the DBC. As depicted in Figure IX several departments exist within the resources directorate. In order to gain depth in the study, only two of these departments are selected for the study of BSC and analysis-oriented information systems. These departments are the accounting department and the department of service and administration. While the entire accounting department is subject to investigation, only the purchase and secretariat team is subject to investigation within the department of service and administration. The accounting department and the purchase and secretariat team are comparable entities in that their sizes are relatively identical. Furthermore, both entities have balanced scorecards themselves but they do not have balanced scorecards of entities below them. That is, the teams within the accounting department do not have their own balanced scorecards.

The fact that BSC is to be implemented throughout the organisation on January 1, 2007, is outside the scope of this research project to investigate.

5.2.4 The case study process

Data collection and analysis were carried out interchangeably (Silverman, 2005, pp. 152-153). A first round of interviews was carried out in June and July 2005. After the first round of interviews data collection was temporarily put on hold in order to spend time understanding and analysing the first set of data. A second round of interviews together with participation in meetings took place in October, November and December 2005. The case study was written in December 2005 and January 2006.

5.2.5 Data collection method and presentation of data collected

Data from several different sources and of different kinds were collected. Especially three data collection techniques (Yin, 1994, p. 80) were made use of. These are interviewing, observation and gathering documents.

In total 21 interviews were conducted. The interviewees represent different stakeholders in relation to the balanced scorecard. These are facilitators, administrators, users at different levels and IS personnel. Some interviewees belong to several groups. This is especially the case with the BSC administrator of the accounting department who also holds the positions of overall BSC administrator, BSC administrator of the accounting department, IS person and user. Therefore, the figures of Table XVI are to be used with caution.

The interviews lasted between 0.5 and 2 hours with 1 hour being the average. The interviews were semi-structured and a list of topics (an interview guide) rather than an exhaustive questionnaire prior to each interview was prepared. The interview guide was sent to the interviewee prior to the interview. Most interviews were tape recorded and transcribed verbatim. No respondents declined to be recorded, although they were given the opportunity. The interviews not tape recorded were the initial ones with the manager of finance. Number and duration of interviews are summarised in Table XVI.

Table XVI. Interviews

Function of interviewee	Number of interviews	Duration of interviews (total number of hours)
BSC facilitator	4	4.5
BSC administrators	3	4
CFO	1	1
Managers	6	6
Team leaders	3	1.5
Employees	4	5
IS personnel	2	2
Total	23	24

The DBC facilitated the research in that the researcher was given access card, keys and a work station close to key informants. Thus, in addition to formal interviewing, several talks with different

employees at all levels of the hierarchy were conducted throughout the case study period.

In addition to observing the daily life of the accounting department, the researcher was invited to attend a number of meetings focusing on the balanced scorecard. These range from quarterly BSC meetings to a training session on Corporate BSC. A total of 11 meetings were attended lasting in total 32.5 hours. Meetings attended are listed in appendix 6.

Finally, internal as well as external documents were reviewed. These range from annual reports and public service statements to strategy maps, PowerPoint presentations about BSC and assessment reports of BSC software. A list of sample documents is provided in appendix 7.

5.2.6 Validity and reliability

Exploration validity (see section 3.3.1 for a definition) was enhanced by for example conducting semi-structured interviews rather than highly structured interviews. Semi-structured interviewing is advantageous in this regard in that the interviewee is allowed and even encouraged to elaborate on issues in ways not thought of by the researcher (Fontana and Frey, 2000). A construct like that of red and green strategies (see below) was uncovered in this way.

Collecting data from different data sources enhances construct validity in that consensus on the terms used was gained when the terms were presented to different people. Furthermore, what is especially fruitful about the interview as a data collection technique is that the interviewee has the opportunity to provide feedback on the terms used. In this way constructs are clarified and their validity enhanced.

The ongoing contact with the organisation studied also enhances internal validity. When investigating the support of an IIS to management accounting, it is important to gain valid knowledge of the causes and effects within the researched area. Observation of for example the quarterly BSC meetings provided evidence on whether the BSC software was triggering discussions about certain topics or whether topics were brought to the table without the assistance of the BSC software.

At the end of the case study period, the researcher gave a presentation of preliminary findings. These were discussed with the managers of the directorate studied. This session helped further enhance construct and internal validity.

While the case study method is particularly good at ensuring construct and internal validity, it is not particularly good at ensuring external validity (Birnberg *et al.*, 1990). Conclusions drawn from the study of the Danish Broadcasting Corporation are highly context dependent. In order to make these conclusions valuable to other organisations than the one studied, emphasis is put on description of the context (Abernethy *et al.*, 1999). In this way the reader may be able to transfer some of the knowledge gained from the study of the DBC to other settings.

In order to ensure reliability, data triangulation was made use of. Furthermore, the fact that the researcher spent a considerable amount of time at the site helped building up comfort (McKinnon, 1988). But still more time could have been spent at the site and for example biases introduced by the interviewees must be kept in mind. This is especially the case with the informants that were not interviewed several times and that the researcher did not engage much with.

5.3 Presentation of the company

This section builds on public information available from for example www.dr.dk and internal documents. The purpose of this section is to describe the context (Pettigrew, 1987, p. 658) of the BSC of the resources directorate.

The Danish Broadcasting Corporation is an independent, licence financed public organisation. That the DBC is an independent organisation means among other things that it is an entity of its own. It has a board of directors whose responsibility it is to make sure that the DBC through its programming meets the demands of the legislation and the public service agreement with the Danish government. The board of directors is appointed by the Minister of Culture, The Danish Parliament and the employees of the DBC. The board of directors in turn appoints the six directors (see more in section 5.3.4).

As a public organisation the owner of the DBC is the Danish state. Since the state through its public service agreement with among others the DBC serve the public, the customers or the ones using the services of the DBC are all Danes that have access to radio, TV or the internet. License fee is at present² paid by users of radio and TV only. Users of the internet do not pay the license fee. Furthermore, as the license fee is highly regulated by law, the ones paying for the services are not necessarily the same as the ones using them. Therefore, a distinction must be made between users and payers (Kaplan, 2001).

That the DBC is a licence financed organisation means that the major part of the revenues (87.5% in 2004) comes from individuals and companies paying the license fee. The DBC is collecting the license fee on behalf of the organisations appointed to fulfil Law of radio and television. In 2004 the DBC collected a total of 3,599.4 million DKK (equivalent to approximately 484.4 million EUR). 485.0 million DKK was forwarded to TV 2 (the second TV station with a public service obligation) and the Ministry of Culture.

5.3.1 The history of the Danish Broadcasting Corporation

The Danish Broadcasting Corporation was established on April 1, 1925. 3 hours of daily radio were produced at the main telegraph station in Copenhagen. The first Danish TV transmission was sent in 1932 but it was not until 1951 that TV was broadcasted regularly; and in 1960 TV transmitters were set up throughout the entire country. By way of comparison the BBC started regular broadcasting already in 1932.

It was not until 1988 that the DBC's monopoly on national TV was revoked. TV 2 is the second national TV station. Unlike the DBC, TV 2 is primarily funded by sales of TV commercials.

In 1996 the DBC goes online with its third media. dr.dk has 20,000 daily users the first year. Two years later, in 1998, dr.dk gets a 24-hour crew. In 2000 all national radio channels are put on the internet and in 2004 dr.dk is the most visited website in Denmark. The digitalisation has also had an effect on the production technology in that all news broadcasts from 2003 onwards were produced digitally and without tape.

² The format of the license fee is at the time of writing under revision.

Today, the DBC produces 10,461 hours of TV, 147,911 hours of radio; and 815,000 people uses dr.dk each week. The organisation has 3,633 employees and total revenues of 3.4 billion DKK.

5.3.2 Mission and strategy

The mission statement of the DBC is phrased in this way:

“DBC serving the public - by empowering the individual to play an active role in a democratic society.”

Article 10 of ‘Law of radio and television activities’ lists a number of demands put on the organisations appointed to fulfil the public service agreement. In order to comply with these demands and realise its mission, top management of the DBC has identified seven strategic goals. These are:

- **Something for everyone:** the DBC shall aim to have everyone use what the DBC has to offer by providing a wide variety of programmes and services.
- **Quality and new thinking:** the DBC shall set the standard for quality and shall stimulate new thinking.
- **Informative and impartial:** the DBC shall promote the democratic debate in Denmark through independent and critical news and current affairs programmes.
- **Danish art and culture:** the DBC shall, as a leading cultural institution, both communicate and create Danish art and culture.
- **All of Denmark:** the DBC shall reflect the entire spectrum of Denmark’s cultural, political and geographic diversity.
- **Competence and flexibility:** the DBC shall, as the most attractive media workplace, attract and develop employees who can, will and dare create value and innovation.
- **Resource management:** the DBC shall be a well-run and efficient company with balanced finances to ensure that users receive value for their licence fees.

Several classifications of strategies have been developed (e.g. Miles and Snow, 1978; Porter, 1980, p. 35; Kaplan and Norton, 2000). Since this case study deals with the balanced scorecard, the three generic strategies used by Kaplan and Norton (2000) and originally identified by Treacy and Wiersema (1995) will be used for classifying the strategy of the DBC. What is characteristic of the way that Kaplan and Norton (e.g. 2000) use the strategy term is that they regard strategy to be something that can be planned (Mintzberg *et al.*, 1998, pp. 47-79). The authors do not to a large extent consider other aspects of strategy such as emergent strategy (Mintzberg *et al.*, 1998, pp. 175-231). What is also descriptive of Kaplan and Norton's perspective on strategy is that it builds on Porter (1980, 1985) (Nørreklit, 2000).

When specifying the strategic goals, the DBC at the same time puts forth (although indirectly) a strategy for achieving its mission. Key words such as quality, impartial and competence are repeated. Since the DBC is a non-profit organisation, focus is not on maximising shareholder value (see e.g. Speckbacher, 2003 on performance management in non-profit organisations), and profit is more like a hygiene factor than a motivating factor (Herzberg, 1968). In this way, the ambition is to balance the finances rather than optimise them (the last strategic goal of the DBC).

Focus is on supplying customers with high-quality broadcasts. Since the DBC has a public service obligation, the broadcasts aim at a heterogeneous group of customers. The DBC also wants to be a highly visible actor in relation to art, culture and democracy. This implies that the strategy can be classified as one of 'customer intimacy' (Treacy and Wiersema, 1995). Although some emphasis is put on efficiency (a characteristic of the strategy called 'operational excellence'), heavier emphasis seems to be put on delivering high-quality broadcasts.

On the other hand, the DBC also has an ambition of being best in class (a characteristic of the strategy called 'product leadership') by setting the standard and being the leading cultural institution. Thus, some product leadership is also included in the strategy.

How this strategy of primarily customer intimacy is pursued with the support of the balanced scorecard and an analysis-oriented information system is analysed in the next sections.

5.3.3 The product and the production process

The Danish Broadcasting Corporation broadcasts a diverse range of transmissions. Examples are the daily news and EuroVision's song contest. As a broadcasting company one of the primary tasks is to put together a programme for each of the three media (radio, TV and the internet) and then broadcast the programmes. Another primary task is to actually produce the transmissions. This task can be carried out within the company, or productions can be bought from suppliers such as Nordisk Film or news agencies such as Reuters. Characteristic of the Danish Broadcasting Corporation is that a major part of productions are made in-house. The argument for doing so is that the DBC wants to have its own fingerprint on what is broadcasted.

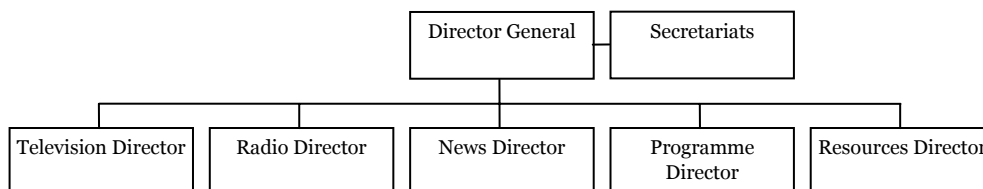
The broadcasting schedule is prepared by the editorial offices. The editorial offices are free to buy from the production directorate of the DBC or from the outside. On the other hand, the production directorate is not allowed to sell to other customers than the editorial offices of the Danish Broadcasting Corporation.

In addition to these primary activities, a number of support activities exist (to stay with the terms of the value chain, Porter, 1985, p. 37). These range from supplying broadcast technologies to maintaining buildings and purchasing.

5.3.4 Organisation and management

The organisation chart will be presented stepwise in order to better facilitate the understanding of the structure. First, at the level of directors five directorates exist. A new Director General started on August 22, 2005. The change in Director General has put its marks on the BSC process among other things. The organisation chart at director's level is presented in Figure VIII.

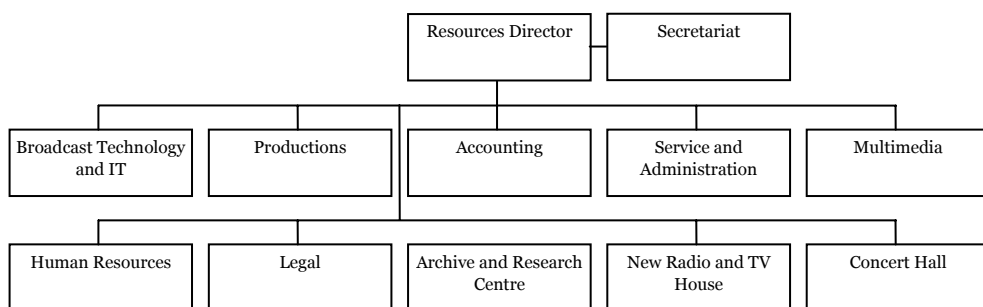
Figure VIII. Organisation chart of the Danish Broadcasting Corporation



Note: By January 1, 2006, the organisation chart has changed

The directorates of television, radio and news are relatively small directorates in that they primarily consist of editorial offices. The editorial offices decide on what to broadcast and then they submit requests for offer to the programme directorate as well as external suppliers of broadcast productions. The programme directorate is producing the broadcasts. The programme directorate is divided into a number of departments that each has its own specialty such as documentary, youth or drama. The resources directorate consists of all staff and support functions ranging from broadcast technology to the archives and accounting. While the primary activities are carried out by the editorial offices and the programme directorate, support activities are carried out by the resources directorate. Figure IX depicts the organisation of the resources directorate.

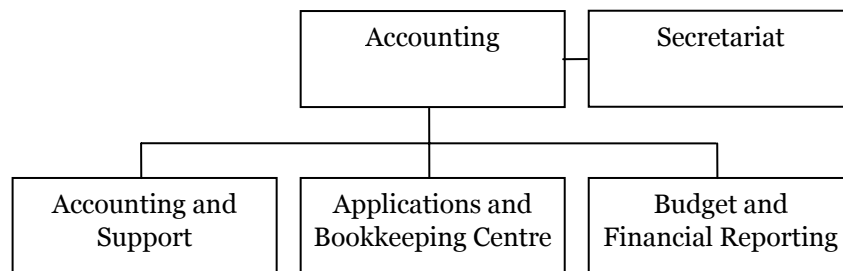
Figure IX. Organisation chart of the resources directorate



The resources director is assisted by a business development manager. Together with the managers of the departments they comprise the management team of the resources directorate.

The study of BSC in the resources directorate will focus on two of the departments within the resources directorate. These are the accounting department and the department of service and administration. A total of 51 persons are employed in the accounting department. The organisation of the department is depicted in Figure X.

Figure X. Organisation chart of the accounting department



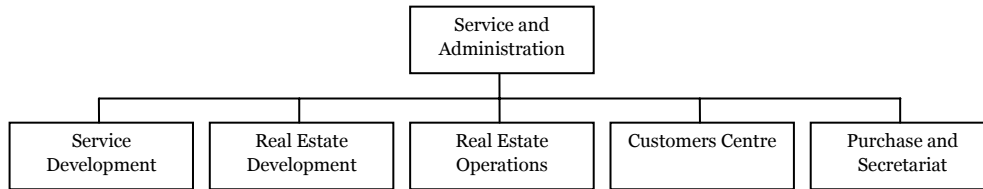
The accounting and support team is the controllers' office. The primary tasks of the team are to assist the directors in carrying out their management accounting and preparing controller reports for the directorates and the boards.

The applications and bookkeeping centre is the largest of the three teams. The team consists of two sub teams. An applications centre maintains and supports the ERP system called Oracle Applications 11i. The other sub team provides the bookkeeping functions of license registration, treasury, accounts receivable, accounts payable and taxes *et cetera*.

The budget and financial reporting team is responsible for - as the name indicates - preparing the budgets and the financial reports. Formerly, the accounting department manager was the manager of this team.

The department of service and administration employs 172 persons. Within this department is the purchase and secretariat team where the department manager was formerly the team manager. The organisation chart of department of service and administration is depicted in Figure XI.

Figure XI. Organisation chart of the department of service and administration



Within the department of service and administration the case study will focus on the purchase and secretariat team since the BSC at departmental level is in a state of flux due to organisational changes. The purchase and secretariat team consists of 25 employees. As the name indicates, the team is both the secretariat of the department and the purchasing function of the entire DBC.

5.3.5 Management accounting within the DBC

The purpose of this subsection is to give an impression of the management accounting practices of the DBC, which constitutes some of the context of the balanced scorecard.

Financial statements are produced on a monthly basis for each directorate, and a consolidated statement is produced for the DBC in total. Even though most directorates are only cost centres, they are treated as profit centres in that transfer prices produce revenue for cost centres. The financial statements produced each month are subject to control where actual figures are compared to budgets. In addition to an organisational dimension of the accounts, a project dimension is also used.

No management accounting innovations such as economic value added or activity-based costing other than BSC is implemented.

Accountants are located in a central accounting function (the accounting department) as well as decentrally in that the directors have their own accountants. The fact that employees throughout the organisation are performing management accounting tasks has created a relatively diverse set of management accounting practices. Therefore, a project called 'One Way of Working' with the aim to harmonise administrative processes and decision rules has been carried out.

As briefly mentioned above, a new Director General was appointed in August 2005. One of the areas that he focuses on is the management accounting practices of the DBC. He wants the management accounting of the DBC strengthened. This intention has until time of writing resulted in the establishment of a separate accounting directorate, abandonment of transfer pricing and more emphasis on BSC, which is going to be rolled out to the entire organisation on January 1, 2007. Thus, the environment of the BSC is positive towards the management accounting technique.

5.3.6 The information systems of the Danish Broadcasting Corporation

The database is the core of the DBC's information systems. On top of the database a number of applications are built. The first one to mention is Oracle Applications 11i, which is the ERP system. The scope of Oracle Applications is relatively narrow in the DBC. Although Oracle is the preferred vendor, other applications are chosen if they in an evaluation phase turn out to be better. This has been the case with among others the payroll software, the broadcasting software, the license fee collection software and the management's portal. A strategy of going for best-of-breed (Light *et al.*, 2001; Hyvönen, 2003) seems to have been chosen. As a consequence, at the software level not much integration exists. But the DBC pays much attention to ensuring that integration exists at the database level, and it is mandatory that all new software applications be built upon the existing database.

Apart from Oracle Applications, all software and databases are maintained by the IS department. Oracle Applications is maintained by a team within the accounting department.

5.4 Introduction to the balanced scorecard of the resources directorate

Bjørnenak and Olson (1999) classify the balanced scorecard as a management accounting innovation. They do so because descriptive objects are unconventional ones like customer satisfaction and because the orientation in time is more focused on the *ex ante*

perspective. With regard to the characteristics identified by Cooper and Kaplan (1998) the balanced scorecard can be described as a management accounting technique where estimates rather than exact figures are sufficient. Furthermore, the scope is very broad in that internal as well as external measures are included. With regard to cost of resources used and definition of costs, it is not possible to describe the BSC along these dimensions since different cost definitions can be used for different measures within the BSC.

This section will describe the content and process of the BSC of the resources directorate. Together with the previous section on the context of the BSC of the resources directorate, this section constitutes the basis for the analyses, discussions and reflections carried out in succeeding sections.

5.4.1 The history of BSC in the resources directorate

The balanced scorecard was brought into the Danish Broadcasting Corporation by the resources director and the business development manager. The resources director felt that performance management within the resources directorate was falling behind and that a performance management technique was needed (see Ittner and Larcker, 1998 on reasons for adopting the balanced scorecard). Also, all top managers of the DBC have a so-called 'annual agreement' with their superior. The annual agreement contains the goals of the individual managers for the coming year. In addition to strengthening the performance management, it was also the purpose of the balanced scorecard to provide a better structure and frame for the annual agreements. The annual agreements needed to be aligned, which is an important feature of the balanced scorecard (e.g. Kaplan and Norton, 1996b, pp. 199-223).

The resources director recruited a business development manager that had experience with implementing the balanced scorecard in organisations like the DBC. The business development manager was given the responsibility to implement BSC in the resources directorate.

The process of implementing BSC was started in spring 2003. The business development manager started the implementation process by sharpening the mission and strategy of the resources directorate. This was done at a seminar where the resources director, the business

development manager and all department managers participated. The annual agreement between the resources director and the Director General was to a large extent the point of departure when the measures of the BSC of the resources directorate were identified. Thus, measures were not derived solely from the strategy, which should be the single point of departure according to the BSC literature (e.g. Kaplan and Norton, 2000). Taking departure in the BSC of the resources directorate, the department managers together with their employees (the extent of employee involvement differs between departments as we will see later) and the resources director developed the department BSCs.

The BSC of the DBC follows the calendar year. 2004 was the first year that the resources director used BSC for performance management. Since it was the first time, several measures were new and neither the resources director nor the department managers were able to set targets that reflected some kind of informed expectation. Similarly, Ittner and Larcker (1998) argue that it can be difficult to establish measures with high predictability without prior measurement. The business development manager says:

“Our ambition was that 2004 was a year of apprenticeship as Bent [the resources director] called it. We didn’t really measure things. It is difficult to hold people accountable for specific targets when we hardly knew what the targets were.” *Business development manager*

As a consequence not much importance was ascribed to the gaps between targets and realised figures during 2004. Furthermore, the content of the measures also changed when they became operationalised. Not all measures, which were identified for the BSCs, were thought through well enough. When it came to gathering data for measures and analysing on these data, several measures needed to be reconsidered.

The BSCs of 2004 were composed of BSCs for the resources directorate and each of the underlying departments. Quarterly meetings were and are still held between the resources director and each of the department managers. By way of comparison it can be mentioned that a quantitative study conducted in Australia by

Bedford *et al.* (2006) finds that monthly reporting is most common followed by quarterly reporting.

The BSCs of 2005 are characterised by the fact that the organisation had now gained some experience with the BSC. The targets were more in line with reality, and the number of measures of the BSCs was considerably reduced. Because target-setting should now be more reliable, a small bonus was assigned to the BSC in 2005. Whether the manager had earned the bonus depends on a subjective evaluation of number of green key performance indicators. An additional bonus is granted depending on the total performance of the resources directorate.

2005 was also the year when the BSC was further pushed down the hierarchy. Departments are composed of teams and in some departments the teams have their own BSCs. This is the case in department of service and administration but not in the accounting department. The resources director to a very large extent let the department managers themselves digest the new performance management technique rather than pushing it out to them. As a consequence, not all departments have BSC at team level.

Today, at the end of 2005 and beginning of 2006, the BSC is still developing, but a kind of settlement is seen. The number and extent of changes from BSC anno 2005 to BSC anno 2006 is expected to be far less than the number of changes from BSC anno 2004 to BSC anno 2005. Although things are stabilising, it is not said that the BSCs are not going to change further. The balanced scorecard rests on the notion of double-loop learning, and continuous changes are to be expected (Kaplan and Norton, 1996a).

5.4.2 The mission and strategy of the resources directorate

Since the present case study is focusing on the balanced scorecard of only one of the directorates, the resources directorate's mission and strategy is presented here. It is the mission of the resources directorate that:

“The resources directorate shall create and develop the best possible basis for the DBC carrying out its core activities within radio, TV and interactive media.”

What is characteristic of this mission is that it considers the DBC as the customer to be served. The resources directorate is a support function.

In order to create and develop a basis for the activities of the DBC, a strategy consisting of four themes is developed. These are:

- Business orientation
- The new radio and TV house – building, operating and moving
- In control of the finances
- Effective and efficient cross-functional processes

The strategy of the resources directorate is to supply the internal customers with services of a standard so that the directorate is considered a professional supplier. What should be characteristic of the services is that they should focus on the integration of the entire organisation by emphasising cross-functional processes. While doing so, it must be assured that the resources directorate as well as the entire organisation stay within budget.

Since the mission as well as the strategic themes focus on supplying the internal customers with services of high standards, the strategy of the resources directorate can be classified as one of ‘customer intimacy’ (Treacy and Wiersema, 1995). Although some emphasis is put on efficiency (a characteristic of the strategy called ‘operational excellence’), more emphasis seems to be put on delivering a good basis for the DBC to carry out its activities. On the other hand, the resources directorate has no ambition of being best in class (a characteristic of the strategy called ‘product leadership’). The ‘customer intimacy’ strategy is also the one pursued at organisational level cf. section 5.3.2.

5.4.3 The design and use of the balanced scorecards

A number of balanced scorecards exist within the resources directorate. In addition to the balanced scorecard of the resources directorate, each department has its own BSC. Furthermore, in some

departments (e.g. in the department of service and administration but not in the accounting department) balanced scorecards are prepared for underlying teams. The BSC of the resources directorate set out guidelines stating what the department BSCs should look like and so forth. This is for example done by requiring that some measures of the BSC of the resources directorate be inherited to the department BSCs. Thus, the BSCs are aligned with one another.

The BSCs contain only three perspectives. These are the customer, process and employee perspectives. That the BSC of the Danish Broadcasting Corporation contains only three perspectives is counter to recommendations by Kaplan and Norton (1996b, p. 34) but in line with empirical studies by for example Malmi (2001) and Speckbacher *et al.* (2003) that show that far from all organisations implement all four perspectives.

Within the customer perspective, a distinction is made between the customers that use the services of the resources directorate and the customer that pays for the services. The customers that use the services are all directorates including the resources directorate. The customer that pays is the management board. The strategy map is reproduced in Figure XII.

Figure XII. The strategy map of the resources directorate

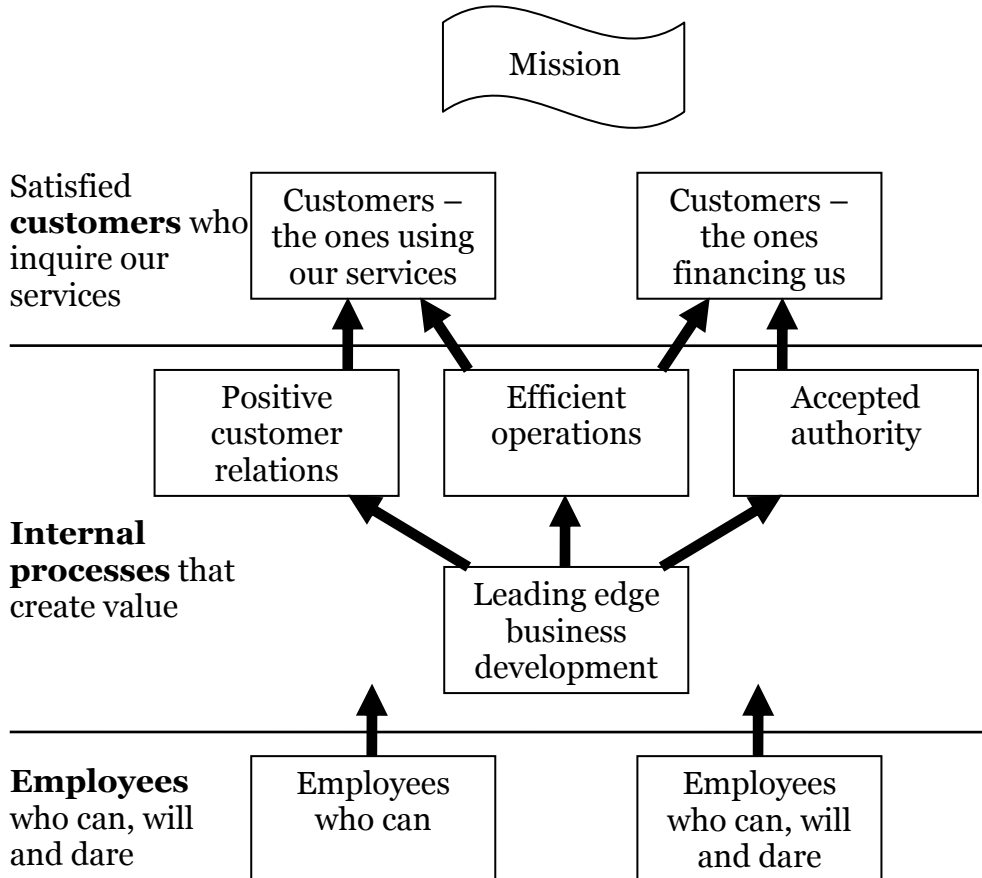


Figure XII illustrates the perspectives and strategic focus areas of the resources directorate. Within each strategic focus area, a number of measures exist. An example of a measure within the strategic focus area called “Customers – the ones using us” is the measure called “Customer satisfaction” which is measured on a scale from 1 to 5 by sending out a survey. An example of a measure related to “Customers – the ones financing us” is “Meeting the budget for net costs”. This is measured by an index of actual costs to budgeted costs.

Other types of measures within the BSCs of the resources directorate are counts (e.g. number of employees that can, will and dare) and tasks (e.g. identify key employees). The progress in relation to tasks is measured as a percentage that is subjectively set by the manager.

The collection of data on the measures is primarily manual. Only data for a few measures are loaded from other databases. The BSCs are

updated quarterly and on that occasion a lot of time is spent on data collection. The fact that data are primarily collected manually is in line with findings by for example Malmi (2001).

On quarterly meetings between the resources director and department managers, the performance of the department is discussed on the basis of the degree of achievement of targets. These quarterly sessions are to a large extent supported by the information system in that the BSC including measures and figures is beamed at the wall, and during the meeting the participants (the resources director, the business development manager and the department manager) navigate through the BSC using the laptop computer.

It is primarily realised figures below target that attract attention and time is spent on understanding and explaining the deviations and identifying remedying actions. On the basis of past performance, future targets may be revised if necessary. With some departments' BSCs, the measures (in addition to the targets) are also evaluated and the composition of measures may be changed (double loop learning, Argyris, 1991). On this point, difference exists between the two units investigated in that the purchase and secretariat team evaluates performance against target as well as the measures themselves. This is to a lesser extent the case of the accounting department. The resources director wants department managers themselves to decide on the pace with which they adopt the different features of the BSC. Therefore, the use of the BSC in one department differs from that of other departments. The two departments studied are characterised by being at the opposite ends of the scale of sophistication of BSC use.

In addition to the quarterly cycle, an annual cycle exists where the BSCs are subject to major revisions and where the targets for the next year are set. The resources director sets the frame of the department BSCs and the department managers design the BSCs. Typically, employees within the departments are invited to sessions where they participate in the development of the department BSC, or employees are invited to sessions where they are presented with the department BSC. The level of employee involvement differs from department to department.

Differences between departments also regard the extent to which quarterly BSCs are discussed with department employees. In the purchase and secretariat team, employees are given responsibility for

single measures, and each quarter the BSC is discussed at a department meeting where employees responsible for the measures explain the status and the future. Also at these meetings the electronic BSC is beamed at the white wall. Since only managers have access to the BSC application, the secretary of the department manager converts the BSC from the BSC software to an MS Excel file that is stored at a file location where all employees have access.

In the accounting department the situation is very different. Here, the BSC primarily is a matter between the department manager and the resources director. The employees of the department are only involved annually when the BSC of the next year is to be developed. At an interview with an employee of the accounting department, one of the first comments was:

“I must admit that I didn’t know anything about that the BSC was something that we had. [...] I had to talk to some colleagues about what it was and then it came to me – after we have been talking a while – that we at some point in time have been presented to the fact that the managers have some goals from the resources director.” *Employee within the accounting department*

That employee was not aware that a BSC was implemented in the department. But as the interview progressed, he remembered that he occasionally had heard about the BSC.

As a consequence of the limited involvement of the employees of the accounting department, the BSC hardly had any effect on the behaviour of the employees. The BSC had an effect on the department manager, since she quarterly was confronted with her performance along the measures. Although no direct effect on the behaviour of employees was found, an indirect effect was present since the department manager directed her attention to matters that were part of the departmental BSC.

One explanation for the limited use of the BSC might be that the manager of the accounting department did not think that the BSC was comprehensive, since many of her daily and very important tasks were not included in the BSC. She says:

“In our department there are so many things that we have to do that are not captured by the BSC. It is only 40-50% that is captured by BSC.” *Manager of the accounting department*

Thus, it was found that the use of the BSC differs substantially between the accounting department and the purchase team within the department of service and administration.

The theory of the balanced scorecard has developed since Kaplan and Norton's first article on the management accounting technique back in 1992 (Kaplan and Norton, 1992). Consequently, different versions of the balanced scorecard now exist. Likewise, companies can implement different features of the balanced scorecard. Speckbacher *et al.* (2003) group BSC implementations in three different categories. The first category is a collection of measures grouped into perspectives. In the second category the adopter employs cause-and-effect chains. Finally, the third category includes action plans and the use of BSC as an incentives base. Some of the same BSC characteristics are used by Bedford *et al.* (2006) in their BSC classification. Using the classification by Speckbacher *et al.* (2003) the BSC of the Danish Broadcasting Corporation can be classified as a type III BSC.

5.4.4 The organisation of the BSC

The resources director is as the one bringing the balanced scorecard into DBC the primary champion of the management accounting technique. Although he is a sponsor of the BSC he has left most tasks in relation to the BSC with other people. The resources director's primary role now is as a manager who uses the BSC to manage the people who report to him.

The assistant of the resources director, the business development manager, is responsible for the operation and development of the BSC. He foresees that quarterly meetings between the resources director and the managers are held and followed up on and that the annual revision and target setting take place as planned. He also attends the quarterly meetings.

The business development manager does not interact with the BSC software. All administrative tasks in relation to the BSC are carried out by an employee in the accounting department who works with development of small, easy-to-use systems. He is not an IS person but he is a very skilled user of MS Office. He has himself built a user interface for administration of measures *et cetera* of the BSC. Throughout this text he will be referred to as the global BSC administrator since he is administering the BSC of the entire organisation.

The global BSC administrator does not have competencies to develop on the core of the BSC software. Therefore, a BSC developer is also part of the BSC team.

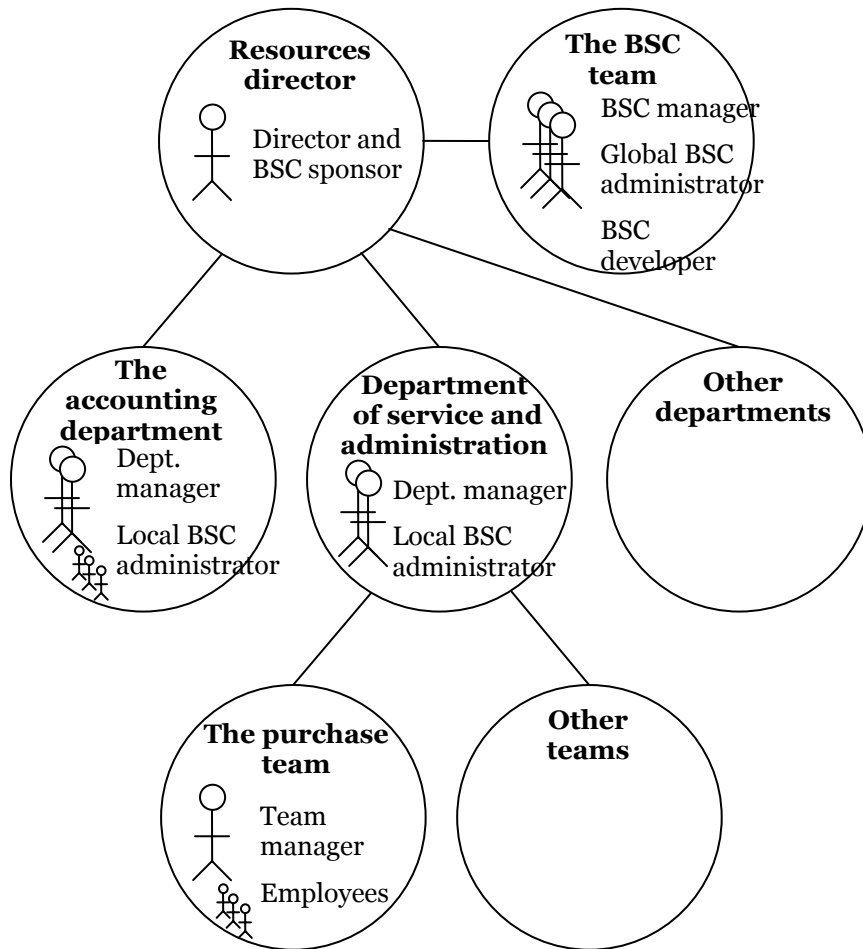
Among the people working with the BSC in the department are the department managers. They have two roles. First, all department managers have their own BSC on which they are measured. Second, the department managers use the BSC to manage the performance of their employees. Departmental BSCs are developed and adjusted by the department managers on the basis of guidelines supplied to them by the resources director and the business development manager.

Since much manual work exists in relation to for example data collection, preparing for the quarterly meetings with the resources director and communication of the BSC to the employees of the departments a local BSC administrator is appointed.

Finally, the remaining employees are to a smaller or larger extent subject to management with the BSC. How the department managers use the BSC in their management differs considerably between the two departments investigated, and thus the role of the employees also differs between the two departments. In the accounting department the role of the employees is limited, whereas employees of the purchase and secretariat team are to take responsibility of individual measures and engage in the development of the BSC.

The organisation of the BSC is summarised in Figure XIII.

Figure XIII. Organisation of the balanced scorecard



5.4.5 The information system supporting the BSC

The description of the part of the information system that supports the BSC takes departure in the list of characteristics of an IIS that was developed in section 2.3.2 of the literature review. Both the present and the future BSC software are described. The description of the present BSC software is based on the experiences of employees with the BSC software, while the description of the future BSC software is based on demonstrations of it and expectations to it.

5.4.5.1 *The present, self-developed BSC software*

The BSC is at the time of writing still supported by self-developed software. The BSC software consists of a number of sub-systems. The fundamental part of the BSC software is programmed by DBC developers in a programming language that is part of the Oracle environment. Included in this part of the software is a web-enabled user interface that is part of the management portal.

A shortcoming of the management portal is that only managers have access to the portal and the BSC user interface. Thus, other BSC users do not have access to for example the graphical presentations where managers can see whether they are on target or not. In the purchase and secretariat team, where the BSC is used proactively by the department manager for managing employees, the BSC is communicated to employees in the format of spreadsheets, PowerPoint presentations or real-time presentations where the department managers log on to the management portal.

Shortly after the start of the BSC, the global BSC administrator himself developed an interface for administration of measures, targets *et cetera* in MS Access. Data still reside on the Oracle database and the MS Access software accesses the Oracle database using ODBC links.

The BSC software is not integrated with other software applications within the DBC except through the database. Thus, data are integrated but the BSC software is not integrated with the remaining software applications. This also indicates that the scope of the BSC software is rather narrow.

The BSC operates at a strategic level, and the BSC software can be described as an analysis-oriented information system. Aggregate figures are reported and unfortunately it is not possible to drill all the way down to the individual transactions.

When the BSC software was initially developed, the knowledge of BSC was scarce and only basic functions were developed. Now, resources are insufficient for enhancing functionality of the BSC software.

A complex application is one with many entities, fields and relationships. The BSC software is a complex software application, which primarily is a consequence of the fact that the BSC has many

features (measures, targets, the organisation, strategic objectives, initiatives etc.). The complexity is most overwhelming in the administrator's MS Access software where all entities, fields and relationships are available. In the user interface at the management portal the complexity is hidden by spreading the many dimensions on a number of screens. So, although it is a complex software application, it is relatively user-friendly with regard to the user interface. Use of the administrator's software application is less user-friendly since deep knowledge of the BSC of the resources directorate including departments and teams is needed.

When you develop an information system yourself, one could expect it to be flexible since you can tailor it for your needs. But this is not the case with regard to the BSC software of the DBC. The business development manager says:

“If you start here from basics [draws a chart showing a learning curve] at the same time that you start working with BSC, you will build your knowledge into the system at the rate that you acquire the knowledge [points to the curve that illustrates that learning about BSC and functionality of the self-developed BSC software increases simultaneously]. Then you get here [points at some point at the middle of the curve] and you realise that you back in time made a one-to-many relationship where you should have made a many-to-many relationship. Now you cannot do what you would like to. If you buy standard BSC software, it is up here [points to the upper part of the learning curve]. The programmers have built a lot of experience into the system.” *Business development manager*

As a consequence, the BSC software is not flexible although the purpose of the software exclusively is to support the BSC of the resources directorate. On the other hand, an advantage of self-developed software is that the costs of the software are very manageable. The money spent on developing the BSC software is at the discretion of the organisation. Furthermore, it might be easier to gain approval for the implementation of BSC since it does not require large investments in an information system.

5.4.5.2 The future, standard BSC software

Corporater BSC, which is the future BSC software of the Danish Broadcasting Corporation, is an analysis-oriented best-of-breed system that is developed with the purpose of supporting balanced scorecard implementations. The software is standard BSC software with much functionality, and the functionality of the software is expected to increase with the ongoing development that takes place in Norway. Thus, the scope of the standard BSC software is narrow.

To the DBC it is mandatory that all software applications use the same Oracle database. This is also the case with Corporater BSC that will be integrated to the existing database. At the software level, some integration will take place against the management portal.

Corporater BSC is a relatively flexible piece of software. The number and names of perspectives, strategic focus areas and measures are at the discretion of the administrator of the BSC software. Large flexibility exists with regard to data load and several different reporting formats exist. The flexibility and the functionality of the standard BSC software add to the complexity of it. Administrator's workbench is less user-friendly than the web-based user interface. The web-based user interface is very user-friendly and the software vendor advertises that no end-users have received any training up till now.

As opposed to an ERP system, implementation and configuration of the standard BSC software can for the most part be carried out by employees of the Danish Broadcasting Corporation. This increases the ease of implementation.

5.5 Analysis

The structure of the analysis is based on the literature review and the literature on the balanced scorecard. Research question 2 (see section 2.7) regards how the design and use of a management accounting innovation (exemplified by the balanced scorecard) is supported by an analysis-oriented information system. With regard to the information system, focus is on its characteristics (see left-hand side of Figure III). The self-developed and the standard BSC software

were described in section 5.4.5 above using the characteristics identified in the literature review. With regard to the management accounting side of the relationship, the boxes called 'Techniques and their design' and 'Behaviour, use and perceptions' are opened (see right-hand side of Figure III). While the list of characteristics identified in the literature review defines the structure of the analysis of the information system, the BSC literature will define the structure of the analysis of design and use of the balanced scorecard.

Four aspects of design and use of the balanced scorecard are identified as relevant for further investigation in the Danish Broadcasting Corporation. These are the design of the balanced scorecard (e.g. the measures selected and how they are summarised at higher-level scorecards), the causal relationship between measures, the four processes of managing strategy (see Kaplan and Norton, 1996a) and the quarterly BSC meetings. The four aspects are chosen from the BSC literature and they are chosen because of their significance in relation to understanding the present case study. The four aspects constitute the first dimension of the analysis framework that is illustrated in Figure XIV below.

A second dimension of the analysis framework is the distinction between the present, self-developed BSC software and the future, standard BSC software. This dimension represents the information systems side of the relationship between management accounting and information systems. The characteristics of information systems identified in section 2.3.2.2 will be made use of here. The purpose of including this dimension is to investigate how information systems with different characteristics in different ways support the balanced scorecard of the Danish Broadcasting Corporation.

Finally, the third dimension is that of the two departments investigated. Differences exist in their use of the balanced scorecard and the BSC software. How the information system can support different uses of the balanced scorecard is analysed using this dimension.

Figure XIV. The analysis framework

Aspects of design and use of the balanced scorecard	Support by present BSC software	Support by future BSC software	The role of the BSC software
Design	Not at all, low, medium or high		The accounting department vs. the purchase and secretariat team
Causality			
Four processes			
BSC meetings			

The first dimension is represented by the rows while the second dimension is represented by the columns. The dimension of departments' use is represented within the cells. On the basis of the three dimensions, the role of the information system is analysed by analysing to what extent (not at all, low, medium, high) the present and future BSC software support the different aspects of design and use of the balanced scorecard.

5.5.1 The design of the balanced scorecards

Many aspects of the design of the balanced scorecards within the resources directorate exist. In order to carry out a comprehensive rather than a broad analysis, only some of these aspects are analysed. The aspects analysed are the ones where the BSC software seems to constrain or support the measures of the BSCs the most.

5.5.1.1 The comprehensiveness of balanced scorecards

According to Kaplan and Norton (2001c, p. 205) BSCs of administrative functions have characteristics common to BSCs of non-profit or government organisations when the remaining parts of the organisation do not have a balanced scorecard. What is characteristic of such BSCs is that the financial perspective is not the outcome perspective to which all other perspectives add up. Instead, the mission rather than the financial perspective is what all efforts

must support (see also Speckbacher, 2003). The financial perspective is on equal terms with the customer perspective. Customers are split in two parts: those who pay for the services and those who receive the services. The shareholders are replaced by the customers who pay (Kaplan, 2001).

The business development manager of the Danish Broadcasting Corporation, who is responsible for the development of the balanced scorecard, is to a very large extent inspired by literature by Kaplan and Norton and the Balanced Scorecard Collaborative. Therefore, the BSC of the resources directorate to a large extent follows the recommendations cited above (see also section 5.4).

At the level of the individual measures, the DBC is faced with challenges since the business development manager and some of the department managers find it hard to identify good measures for those parts of the business that are characterised by being project oriented rather than operations oriented. The accounting department to a large extent is project oriented when considering the controllers who have many ad hoc projects. The accounting department manager struggles with finding measures for the BSC that embrace the ad hoc projects. As a consequence, the BSC of the accounting department is not comprehensive since it does not cover all strategically important areas of the department's work (see citation from the accounting department manager above).

The business development manager and the accounting department manager both would like to see that the balanced scorecard of the accounting department was more comprehensive. The consequences of a non-comprehensive BSC is a reduction of its value as a management accounting technique. The question is to what extent the BSC software plays a role with regard to the lack of comprehensiveness. Is there a relationship between the information system and the actual management accounting practice, which obviously differs from the practice that the organisation would like to see in place? The empirical evidence does not indicate that the BSC software plays a significant role with regard to the comprehensiveness of the balanced scorecards. The identification of measures is a design activity. Design activities are activities that primarily include intellectual processes rather than processes of calculation or presentation. Design activities can to a lesser extent be supported by an information system. Also, neither the business

development manager nor the accounting department manager at any time refers to the BSC software as a limiting factor. Section 5.5.3 on the four processes of the BSC will elaborate on this issue.

Since the information system plays a modest role in relation to the identification of the measures, the future BSC software is not expected to represent a lever for change in this regard.

The balanced scorecard of the purchase and secretariat team seems to be more comprehensive. The BSC is an important management tool to the department manager and it is continuously calibrated to embrace areas that need attention.

5.5.1.2 The scales of the measures

A second issue with regard to the design of the BSCs is the occurrence of measures that to a limited extent can be measured along a scale. This is for example the case with the measure called 'Completion of recommendation to the management board regarding evaluation of rationality of projects' of the accounting department. The recommendation to the board should be completed by some date, and before that date the target is 0% completion and after that the target is 100% completion. Either the recommendation has been made on time or not. Since the scale is relatively simple, not much room exists for following up on progress and even lesser room exists for relating the measure to other measures via causal relationships.

Measures using this scale of completed or not completed are used by both the accounting department and the purchase and secretariat team. Within the accounting department, the reason for their existence seems to be that the collection of measures has not been subject to scrutiny and revision. In the purchase and secretariat team the measures with this scale are chosen with a purpose. Since the balanced scorecards of 2004 and 2005 represent a stage of developing the balanced scorecard, a number of actions have to be carried out before the measures following the binary scale can be replaced by other and better measures. Until you have developed the management system, you cannot measure things. Binary scale measures are utilised for the purpose of managing the development of the management system in the purchase and secretariat team. The department manager explains:

“Do you have a decomposition of what your services are? Do you have an estimate of the market share? And so on. Yes, we have several of these measures. [...] Next year there will be outcome measures on these areas.” *Manager of the department of service and administration*

Since it is an issue of translating the vision to operational measures and as with the case of non-comprehensiveness, the BSC software does not seem to be a constraint. The future BSC software is not expected to be a constraint or a facilitator either.

5.5.1.3 The frequency of measures

At present the balanced scorecard is basis for performance evaluation on a quarterly basis. High activity exists around the closing date of the balanced scorecard each quarter. Realised figures are collected, meetings are prepared and performance evaluations are carried out. But the activity is relatively low at other times of the quarter. Managers as well as employees are not used to enter the BSC software outside the quarterly meetings. The manager of the accounting department says:

“We only do quarterly follow-ups. I don’t enter the BSC software in and out of season since it makes no sense since it doesn’t change.” *Manager of the accounting department*

That BSC activities are only carried out in relation to the quarterly meetings is true of both departments investigated.

Some measures are only updated quarterly or more infrequently. But measures such as absence due to illness, billable hours and license fee income can be but are not updated on an ongoing basis. Regardless that it is relevant to use the balanced scorecard more interactively (Simons, 1995, pp. 91-124) it is not. The business development manager misses the functionality within the present BSC software to handle measures with different update frequencies, and it is one of

his primary requirements to the new BSC software that measures can have different update frequencies.

“I have concluded that we cannot come any further with the balanced scorecard until we get a better system. [...] An example: The period that we have on our measures has to be the same for all measures. So either you have all measures per week or per quarter. But there are some things that would be natural to evaluate weekly such as invoicing in the production department. They come every week so why wait?” *Business development manager*

As a consequence of the missing functionality, a desired way of using the balanced scorecard is not implemented due to a constraint of the present BSC software.

The quarterly balanced scorecard meetings of the DBC are part of the business planning process (Kaplan and Norton, 1996a, p. 77). In the analysis of the BSC software's support of the four processes of managing strategy (see section 5.5.1), it was found that the business planning process is supported and constrained by the BSC software. With the move from self-developed BSC software to standard BSC software and with the requirement to the new BSC software that it must be able to handle different update frequencies, it is expected that the use of the balanced scorecard will change when the new BSC software is implemented.

5.5.1.4 Summation of measures at higher-level balanced scorecards

Balanced scorecards exist at the level of the resources directorate, at departmental level and in the department of service and administration also at the team level (having BSCs at different levels within the organisation is a key feature of the BSC; Bedford *et al.*, 2006). The BSC of the resources directorate consists of a number of measures that are summations of measures from BSCs of the underlying departments. Examples are customer satisfaction, employee satisfaction, number of employees, who can, will and dare, meeting the budget for net costs and cost efficiency. Different formulas are needed when summing these diverse measures, but the

self-developed BSC software is not good at handling summations. As a consequence, the balanced scorecard of the resources directorate is heavily underemphasised, and the business development manager says:

“We have from the very beginning underemphasised the importance of it [the BSC of the resources directorate]. [...] A reason why we have chosen not to assign importance to it is that we have opted out that [...] when I add up things then it [the BSC software] should assign weights to them. When you add up things that aren't possible to add up.”
Business development manager

One of the respondents of the quantitative study by Speckbacher *et al.* (2003) says that his company rejected the BSC since it is difficult to aggregate divisional, qualitative measures to the corporate level. This problem of adding apples and pears is only one of the problems that the DBC is facing when preparing the directorate scorecard. The primary problem regards the BSC software's inability to support weighted summations. Thus, as with the frequency of measures, the BSC software is also limiting the BSC use with regard to BSC hierarchies. A requirement to the new system is that it easily can handle different ways of summing measures from departmental level to directorate level. Furthermore, it should also be possible to represent a departmental measure directly on the directorate scorecard (e.g. license fees, which is a measure of the department of service and administration). The new BSC software is able to support such summations, and the directorate BSC will then receive more attention.

The analysis is summarised in the table below, which matches the analysis framework.

Table XVII. The BSC software and the design of the balanced scorecards

Aspects of design of the balanced scorecard	Support by present BSC software	Support by future BSC software	The role of the BSC software
The comprehensiveness of balanced scorecards	Not at all	Not at all	The BSC software to a lesser extent plays a role since selecting measures is a design activity.
The scales of the measures	Not at all	Not at all	The BSC software to a lesser extent plays a role since selecting measures' scales is a design activity.
The frequency of the measures	Not at all	High	The present BSC software is a constraint. When the BSC software supports measures with different frequencies, the BSC will change. The change is more likely to take place in the purchase and secretariat team.
Summation of measures	Low	High	The present BSC software is a constraint. When the BSC software supports summation of measures, the BSC of the resources directorate will be given more emphasis.

From the table it is seen that the BSC software does not play a role in relation to the collection of measures and their scale. The BSC software (the present and the future) is flexible in that regard, and incomprehensive as well as comprehensive balanced scorecards can

be designed, and measures with inappropriate as well as appropriate scales can be chosen.

From the table it is also seen that the present and the new BSC software play a role in relation to the frequency of measures and the summation of them. The future BSC software will provide the Danish Broadcasting Corporation with more functionality, and the design of the BSCs will change.

5.5.2 Causality

Causality is one of the crucial features of the balanced scorecard. As opposed to a collection of measures, the balanced scorecard must illustrate the strategy of the organisation by linking the measures together (Kaplan and Norton, 1996a). Regardless of the importance of causality from a theoretical point of view, companies prioritise causality lower than other characteristics of the balanced scorecard (Malmi, 2001; Nielsen and Sørensen, 2003).

5.5.2.1 Causality when identifying measures

In the Danish Broadcasting Corporation measures are derived from the strategy and in this process the people identifying the measures have thought in terms of causality. A causal relationship is expected to exist between the measures going from the employee perspective to the customer perspective. The hypothesis is that by increasing the number of employees who can, will and dare, a higher customer satisfaction will be achieved. Strategy is a hypothesis of cause and effect (Kaplan and Norton, 2000).

The present BSC software does not support the process of translating strategy to measures and visualising the causal model in a strategy map (Kaplan and Norton, 2000). Instead, the strategy map is prepared using MS PowerPoint. In the BSC software perspectives, critical success factors and measures are placed side by side. In Corporater BSC, which is about to be implemented, it is possible to draw strategy maps and link the measures to the strategy maps so that strategy maps contain the performance on the individual measures. Furthermore, a special part of the BSC software allows for taking the strategy map builder off-line so that the managers developing the BSC can do so off-site. Thus, the new BSC software is

going to support causality in relation to strategy formulation and identification of measures. Since the two departments investigated make different use of the balanced scorecard, it is also expected that they to different degrees will make use of the possibility to draw strategy maps with the new system. The purchase and secretariat team is the one most likely to make use of it.

5.5.2.2 Statistical tests of causality

Hypotheses (i.e. the strategy) need to be tested (Kaplan and Norton, 1996b, p. 252). Otherwise, the Danish Broadcasting Corporation would not know if the measures chosen are the right ones (double loop learning; Argyris, 1991). A statistical test of the relationship between the measures is not carried out in neither of the two departments investigated. Neither does the current BSC software support statistical tests. Neither will the new BSC software.

The issue of cause-and-effect relationships seems to be a troublesome one. Malmi (2001) concludes that companies are confused with regard to cause-and-effect relationships. According to Nielsen and Sørensen (2003), not many organisations in Denmark work with causality since causality is perceived as part of the BSC theory that is in practice added along the way, as organisations build up experience with the BSC. Bedford *et al.* (2006) report that 43.5% of organisations do not use cause-and-effect logic. Several other studies can be added to this list (e.g. Kasurinen, 2002; Malina and Selto, 2004). Bedford *et al.* (2006) find only little support for the proposition that the use of cause-and-effect logic should have an impact on benefits of BSC use. It is evident that cause-and-effect logic is given lower priority in practice. Also, the CEO of the vendor of the standard BSC software in an interview said that developing functionality for testing causal relationships is not given priority at their side either. On the other hand, Kaplan and Norton (2001c, p. 308) report that the Rockwater division of Brown & Root Energy Services carries out statistical tests on the relationship between for example employee morale and customer satisfaction.

5.5.2.3 Qualitative tests of causality

When asked if the DBC tests the causal model, the business development manager says:

“It is not an ambition in the short run to test causal relationships.” *Business development manager*

But then he continues to tell about the relationship between customer satisfaction and meeting the budget in a department within the resources directorate:

“In the productions department they had the largest customer satisfaction. [...] But the department did not meet its budget. This is the story about how it is easy to get happy customers. You can sell your product at half the price. Or supply services without charging for them. But then you cannot meet the budget.” *Business development manager*

So, some kind of hypothesis testing is carried out. It appears that the causal relationship between the measures is tested qualitatively and with the use of sensing (Kaplan and Norton, 1996a) rather than statistically. Typically, a manager can sense whether good or bad effects flow from actions taken or states reached. This is also in line with van der Veecken and Wouters (2002) who find that lower-level managers to a lesser extent make use of accounting information since they already know the state of affairs from their daily work (action-oriented knowledge).

Qualitative tests of relationships cannot be supported by an information system since explanations are sought for in the daily experiences and the action-oriented knowledge.

Both managers of the two departments investigated indicate that they carry out some qualitative analysis on the relationship between measures. But it is not done regularly and not as an explicit action to test relationships.

5.5.2.4 Visual tests of causality

A third way of testing causal relationships could be referred to as visual testing, which is a variant of qualitative testing where the manager supplements the action-oriented knowledge with the strategy maps and the speedometers. Statistical tests are very rigorous, but less rigorous methods seem to be satisfactory to business managers. If the BSC provides strategy maps containing measures and figures, managers may be able to see whether relationships exist or not by glancing over the numbers. Visual testing of the causal relationship is not supported by the current BSC software, and no such testing is carried out in either of the two departments. In the new BSC software it is possible to see strategy maps with measures and figures on them. Furthermore, much better reporting facilities exist so that different measures easily can be put together in a report. An important characteristic in relation hereto is that figures from previous periods can be reported together with figures from the present period. Thus, visual testing of causal relationships where a time lag (Kaplan and Norton's lacking treatment of the time lag between measures is criticised by among others Nørreklit, 2000; Bukh and Malmi, 2005) is expected can be carried out in the new BSC software. The business development manager expects that this feature will change the way that the balanced scorecard is used.

To sum up, three different ways of testing causal relationships within a balanced scorecard are found by investigating BSC in the DBC including the company's future BSC software. These are statistical testing (as also described by Kaplan and Norton, 2001c, p. 308), visual testing and qualitative or subjective testing (Kaplan and Norton, 1996a). At present the DBC only tests causal relationships by using the manager's senses, but visual testing will probably be carried out when the new BSC software is implemented. Thus, the BSC software is a constraint in relation to testing causal relationships. Whether both departments will make use of visual testing is questionable.

Table XVIII. The BSC software and causality

Aspects of design of the balanced scorecard	Support by present BSC software	Support by future BSC software	The role of the BSC software
Causality when identifying measures	Not at all	Medium	Identifying measures is a design activity and although the new BSC software supports strategy maps the system will not play a major role in either of the two departments.
Statistical tests of causality	Not at all	Not at all	Neither the department managers nor the business development manager requests functionality for statistical tests. Thus, in the case of the DBC the BSC software is no constraint.
Qualitative tests of causality	Not at all	Not at all	Neither of the two instances of BSC software supports qualitative tests. Qualitative tests are carried out by both departments on the basis of action-oriented knowledge.
Visual tests of causality	Low	High	The future BSC software supports visual testing. This change in functionality will probably not change the testing carried out in neither of the two departments.

In general, the present and future BSC software play only a minor role. Although the functionality will increase with Corporate BSC, it is less likely that it will be used for generating strategy maps or the testing of causal relationships in neither of the two departments investigated.

5.5.3 The four processes of managing strategy

Kaplan and Norton (1996a, p. 77) identify four processes of managing strategy. These are translating the vision, communicating and linking, business planning and feedback and learning. The BSC software of the Danish Broadcasting Corporation seems to support some of these processes, while others are not supported. Which processes are supported respectively not supported and the reason for this will be discussed in this subsection.

5.5.3.1 Translating the vision

Translation of the vision into operational measures was done the first time in spring 2003. At a managers' seminar the vision, mission and strategy were strengthened and at the same seminar the first part of the work of identifying perspectives, strategic focus areas and measures was carried out. The process was not supported by the BSC software, since it did not exist at that time. Even if it did, no such functionality exists within the present BSC software. With the new BSC software it is possible to draw strategy maps with an off-line part of the BSC software. Whether this new functionality will be made use of by any of the two departments is questionable, since there probably are not enough benefits of having an electronic version of the strategy map to compensate for the costs of learning how to use the system and forcing the managers to accept the presence and role of the tool.

5.5.3.2 Communicating and linking

With regard to communicating and linking, the role of the BSC software of the Danish Broadcasting Corporation differed between the two departments investigated. In the accounting department PowerPoint presentations were used as the presentation medium.

The PowerPoint presentations support one-way communication, and they are in the accounting department used to communicate the BSC and the figures to the employees. The PowerPoint presentations are to a much lesser extent a vehicle for discussion and questioning. Since PowerPoint presentations are static compared to the BSC software, it seemed that the communication within the accounting department was less successful than that of the purchase and secretariat team (please refer to the citation where an employee of the accounting department says that he did not know about the BSC until he received the interview guide).

In the purchase and secretariat team the communication was different. Here the BSC software was used so that for example details were present at the meetings. The BSC software was actively used at the department meeting where the BSC was discussed. The BSC software did not represent one-way communication alone, since it was possible to interact with the software and use it as a driver for discussion and analysis. Two-way communication was made use of during the meetings. But between the meetings the BSC software did not support two-way communication because there was no opportunity to for example comment on measures. Furthermore, only managers had access to the BSC software, which further limited the communication outside the meetings. Thus, the BSC software supported communication at the meetings but it was not made use of in both departments. Since the communication of the accounting department is less effective, it can be assumed *ceteris paribus* that the BSC software has some advantage over the PowerPoint presentation.

When a larger number of users get access to the new BSC software, the manager of the accounting department might use it for the communication of the BSC. The mere fact that users can access the software themselves may result in more users entering the software. Today, only managers can enter the BSC software.

The BSCs of the departments are all linked to the strategy and somehow derived from the BSC of the resources directorate. Thus, the linking of BSCs is carried out within the DBC. But the linking is to a lesser extent supported by the BSC software, since nothing within the BSC software forces a departmental BSC to for example inherit some measures from a BSC at a higher organisational level. This functionality is not a part of the new BSC software either. Since the

BSCs today are linked without the support of the BSC software, it is not an item where missing functionality limits the way that the BSC is implemented. Both departments align their balanced scorecards to that of the resources directorate, since it is required by the resources director.

5.5.3.3 Business planning

The BSC of the Danish Broadcasting Corporation is used for managing performance by setting targets on measures and identifying initiatives. At quarterly meetings the progress or status of measures and initiatives are evaluated. At the meetings attended (with both departments) the discussions of the BSC were to a large extent supported by the BSC software. The meeting participants navigated through the system during the meeting. At a quarterly BSC meeting between the resources director and the manager of the department of service and administration, the BSC software defaulted, and the meeting participants could not get access to the underlying figures of a measure. The heavy reliance on the BSC software forced the meeting participants to skip the investigation that they were trying to carry out. As a consequence, more stability of the future BSC software is hoped for by the business development manager.

5.5.3.4 Feedback and learning

To what extent feedback and learning is supported by the BSC software was partly discussed above, since feedback and learning are closely related to causal relationships. Since the current BSC software does not support neither statistical, visual nor subjective testing of the relationship between measures, it must be concluded that the BSC software has a shortcoming in that regard. Subjective testing is of course not supported by the BSC software due to the way that subjective testing is defined (Kaplan and Norton, 1996a). Visual testing is supported by the future system, but whether any of the two department managers will carry out visual testing is questionable.

The testing of causal relationships is but one part of feedback and learning. With regard to the ongoing revision of the BSCs by for example changing the measures, this is fully supported by the present

as well as the new BSC software. Thus, while the BSC software does not support the testing of the relationships, the BSC software does support the dynamic of a BSC where measures are changed.

Table XIX summarises the relationship between the BSC software and management accounting with regard to the four processes. The processes of communicating and linking are dealt with separately due to different findings with regard to communicating and linking respectively.

Table XIX. The BSC software and the four processes

Aspects of design of the balanced scorecard	Support by present BSC software	Support by future BSC software	The role of the BSC software
Translating the vision	Not at all	Medium	Translating the vision is a design activity, and although the new BSC software supports strategy maps the software will not play a major role in either of the two departments.
Communicating	Low	High	Both pieces of BSC software are vehicles for communication. Nevertheless, the accounting department does not make use of that vehicle. It may do so with the new BSC software due to its greater accessibility.
Linking	Not at all	Not at all	Linking is a design activity and the present and new BSC software play no major role in either of the two departments.
Business planning	Medium	High	Both the present and the new BSC

Aspects of design of the balanced scorecard	Support by present BSC software	Support by future BSC software	The role of the BSC software
			software support business planning activities, and the functionality is made use of by both departments. Thus, BSC software plays a supporting role.
Feedback and learning	Not at all	Medium, visual testing of relationships	The testing of causal relationships is carried out by both departments without the use of the BSC software. Whether enhanced functionality in the new BSC software will be made use of is questionable. Both pieces of BSC software support that measures are changed, which they are.

Note: The process called ‘communicating and linking’ is split in communication and linking respectively.

From Table XIX it is seen that the present and the new BSC software play an important role with regard to communicating and business planning. On the other hand, the BSC software is not a constraint with regard to translating the vision and linking. With regard to feedback and learning, it is found that causality testing is not supported whereas the revision of measures is supported. What the processes, that are not supported, seem to have in common is that they require design activity rather than calculation and communication. Thus, the degree of design activity seems to determine to what extent BSC software advantageously can support a management accounting process. When the BSC software does support a process, where BSC software support is not needed, that particular functionality of the BSC software is not highly appreciated.

5.5.4 The use of the IIS during the quarterly BSC meetings

The quarterly BSC meetings between the resources director and the accounting department and the department of service and administration respectively were attended. These meetings are subject to analysis in this section.

5.5.4.1 Discussions and analyses centred on the BSC software

The BSC software was used heavily throughout the meetings in that the BSC of the department in question was beamed at the white wall from the beginning until the end of the meeting, which lasted about an hour. The business development manager navigated the BSC software and the resources director opened the meeting by asking what the department manager would like to talk about.

A number of measures were discussed during the meeting. In order to explain what caused a measure to be above or below target, the department manager supplemented the BSC with action-oriented knowledge (van der Veecken and Wouters, 2002) about what was actually going on in the department. Another way of finding explanations was to use the drill down functionality of the BSC software. With the present BSC software it is possible to perform drill down analyses along the dimensions of period and organisation. In this way for example an increase in absence due to illness could be limited to only some of the teams within the department.

At the meeting with the department of service and administration the BSC software malfunctioned and a drill down analysis could not be carried out. The malfunction immediately stopped the analysis and no further insights into the underlying causes of the deviating performance could be found. The heavy reliance on the BSC software forced the meeting participants to move on to another measure and leave the measure in question unanalysed.

Generally, the BSC software was the facilitator and not the driver (Scapens and Jazayeri, 2003) of the BSC process in the case of the DBC. Should the BSC software be a driver of change, it should have been able to trigger changes by itself. This is not the case. Rather, it was decided to discuss the measures in 'real-time'. This decision triggered that the BSC software was heavily relied on as a facilitator

of 'real-time' discussions. The heavy reliance on the BSC software gave it power to decide how the BSC was to be used during the meetings of both departments. The new BSC software is expected to play an even larger role with its better analysis functionalities.

5.5.4.2 Strategies of red and green

The managers of the two departments investigated had quite different approaches toward the colours of the BSC. Two strategies of red and green seemed to exist and the BSC software in different ways supported both strategies.

The first strategy will be referred to as the red strategy. The manager of the accounting department applied this strategy. What set the agenda of the quarterly BSC meetings were to a large extent the colours of the measures. Measures coloured green were on track and needed no attention while red measures drew attention. Since no explicit agenda was prepared for the quarterly meetings, the department manager needed a device for setting the agenda.

Data for most of the measures are collected manually and several measures are subjective in that the degree of goal achievement is to some extent determined by the department manager herself. With the high level of data subjectivity, the department manager had an opportunity to use the level of goal achievement to set an agenda. The manager of the accounting department says:

“Have I achieved it or haven't I? Hmm, yes, I have. Some times I choose to say no if it is touch and go. Because it is so that when I have the meetings with Bent [the resources director], he is interested in talking about the ones that are red. And if I think that I face a challenge with regard to something then I paint it red because then I can have a discussion about it.” *Manager of the accounting department*

In this way, the manager of the accounting department coloured measures red if she wanted them to be discussed at the quarterly BSC meeting.

The manager of the department of service and administration had quite an opposite attitude towards the colour of the measures. To her it was very important that the BSC was green. And her BSC was largely all green at the quarterly BSC meeting. One measure, absence due to illness, was red, though. Since the measure was red due to an error in the data, she was well prepared for repudiating that anything should be off track. This was apparent from an interview with her assistant who prepared her BSC material for the meeting:

“There are tons of double entries in ‘Perspektiv’ [the system where employees’ hours are entered] that are pulled over here. It gives some 3.7% where we are allowed to have 3.0% only. And according to our own figures it is only 2.0%. [...] But Bettina [the manager of department of service and administration] also has a status on this. What are the causes? And then she talks to Bent [the resources director] about it.” *Local BSC administrator of department of service and administration*

Furthermore, the subjectivity of data introduced degrees of freedom that the manager of department of service and administration following the green strategy can make use of.

In justice, it must be added that the good performance of the manager of department of service and administration was not primarily due to sand bagging and similar techniques. The department manager was very enthusiastic and hard working, and with the balanced scorecard she had managed to accelerate performance improvements of her department.

The red and green strategies probably will become more difficult to follow when the new BSC software is implemented. With the new BSC software more data will be automatically loaded from existing databases. Furthermore, the continuous development of the BSCs might decrease the number of subjective measures and measures based on data of poor quality. In this way, characteristics of the present BSC software open up for alternative uses of the BSC that probably will change when the BSC software is replaced. Thus, the BSC software is in this regard a driver of change.

Table XX summarises the findings in relation to the quarterly BSC meetings.

Table XX. The BSC software and the quarterly BSC meetings

Aspects of design of the balanced scorecard	Support by present BSC software	Support by future BSC software	The role of the BSC software
Discussions and analyses centred on the BSC software	Medium	High	Both the present and future BSC software support the quarterly BSC meetings where the BSC software is made use of by both department managers.
Strategies of red and green	High	Medium	The two department managers apply different strategies. They are both supported by the present BSC software. With the future BSC software it will probably be more difficult to pursue the two strategies.

The present BSC software is used extensively at the quarterly meetings by both department managers. This is probably not going to change with the new BSC software.

The subjectivity of data allows the department managers to pursue two different strategies in relation to the colours of their balanced scorecards. Whether the strategies will remain viable with the future BSC software is questionable.

5.6 Discussion

This section will contain a discussion and reflexion upon the findings and analyses presented in the previous sections. The purpose of this

section is to reflect on the findings in light of the current literature as reviewed in Chapter 2. First, the role of the BSC software in relation to the design and use of BSC is up for discussion. Next, the normativity of the BSC software and information systems in general is discussed. Finally, the case of BSC in the Danish Broadcasting Corporation is discussed in relation to the four-stage model (Kaplan, 1990).

5.6.1 Normative BSC software

To what extent the BSC software is a vehicle for developing a comprehensive balanced scorecard or developing more scalable measures seems to depend on to what extent the BSC software has a structure that guides the design of the BSC. When BSC software is very flexible with regard to what measures can be implemented, the BSC designer is not by the BSC software forced to include some measures over others. This was the case with regard to the present as well as the new BSC software. Thus, very flexible BSC software is no guarantee that you design a theoretically sound BSC. Or put in another way, that you purchase BSC software does not guarantee that you design a BSC according to the later writings by Kaplan and Norton (e.g. Kaplan and Norton, 2001a, 2001b, 2001c) rather than merely a collection of measures independent of each other (Malmi, 2001). Rather than having no opinion about what measures to implement (i.e. the BSC software is non-normative), the BSC software could have had the balanced scorecard theory built in. This is in information systems done through wizards or guides. A wizard leads the user through a setup process by asking a number of questions to which a limited number of responses are available. Such wizards can contain theory and thereby to some extent ensure or maybe just inspire the user of the BSC software to design the BSC so that it follows the recommendations of the balanced scorecard theory. The present BSC software of the Danish Broadcasting Corporation does not offer any guides or wizards. Guides and wizards on theoretical aspects of the BSC (as opposed to e.g. the creation of a measure) are also rather few in the new BSC software.

A continuum from totally flexible to very constrained and guided seems to exist. At the end of the continuum, where total flexibility exists, BSC software is not normative at all. At the other end of the continuum, BSC software could for example provide a limited

number of predefined balanced scorecards to choose from. Davenport (1998) warns against information systems that take away the distinctiveness of organisations as would be the case of highly predefined BSC software. On the other hand, a totally flexible system such as spreadsheet software places all responsibility on the user's side. BSC software such as Corporater BSC is placed somewhere in the middle of the continuum in that it to a large extent is flexible, but a framework for building balanced scorecards exists. Examples of pieces of such a framework are strategy map functionality and trees of perspectives, strategic focus areas and measures (a hierarchy with three levels). Where on such a continuum should BSC software be located? From the analysis of the measures of balanced scorecards of the Danish Broadcasting Corporation it is seen that there is room for improvement with regard to the quality of the measures. If the BSC software was more normative, the balanced scorecards of the DBC probably would have been more comprehensive or more scalable.

This discussion is not unique to the balanced scorecard and BSC software. The discussion has implications for all management accounting techniques that are implemented by use of an information system. This issue should be of particular concern to practitioners implementing a management accounting technique with the support of an information system.

5.6.2 The four-stage model

Kaplan (1990) proposes a model for cost systems that are expected to pass through four stages of development. Although the four-stage model addresses cost systems, this subsection will use the four-stage model to analyse the development of BSC in the Danish Broadcasting Corporation. Arguments for the applicability of the four-stage model in this situation are several. First, the four-stage model proposes a relationship between management accounting and information systems. This is analogous to the present case study. Second, the four-stage model discusses the integration of information systems, which also seems to be relevant to discuss in the case of the Danish Broadcasting Corporation. The proposed development from the third to the fourth stage with the move towards full integration is worth discussion. Finally, the four-stage model was presented more than 15 years ago and things may have changed up until today.

The implementation of the balanced scorecard was initiated in spring 2003. A first design of the balanced scorecards was ready for implementation at the end of 2003, and 2004 was the first year when the balanced scorecard formed the basis for performance management. In 2004 and 2005 the balanced scorecard was supported by self-developed BSC software. In the fall of 2005 it was decided to implement standard BSC software to replace the self-developed software whose functionality started falling short of expectations. The new BSC software probably will be implemented in some parts of the resources directorate during 2006, so that the Danish Broadcasting Corporation is ready to go live with the new BSC software throughout the entire organisation on January 1, 2007.

What is characteristic of the period with the self-developed BSC software is that the BSC software was expected to support a phase of learning and experiencing. It was not the purpose of the BSC software to support a BSC implementation with all the whistles and blows. Another important characteristic is that the costs of the system should be kept at a minimum. Emphasis was not put on automation since it was unknown whether measures would remain for a long time.

During summer 2005 the business development manager realised that the BSC design and use could not be further developed with the support of the self-developed BSC software. Therefore, standard BSC software was needed if further development of the BSC should take place. It was decided to purchase a standard BSC software application called Corporater BSC.

Based on presentations of and the researcher's training on the present and the new BSC software, it seems that what is characteristic of the new BSC software is that it is very functional and flexible compared to the self-developed BSC software. Furthermore, with the standard BSC software much of the manual work in relation to for example data collection is expected to decrease. With more automation a higher degree of data integration will follow. Limitations of the old BSC software will be reduced and BSC is assumed to further develop.

Similarities and differences exist between the development of the BSC at the DBC and the four-stage model with its four stages going from stand-alone systems to integrated systems. First, what is characteristic of the four-stage model is that it assumes that the level

of integration increases over time ending with a fully integrated cost system. With the BSC of the DBC a similarity exists in that the new BSC software to a larger extent will be integrated with existing databases than is the case with the old BSC software. Thus, the level of data integration (see section 2.3.2 for a discussion of different levels of integration) will increase just like advocated by the four-stage model. But the level of integration will not increase at the software level. The old BSC software was integrated with the management portal. The new BSC software will only be integrated with the management portal to the extent that it will be possible to navigate between the two intranet sites. The layout of the new BSC software may be adapted to that of the management portal to the extent that it easily can be done. Thus, no high level of software integration is expected or requested. By this a difference exists between the four-stage model and the case of BSC in the DBC in that only data integration is implemented in practice, whereas theory prescribes a larger degree of integration at other levels.

Within the DBC the BSC software is not the only software that is not integrated at the software level. The DBC follows a strategy of best-of-breed (Moriarty, 1999; Hyvönen, 2003) by only selecting fully integrated software when it can match or outperform other software with regard to functionality and user-friendliness. As a consequence, the four-stage model cannot be confirmed with regard to the level of integration, since no move is yet seen from stage three (stand-alone systems with a shared database) to stage four (integrated systems). The question is whether companies following a strategy of best-of-breed will ever reach the fourth stage. Evidence from the Danish Broadcasting Corporation supports such a hypothesis.

An alternative hypothesis is that we have already passed through the fourth stage and now we experience a fifth stage. The early promises of ERP systems were that they were the information system for the entire company. With the findings in Chapter 4 that analysis-oriented information systems are better at supporting reporting and analysis, the expectation by ERP vendors is disproved. We might experience a fifth stage where information systems are disintegrated at the software level but still integrated at the data level. It can be hypothesised that we experience a general movement away from one fully integrated information system towards several best-of-breed software applications bound together by a database and an infrastructure. Supporting the hypothesis is the fact that Microsoft

and SAP both are engaged in developing integration technologies referred to as the .net technology (e.g. Tirschwell, 2004) and NetWeaver (e.g. Reinhardt, 2005) respectively on which other applications can build.

While a general movement away from the fourth stage of integration towards a fifth stage of partial integration seems to be in evidence, this does not seem to be the case with regard to the DBC, since the balanced scorecard of the DBC has never been fully integrated with for example the accounting system.

Although a high level of integration is aimed for in the four-stage model, the advantages of integration are somehow reduced in a later article by Cooper and Kaplan (1998). The authors argue that integration in relation to activity-based costing and operational control has some peril associated with it. Likewise, it could be argued that fully integrated BSC software is not optimal because of differences in the underlying logic of a transaction-oriented ERP system and analysis-oriented BSC software. BSC software should not adhere to the same strict rules of for example an audit trail as transaction-oriented information systems should (Gelinis *et al.*, 2005, p. 600).

A second characteristic of the four-stage model is that at the fourth stage two subsystems exchange for example budgets and feedback on current operations. To what extent the conventional management accounting system with its budgets and variance analyses will be better integrated with the balanced scorecard is yet to be seen. The balanced scorecard literature would like to see that budgets are derived from the balanced scorecard. At present the BSC software and the Oracle Applications 11i of the Danish Broadcasting Corporation seem separated. Whether some kind of integration will be developed is questionable. It might be that the budget is prepared with an eye on BSC targets, but an automatic translation of BSC targets into budget figures is not probable.

Third, it is characteristic of the four-stage model that it is management accounting that is the driver of change. In stages three and four it is apparent that the information system arranges to support the management accounting that is needed. But as discussed in section 5.6.3, a unidirectional relationship is not able to fully capture the relationship between the design and use of BSC in the

DBC and the BSC software. Rather, the existence of a bidirectional relationship involving more variables seems to be the case.

5.6.3 The role of the BSC software

The BSC software can have different roles within the relationship between management accounting and integrated information systems (including BSC software). This section will first discuss the content of the management accounting and IIS constructs. Then new variables will be identified. The third subsection will deal with the directionality of the relationships. Finally, the temporal dimension will be discussed.

5.6.3.1 Decomposition of the management accounting and IIS constructs

A list of characteristics of an IIS was presented in section 2.3.2.2. Not all characteristics seem equally important when considering how the BSC software of the Danish Broadcasting Corporation supports their balanced scorecard. Especially one particular characteristic seems to have explanatory power. This characteristic is functionality. It is lack of functionality that prevents the DBC from making higher-level scorecards with weighted aggregations. It is also lack of functionality that hinders automatic collection of data and reporting of data with different frequencies.

Accessibility seems to be another important characteristic of the BSC software. That employees cannot enter the BSC software themselves keeps them away from using the balanced scorecard on a more regular basis.

Finally, the limited normativity of the present BSC software results in lack of support to design and use of the balanced scorecard in ways that could be better than the current design and use. With the large flexibility with regard to measures, no help is provided to pick more appropriate measures.

With regard to management accounting, the research question concerns both design and use of a management accounting innovation. The BSC software offers different support to design *versus* use of the balanced scorecard of the Danish Broadcasting

Corporation. But the analysis does not show that design is more or less supported than use by the present and future BSC software. Therefore, design and use seem to be two equally important aspects of management accounting.

5.6.3.2 New variables

It seems relevant to distinguish between tasks that are complex and unanalysable and tasks that are simple and analysable when trying to explain why different processes within the balanced scorecard are supported by BSC software to different extents. An example of a complex task is translation of the vision. In the analysis of the four processes of the balanced scorecard, it was found that translation of vision was not well supported by BSC software since functionality did not exist at present, and even if it did exist, it probably would not be used. An example of a simple task is that of business planning where targets are set. Such a task is supported by the BSC software where you can create measures and enter targets for each of them. Thus, task complexity, which is a well-studied construct in the contingency literature reviewed in section 2.5.4.2 (see e.g. van der Veeken and Wouters, 2002), seems to be a relevant variable to include when understanding how information systems support balanced scorecard design and use. van der Veeken and Wouters (2002) distinguish between application of action-centred skills and analytical skills when analysing the use of accounting information systems. They find that operations managers to a lesser extent make use of the accounting information system when they manage the complex building projects. On the other hand, top management made use of the accounting information system in conjunction with analytical skills when performing the simpler task of analysing performance across the building projects. These findings seem to be comparable to what is found in the Danish Broadcasting Corporation. Here, the BSC software is used for simpler tasks or aspects of balanced scorecard design and use, whereas the BSC software is less useful for complex tasks.

In order to explain the increase in aspects of balanced scorecards (Speckbacher *et al.*, 2003; Bedford *et al.*, 2006) that are implemented at the Danish Broadcasting Corporation, it seems relevant to include a variable that is external to the unit of analysis, the resources directorate. The balanced scorecard was introduced by

the resources director when he first came to the Danish Broadcasting Corporation. Later, when a new Director General was appointed, focus on the balanced scorecard as a management accounting technique was further strengthened. This indicates that external pressures are increasing the use of the balanced scorecard as a performance management technique. One important source is the increased competition within the broadcasting industry with the establishment of several new broadcasters within television, radio and web-based news. The competitiveness of the industry is in other studies found to have an effect on the management accounting of organisations in that number of management accounting systems is larger in highly competitive environments (see e.g. Libby and Waterhouse, 1996; Williams and Seaman, 2001).

Finally, when explaining why the use of the balanced scorecard differs between the two department managers, a variable of control types (Ouchi, 1977) seems to have explanatory power. Output control as well as behaviour control can be found in the Danish Broadcasting Corporation. The manager of the accounting department seems to be focused on controlling output. She has a focus on daily issues. With her red strategy, she uses the balanced scorecard to signal what output measures need special consideration. An example of a measure on her balanced scorecard is number of auditor remarks that the annual report receives. That the finance manager focuses on outputs seems to be a response to the poor knowledge of transformation processes. Her department has many projects that are new and where no recipe for solution exists.

The manager of department of service and administration seems to be more focused on the processes and the structures. Before she is able to populate her balanced scorecard with “real” measures, she fills it with measures for how her department is progressing with regard to establishing the measurement system. Her use of the balanced scorecard is rather structured, and when she finds a measure on which she is not performing well, she looks for a structural problem (the time registration system). Department of service and administration contains primarily well-defined processes such as registration of vendor invoices, mail handling and purchasing. With this good knowledge of the transformation process it is possible to employ behaviour control (Ouchi, 1977).

5.6.3.3 *The relationship between the variables*

Now that the variables are identified, it is time to turn to their interrelationships. The first discussion regards whether the IIS is the dependent or the independent variable. From the literature review it can be seen that there are different attitudes towards this question. Several quantitative studies treat the IIS as the independent variable and management accounting as the dependent variable (e.g. Booth *et al.*, 2000a; Spathis and Constantinides, 2004). This was also the case with the quantitative study reported in Chapter 4. Also contributions by Davenport (1998) and Granlund and Malmi (2002) treat the information system as an independent variable.

From the study of BSC in the Danish Broadcasting Corporation it is evident that the roles of the BSC software and the design and use of the BSC change from situation to situation. According to the business development manager, it was a need for extending the design and use of the BSC, that was created from a fiercer competition, that initiated the replacement of the present BSC software. This is an example of a situation where the design and use of the BSC is the independent variable and the BSC software is the dependent variable. The four-stage model by Kaplan (1990), which also examines the relationship between management accounting and information systems, is an example of research applying the same relationship.

Situations of BSC in the Danish Broadcasting Corporation where the BSC software seems to be the independent variable also exist. One example of such a situation is the quarterly BSC meetings between the resources director and the individual department managers. During the meetings attended, it became clear that the use of the BSC to a large extent relied on the BSC software. This became particularly evident when the BSC software defaulted, and the discussions and analyses stopped. The BSC software had a role where it decided how the BSC was used. But it was not a role that could not be changed. The resources director said:

“You can easily run this kind of management even though you haven’t got support of the data collection from an information system. Then it would only imply that the secretary should enter it all into a spreadsheet.” *Resources director*

The BSC software was assigned the role of a supporter and the role could be changed. But if the role was changed, the use of the BSC during the quarterly BSC meetings probably also would change.

In continuation of the examples above, the relationship between management accounting and the information system is not unidirectional. Rather, it seems to be cyclical recursive (Luft and Shields, 2003) in that the design and use of the BSC had an impact on the BSC software (the present BSC software is replaced) which in turn is expected to have an impact on the use of the BSC and so forth. Such bidirectional and recursive relationships are hard to model with quantitative methods, and therefore it is not unusual to introduce some assumptions to the model (as done in Chapter 4).

In case that the BSC software is regarded neither an independent nor a dependent variable it could be regarded an intervening variable (Luft and Shields, 2003; Gerdin and Greve, 2004). In such a model the independent variable could be the increasing competition in the industry. If the BSC software is considered an intervening variable (Luft and Shields, 2003; Gerdin and Greve, 2004), the impact of the competitive environment goes through the BSC software. In this way, the actual design and use of BSC is changed by changing the BSC software. The BSC software has a direct impact on BSC design and use, and the BSC software is changed by the external environment. What speaks against the IIS being an intervening variable is the fact that the external environment has a direct impact on management accounting design and use, which is not modelled when the impact goes through the IIS. Therefore, it is not relevant to consider a model where the IIS is an intervening variable.

A moderating variable is a variable on which the impact of the need for heavier emphasis on performance management is contingent. It is a criterion that the moderator has no significant effect on the dependent variable (in this case management accounting) and that the moderator is not theoretically expected to relate to the independent variable (Luft and Shields, 2003; Gerdin and Greve, 2004). Such a model would not be relevant to consider, since the balanced scorecard software theoretically is expected to have a relationship with balanced scorecard design and use. Furthermore, the results of the survey study reported in Chapter 4 show that a

significant relationship exists between analysis-oriented information systems and management accounting.

Luft and Shields (2003) introduce a third way of modelling the relationship between three variables. This is a model where two independent variables (in this case the external demand for better performance management and the balanced scorecard software) interact when having an effect on the dependent variable (in this case management accounting). Such a model seems to be appropriate when considering the relationship between external demand for better performance management, BSC software and balanced scorecard design and use. Here, there is room for the impact that the BSC software had on the quarterly meeting between the resources director, the department manager and the business development manager where the default of the software caused the discussions to stop. Scapens and Jazayeri (2003) discuss this reduced role of the IIS when they argue that the ERP system is a facilitator rather than a driver of management accounting change. Figure XV illustrates a model where the BSC software and the external demand for better performance management are interactive, independent variables.

Figure XV. The BSC software and competition as interactive, independent variables

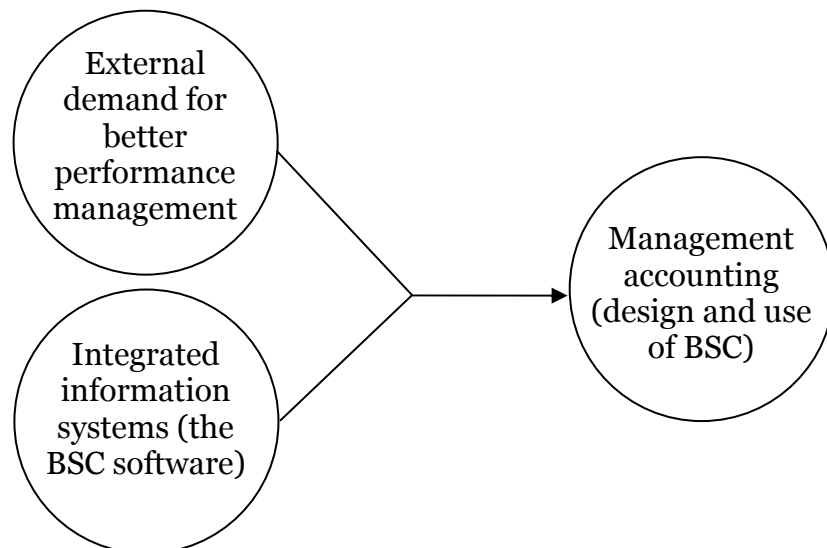
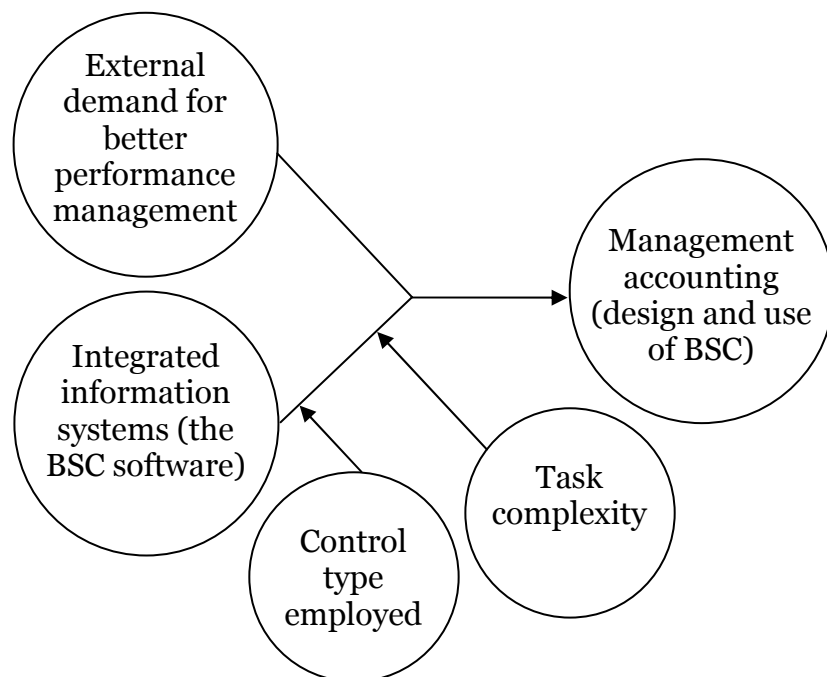


Figure XV builds on the theoretical framework developed in section 2.4.2 and illustrated in Figure III. But in this framework the external demand for better performance management is introduced, and the role of the integrated information system (in this case the BSC software) has changed.

More variables need to be added to the framework, since control type employed and task complexity are found to moderate the support of BSC software to BSC design and use. This complicates the model that is depicted in Figure XVI.

Figure XVI. The BSC software and competition as interactive, independent variables and other variables moderating the support of the BSC software



The model depicted in Figure XVI does not satisfactorily illustrate the bidirectional relationships between the variables. In reality much more interrelatedness exists. One example is the impact of management accounting on the BSC software (where e.g. weighing of measures required new BSC software). But rather than complicating the model it will remain simple while at the same time bearing in mind the underlying complexities.

5.6.3.4 The temporal dimension

One underlying complexity, which is not depicted in Figure XVI, is the temporal dimension. It is argued that integrated information systems are harder to change than management accounting (Granlund and Malmi, 2002). The argument is supported by research showing that especially ERP systems are hard to change when they are implemented (Davenport, 1998). When integrated information systems are hard to change, it is concluded that the change in the IIS comes before management accounting change. On the other hand, institutional theory indicates that management accounting also can be hard to change (see e.g. Granlund, 2001). Following this line of reasoning, it could be argued that management accounting change comes before in time than the change in the IIS. Now, let us turn to what the case of BSC in the Danish Broadcasting Corporation tells us about what comes first.

It is very clear from the case that the decision to implement new BSC software is a response to something, and that the change in software comes later in time than what triggered the change. What seemed to trigger the change was a need to improve performance management due to increase in competition. Thus, the change in the environment comes before the decision to change management accounting, which in turn comes before the decision to change the BSC software. From this it looks as if management accounting is changed before the IIS. But management accounting change was not actually a possibility before the BSC software was improved. This indicates that the software needs to change before management accounting changes. Here, the distinction between management accounting design and use appears helpful. Management accounting design is in the case of BSC in the Danish Broadcasting Corporation carried out before the software is changed. But management accounting use is dependent on the software change. Thus, it is not satisfactory to discuss management accounting change vis-à-vis software change at a level with only two constructs. Rather, it is necessary to decompose the upper-level constructs in order to understand the temporal dimension. When management accounting is decomposed into management accounting design and use, it becomes apparent that management accounting and integrated information systems are

deeply intertwined. The two are changed in concurrence since they are dependent on each other.

5.6.4 Limitations

The case study is subject to a number of limitations that should be borne in mind when for example generalising from the findings. First, only two departments within the Danish Broadcasting Corporation are investigated. Different findings or other variables might have appeared had other departments been investigated. Second, the effects of the balanced scorecard have not been subject to study. Thus, it is assumed that the balanced scorecard is an effective management accounting technique without testing such a hypothesis.

5.7 Summary and introduction to the next chapter

The case study of the balanced scorecard of the Danish Broadcasting Corporation has shed light on how the design and use of a management accounting innovation is supported by an analysis-oriented information system (research question 2).

One particular contribution to current knowledge within the research field regards the directionality and other characteristics of the relationship between management accounting (in this case the balanced scorecard) and information systems (in this case BSC software). It is found that the relationship is complex in that a bidirectional relationship exists. Furthermore, it is found that the information system is not the primary source of change. An increase in industry competition seemed to be the driver of a need for more sophistication of the balanced scorecard. The information system is a facilitator rather than the primary driver (Scapens and Jazayeri, 2003). The relationship is cyclical and recursive in nature (Luft and Shields, 2003).

A second theoretical contribution is the investigation of what parts of the balanced scorecard are supported by the BSC software. It is found that processes where intellectual or mental activities are the primary input to a lesser extent are supported by BSC software. Even in cases where the BSC software supports such processes, it is less likely that the functionality will be used. This finding is analogous to the finding

of Chapter 4 that an analysis-oriented information system supports some tasks while other tasks are better supported by other information systems.

Third, it is suggested that a fifth stage exist in the four-stage model (Kaplan, 1990). In the Danish Broadcasting Corporation the expectation that the ERP system is the system of the entire organisation has been disproved. In the fifth stage the information systems are characterised by being integrated at the data level while being disintegrated at the software level. While this contradicts the four-stage model in which systems should become even more integrated, it does not contradict Cooper and Kaplan (1998) who argue that full integration has its perils.

Finally, new variables are added to the framework. These include industry competition, control types employed and task complexity. These are all well-known variables from the contingency literature within management accounting. That other variables seem to be in play further underscores the finding that the integrated information system merely is a facilitator of management accounting in the complex world of many influencing factors.

A synthesising discussion of the two empirical studies and existing literature is the content of Chapter 6, which also constitutes the concluding chapter of the thesis.

Chapter 6. Discussion, contribution and future research

6.1 Introduction

Research questions 1 and 2 both regard the support of integrated information systems to management accounting. Thus, although the research questions are distinct from one another, they try to say something about a common theme. Both research questions deal with the distinction between transaction-oriented and analysis-oriented information systems. The first research question regards management accounting tasks, whereas research question 2 regards management accounting techniques. Regrouping the measurement items of the questionnaire behind research question 1 resulted in variables that relate to characteristics of management accounting techniques. Thus, the quantitative study also has some findings of relevance to management accounting techniques.

On the basis of the commonalities of the research questions, cross-study discussions are reported in this chapter. The actual relationship between management accounting and the IIS is discussed. Verbs like impact, support, facilitate, moderate, mediate, drive and restrain are used about the relationship between management accounting and the IIS. Each verb contains different meanings. Some of the verbs are synonyms while others are contrasts. What is actually the relationship between management accounting and the IIS? Together, the two studies may be able to give an indication of this.

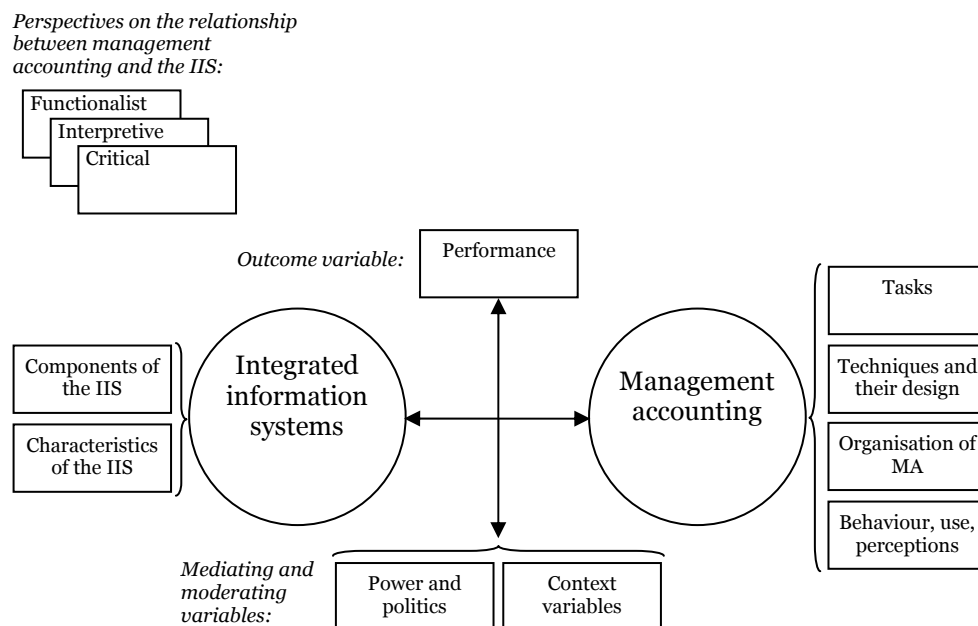
The cross-study discussions are reported in section 6.2. After this, conclusions are drawn. The concluding section will represent the research contributions of this thesis. This is done with reference to the theoretical framework developed in section 2.4. Finally, directions for future research are suggested in section 6.4.

6.2 Cross-study discussion

6.2.1 The relationship between management accounting and the IIS

In section 5.6.3 the role of the BSC software of the Danish Broadcasting Corporation was discussed. This section will extend this discussion by incorporating the theoretical framework developed in section 2.4.2 and the two studies as reported in Chapter 4 and Chapter 5. Thus, the discussion of the role of how integrated information systems support management accounting is an extension of the theoretical framework. The theoretical framework is reproduced in Figure XVII below.

Figure XVII. A theoretical framework for research on management accounting and the IIS (a reproduction of Figure III)



In the theoretical framework the relationship between management accounting and the integrated information system is bidirectional in that management accounting is expected to have an impact on the IIS as well as the IIS is expected to have an impact on management accounting. The quantitative study only deals with a unidirectional

relationship, whereas the qualitative study deals with a bidirectional relationship. See discussions hereof in sections 4.1.1 and 5.1 respectively.

The quantitative study was not able to say whether other variables advantageously could have been included. Furthermore, quantitative studies are considered to have challenges with regard to their internal validity (e.g. Birnberg *et al.*, 1990). These are two of several reasons why the quantitative study was supplemented by a case study since the latter is able to investigate the relationship in more detail and when doing so ensure exploration validity (see section 3.3.1 on exploration validity) and internal validity.

The quantitative study investigated the support of integrated information systems to management accounting tasks. A unidirectional relationship was investigated. A number of context variables were included as control variables. The qualitative study investigated the support of integration information systems to management accounting techniques. A bidirectional relationship was investigated. Since the case study method is good with regard to exploration validity (see section 3.3.1 on exploration validity), it was possible to uncover three new variables that were added to the framework. These were External demand for better performance management, Task complexity and Control type employed. All of these three new variables belong to the box of the original theoretical framework called Context variables.

On the basis of the theoretical framework and the findings and discussions of the two studies, the relationship between management accounting, the IIS and additional, relevant variables is discussed next.

6.2.1.1 The direct relationship between management accounting and the IIS

The support of the IIS to management accounting tasks was investigated in Chapter 4 where management accounting tasks were regressed on components of the IIS (transaction-oriented vs. analysis-oriented information systems). The primary conclusion was that data collection is best supported by a transaction-oriented information system, whereas reporting, analysis and budgeting is better supported by an analysis-oriented information system.

The case study investigated the same broadly defined relationship but with its focus on management accounting techniques (such as the balanced scorecard) rather than on management accounting tasks.

In the Danish Broadcasting Corporation the BSC software seemed to play a significant role with regard to the design and use of the balanced scorecard. In Chapter 5 it was reported how the default of the BSC software stopped further investigation of a measure whose target was not met. Furthermore, the efforts needed to develop functionality within the self-developed system prevented the balanced scorecard from for example weighing measures. Thus, in the case of balanced scorecard in the Danish Broadcasting Corporation, the IIS seemed to have an impact on the design and use of a management accounting technique. With regard to the reverse relationship the balanced scorecard certainly had an impact on the IIS, since the IIS was self-developed on the basis of BSC requirements.

The two studies report different significances of the direct relationship between management accounting and information systems. In the quantitative study, significant relationships were found. What is characteristic of quantitative studies is that the variables are developed *a priori* and alternative explanations are not possible. Thus, it may be so that excluded variables have an impact on the dependent and the independent variables, and thereby internal validity is jeopardised. The case study only to some extent verifies the existence of a direct relationship between management accounting and the IIS. Several studies investigate the relationship between management accounting and the IIS (although they study transaction-oriented information systems only). In this way for example Booth *et al.* (2000a), Spathis and Constantinides (2004) and Wieder *et al.* (2004) expect and find some direct relationships between management accounting and ERP systems. On the other hand, Scapens and Jazayeri (2003) applying the case study method conclude that the ERP system (they also focus on transaction-oriented information systems only) is not found to be a driver of management accounting change but rather a facilitator. Thus, other variables are in play when investigating the relationship between management accounting and the IIS. In the study of the balanced scorecard of the Danish Broadcasting Corporation the variable of external demand for better performance management due to an increase in competition was found to be the primary reason for

change in the balanced scorecard. In addition, task complexity and control type employed were found to be important moderating variables with regard to the role that the BSC software played.

These structural differences between findings of survey studies and findings of case studies seem to be rather indicative of the differences between the two research methods. On the basis of the survey study, a conclusion with high external validity is drawn involving relatively few variables. In this research project the survey study was used to test whether analysis-oriented information systems were any different from transaction-oriented information systems with regard to their support of management accounting. If that was not the case, there would only be few reasons for taking a closer look at analysis-oriented information systems from a management accounting perspective. With the case study method I was able to gain an understanding of how an analysis-oriented information system supports management accounting. During the study, it became clear that other important variables needed to be taken into consideration in order to understand the relationship between the BSC software and the balanced scorecard design and use. These two sets of conclusions are to some extent in harmony with previous studies in that survey studies investigate the narrow relationship between ERP systems and management accounting, while the case study by Scapens and Jazayeri (2003) investigate the complex relationship between the two variables.

6.2.1.2 The IIS as a moderating variable

In the Danish Broadcasting Corporation the IIS could be considered a moderating variable (Luft and Shields, 2003; Gerdin and Greve, 2004). In light of the fiercer competition, the business development manager has several requirements to the balanced scorecard that needed to be implemented. But not all enhancements to the design and use of the balanced scorecard were implemented due to limitations in the self-developed BSC application. Examples of such enhancements are weighing of measures and summation of lower-level BSCs to higher levels in the organisation. At some point, these limitations became too restrictive, and the BSC software could not support the change in design and use of the balanced scorecard that was needed due to the increased competition among broadcasting companies. Therefore, a decision was made to implement standard

BSC software. Thus, the IIS can be argued to be a moderating rather than a direct variable, which is also argued by Scapens and Jazayeri (2003).

What seems to be characteristic of research on management accounting and ERP systems is that quantitative studies investigate a direct relationship and thereby not the ERP system as a moderating variable. This was also the case with regard to the survey study reported in Chapter 4. This is counter to case studies where exploration validity (see section 3.3.1 on exploration validity) is higher. It seems to be the case that the relationship between management accounting and the IIS is more complex than a direct relationship.

6.2.1.3 The IIS and the increase in competition as interacting, independent variables

A moderating model does not explain or expect direct effects of the IIS on management accounting (or the other way around) since “the moderator is *not* theoretically related with either the dependent or the independent variable” (Gerdin and Greve, 2004, p. 310, emphasis in original). When a relationship is expected between management accounting and the IIS (as it is in this research project) and when the IIS is not found to be the only driver of management accounting change, an interaction model may be helpful (Luft and Shields, 2003). In an interaction model the effect of the decision to implement for example the balanced scorecard is conditional on the IIS. Furthermore, the IIS and the competitive environment (the independent variables) do not influence each other.

This indicates that an interaction model is a relevant alternative for explaining the relationship between management accounting and the IIS than a causal model (as investigated in the quantitative study) or a moderating model (where the IIS is not expected to have any effect on management accounting). In the Danish Broadcasting Corporation the degree of success of implementing all wished features of the balanced scorecard was conditional on the self-developed BSC software. When the BSC software did not support weighing of measures, it was not implemented.

6.2.1.4 The role of the IIS

Two strands of literature seem to exist. The quantitative studies primarily emphasise a direct relationship between management accounting and the IIS, whereas case studies report that the IIS is a facilitator (a moderating or interacting variable) of management accounting change. The studies of this research project have shown that the relationship between management accounting and the IIS is a complex one where other variables have explanatory power. An interaction model seems to be appropriate in the Danish Broadcasting Corporation, since the balanced scorecard software plays a direct role in relation to the design and use of the balanced scorecard. At the same time, the increase in competitive pressure requires more focus on performance management. What seems to be generally found is that the IIS plays a role, but it is not the role of the primary driver of management accounting change. Rather, integrated information systems are able to support management accounting.

6.2.1.5 Variables moderating the support of the IIS

The case study reported in Chapter 4 found that task complexity and control type employed moderate the support of the IIS. Task complexity is a moderating variable, since integration information systems primarily support less complex tasks where the variables are few and their interrelationships are known. An IIS is less well-suited for the support of tasks such as strategy development.

Control type employed also has a moderating effect on the support of the IIS to management accounting. In the Danish Broadcasting Corporation it was found that when focus is on controlling output and to a lesser extent on controlling the behaviour of the employees, the IIS plays a reduced role, since it is not used as a vehicle for communication. On the other hand, the department manager that employs behavioural control to a large extent used the balanced scorecard software and the balanced scorecard to engage her employees. Jönsson and Grönlund (1988) discuss the use of output-oriented vs. behaviour-oriented measures (Ouchi, 1977). They find that central managers use output-oriented control while lower-level managers use behaviour-oriented controls. That the finance manager seems to have less success with the balanced scorecard than the manager of department of service and administration might be a

result of the fact that she uses output-oriented control, while she may be better off using behaviour-oriented controls where focus is on the solution of the tasks rather than on the number of tasks solved on time.

That variables exist that can shed light on the relationship between integrated information systems and management accounting is the conclusion of other studies as well. van der Veeken and Wouters (2002) find that lower-level managers apply action-centred skills when managing project costs. When doing this they to a lesser extent make use of the accounting information system. On the other hand, top-level managers to a larger extent use the accounting information system when they use analysis-centred skills to manage costs at a more aggregated level. Thus, what skills are applied is by van der Veeken and Wouters (2002) found to be a variable moderating the support of integrated information systems for management accounting. As discussed in section 5.6.3.2, the role that task complexity plays in the Danish Broadcasting Corporation seems to be comparable to the role that the application of action-centred or analysis-centred skills play in the road building company that van der Veeken and Wouters (2002) study. This consistency in findings across industries (a road building company and a broadcasting company) suggests that the support of the IIS to management accounting is dependent upon the complexity of tasks.

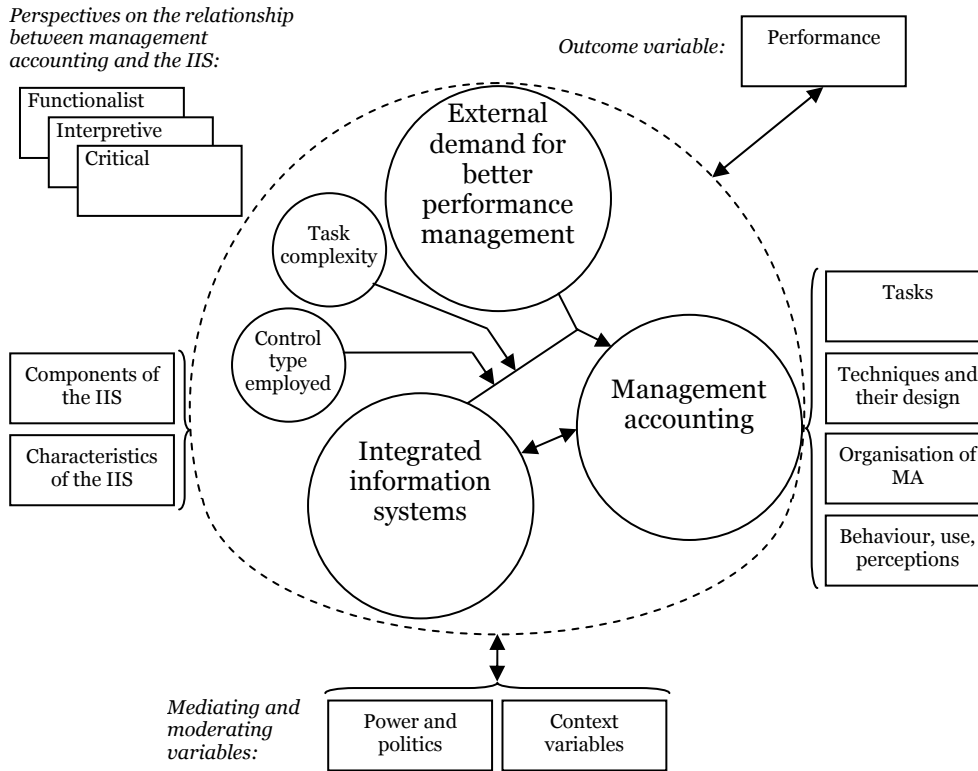
Hedberg and Jönsson (1978) investigate the relationship between environmental stability, information systems and their ability to make the organisation adapt to the stability or instability of the environment. The authors find that information systems generally have a stabilising effect and thus to a lesser extent are well-suited for unstable environments. The Danish Broadcasting Corporation seems to be operating in an environment with increasing instability. As a consequence, the balanced scorecard is implemented in order to control a broader range of aspects of the business. It seems as if the standard BSC software called Corporater BSC is able to support the enhanced use of the balanced scorecard, which somehow is counter to the argument of Hedberg and Jönsson (1978) that information systems are not well-suited for handling instability. The study of Hedberg and Jönsson (1978) is almost 30 years old and must have changed in the area of information systems since then.

6.2.1.6 Revision of the theoretical framework

On the basis of the knowledge gained through the empirical studies and the above discussions about the role of the IIS in relation to management accounting, the theoretical framework developed in section 2.4 is revised. Most importantly the variables called 'External demand for better performance management', 'Task complexity' and 'Control type employed' are included. From the above discussions of the role of the IIS in relation to management accounting it is seen that the IIS sometimes have a direct effect on management accounting, which indicates that the IIS is an independent variable interacting with other variables also having a direct effect on management accounting. At other times the IIS has no direct effect but it seems more appropriate to consider the IIS a variable that moderates the impact of environmental change on management accounting. Thus, several kinds of relationships can be suggested between external demand for better performance management, management accounting and the IIS.

In order to include some of the complexity uncovered in the study of the balanced scorecard in the Danish Broadcasting Corporation, the framework is revised in a number of ways. First, an interaction between external demand for better performance management and the IIS affecting management accounting is added. This model seems to be the one best explaining the implementation of the balanced scorecard in the Danish Broad Corporation where the role of the IIS was supportive rather than direct. Second, the moderating effects of task complexity and control type employed are added. The revised theoretical framework is illustrated in Figure XVIII below.

Figure XVIII. A revised theoretical framework for research in management accounting and the IIS



6.3 Conclusions and contributions

Conclusions and research contributions are organised according to the three main sections of the thesis. First, conclusions of the literature review are presented. Then each of the two empirical studies are concluded upon.

6.3.1 Current research on management accounting and integrated information systems

Current research on management accounting and integrated information systems was reviewed in Chapter 2. Research on management accounting and IIS is scarce, and no comprehensive review of literature within the field exists. Therefore, Chapter 2 contributes to research by developing a theoretical framework for research on management accounting and integrated information

systems and mapping current research using that framework. The purpose was to build a foundation for the present research project so that it can fill gaps in current research.

Information systems supporting management accounting consist of different components which vary along a number of characteristics. In the literature review a distinction was made between transaction-oriented information systems such as ERP systems and analysis-oriented information systems such as strategic enterprise management systems. Studies on the relationship between management accounting and ERP systems have been conducted from different perspectives. One example of such studies is a quantitative study by Booth *et al.* (2000a) on the relationship between ERP systems and management accounting tasks. Booth *et al.* (2000a) find that ERP systems are effective with regard to transaction processing and less effective with regard to reporting and decision support. The study is conducted from a traditional management accounting perspective. Applying institutional theory, Granlund and Malmi (2002) look for institutional vs. functional-economic explanations (DiMaggio and Powell, 2003) for the moderate impact of ERP systems on management accounting. It is found that for example the balanced scorecard is implemented outside the ERP system. The authors conclude that the missing impact can best be explained in functional-economic terms. One final example of a study on management accounting and ERP systems is a study conducted by Quattrone and Hopper (2005). Using actor-network theory (e.g. Latour, 1987), they find that the ERP systems of two different organisations are used in very different ways. In one organisation the ERP system is used to collapse the distance between head quarter and subsidiaries, whereas the very opposite situation is found in another organisation where the existing distance was not changed with the implementation of an ERP system.

While some research has been conducted on the relationship between management accounting and ERP systems, not much research investigates how analysis-oriented information systems support management accounting. Granlund and Malmi (2002) write that SEM systems might provoke companies to change their management accounting practices. Other researchers such as Gould (2003) and Brignall and Ballantine (2004) expect analysis-oriented information systems such as SEM systems to be able to support management accounting. Unfortunately, only very little empirical research on

management accounting and analysis-oriented information systems exists. Thus, research opportunities exist for example with regard to the relationship between analysis-oriented information systems and management accounting tasks, the design and use of management accounting techniques and the management accountant.

This thesis focused on the relationship between analysis-oriented information systems and management accounting tasks, techniques and behaviour from and functionalist point of view.

6.3.2 The relationship between components of the IIS and management accounting tasks

The literature review indicated that analysis-oriented information systems might be better at supporting management accounting than ERP systems (an example of a transaction-oriented information system). In order to verify whether analysis-oriented information systems have a stronger relationship with management accounting than do ERP systems, a quantitative study was conducted. It was the purpose of the study to investigate the relationship between analysis-oriented components of the IIS compared to transaction-oriented components and management accounting tasks.

When regressing the management accounting tasks of data collection, reporting, analysis and budgeting on transaction-oriented and analysis-oriented information systems, it was found that transaction-oriented information systems are better at supporting data collection. On the other hand, analysis-oriented information systems are better at supporting reporting, analysis and budgeting. These findings confirm the study by Booth *et al.* (2000a) who conclude that ERP systems are good at supporting data collection but not particularly good at supporting reporting and decision making.

Factor analyses resulted in two more factors. These are non-financial, external and ad hoc management accounting and allocation of costs. These factors to some extent resemble features of management accounting innovations (Bjørnenak and Olson, 1999). Regression analyses indicate that analysis-oriented information systems to a significantly larger extent support these aspects of management accounting.

With the findings of the quantitative study it can be concluded that transaction-oriented as well as analysis-oriented components of the IIS must be considered when investigating how information systems can support management accounting. The primary research contribution of this part of the thesis is that analysis-oriented information systems (such as SEM systems and BSC software) are found to be better at supporting reporting, analysis and budgeting while transaction-oriented information systems (such as ERP systems) are better at supporting data collection.

6.3.3 A management accounting innovation supported by an analysis-oriented information system

Granlund and Malmi (2002) find that balanced scorecards are implemented outside the ERP system. The quantitative study suggests that this is probably so because other systems than ERP systems are better at supporting the balanced scorecard. But how exactly is it then that the balanced scorecard is supported by information systems? The second empirical study (the case study of the Danish Broadcasting Corporation) was set out to investigate how the design and use of a management accounting innovation could be supported by an analysis-oriented information system.

Implementation of the balanced scorecard was initiated in the Danish Broadcasting Corporation in spring 2003. BSC software was developed by the IS department itself. In this way, it was easy to gain acceptance of the balanced scorecard project since initial investments could be kept at a minimum. During the case study period (summer and fall 2005) considerations regarding replacing the self-developed BSC system with standard BSC software were done. The considerations were initiated by an increase in the competition of the industry. The self-developed BSC software was not good at handling hierarchies of organisational units and weighing of measures. Further development of the self-developed BSC software would be time consuming and therefore expensive, and it seemed to be the time to change to standard BSC software with more built-in BSC functionality.

This change from self-developed software to standard software is rather interesting. On the basis of the replacement of the self-developed information system, it could be hypothesised that

management accounting techniques are better supported by small, flexible information systems in the initial phases where changes are frequent. Later, when for example the balanced scorecard has stabilised in the sense that functionality is implemented and the organisation has adopted the management accounting technique, it may be better supported by standard software that is less flexible but has more functionality. But the case of the balanced scorecard did not seem to support this hypothesis, since the self-developed BSC software was not flexible. On the other hand, the Danish Broadcasting Corporation has been experimenting with their self-developed BSC software so that they can better develop a requirement specification for the next BSC system. How the new BSC system will support the balanced scorecard differently than the existing system would be an interesting avenue for further research.

Kaplan (1990) proposes a model for cost systems that are expected to pass through four stages of development. The four stages go from cost systems that cannot deliver correct information to separate cost systems and finally to one integrated cost system. Kaplan (1990) argues that a third phase of experimentation in stand-alone systems is necessary. Afterwards the cost systems can be integrated. In section 5.6 it was discussed whether the balanced scorecard (although not a cost system) of the Danish Broadcasting Corporation follows the four stages. With the acquisition of best-of-breed BSC software the DBC is not moving to phase four. Rather, the DBC seems to stay in the third phase where information systems supporting management accounting to some extent are disintegrated. The question is whether the Danish Broadcasting Corporation, pursuing a strategy of best-of-breed, will ever move to stage four. An IIS consisting of transaction-oriented and analysis-oriented components that are only integrated at the data level seems to be a viable solution. Integrating for example the user interface does not seem to be necessary. Therefore, it might be that the four-stage model is only valid with regard to integration at the data level. Thus, integration seems to be a variable that is scalable along a continuum going from no integration at all to integration with regard to data, user interface and business rules.

Furthermore, the balanced scorecard of the Danish Broadcasting Corporation was analysed in light of the four processes of managing strategy (Kaplan and Norton, 1996a, p. 77). It was seen that the information system to different extents supports each of the four

processes. The process of translating the vision is a design activity that to a lesser extent is supported and supportable by information systems. The process of identifying relevant measures has to be carried out by humans. With regard to communicating, the new BSC software will be able to communicate measures and level of achievement to the employees. Today, only managers have access to the self-developed information system, and this delimits the BSC system's ability to facilitate communication. Business planning is highly facilitated by the BSC system that contains measures, targets and realised figures. The role of the BSC system became particularly apparent when the BSC system defaulted during one of the quarterly meetings between departments managers and the resources director. Suddenly, it was not possible to drill into a measure along which the department underperformed. Since no further data were available, the discussion stopped and the meeting participants had to move on to another measure. With regard to feedback and learning, the present self-developed BSC system does not support double-loop learning where relationships between measures are tested. The acquired standard BSC software does not support statistical tests of relationships between measures, but through strategy maps reporting realised figures some kind of visual testing of relationships is possible. Regardless that this is a process where information systems can be a facilitator, several interviewees state that testing the hypothesis of strategy is not a prioritised process. Conclusively, it is found that information systems support only some processes. Thus, one must not think that implementing a balanced scorecard is merely about purchasing standard BSC software with all the whistles and bells.

Finally, three variables were found to have explanatory value. First, competition in the industry seems to be an interactive, independent variable together with the IIS. It was an increase in competition that demanded better performance management. Second, task complexity explains the extent to which the IIS is a support of different aspects of the balanced scorecard. Complex activities such as strategy formulation are ill-supported by the BSC software, whereas simpler activities such as target setting and performance measurement against these targets are well-supported by the BSC software. This is in line with the findings by van der Veeken and Wouters (2002) that cost management at aggregate level is by top-level managers supported by the accounting information system. On the other hand,

lower-level managers facing the complexity of everyday life do not make use of the accounting information system. Finally, the control type employed by the department managers seems to determine the extent to which the IIS is used. In using behaviour-oriented control, the department manager makes heavy use of the BSC software for communication with her employees. On the other hand, the finance manager, who seems to employ output-oriented control, does not to a very large extent involve her employees, and she to a lesser extent makes use of the BSC software. Jönsson and Grönlund (1988) find that lower-level managers employ behaviour-oriented controls, while top-level managers employ output-oriented control. That the finance manager seems to have less success with the balanced scorecard than the manager of department of service and administration might be a result of the fact that she uses output-oriented control, while she may be better off using behaviour-oriented controls where focus is on the solution of the tasks rather than on the number of tasks solved on time.

6.3.4 Summing up

What this thesis really boils down to is the received wisdom that information systems supporting management accounting are diverse and not necessarily fully integrated. Previous research has primarily investigated ERP systems, which are examples of transaction-oriented information systems. Findings, that ERP systems have only moderate impact on management accounting, seem to be explained by this narrow focus on ERP systems. The present research project shows how different management accounting techniques are supported by an IIS consisting of transaction-oriented as well as analysis-oriented components. Furthermore, it is shown that for an IIS to work it is not necessary to have full integration. Data integration seems to some extent to be advisable. On the other hand, best-of-breed systems with different user interfaces can be better than suites in several situations. Often, best-of-breed systems offer better functionality and greater flexibility than highly integrated ERP or SEM suites.

Finally, it is found that the integrated information system is not the primary driver of management accounting change. Rather, the IIS takes part in a complex web of interacting, independent and

moderating variables. The IIS seems to play a supporting role in relation to management accounting.

6.4 Directions for future research

Among the directions for research identified in section 2.6 some have been investigated in the present research project. In this research project focus has been on the relationship between analysis-oriented information systems and management accounting tasks and techniques from a functionalist perspective. While paying attention to this part of the under-investigated research field, attention has not been paid to other parts of the relationship between management accounting and the IIS. Rather than sketching out the many remaining research opportunities that can be derived from the literature review, I will in this section sketch out some directions for future research that directly follows from the present research project. These are research opportunities that would be relevant to undertake in continuation of this research project.

6.4.1 The relationship between characteristics of management accounting techniques and characteristics of components of the IIS

Figure I on page 11 illustrates how management accounting theory implemented in practice is dependent on among other things the support from information systems. Further development of an understanding of the relationship between characteristics of management accounting techniques and characteristics of IIS components would help organisations better translate management accounting theory into practice. Therefore, a theory on what kind of IIS components to choose when implementing a given management accounting technique would be of great value to organisations.

In order to further develop this insight into management accounting technique and IIS characteristics, a quantitative study can be conducted where respondents are asked to describe one or more of their management accounting techniques in place in terms of the characteristics identified in section 2.3.1. Moreover, respondents should be asked about the benefits derived from their application of the management accounting technique. Finally, respondents should

be asked to describe the information system supporting the management accounting technique in terms of the characteristics identified in section 2.3.2. The study should not be delimited to a certain management accounting technique, since this would reduce the applicability of the findings to the selected management accounting technique only.

6.4.2 The role of integrated information systems when translating BSC design and use into BSC benefits

A particularly interesting quantitative study by Bedford *et al.* (2006) was presented at the latest annual congress of the European Accounting Association. The study investigates BSC design and use of 92 Australian companies and whether different uses of the BSC result in different BSC benefits. Some relationships between BSC design and use and BSC benefits are found.

In continuation of the above research opportunity with regard to the role of integrated information systems when translating implementation of management accounting techniques into benefits, it would be relevant to focus a study on the balanced scorecard. Bedford *et al.* (2006) investigate the relationship between different BSC designs and uses and different BSC benefits. The question is to what extent integrated information systems described along the characteristics identified in section 2.3.2 support the transformation of BSC use into BSC benefits. It would be hypothesised that analysis-oriented information systems to a larger extent than transaction-oriented information systems would support the balanced scorecard. Further hypotheses could be developed on the basis of the knowledge that is generated in this research project. The outcome from such a research project would further the understanding developed in this research project about how information systems can and should support the balanced scorecard.

6.4.3 From self-developed system or spreadsheet solution to standard software

In the Danish Broadcasting Corporation the balanced scorecard was implemented with the support of a self-developed BSC system. During the focus group interview, where survey results were

discussed, several participants talked about how budgeting was today supported by spreadsheet solutions and how they considered replacing them with standard budgeting software such as that from Cognos and Hyperion. Thus, it seems to be characteristic of implementation of management accounting techniques that they are first supported by some kinds of information systems and later by other kinds of information systems.

The Danish Broadcasting Corporation was just about to replace their self-developed BSC system with a standard BSC system from Corporater. Information about the processes of deciding to abandon the present system and deciding on what system to implement instead has been collected. Further information needs to be collected on the actual support by the new BSC system and the implementation of it as this project progresses. On the basis hereof, it might be possible to gain an understanding of what drives the replacement of less sophisticated information systems with more sophisticated ones. When is it that the management accounting techniques no longer can be supported by for example spreadsheet solutions? What characteristics differ between spreadsheet solutions and more sophisticated information systems? Is it so that spreadsheet solutions are appropriate when companies experiment with and learn how to use a certain management accounting technique? Such questions need answers in order for us to better understand how different information systems support management accounting techniques at different times in their existence.

6.4.4 Testing the influence of task complexity on the support of integrated information systems to management accounting

In the study of the Danish Broadcasting Corporation it was found that task complexity had a moderating effect on the support of the BSC software to balanced scorecard use. BSC software was not used and was not expected to be used (when the new BSC software would be implemented) during for example strategy formulation. Strategy formulation is a complex task where many variables are included and where what variables to include is not determinable prior to the process. On the other hand, the BSC software was good support for the calculation of realised results against target results. Similarly, van der Veeken and Wouters (2002) found that managers facing complex

tasks did not make use of the accounting information system, while managers with less complex and more structured tasks made use of the accounting information system. Whether these two findings are just coincidences or whether a generalisable relationship exists where task complexity is a moderating variable of the relationship between integrated information systems and management accounting needs to be investigated. Such a contingency study could advantageously be conducted by use of the survey method.

The present research project has offered answers to some of the research gaps identified in section 2.6. Other research gaps have been left to be closed by other research projects. New research gaps have appeared in continuance of this research project as this section suggests. Further research on management accounting and information systems is needed in continuation of this research project.

Resumé (Summary in Danish)

Økonomistyring er i praksis afhængig af informationssystemer, idet økonomistyring er en forholdsvis informationstung disciplin. Økonomistyring er jo netop i denne afhandlings kapitel 2 defineret som indsamlingen, analysen og rapporteringen af information med det formål at støtte ledere i at nå virksomhedens mål. Private såvel som offentlige virksomheder bruger to- og tre-cifrede millionbeløb på implementering af informationssystemer med netop det formål at forbedre styringsgrundlaget. Idet økonomistyring er så informationstung en disciplin, og der bruges så mange ressourcer på informationssystemer, er der behov for en problematisering af, om virksomhederne udnytter informationssystemerne bedst muligt til understøttelse af deres økonomistyring. Med udgangspunkt heri er det afhandlingens formål at undersøge, hvordan informationssystemer kan understøtte økonomistyringen.

Der har historisk været, og der er fortsat stort fokus på såkaldte ERP-systemer. ERP-systemer er store informationssystemer, der med deres mange forskellige moduler understøtter mange af virksomhedens aktiviteter såsom bogføring, lønudbetaling, produktionsstyring, indkøb, salg, distribution og ledelsesrapportering. Det er imidlertid afhandlingens overordnede hypotese, at de transaktionsorienterede ERP-systemer nok er gode til at understøtte virksomhedens håndtering af transaktioner (såsom bogføring og lønudbetaling), mens de er mindre gode til at understøtte for eksempel overbliksgivende rapportering og analyse samt præstationsstyring på strategisk niveau. På disse sidstnævnte områder synes analyseorienterede performance management-systemer som for eksempel SAP BW, Corporater BSC og Hyperion at give en bedre understøttelse. Denne overordnede hypotese er udledt af arbejder af blandt andet M. Granlund og T. Malmi (Granlund og Malmi, 2002), S. Brignall og J. Ballantine (Brignall og Ballantine, 2004) og B. Wieder m.fl. (Wieder *et al.*, 2004). På grundlag af denne overordnede hypotese og et litteraturstudium er følgende to forskningsspørgsmål identificeret:

1. Er analyse-orienterede informationssystemer bedre end transaktionsorienterede informationssystemer til at understøtte opgaver inden for økonomistyringen?
2. Hvordan er design og anvendelse af en moderne økonomistyringsteknik understøttet af et analyse-orienteret informationssystem?

Forskningsfeltet inden for økonomistyring og informationssystemer og i særdeleshed de to forskningsspørgsmål angribes i denne afhandling fra et funktionalistisk paradigme og mere specifikt systemteori (Hopper og Powell, 1985). Det betyder, at der fokuseres på de objektive forhold og deres indbyrdes sammenhænge. Det betyder endvidere, at økonomistyring og informationssystemer er to gensidigt afhængige delsystemer.

Afhandlingen består af seks kapitler. Det første kapitel udgør motivation, formål, forskningsparadigme og introduktion til afhandlingens struktur og indhold. Relevansen af afhandlingens tema motiveres med, at implementering af blandt andet økonomistyringsteknikker (som for eksempel activity-based costing og balanced scorecard) i praksis både begrænses og understøttes af blandt andet informationssystemer. Med udgangspunkt heri identificeres afhandlingens formål, som er at undersøge, hvordan informationssystemer kan understøtte økonomistyringen. Det paradigmatisk ståsted for afhandlingen identificeres jævnt ovenfor. Kapitlet slutes af med en introduktion til afhandlingens struktur og indhold.

Afhandlingens kapitel 2 udgør litteraturstudiet. Med udgangspunkt i et funktionalistisk paradigme tros der på, at viden er akkumulativ, og at forskning derfor skal bygge videre på allerede gennemført forskning (Eisenhardt, 1989). Litteraturstudiet afdækker derfor den eksisterende forskning, og på baggrund heraf identificeres forskningsmuligheder. Blandt disse identificeres afhandlingens to forskningsspørgsmål.

I kapitel 3 redegøres for afhandlingens forskningsdesign. Dette følger naturligt i forlængelse af litteraturstudiet og identifikationen af forskningsspørgsmål i det forudgående kapitel, da forskningsdesignet udgør svaret på, hvordan forskningsspørgsmålene vil blive forsøgt besvaret. De mere specifikke dele af forskningsdesignet beskrives

imidlertid i hvert af de to empiriske kapitler i sammenhæng med afrapporteringen af de empiriske undersøgelser.

I kapitel 4 afrapporteres en kvantitativ spørgeskemaundersøgelse af sammenhængen mellem økonomistyringsopgaver (dataindsamling, rapportering, analyse og budgettering) og forskellige typer af informationssystemer. Med udgangspunkt i forskningsspørgsmål 1 udvikles der en række hypoteser. Disse testes, analyseres og resultaterne diskuteres i lyset af den eksisterende forskning.

Besvarelsen af forskningsspørgsmål 2 findes i kapitel 5. Forskningsspørgsmålet besvaret gennem et casestudie af DRs anvendelse af balanced scorecard i ressourcedirektørområdet. Kapitlet indeholder en redegørelse for det anvendte forskningsdesign, en præsentation af det indsamlede datamateriale, en analyse af datamaterialet og en diskussion af analysens resultater i lyset af den eksisterende forskning.

Afhandlingens sidste kapitel udgør en diskussion af resultaterne på tværs af de empiriske undersøgelser. Kapitlet indeholder endvidere en konklusion og sammenfatning af projektets forskningsbidrag. Kapitlet slutes af med forslag til videre forskning.

Afhandlingens relevans kan ses i lyset af dens væsentligste konklusioner og forskningsbidrag:

1. Konklusionen på litteraturstudiet af fællesmængden af litteratur inden for økonomistyring og informationssystemer er, at forskningen primært har beskæftiget sig med de transaktionsorienterede ERP-systemer. Resultatet af forskning af blandt andet Malmi og Granlund (2001) er imidlertid, at også analyse-orienterede informationssystemer bliver brugt som understøttelse af økonomistyringen, og at det er denne type informationssystemer, der i større grad understøtter økonomistyringen. Afhandlingens fokus er derfor på disse analyse-orienterede informationssystemer.
2. Ved hjælp af en spørgeskemaundersøgelse undersøges i hvilken grad transaktionsorienterede henholdsvis analyse-orienterede informationssystemer understøtter de forskellige opgaver inden for økonomistyringen. Et vigtigt forskningsbidrag er, at transaktionsorienterede informationssystemer (typisk ERP-systemer) er bedst til at

understøtte dataregistrering, mens analyse-orienterede informationssystemer (som for eksempel SAP BW og Hyperion) er bedst til at understøtte analyse, rapportering og budgettering. På baggrund af dette resultat er det vigtigt, at forskningen inden for informationssystemer og økonomistyring også inkluderer analyse-orienterede informationssystemer.

3. Et casestudium af anvendelsen af balanced scorecard i DR resulterede i en række interessante resultater. For det første er informationssystemer ikke den primære kilde til ændringer i økonomistyringen. Der er en række andre faktorer, der påvirker sådanne ændringer. I DRs tilfælde var der blandt andet tale om en stigende konkurrence på det marked, virksomheden bevæger sig i. Et andet resultat er, at ikke alle dele af økonomistyringen understøttes af informationssystemer. Delopgavens kompleksitet (f.eks. van der Veeken og Wouters, 2002) ser ud til at kunne forklare, hvorvidt den med fordel kan understøttes af et informationssystem. En kompleks del af anvendelsen af balanced scorecard er eksempelvis oversættelse af strategien til operationelle mål. Denne opgave kan et informationssystem kun i begrænset omfang understøtte. Informationssystemerne er derimod gode hjælpere i forbindelse med at holde styr på målopfyldelsen, som for mange nøgletals vedkommende kan registreres elektronisk. Et sidste resultat, som skal fremhæves her, er, at implementeringen af et balanced scorecard-system, som mere fokuseret understøtter balanced scorecard-teknikken (sammenlignet med Excel eller et selvudviklet system), sætter grænser for udfaldsrummet for anvendelsen af et balanced scorecard. Der var således nogle anvendelsesformer, som ikke fortsat vil være mulige at gøre brug af med et mere dedikeret og stringent informationssystem.
4. I afhandlingens sidste kapitel identificeres en række forslag til videre forskning. Blandt disse skal for det første nævnes de mange spørgsmål, der rejses, når diskussionen handler om brugen af simple informationssystemer som Excel og selvudviklede systemer kontra anskaffelsen af mere komplekse og dedikerede informationssystemer som f.eks. det balanced scorecard-system, som DR valgte at anskaffe. Der er behov for

mere viden om, hvornår simple henholdsvis komplekse men mere dedikerede informationssystemer med fordel kan anvendes, og hvornår man skifter fra det ene til det andet (typisk fra et simpelt system til et dedikeret system). For det andet er der behov for videre undersøgelse af hvilke dele af for eksempel balance scorecard-teknikken (oversættelse af strategi til nøgletal, opfølgning på målopfyldelse osv.), der med fordel kan understøttes af et informationssystem. Der mangler undersøgelser af, om informationssystemer med fordel kan understøtte større dele af økonomistyringen, eller om man i stedet for skal koncentrere sig om understøttelse af udvalgte dele.

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Appendices

1. List of journals reviewed

Abacus
Academy of Management Journal
Academy of Management Review
Accounting and Business Research
Accounting and Finance
Accounting Horizons
Accounting, Auditing and Accountability Journal
Accounting, Management and Information Technologies (-2000) /
Information and Organization (2001-)
Accounting, Organizations and Society
Administrative Science Quarterly
Advances in Accounting Information Systems (-1999)/International
Journal of Accounting Information Systems (2000-)
Artificial Intelligence in Accounting and Auditing
British Accounting Review
Business Process Management Journal
Communications of the AIS
Contemporary Accounting Research
Critical Perspectives on Accounting
European Accounting Review
Financial Accountability and Management
Information Systems Journal
Information Systems Research

International Journal of Intelligent Systems in Accounting, Finance and Management

International Journal of Operations and Production Management

Journal of Accounting and Economics

Journal of Accounting Research

Journal of Accounting, Auditing and Finance

Journal of Business Finance and Accounting

Journal of Information Systems

Journal of Management Accounting Research

Journal of Management Information Systems

Journal of Management Studies

Journal of the AIS

Logistics Information Management (-2003)/Journal of Enterprise Information Management (2004-)

Management Accounting Research

MIS Quarterly

Production and Operations Management

Review of Accounting Studies

The Accounting Review

The Journal of Bank Cost and Management Accounting (-2003)/Journal of Performance Management (2004-)

2. List of single interviews with companies

Velux

Oticon

SimCorp

Chr. Hansen

Copenhagen Airports

Danisco

The Danish Broadcasting Corporation

Aasted-Mikroverk

Coop Denmark

3. The measurement instrument

Survey on management accounting and integrated information systems

Definitions:

Management accounting	Management accounting is here defined as the tasks that exist in relation to decision making with financial implications. Therefore, management accounting is among other things about data collection, profitability calculation, the reporting of results and analysis of these.
ERP system	An enterprise resource planning system is an integrated information system that supports a multiplicity of processes across the organisation. All modules of the ERP system uses the same database so that data are stored only once.
Database and data warehouse	The database of the ERP system is used for storage of data that are generated on a daily basis. To separate transaction handling and analysis you can choose to have a data warehouse where data from the database is continuously copied to.
Analytical application	Analytical applications are applications for for example advanced reporting (e.g. balanced score-card), cost allocation (e.g. activity-based costing), simulation, forecasting and data analysis.
Integrated information system	An integrated information system is the sum of systems that are integrated with each other. Via a data warehouse analytical applications are integrated with the ERP system and together they constitute an integrated information system (IIS).
Reporting	Reporting is presentation of data. Reporting typically is one-way communication where the process ends when the user receives the report.
Analysis	Analysis takes its departure in the data reported. Analysis is two-way communication where the user asks questions to the data behind the report.

Answering the survey:

The survey is about management accounting and integrated information systems (IIS). Therefore, when answering the questions you must take departure in how you perform management accounting with the IIS. Please in this survey neglect management accounting done outside the IIS.

Section C-E:

If you cannot answer the question please tick *Don't know*.

	Not at all/not possible	Not at all	To	very large extent	Don't know
	1	2	3	4	5
1. To what extent are accounting data stored in the database of the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Here you must answer the question on a scale from 1 to 5 where

- 1 = To no extent/not at all (Not at all/not possible)
- 2 = To low extent
- 3 = To some extent
- 4 = To large extent
- 5 = To very large extent

Please note that *Not at all* exists in two versions: i) Not at all but possible and ii) Not at all and not possible. If you wants to answer *Not at all* you must therefore also consider whether it is possible.

A. Who answers the survey?	
1. Your title/function:	_____
2. Group unit or strategic business unit?	<input type="checkbox"/> Group unit <input type="checkbox"/> Strategic business unit
3. Trade, service or manufacturing (or a combination)?	<input type="checkbox"/> Trade <input type="checkbox"/> Service <input type="checkbox"/> Manufacturing
4. Number of employees:	_____
5. Is the company a subsidiary?	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. Is the company part of an international group?	<input type="checkbox"/> Yes <input type="checkbox"/> No
7. The group unit's or the strategic business unit's annual turnover in million DKK:	_____
8. The Danish turnover in per cent of total turnover:	_____

B. What integrated information systems support the management accounting of the company?							
	No, implementation is not planned	No, but implementation is planned	Implementation in progress	Implemented	Implemented and further developed	Implemented but not in use	Don't know
	↓	↓	↓	↓	↓	↓	↓
1. ERP system:							
SAP R/2 or R/3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oracle Applications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft Axapta, XAL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Modules of the ERP system:							
Sales and distribution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Production planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Material management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plant maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Finance (general ledger, accounts receivable, accounts payable, payroll etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Controlling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Investment management (shares, bonds etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cash flow and currency management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Group controlling (consolidation, elimination etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Human resource management (competency development, admin. of terms of employment etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Module for the support of administrative processes (secretariat, IT etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Administration of tenanted property	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Industry solutions (for public organisations, retail sector etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customer relationship management (CRM) (support of a call centre etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supply chain management (SCM) (mgmt. of internal as well as external parts of the value chain)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-business	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Document management (scanning of supplier invoices etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Data warehouse (db separated from the db of the ERP system; used for analytical applications)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Analytical applications (potentially part of a strategic enterprise management system):							
Activity-based costing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Software for reporting and analysis of both financial and non-financial measures (e.g. BSC)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Executive portal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Data mining (identification of relationships within a data set)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Planning and simulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consolidation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C. How are accounting data collected and stored?						
	1	1	2	3	4	5
	Not at all/not possible	Not at all	To	very	large	extent
						Don't know
1. To what extent are accounting data stored in the database of the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. On what dimensions do you register revenues and costs?						
Revenues:						
Place/department/function	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Product/project	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Customer/customer group	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Market	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Costs:						
Place/department/function	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Process/activity	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Product/project	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Responsible person	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
3. To what extent do you work with hierarchies on the dimensions (e.g. products and product groups, customers and customer groups)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. To what extent do you register quantities (units, kg, hours etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. To what extent do you register unit price of purchases?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. To what extent do you post calculated costs (e.g. allocation of costs)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. From what departments are data collected and stored in a shared database?						
Purchase	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Manufacturing	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Sales and marketing	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Development	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Accounting	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Other administrative functions (IT, secretariat etc.)	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	No	<input type="checkbox"/>	Yes	<input type="checkbox"/>
8 To what extent are non-financial, quantitative data (production statistics, employee's use of hours etc.) collected in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 To what extent are non-financial, qualitative data (customer satisfaction, employee satisfaction etc.) collected in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. To what extent are external data (industry statistics, competitor analyses etc.) collected in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. To what extent are data collected ad hoc in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. To what extent are you satisfied with the integrated information system's support of data collection?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. To what extent do you give high priority to data collection?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. To what extent do you utilise the integrated information system's possibilities for data collection?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. In what ways can data collection be improved in your company?						

D. How do you work with reporting (questions 1-12) and analysis (questions 13-19) in your company?						
	Not at all/not possible	Not at all To very large extent				Don't know
	1	1	2	3	4	5
1. To what extent is the integrated information system used for reporting?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. On what dimensions do you calculate profitability?						
Place/department/function	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Process/activity	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Customer/customer group	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Market	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Product/project	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Responsible person	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
3. To what extent are capacity costs allocated to customers, products etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. To what extent is the allocation of costs calculated on basis of a multiplicity of cost drivers (number of orders, number of administrative services used etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. To what extent do non-financial data (e.g. customer satisfaction) enter into the reports of the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. To what extent are reports generated ad hoc (not periodic) in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. To what extent does the user himself design his own reports in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. To what extent are reports of the integrated information system delivered on the screen to the user (as opposed to on paper)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. What departments generate reports in the integrated information system?						
Purchase	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Manufacturing	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Sales and marketing	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Development	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Accounting	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Other administrative functions (IT, secretariat etc.)	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
10. To what extent are you satisfied with the integrated information system's support of reporting?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. To what extent do you give high priority to reporting?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. To what extent do you utilise the integrated information system's possibilities for reporting?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. To what extent are the integrated information system used for analysis of accounting data?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. To what extent is an electronic report analysed by drilling down to higher levels of detail?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. To what extent do you do simulations and forecasts in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. To what extent is the integrated information system used for strategic management accounting?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. To what extent are you satisfied with the integrated information system's support of analysis?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. To what extent do you give high priority to analysis?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. To what extent do you utilise the integrated information system's possibilities for analysis?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. In what ways can reporting and analysis be improved in your company?						

E. How are budgeting and planning carried out with information technology in your company?						
	Not at all/not possible	Not at all To very large extent				Don't know
	1	1	2	3	4	5
1. To what extent are budgets prepared within the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. To what extent do you budget on non-financial, quantitative measures (production statistics, employee's use of hours etc.) in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. To what extent do you budget on non-financial, qualitative measures (customer satisfaction, quality, employee satisfaction etc.) in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. To what extent are revenues budgeted as number of units x price per unit (as opposed to as an amount) in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. To what extent are costs budgeted as number of units x price per unit in the integrated information system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. To what extent does for example the manufacturing department prepares budgets taking departure in the budget of the sales department (and the purchase department taking departure in the budget of the manufacturing department)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Who participates in the budgeting process:						
Purchase	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Manufacturing	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Sales and marketing	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Development	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Accounting	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Other administrative functions (IT, secretariat etc.)	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/> No			<input type="checkbox"/> Yes	<input type="checkbox"/>
8. To what extent are you satisfied with the integrated information system's support of budgeting?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. To what extent do you give high priority to budgeting?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. To what extent do you utilise the integrated information system's possibilities for budgeting?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. In what ways can budgeting be improved in your company?						

F. Overall evaluation of your utilisation of the IIS with regard to management accounting						
	Totally disagree				Totally agree	Don't know
	1	2	3	4	5	
We fully utilise the possibilities of the IIS with regard to management accounting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

G. Comments

Thank you for your response.

4. Factor loadings of management accounting items

Item	Factor						
	1	2	3	4	5	6	7
Number of dimensions of data collection	0.516	0.077	0.138	0.075	0.135	0.293	-0.173
To what extent do you work with hierarchies on the dimensions?	0.246	0.144	0.336	0.051	0.378	0.190	0.087
To what extent do you register quantities?	0.217	0.074	0.186	0.220	0.590	0.058	-0.068
To what extent do you register unit price of purchases?	0.481	0.029	0.094	0.079	0.592	-0.008	0.146
To what extent do you post calculated costs?	0.153	0.179	0.017	0.023	0.488	0.240	0.118
Number of departments collecting data	0.682	0.133	0.242	0.087	0.125	0.095	-0.072
To what extent do you collect non-financial, quantitative data?	0.092	0.336	0.167	0.133	0.422	0.190	-0.254
To what extent do you collect non-financial, qualitative data?	0.122	0.680	0.163	0.081	0.125	0.080	0.035
To what extent do you collect	0.086	0.601	0.106	0.074	0.153	0.060	0.045

	Factor						
Item	1	2	3	4	5	6	7
external data?							
To what extent do you collect data ad hoc?	0.074	0.518	0.298	0.044	0.067	0.010	-0.170
Number of dimensions of profitability reporting	0.594	0.126	0.179	0.131	0.245	0.268	-0.082
To what extent are capacity costs allocated to customers, products etc.?	0.161	0.113	0.056	0.125	0.086	0.695	-0.003
To what extent is the allocation of costs calculated on basis of a multiplicity of cost drivers?	0.144	0.236	0.039	0.090	0.194	0.640	0.096
To what extent do non-financial data enter into the reports?	0.157	0.691	0.122	0.119	-0.011	0.148	0.083
To what extent are reports generated on an <i>ad hoc</i> basis?	0.155	0.127	0.704	0.013	0.040	0.030	-0.108
To what extent does the user himself design his own reports?	0.077	0.082	0.535	0.123	0.072	-0.031	-0.046
To what extent are reports delivered on the screen to the user?	0.181	0.175	0.621	0.068	0.092	0.016	0.044

Item	Factor						
	1	2	3	4	5	6	7
Number of departments generating reports	0.680	0.060	0.332	0.081	0.255	0.026	0.061
To what extent is an electronic report analysed by drilling down to higher levels of detail?	0.111	0.188	0.517	0.110	0.163	0.137	0.337
To what extent to you do simulations and forecasts in the integrated information system?	0.126	0.300	0.375	0.171	0.171	0.196	0.366
To what extent is the integrated information system used for strategic management accounting?	0.125	0.283	0.533	0.158	0.076	0.191	0.220
To what extent to you budget on non-financial, quantitative measures?	0.126	0.383	0.130	0.364	0.058	0.210	-0.055
To what extent to you budget on non-financial, qualitative measures?	0.084	0.526	0.131	0.249	0.102	0.203	0.240
To what extent are revenues budgeted as	0.156	0.142	0.145	0.889	0.103	0.079	0.017

	Factor						
Item	1	2	3	4	5	6	7
units x price per unit?							
To what extent are costs budgeted as units x price per unit?	0.160	0.207	0.153	0.759	0.154	0.114	0.065
To what extent does for example the production department prepares budgets taking departure in the budget of the sales department?	0.489	0.174	0.081	0.328	0.165	0.118	0.085
Number of departments preparing budgets	0.685	0.165	0.006	0.065	0.049	0.023	0.202

5. Statistics of the equation explaining management accounting practices

Dependent variable	Independent variables	Unstd. coeff.	Std. error	Std. coeff.	P-value
Data collection (R ² =0.320, p-value=0.000, DW=1.812)	(Constant)	-0.365	0.148	0.000	0.014
	Transaction-oriented information systems	0.289	0.051	0.289	0.000
	Analysis-oriented information systems	0.178	0.051	0.178	0.001
	Company size	0.000	0.000	-0.045	0.347
	Company type: Trade	0.177	0.118	0.077	0.134
	Company type: Service	-0.119	0.129	-0.058	0.358
	Company type: Manufacturing	0.318	0.126	0.156	0.012
	Group vs. SBU	0.234	0.095	0.115	0.014
	Part of international group	0.346	0.102	0.161	0.001
Reporting and analysis (R ² =0.266, p-value=0.000, DW=2.035)	(Constant)	-0.359	0.153	0.000	0.020
	Transaction-oriented information systems	0.200	0.053	0.200	0.000
	Analysis-oriented information systems	0.318	0.053	0.318	0.000
	Company size	0.000	0.000	-0.089	0.071
	Company type: Trade	0.153	0.122	0.067	0.211
	Company type: Service	0.168	0.134	0.083	0.210
	Company type: Manufacturing	0.002	0.130	0.001	0.985
	Group vs. SBU	0.377	0.099	0.184	0.000
	Part of international group	0.183	0.106	0.085	0.085
Budgeting (R ² =0.161, p-value=0.000, DW=1.873)	(Constant)	-0.267	0.164	0.000	0.104
	Transaction-oriented information systems	0.206	0.056	0.206	0.000
	Analysis-oriented	0.232	0.057	0.232	0.000

Dependent variable	Independent variables	Unstd. coeff.	Std. error	Std. coeff.	P-value
	information systems				
	Company size	0.000	0.000	-0.093	0.080
	Company type: Trade	0.021	0.131	0.009	0.873
	Company type: Service	0.138	0.143	0.068	0.338
	Company type: Manufacturing	0.276	0.140	0.136	0.048
	Group vs. SBU	0.167	0.105	0.082	0.114
	Part of international group	0.023	0.113	0.011	0.837
Organisational breadth of management accounting (R ² =0.332, p-value=0.000, DW=1.861)	(Constant)	-0.172	0.146	0.000	.241
	Transaction-oriented information systems	0.331	0.050	0.331	0.000
	Analysis-oriented information systems	0.225	0.051	0.225	0.000
	Company size	0.000	0.000	-0.048	0.306
	Company type: Trade	-0.001	0.117	0.000	0.996
	Company type: Service	-0.182	0.128	-0.090	0.156
	Company type: Manufacturing	0.399	0.124	0.196	0.001
	Group vs. SBU	0.126	0.094	0.061	0.182
	Part of international group	0.086	0.101	0.040	0.397
Non-financial, external and ad hoc management accounting (R ² =0.302, p-value=0.000, DW=1.993)	(Constant)	-0.207	0.149	0.000	0.167
	Transaction-oriented information systems	0.173	0.051	0.173	0.001
	Analysis-oriented information systems	0.420	0.052	0.420	0.000
	Company size	0.000	0.000	-0.027	0.572
	Company type: Trade	-0.155	0.119	-0.068	0.194
	Company type: Service	0.139	0.131	0.069	0.287
	Company type: Manufacturing	0.000	0.127	0.000	1.000
	Group vs. SBU	0.366	0.096	0.179	0.000
	Part of international	-0.005	0.103	-0.002	0.960

Dependent variable	Independent variables	Unstd. coeff.	Std. error	Std. coeff.	P-value
	group				
Allocation of costs (R ² =0.153, p-value=0.000, DW=1.606)	(Constant)	-0.373	0.165	0.000	0.024
	Transaction-oriented information systems	0.125	0.057	0.125	0.028
	Analysis-oriented information systems	0.282	0.057	0.282	0.000
	Company size	0.000	0.000	-0.067	0.204
	Company type: Trade	-0.089	0.131	-0.039	0.499
	Company type: Service	0.313	0.144	0.154	0.031
	Company type: Manufacturing	0.232	0.140	0.114	0.099
	Group vs. SBU	0.158	0.106	0.077	0.137
	Part of international group	0.202	0.114	0.094	0.077

6. Attendance of meetings at Danish Broadcasting Corporation

Setting and purpose of meeting	Participants	Number of meetings	Duration of meetings (total number of hours)
The quarterly BSC results of the purchase team are presented and discussed at a department meeting. 12 August 2005	All employees of the purchase team	1	1
The scorecard of the resources directorate is not yet made and department of service and administration does not know the demands for their scorecard. The purpose is for department of service and administration to get hold on the demands for their scorecard for 2006. 22 August 2005	BSC administrator of department of service and administration (organiser), the manager of department of service and administration, the BSC facilitator and the BSC administrator of the resources directorate overall	1	1
As part of the testing of the BSC application called Corporater BSC a training session was held by the consulting company selling the software licenses. 10-12 August 2005	BSC administrator of the resources directorate overall, the BSC administrator of the IT department, the person in charge of implementation of applications and two IS specialists	1	20 hours (three days)
Preparation for	The manager and the BSC	1	1

Setting and purpose of meeting	Participants	Number of meetings	Duration of meetings (total number of hours)
quarterly BSC meeting with Bent Fjord 17 October 2005	administrator of the IT department		
Quarterly BSC meeting between Bent Fjord, Lars Holmbjerg and department manager about BSC status 25 October 2005	The CFO, the BSC facilitator and the manager of the IT department	1	1
Quarterly BSC meeting between Bent Fjord, Lars Holmbjerg and department manager about BSC status 25 October 2005	The CFO, the BSC facilitator and the manager of the accounting department	1	1
Quarterly BSC meeting between Bent Fjord, Lars Holmbjerg and department manager about BSC status 11 November 2005	The CFO, the BSC facilitator and the manager of department of service and administration	1	1
Follow-up meeting on the researcher's presentation of observations 22 November 2005	The CFO and the BSC facilitator	1	1
Preparation for presentation of Corporater BSC to Bent Fjord 1 December 2005	BSC administrator of the resources directorate overall and the BSC administrator of the IT department	1	2.5
Preparation for presentation of Corporater BSC to	BSC administrator of the resources directorate overall, the BSC	1	1.5

Setting and purpose of meeting	Participants	Number of meetings	Duration of meetings (total number of hours)
Bent Fjord 12 December 2005	administrator of the IT department and the BSC facilitator		
Presentation of Corporater BSC to Bent Fjord 15 December 2005	The CFO, BSC administrator of the resources directorate overall, the BSC administrator of the IT department and the BSC facilitator	1	1.5
Total		11	32.5

7. Sample documents from the Danish Broadcasting Corporation

Annual reports, 2000 – 2004

Organisation charts

“the DBC – not like the rest of them” (presentation of the DBC)

Memorandum on management control

Public service statement

Reports and presentations about perspectives, strategic objectives, key performance indicators, targets, results and initiatives of the resources directorate, the accounting department, department of service and administration and the purchase and secretariat team

Strategy map of the resources department

Requirements specification of new BSC software

Script for vendor’s presentation of BSC software

Screen dumps from present and future BSC applications

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