

Design and use of costing systems in university hospitals:

Empirical investigations

by

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My experiences from working in Norwegian university hospitals as a financial advisor since the early 1990s motivated the research efforts. At business school we learn that knowing the product costs are a key to good management decisions. My work-experience is that we do not know what the services hospitals provide patients costs. Yet to know the national prices are important when managing the operating units within these ever larger organizations. This theory – praxis gap motivated further studies in management accounting and exploring the scientific accounting research literature. At work I was involved in various costing efforts and given the opportunity to design an advanced costing system. The good news from these efforts is that what we learn in business school is valid in some Nordic hospitals. Yet the road to a use of more advanced cost information in the internal control of complex hospitals seems to be long in some of the other investigated hospitals.

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Design and use of costing systems in university hospitals: Empirical investigations

1 Introduction

A large number of reform initiatives have been initiated in the public sector during recent decades (Hood, 1995). In the 1980s the critique of the inefficiency and ineffectiveness of the public sector resulted in a wave of reforms (van Helden, 2005). The reforms have had a number of dimensions as component parts of the restructuring of public services. According to Lapsley (1999) central dimensions are decentralization, corporatization, the displacement of old-style public administration and a desire to place public services in markets or quasi-markets. This has focused the need for contracts, employee incentives to perform, and “*a more explicit role for the management (in a top-down, hierarchical, functional concept) of the public services*” (Lapsley, 1999:201). In terms of Lapsley (1999:201), other aspects of the reforms are: “*the perceived need to rationalize public services and, above all, the stress on quantification as a means for demonstrating achievements (efficiency gains, new levels of performance) and of holding responsible persons accountable*”. This shift has been denoted as New Public Management (NPM) (Hood, 1995). The reforms have brought changes in public sector organizations that involve the introduction of private sector management techniques as new costing systems (van Helden, Aardema, ter Bogt & Groot, 2010).

The motive for these reforms has been to improve the financial management of the public sector. Hood (1995:5) regarded accounting as a key element in the NPM-reforms because the activities of the public sector needed to be “*more closely costed and evaluated by accounting techniques*”. According to Guthrie, Olson and Humphrey (1999:211), “*Managers, service providers, government officials and the general public increasingly find it a necessary part of life to know how to prepare, maintain, respond to, interpret, comply with, or challenge financially oriented information*”. Financial management is thus “*in a sense the technical lifeblood of NPM-organizational structures*” (Guthrie, Olson, & Humphrey, 1999:211). These reforms, therefore, have by accounting researchers been given the name New Public Financial Management (NPFM) (Olson, Guthrie, & Humphrey, 1998).

Lapsley (1999) concludes that accounting and financial mechanisms have the capacity to change; however, when introducing new accounting information into the public sector, there is also a potential for more complex interactions between accounting, public service managers and public policy makers. The risks of possible negative effects of the reform initiatives have made accounting researchers issue a global warning (Olson et.al., 1998). Accounting researchers have pointed to “*the repeated contrasts between the claimed logical necessity to implement NPFM-reforms and the complex mess of “unintended” consequences so often generated*” (Guthrie et.al., 1999:209). Examining the actual accounting practices in different contexts, researchers found that there are indications that the new concepts are applied in different ways (Guthrie et.al., 1999)¹. These researchers caution against the interpolation of reform experiences from one country’s public sector to another (Guthrie et.al., 1999; Olson et.al., 1998). The public sector may be caught in an “*evaluatory trap*”: new performance measurement and evaluation systems only increase the indirect cost of public services (Olson, Humphrey, & Guthrie, 2001). “*If we want public sector accounting systems to strengthen processes of democratic governance, then it is vital that they contain information which politicians, service recipients, providers and other actors can and want to talk about and are able to use*” (Guthrie et.al., 1999:224).

According to Guthrie, Olson and Humphrey (1999:225), “*politicians, as with political scientists, and other public sector stakeholders have been too thrusting or insufficiently interested in NPFM techniques and NPFM system designers*”. Despite these warnings there has been a development of ever more advanced management models including costing systems in the public sector (Guthrie, Humphrey, Jones & Olson, 2005). These advanced management models and the dilemmas with regard to their different practices have motivated a closer look on how costing systems are designed and used in the public sector.

This summary of the thesis is organized as follows. In the next chapter I will discuss the research scope of the thesis. Next the research approach and methodology will be outlined in the third chapter. In chapter four the findings of the thesis will be presented. Then in the fifth chapter the scientific and managerial contributions from this thesis will be discussed. The last chapter will present suggestions for future research.

¹ As for example, “accrual accounts”, “performance indicators”, “delegated budgets”, “devolved budgets”, “full costs”, “output groups”, “output statements”, “accrual output based budgeting” and “fiscal responsibility statements”.

2 The research scope

In this chapter the research scope is discussed in terms of research aim and research questions. The research aim of the thesis is defined in section 2.1. In section 2.2 the selected research questions of the thesis are presented. Section 2.3 will comment on the theoretical perspectives of the research.

2.1 Research aim

The general aim of this research is to enhance the understanding of the development of increasingly more advanced costing systems and their use in recent years in the public sector despite warnings from accounting researchers of the possible negative effects of the new reform initiatives. Such research may contribute to and extend the theoretical and practical accounting knowledge (Scapens, 2008). The size of the public sector and the central position of cost information in the control of organizations indicate that this is an important area for extending the accounting knowledge. The new insight may also have a potential for informing both managers and policy makers in the public sector (van Helden et.al., 2010).

One characteristic of the public sector is its complexity (Lapsley, 1988). The type of organizations comprising this sector, the scale of their operations and their accounting practices vary (Lapsley, 1988). The distinction central – local is often useful in public sector accounting research (Mellempvik, Gårseth-Nesbakk, & Olson, 2005). The concept “central” most often refers to the central government and its agencies (for example, the Norwegian Healthcare system) while “local” may refer to a single municipality or a local unit such as a hospital (Broadbent & Guthrie, 1992).

A hospital provides wide variety of healthcare-services to individual patients. These services may involve complex production processes. Hospitals are often organized within the public sector in large healthcare systems. A healthcare system consists of different groups of healthcare service providers. Hospitals are important institutions in healthcare systems.

Within the group of hospitals one may find different categories such as primary, secondary and tertiary care hospitals. Tertiary care hospitals are often university hospitals. University

hospitals have the most complex service production and cost structure, therefore one may expect that to their owners these institutions present the largest challenge to control their costs. In the late 1970s the invention of the Diagnosis Related Groups (DRG) was a major event in making the production processes in hospitals more transparent (Preston, 1992)². This led to the subsequent introduction of costing systems placed centrally in healthcare systems and the use of the national average costs as prices financing the provision of healthcare (Samuel, Dirsmith, & McElroy, 2005). We know that, “*As organizations become more complex, more hierarchical, and more decentralized, the demand for effective management accounting systems increases*” (Bruns Jr & Kaplan, 1987:1). If the NPM-reforms have made an impact in healthcare, I would expect to find the most advanced design and use of costing systems in the most complex category of hospitals. Consequently, this thesis will focus on university hospitals.

The specific aim of this thesis is to enhance our understanding of the design and use of costing systems in university hospitals which represent a large and complex local level in the healthcare system.

Corbin and Strauss (2008) suggest that there are four sources for identifying research problems. One such source is problems that are suggested or assigned by an advisor or mentor. Another source is problems that are derived from technical and non-technical literature. A third source may be the use of personal and professional experience. A fourth source is problems that emerge from the research itself. In this thesis my main sources for identifying the research problems are problems derived from the literature, my professional experience and problems that emerge from my research.

2.2 Research questions

Since the identification of researchable problems is very important for the construction of research questions, I have chosen first to motivate the overall research problem, then delimitate it and finally formulate the selected research questions.

The general research problem is derived from the literature. The provision of accounting information “*into areas where costs were previously aggregated, pooled or undefined*” is

² The DRG-family: <http://www.fisher-zim.ch/textk-pcs/index.htm>.

central in the reform initiatives (Hood, 1995:93). Costing systems provide such accounting information³. A review of the public sector management accounting research, however, indicates that “*issues related to costing and cost management are less intensively researched*” (van Helden, 2005:113). The limited research may influence our understanding of the effects of the newly introduced NPM-reforms. Given this background, the general research problem of this thesis is to better understand the development in recent years of increasingly more advanced costing systems in the public sector and the dilemmas with regard to their different practices. Such developments and dilemmas have emerged despite the warnings from accounting researchers of the possible negative effects of the new reform initiatives. The general research problem is very comprehensive, so this necessitates further delimitation of the scope of the research.

Corbin and Strauss (2008:21) suggest that a second source for identifying research problems is the use of “*personal and professional experience*”. I have been working as financial adviser in Norwegian university hospitals since 1994; consequently, my own experiences have guided my focus in this thesis. Until the late 1990s, Norway was a hesitant NPM-reformer (Pettersen, 2001a). Since that time, however, researchers have reported about several reforms such as the introduction of national DRG-prices in 1997 (Pettersen, 1999; Pettersen, 2001b), the Norwegian Health Care Reform in 2002 (Hagen & Kaarbøe, 2006) involving the translation of private sector accounting norms into healthcare (Robbestad, 2011) and new revenue allocation models for hospitals (Hagen, 2004; Kaarbøe, 2005).

In addition, the praxis of budgetary control at the hospital where I first started to work has been described as decoupled (Pettersen, 1995). Being a part of an accounting praxis where plans and actions were not coupled was frustrating for my work as an advisor within this hospital. When the national DRG-prices were introduced, no local costing system was installed in the hospital. In 2002 there was still “*no cost calculation based on patient groups such as the DRG-cost indexes, cost per procedure, or cost grouped according to specialties*” (Nyland, 2003:148)⁴. The intended use of these national DRG-prices, however, was to allocate resources to the hospital-level and not to the organizational unit within the hospital providing services to the patient (for example, National DRG-pricelists, 2007; 2012)⁵. Despite

³ I view a costing system as a model (allocation rules) installed in an organization.

⁴ In 2012: the hospital still do not estimate the costs of its services.

⁵ Since 2002: to the regional health care provider-level.

this, my experience is that these revenues are accounted for at the organizational unit (a ward or out-patient clinic) that the DRG-grouper system classifies as the most resource-demanding⁶. When revenues are compared with local expenses, some units then turn out to have large surpluses (for example surgery departments) while others have deficits. The praxis prevails despite not being recommended by the central authorities due to the risks for unintended consequences (Larsen, 2007). In particular, the central authorities at the Ministry level are concerned about the dangers that this praxis may influence decisions concerning the allocation of treatments among patients.

Accounting researchers have argued that there is a need to develop a common language in Norwegian hospitals to support useful dialogue among the different actors in the healthcare system (Nyland & Østergren, 2008). My own experience with the NPM-reforms in the Norwegian healthcare-system supports this view⁷. The combination of the conclusions of accounting researchers and the personal experiences are two sources for a further identification of researchable sub-problems and construction of research questions.

During the past 25 years, the need for more sophisticated costing systems in the business sector has been intensely advocated (Cooper & Kaplan, 1988; Gosselin, 2007). Despite this rhetoric, advanced costing systems as activity based costing (ABC) systems have not been extensively implemented in business settings (Abernethy, Lillis, Brownell & Carter, 2001; Al-Omiri & Drury, 2007). Failures of ABC-implementation have also been reported (Gosselin, 1997). In the same period, reforms involving new costing systems have been introduced in public organizations including healthcare systems. In a review of the public sector accounting research, van Helden (2005) indicates that issues related to costing and cost management are less intensively researched than, for example, resource allocation (budgeting) and performance measurement. Given this context an important question arise concerning the state of knowledge within scientific accounting literature on the design and use of costing systems in hospitals and healthcare. This is the first research question of the thesis.

A third source for identifying a research problem is the use of “*problems that emerge from the research itself*” (Corbin & Strauss, 2008:21). In recent years product costing systems have

⁶ See, for example, the Nordic countries: www.nordclass.uu.se

⁷ Involving financial management concepts as “accrual accounts”, “performance indicators”, “delegated budgets”, “full costs”, “mergers”, “corporatisation”, “revenue allocating models” and new costing systems.

been established central in healthcare systems for formulating healthcare policy, benchmarking and financing purposes. Even so, researchers have reported that the use of cost information from such systems may promote “*averageness*” (Llewellyn & Northcott, 2005). At the Norwegian university hospital where I was employed my experience was that the relationship between local costs and national DRG-prices was often questioned by both the administrative and clinical managers. The review of the literature identified that no statistical evidence had been reported about the dilemmas in the local control of hospitals when the hospitals were financed by using national DRG-prices (Kjøllestad, Essay I). The second research question is based on these dilemmas: To what extent is there coherence between national prices and local cost estimates?

Hospital revenues in Nordic hospitals are related to central funding systems with a variety of characteristics (Anell, 2005; Hagen, 2004; Hagen & Kaarbøe, 2006; Häkkinen, 2005; Pedersen, Christiansen, & Bech, 2005). These revenues have a different mix of fixed and variable components and are related to actual cost or average cost in various ways. The review of the literature identified that accounting researchers have discussed very little about the actual design and use of cost accounting models in hospitals in relation to the funding systems (Kjøllestad, Essay I). Consequently, the third research question is: What is the actual design and use of cost accounting systems in major Nordic hospitals?

We know that there are challenges to “*mapping costs to the highly differentiated activities of health care to create averages*” (Llewellyn & Northcott, 2005:556). These challenges in developing relevant costing systems in hospitals are partly due to the ambiguity in the treatment procedures related to each patient and partly caused by the horizontal processes that characterize the care of patients across different organizational units. As accounting information most often follows the hierarchical, functional vertical lines, horizontal coordination of transactions may be organized without relevant costing information. One way to solve – at least partially – this information problem might be to define the transaction volume as a basis for estimating the average cost per service. Such averages may be viewed as a standard cost constructed by a process-costing system. The cost per patient is calculated by multiplying the standard cost per service by the actual volumes in a job-order system. Such a system has been labeled a Clinical Costing System (Abernethy & Chua, 1996). Advanced costing systems exist in some Nordic university hospitals (Kjøllestad, Essay III), but the literature has not yet reported how advanced costing systems in hospitals have been

implemented and developed (Kjøllestad, Essay I). On this basis, the fourth research question is: What factors influence the process of developing an advanced costing system in a university hospital?

The text of this thesis reflects important influences on the research process. According to Sandberg and Alvesson (2011:25), “It is in the crafting of the research text that the final research question is constructed, which is the one that specifies the actual contribution of the study”. The formulated research questions may therefore in some cases be similar to the aims and problems that inspired the research, however, in other cases they may bear stronger imprints from considerations of how to craft a persuasive text.

The central concepts of this thesis are illustrated in Figure 1.

		Level in the healthcare system	
		Central	Local
Costing system	Design	1	2
	Use	3	4

Figure 1 The central concepts of this thesis

In terms of Sandberg and Alvesson (2011) the formulation of the first research question is based on gap-spotting: the existing literature (van Helden, 2005) needs to be extended or complemented. My review of the literature indicated that there was a need for more empirical studies (Kjøllestad, Essay I). The next three studies are empirical investigations.

The review of the literature also indicated that no statistical evidence has been reported about the dilemmas in the local control of hospitals when these hospitals are supposed to be controlled by using national DRG-prices (Kjøllestad, Essay I). The second essay addresses the design of costing systems placed centrally and locally in healthcare systems (Figure 1: quadrant 1 and 2) and discusses possible implications for a local use of such cost information (Figure 1: quadrant 4).

The new costing systems placed centrally in healthcare systems have been given much attention by accounting researchers, but the design and use of *local* costing systems have been

overlooked (Kjøllestad, Essay I). The third essay addresses the design and use of local costing systems (Figure 1: quadrant 2 and 4).

The last empirical study addresses how an advanced costing system in a particular university hospital has been established and developed. This type of inquiry has also been overlooked by accounting researchers (Kjøllestad, Essay I). The essay focuses how an advanced costing system in a particular university hospital is designed and changed over time (Figure 1: quadrant 2).

Figure 2 illustrates the relationship between the specific aim of the research in this thesis and the separate research questions of each of the four essays.

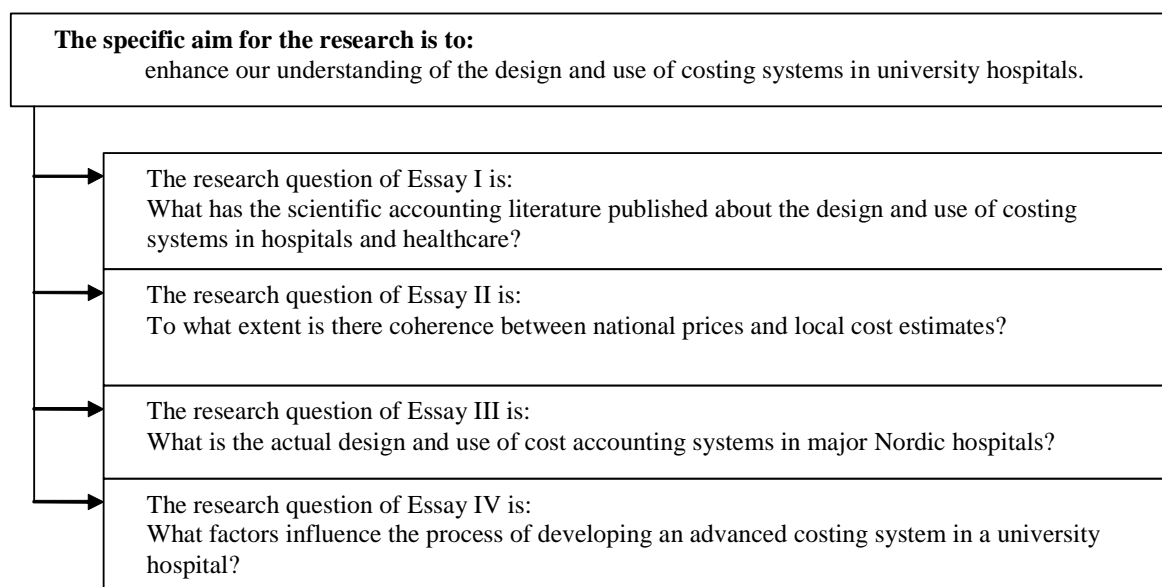


Figure 2 The relationship between the specific aim and the individual research questions

The theoretical perspectives of the thesis will be the focus of the next chapter.

2.3 Theoretical perspectives

The central concepts of this thesis are the design and use of costing systems placed centrally and locally (in hospitals) in healthcare systems (Figure 1). The NPM-reforms in healthcare constitute the context for these concepts. Three theoretical perspectives have influenced this thesis: the design and the use of costing systems and their context in healthcare.

In terms of Ghauri and Grønhaug (2005), the main purpose of any research is to produce insights or knowledge. *“Knowledge can be classified in various ways as: theories/models, concepts, methods/ techniques and facts”* (Ghauri & Grønhaug, 2005:36). Doing research is intended to add valid knowledge to present knowledge. Textbooks in management and cost accounting are one source of the existing knowledge (Drury, 2008; Horngren, Datar, Foster, Rajan & Ittner, 2009). A more updated source of knowledge may be the accounting literature reports about the design and use of costing systems and the NPM-reforms in healthcare and hospitals.

A traditional costing system allocates costs to products based on volume as the allocation base (Johnson & Kaplan 1987). A refined costing system reduces the use of broad averages for assigning the cost of resources to cost objects and provides *“better measurement of the costs of indirect resources used by different cost objects”* (Horngren et.al., 2009:169). Homogenous cost pools and allocation bases are important for computing more accurate costs of a given cost object. In a homogenous cost pool *“all of the costs have the same or similar cause-and-effect relationship with a single cost driver that is used as the cost-allocation base”* (Horngren et.al., 2009:169). In terms of Horngren et.al. (2009:170), *“Activity Based Costing”* (ABC) is one of *“the best tools for refining a costing system”*. ABC refines a costing system by identifying individual activities as the fundamental cost object (Cooper & Kaplan, 1987). The art of designing a costing system is in choosing a limited number of activity measures and hence the number of cost pools (Noreen, 1991). In such a process both activity measures and cost pools are aggregated.

When information is aggregated, details are lost. This process affects both the homogeneity of the cost pools and the activity measures as well as the usefulness of the cost estimates (Demski, 1997). *“Because a costing system is a model of an unobserved true cost, reported product costs likely contain biases and errors”* (Labro & Vanhoucke, 2007:941). Datar and Gupta (1994) have introduced a conceptual model of errors in product cost estimates: specification-, aggregation- and measurement errors. Incremental changes in costing systems are often the norm rather than the exception (Labro & Vanhoucke, 2007). The costing system approached in praxis may thus vary in many dimensions. Bjørnenak and Olson (1999) have developed a framework for describing and analyzing management accounting models. The scope dimension involves descriptive objects, causal variability factors, type of data, number of periods, division of time and time-perspective in data. The system dimension focuses on

the link between the user of the system and how the system is designed. Two aspects are emphasized in this dimension. One is the number and lifetime of systems. The other is the integration of user-involvement and acceptance of information asymmetry in the design of the model. The conventional wisdom perspective of one management accounting system that may use “*different costs for different purposes*” (Horngren et.al., 2009:38) is challenged by the “*different systems for different purposes perspective*” (Bjørnenak & Olson, 1999:334).

Other researchers have pointed out that the relationship between the design elements of costing systems in business organizations is not well established (Abernethy et.al., 2001; Al-Omiri & Drury, 2007). In this thesis both the local ad-hoc costing system which is used in Essay II and the design of a costing system in Essay IV were inspired by the ABC-technique. Datar and Gupta’s (1994) model of errors in product cost estimates was applied in Essay IV to identify the different versions of the costing system. Bjørnenak and Olson’s (1999) framework for describing and analyzing management accounting models was applied in Essay IV to describe the versions of the costing system.

The call for more refined costing data, while at the same time observing low adoption rates in the business sector, has been labeled the ABC-paradox (Gosselin, 1997). System complexity seems to be among the most important barriers for effective control system design in hospitals (Carey & Burgess, 2000; MacArthur & Stranahan, 1998). In a hospital setting detailed costing represents the collection of costs for treating every patient (Abernethy & Chua, 1996; Jarvinen, 2006; Lowe, 2000). Detailed costing in hospitals is thought to be complicated, costly to develop and maintain (Jones, 1999b; Llewellyn & Northcott, 2005). Yet the existence of national prices and the benchmarking of hospital costs signal that there is an average cost of production in healthcare (Llewellyn & Northcott, 2005). Accordingly, researchers have discussed the danger that the use of national average costs may position “*averageness as an ambition for the hospital as a social institution*” (Llewellyn & Northcott, 2005:567). In Essay II this thesis will provide empirical evidence of the dilemmas in the local control of hospitals when they are promoted (financed by national average prices) to be cost average (Llewellyn & Northcott, 2005).

Theories on the design and use of control systems are rich on how systems are designed to fit organizational structure and other contingency factors (Otley, 1980). According to Otley (1980), it is often impossible to separate the effect of accounting information systems from

the other controls as they form a control-package for the local user. The user of such systems thus relates jointly to the control-package of local organizations. Studying accounting changes in an Australian hospital, Abernethy and Chua (1996) observed that the design of the “package” is actively shaped by the strategic choices of its dominant coalition. This Australian hospital underwent material changes in its governance structure, culture, and accounting control system, but the design elements of the package were not described in the study. In the Nordic study this package-perspective emerged from the interviews (Kjøllestad, Essay III). The theoretical perspective was thus lifted from costing system to cost accounting models (Anthony & Young, 2003; Kaplan & Atkinson, 1998). In Essay III the use of cost accounting models in Nordic university hospitals will be explored. In addition, in Essay III the elements of two cost accounting model “packages” will be described.

The introduction of new funding systems as prospective payment system (PPS) in the US in the early 1980's represents major changes in the costing systems in the healthcare sector (Preston, 1992; Samuel et.al., 2005). The new funding systems have been used to force a local response as improved management of hospital costs (Preston, 1992). The motivation of these NPM-reform initiatives has been to induce financial accountability into hospital management (Doolin, 1999; Jones, 1999a; Rea, 1994). The introduction of the DRG-system was regarded as having the potential to “*penetrate and alter the internal operating processes of hospitals*” (Covaleski, Dirsmith, & Michelman, 1993:65). Accounting researchers have, however, characterized such NPM-reforms as “accounting colonization” (Chua, 1995; Doolin, 1999; Lowe, 2000), “government at a distance” (Preston, Chua, & Neu, 1997) or as efforts to “monetize medicine” (Samuel et.al., 2005). Effects of changes in payment mechanisms on the operating decisions within hospitals have been reported (Eldenburg & Kallapur, 1997; Eldenburg & Soderstrom, 1996). A low sense of ownership of the new activity-based contracts has been reported (Ellwood, 1996a; Jones, 1999a; Jones, 1999b). The image of the hospital as a market-driven and flexible organization responding to changes in prices has been reported to be inadequate (Ellwood, 1996b; Lindkvist, 1996).

Researchers have tried to explain why such market reforms have failed by pointing at the different control logics - administrative and clinical - that are present in hospitals (Abernethy & Stoelwinder, 1995; Nyland & Pettersen, 2004). A weak link between prices and the physicians' quotas may have perpetuated a decoupling between these logics (Jones &

Dewing, 1997). Different conceptualizations of the reforms may explain such a decoupling between plans and action (Pettersen, 2001b).

Differences in the reforms between countries have been studied (Jegers, 1996; Pettersen, 2004; Siverbo, 2004). Jegers (1996) investigated the budgeting and cost accounting procedures of Intensive Care Units (ICU's), that is, at the operating level in hospitals, in 12 European countries. Jegers concluded that the cost calculation methods in ICUs were rather under-developed. Siverbo (2004) reviewed the published experiences from the purchaser-providers split in Sweden – at the strategic level in healthcare systems – and contrasted these with those from Britain. Both countries experienced difficulties in making use of the market mechanism. The idea of competition was soon replaced by ideas of co-operation and co-ordination. In both countries, “soft” contracts were the final course of action. Pettersen (2004) has discussed the recent reforms in the Nordic hospital sector. She reported that the initiative, content and implementation of the reforms have varied (Pettersen, 2004).

In this thesis the NPM-reforms in healthcare systems represent important changes in the context of the focused costing systems. In all the investigated contexts NPM-reforms involving, for example, DRG-prices have been introduced. The NPM-reforms, however, are not studied per se in this thesis.

The selected research approach and methodology will be the focus of the next chapter.

3 The research approach and methodology

In this chapter the focus is on the research approach (3.1), the data (3.2) and the role of the researcher in the research process (3.3).

3.1 The research approach

A research approach can be viewed as the methods that are applied during a research project (Ghuri & Grønhaug, 2005; Jankowicz, 2005). “*Research methods refer to systematic, focused and orderly collection of data for the purpose of obtaining information from them, to solve/answer a particular research problem or question*” (Ghuri & Grønhaug, 2005:109). In Essay I, a qualitative analysis of the relevant literature is carried out. In Essay II the selected

approach is quantitative and based on a correlation analysis. The research approach in Essay III is qualitative and based on a comparative case study. In Essay IV the research approach is qualitative and based on an analysis of a development process. The research methods in the final two essays are based on interpretive research perspectives (Jankowicz, 2005; Morgan & Smircich, 1980; Spiggle, 1994). The research approach of this thesis thus uses a mix of different research methodologies.

In terms of Ghauri and Grønhaug (2005:110), the main reason for selecting qualitative or quantitative research approaches “*should be the research problem and the focus of the study*”. The specific aim of this thesis is to better understand the design and use of costing systems in university hospitals (Figure 2). When exploring research problems involving the understanding of the dynamics in complex social phenomena, a qualitative research approach is recommended (Corbin & Strauss, 2008; Jankowicz, 2005). Research problems focusing on uncovering a person’s experiences, understanding a phenomenon about which little is known or investigating an event or social process is, however, difficult to study with quantitative methods. Such is the case for major parts of this thesis; therefore a qualitative approach is used in three of the four essays. In the fourth inquiry, presented in Essay II, the research problem addresses a more specific question regarding the coherence between national prices and local cost estimates. This allows for a more focused quantitative approach than do the other three essays.

3.2 The data

The research process has covered the period from 2006 to 2012. The thesis consists of four separate studies based on a mix of different research methodologies. There are two broad types of data. Primary data are “*original data collected by us for the research problem at hand*” (Ghauri & Grønhaug, 2005:91). Secondary data are information collected by others for purposes that can be different from our own. I have used both types of data. The use of specific type of data varies, dependent on the research question that is examined.

The first essay is based on the study of relevant research literature from the period 1990-2007. The selection of journals and the use of a classification scheme were inspired by a comprehensive review of North American management accounting research (Shields, 1997).

The second essay is based on secondary data from the largest university hospital in Norway. The data is from the first 6 months of 2003. It is retrieved from the then-existing costing system and national price list. The data covers every investigation carried out at the Department of Radiology, along with the relevant national price per session. The cost per session was calculated based on an ad-hoc costing system constructed by the researcher.

The third essay is based on both primary and secondary data. The primary data is comprised of interview-data about costing systems and its use in the four most prominent university hospitals in the Nordic countries. Central actors representing different administrative levels were interviewed about their use of cost information in the hospitals' budgetary control-procedure. The persons responsible for the actual operation of the local costing systems were interviewed about the design of the costing systems. Background information, such as that gained from annual reports, was used as secondary data.

The last essay describes and analyzes a development process of an advanced costing system in a university hospital. The four versions of the costing system are *the* central secondary data. The researcher's experiences from the 10 years long process made it possible to find this secondary data. Because this study, to a great extent, is based on the use of the researcher's own experiences as data, the role of the researcher in the research process will be further discussed.

3.3 The role of the researcher in the research process

The role of the researcher and, in particular, the use of the researcher's own experiences in the research process needs a further comment. *"The idea of "scientific rigor", understood as following a strict and impersonal protocol, is not fruitful when applied to studies of complex human conduct"* (Tengblad, Czarniawska, & Solli, 2005:10). According to Tengblad et.al. (2005:11), *"This does not mean that anything goes. It is still crucial that the research is trustworthy and credible, but good research should preferably also be theoretically interesting and practically useful"*. In terms of Corbin and Strauss (2008:32), *"Data collection and analysis have traditionally called for "objectivity". But today we all know that objectivity in qualitative research is a myth"*. They suggest replacing the concept "objectivity" with "sensitivity". According to these researchers, *"Sensitivity means having insight, being tuned into, being able to pick up on relevant issues, events, and happenings in*

data” (Corbin & Strauss, 2008:32). Corbin and Strauss (2008:41) point out that “*Sensitivity ... is derived through what the researcher brings to the study as well as through immersion in the data during data collection and analysis*”. Professional experience can enhance sensitivity. Such experience can enable the researcher to understand the significance of some things more quickly. There is, however, a danger that in the interpretation process the researcher may force his/her ideas on the data. Corbin and Strauss (2008:33) thus provide the advice that the more we are aware of the subjectivity involved in data analysis, “*the more likely we are to see how we are influencing interpretations*”. These concerns motivate the focus in this section on the role of the researcher in the research process.

In the second essay the researcher’s “*personal and professional experience*” was the source for formulating the research question (Ghuri & Grønhaug, 2005:47). In addition, the closeness to the data gave the researcher access to relevant secondary data. The researcher knew what to look for, how to obtain it and how to analyze it. The research process was not dependent on other actors.

In the Nordic study (Essay III), the characteristics of large university hospitals were well-known to the researcher. Knowledge of these characteristics was gained from the researcher’s experience of working with controlling university hospitals including participation in both the processes (as for example the budget control process) and the operation and development of costing systems (as for example national funding systems, national and local costing systems). This enabled the researcher to formulate questions during the interviews to get the relevant primary data. In this study the researcher may be seen as a “*referent*” (Pettersen & Mellempvik, 2006:58).

The story in Essay IV is based on the researcher’s experiences. This kind of research is thus based on the subjective experiences by the researcher, and the empirical data is gathered in his role as the researcher. The researcher could use his experiences to obtain and analyze the secondary data as the different versions of costing system. One possible solution to the eventual dilemma is to discuss the participation in order to enable the reader to make up her/his mind of the implications for the validity of the findings. “*Participation*” and “*observation*” are central in case studies (Yin, 2003). When engaged in a problem-solving process, one may learn a great deal. The experiences may be useful for both practitioners and researchers. The issue at hand is how best to capture these experiences.

Three situations involving the time-dimension of a process can be identified: before, in the middle of, and after the action has taken place. The researcher's prime role in the process may be either as observer or actor. Traditional mainstream business research is often based on phenomena that *have* taken place. The researcher may then as a visiting observer interview the actors who have participated, asking about their experiences of the action. According to Ghauri and Grønhaug (2005:109), in business studies "... *we normally use techniques such as structured, semi-structured or unstructured interviews, surveys and observations*". "*Typically the academic (accounting) literature has merely analyzed and interpreted the innovations constructed elsewhere after the fact*" (Kasanen, Lukka, & Siitonen, 1993:243). Research can also be initiated before a process or in the middle of the process. If the process can be identified before the action commences, the action research approach is suitable (Lewin, 1946).

In this second approach, the researcher can participate in the process and gain his/her own experiences. The researcher will be an observer with only modest involvement in the action. A variant of action research is performed when the researcher constructs a solution to an identified practical problem and implements the solution within an organization (Kasanen et.al., 1993). In each of these approaches, the researcher participates primarily with his/her experience as a researcher.

A third approach is used when an actor in the selected process decides to report on the action in which he/she is going to participate. As an employee of the organization he/she then has to have the firm's authorization to report on the process after the action has ended.

A fourth approach is when the actor decides to report from the process when the action is finished (Eden & Huxham, 1996). In these last two approaches the researcher has to approach the academic community to obtain a sufficient insight about doing research to be able to report on the local action.

The research presented in Essay IV is not traditional research. Because the decision to carry out research was taken years after the development process began, the researcher cannot make use of the second or the third approach. The study will make use of the last approach. The researcher has, in a ten-year period, participated in a process (as a project leader and main

actor) of developing an advanced costing system in a university hospital. “*The focus in a longitudinal study is on changing, catching reality in flight*” (Pettigrew, 1990:268). Action and knowledge creation need not be separate worlds. In terms of (Hopwood, 2005:6), “*It is also a knowledge that emerges from those who both engage in and reflect on practice, where using knowledge follows the act of creating it*”. The research may partly be understood as an action research project, but a more appropriate label may be that it is an experience-based longitudinal case study.

To sum-up: this thesis consists of four separate studies with a variety of research approaches, research methods and data. This variety makes it difficult to discuss the relationship between the theoretical perspectives, methodology and data as one body. There is not one clear cut explanation of the conceptual or theoretical “glasses” that has been employed to organize and present the data of the thesis (Ghauri & Grønhaug, 2005). Such a discussion may be more easily carried out related to each study. The next chapter will present the findings of from the four studies.

4 Findings

This chapter will present a summary of the essays with special emphasis on the main findings from the literature review (4.1) and the three empirical studies (4.2 - 4.4).

4.1 Costing systems in healthcare: A literature review

The research question of this study concerns what the scientific accounting literature has published about the design and use of costing systems in hospitals and healthcare. Ten international scientific accounting journals were searched for articles about “*hospital*” and “*health care*”. This search process resulted in 62 relevant articles, which were classified and analyzed (Shields, 1997). Three conclusions were reached.

The first conclusion from this study is that costing systems involving the Diagnosis Related Groups (DRG), and particularly the use of funding systems involving DRG-prices, have received much attention.

The second conclusion is that there has been little focus on the design and use of local costing systems.

The third conclusion is that case studies have reported that the introduction of the new cost information has had unintended consequences for the control of the hospitals.

The main finding of this study is that, to a great extent, accounting researchers have focused on national costing systems and the use of national prices to allocate resources to hospitals. Little attention has been paid to local costing systems in hospitals.

This review suggests the need for rethinking the conventional studies of healthcare practices. We know little about the actual design and use of costing systems at the local level. There is a need for more empirical studies of these topics.

4.2 National prices and local cost estimates in a university hospital: A correlation analysis

The research question in this empirical study considers to what extent there is coherence between national prices and local cost estimates. The theoretical frame of reference for this study is Cooper and Kaplan's ideas of measuring the resource consumption in great detail in order to improve local decision making (ABC) (Cooper & Kaplan, 1988) and Llewellyn and Northcott's discussion of the possible dangers to hospital life of the use of national average costs (Llewellyn & Northcott, 2005). An empirical study was carried out at a Norwegian university hospital (tertiary care). This involved the construction of local ad-hoc cost estimates and comparing these estimates with the corresponding national prices. A statistical analysis was carried out. The study led to three conclusions.

The first conclusion is that there was low correlation between the national prices and the local cost estimates.

The second conclusion is that much of the variation was explained when using categorical cost estimates. Categories of hospitals (primary – secondary – tertiary care) may reflect a different cost structure than the national average.

The last conclusion is that local product cost information may be one important input to ascertain profitability or loss and to provide a basis for exploring alternative actions and consequences.

The main finding of this study is that the statistical analysis showed that there was low correlation between the national prices and the local cost estimates.

This quantitative analysis of an explicit relationship has illustrated that hospitals with a low correlation between national average prices and local cost estimates may benefit from having a local costing system. This finding may motivate further studies on the design and use of local costing systems in university hospitals.

4.3 Cost accounting in Nordic university hospitals

The research question in this third study focuses on the actual design and use of cost accounting systems in major Nordic hospitals. The theoretical frame of reference of the study focuses on the link between the cost accounting data and the management control system in a hospital (Anthony & Young, 2003; Horngren et.al., 2009; Kjøllesdal, Essay I). A comparative case study of Nordic university hospitals was conducted to address the research question. This led to three conclusions.

The first conclusion is that there is diversity in how the hospitals design their cost accounting models.

The second conclusion is that the different configurations seem to form different “packages” with distinctive characteristics. On the one extreme, rather simple systems are designed as more mechanistic and arbitrary allocation models. In other cases more advanced tools are used for planning, allocating resources and to measure performance.

The third conclusion is that we have observed on a more speculative basis a link between the design and use of systems and the funding model.

The main knowledge gained from this study is that a university hospital may have a mix of cost accounting models and that one of these costing systems may be advanced. Some hospitals calculated the local standard cost per service by an advanced costing system.

These findings motivate rethinking of traditional contingency studies and suggest that the link between overall governance and management accounting in the public sector context should be given more attention. We have seen the importance of funding and governance and their impact on the design and use of management control systems.

One important observation is that a major university hospital can manage and survive with a very simplified version of actual cost information⁸. In such a version only volumes and total costs are used and compared to the budgets. Arbitrary allocations seem to be handled by ad-hoc procedures of “taking back” surpluses and by subjective assessments for block-grants. Compared with the other Nordic hospitals, the hospital with the simplified and arbitrary system is a success story in terms of growth and increased resources. The rationale for not using advanced systems in rich organizations should be addressed by further research.

Another observation is the adoption of more advanced systems, but not using these systems to control the local activity as observed at one of the investigated hospitals (Karolinska)⁹. Attention is given to increased resources in all the cases, but only two of them use local cost information on services and patients to control the activity. At Karolinska increased resources were not linked to systems for services or patient costs. Other types of use do not seem to be strong enough to legitimize the systems. This observation suggests that more research attention be given to the hierarchy of multipurpose systems, for example, costing systems.

Two of the cases seem to be strongly informed by their advanced costing systems¹⁰. In both cases, they also seem to be well-controlled in terms of keeping spending within their budget limit (a surplus). We do not claim that there is a cause and effect relationship between the use of more advanced systems and financial performance or control. Yet in both cases the systems are used to control activity, and they clearly inform decision making in the organization. This link between actual decision making and cost accounting information should be given more attention.

4.4 Developing an advanced costing system in a university hospital

The research question in this final empirical study is: What factors influence the process of developing an advanced costing system in a university hospital? The theoretical frame of reference is based on Bjørnenak and Olson’s (Bjørnenak & Olson, 1999) ideas of design elements in a management accounting model and Datar and Gupta’s (Datar & Gupta, 1994)

⁸ Haukeland, Bergen, Norway

⁹ Karolinska, Stockholm, Sweden

¹⁰ Rigshospitalet, Copenhagen, Denmark and the HUS-organization, Helsinki, Finland

model of errors in a cost model. Possible lessons learned from the described process are discussed in terms of Mellemvik et.al.'s (2005) model of the accounting process. The study can be characterized as action research and an experience-based longitudinal case study. Three conclusions were made.

The first conclusion from this study is that two main forces influenced costing system development: new goals for development and the ambition to reduce errors in the costing system. Both these sources for change in costing system design resulted in an increase in the size and the complexity of the system.

The second conclusion is that increasing the system size by including more details resulted in new errors. In addition during the process, the researcher's insight into costing system design in hospitals also increased, and solutions to correct these new errors were found by adding new details.

The third conclusion is that these forces resulted in new development initiatives and new versions of the system. The development process became incremental. The CEO was not willing to reduce the ambitions for the use of the costing system. Both the process and the costing system had become irreversible.

The main finding from this study is that the studied process can be summarized as an incremental and irreversible development process, due to changes in the intended use of the costing system, the ambitions related to reducing errors in the system and other, external, factors. Consequently, the size and complexity of the system increased during the process.

To analyze the development process was an opportunity I faced after the process had started. The applied research method may have influenced my conclusions. Consequently another research design (for example, action research) may improve our understanding of the process of developing advanced costing systems in hospitals.

5 Discussions

The specific aim of this thesis is to enhance our understanding of the design and use of costing systems in university hospitals which represent a large and complex local level in a healthcare system. This thesis has placed a special emphasis on Nordic university hospitals.

We have seen that the investigated hospitals, in a context of NPM-reforms, have developed different mixes of costing systems. In section 5.1 the new insights will be formulated and linked to the literature. The scientific contributions may also have practical implications. Possible managerial contributions will be indicated in section 5.2.

5.1 Scientific contributions

The main contributions from this thesis are empirical rather than theoretical. Three empirical studies and one literature review study have been conducted. In this section the scientific contributions from this thesis will be formulated.

We know that costing and cost management have not been the focus of much public sector management accounting research (van Helden, 2005). Van Helden (2005) concludes that there still remains a general gap in the knowledge of the effectiveness of the newly adapted accounting techniques. The review of the scientific accounting literature supplements van Helden's conclusion by pointing out that the design of local costing systems in hospitals has not been the focus of many accounting researchers (Kjøllestadal, Essay I). The main focus has been on costing systems placed central in healthcare systems and the effects of their use. Because this is the only literature review in the actual area, we label the contribution "the *literature gap-contribution*".

Accounting researchers have pointed out how national average prices may promote "*averageness as an ambition for the hospital as a social institution*" (Llewellyn & Northcott, 2005:567). This thesis has provided empirical evidence of a low correlation between cost estimates from costing systems placed centrally and those placed locally in a healthcare system (Kjøllestadal, Essay II). No previous analysis has been made of the explicit relationship between national price and local service cost (Kjøllestadal, Essay I). This thesis has also provided empirical evidence of the dilemmas in the local control of a hospital when promoted (financed by national average prices) to be cost average (Kjøllestadal, Essay II). This is labeled "the *price-cost low-correlation contribution*".

The need for more refined costing data has been argued, but low adoption rates of more advanced costing systems are still observed (the ABC-paradox) (Gosselin, 1997). This is well known from the business sector (Gosselin, 2007). Low adoption rates of advanced costing

systems in American hospitals have been reported (Hill, 2000). This thesis supplements the literature by providing empirical findings which indicate advanced costing systems in some Nordic university hospitals (Kjøllesdal, Essay III). In addition, Abernethy and Chua (1996) have reported that reforms (involving, for example, DRG-prices) forced an Australian hospital to change its control-package. This seems to be consistent with the findings of this thesis in the sense that different external funding models may form different control systems within hospitals (Kjøllesdal, Essay III). While reading the literature one may get the impression that cost accounting models are similar across hospitals and contexts (Kjøllesdal, Essay I), the Nordic study indicates that complex hospitals have a mix of costing systems in packages and that the use of particular costing systems may vary even within similar political contexts (Kjøllesdal, Essay III). This is “the *costing system mix*-contribution”.

In a hospital setting detailed costing represents collecting the costs of treating every patient (Abernethy & Chua, 1996; Jarvinen, 2006; Lowe, 2000). The design elements of such costing systems have not been reported in the literature (Kjøllesdal, Essay I). The design elements are important when evaluating whether a costing system and its use is advanced (Bjørnenak & Olson, 1999), but we know that detailed costing systems in hospitals have been thought to be complicated and expensive to develop and maintain (Jones, 1999b; Llewellyn & Northcott, 2005). This thesis supplements the literature by describing the elements of an advanced costing system in a university hospital. In Essay II the detailed costing of one particular hospital service is illustrated. In Essay IV the process of increasingly more detailed costing of the many services of a complex hospital is analyzed. In addition, Essay IV illustrates that the change of the design elements of a costing system is contingent on more factors than have been previously examined in the literature (Bjørnenak & Olson, 1999; Datar & Gupta, 1994). These factors may influence the design process so it becomes incremental and irreversible and thereby resulting in an increasingly larger and irreversible costing system. This is “the *development*-contribution”.

5.2 Managerial contributions

This thesis has focused on complex hospitals. Some of the hospitals that have been investigated are *very* complex organizations. The conclusions made in this thesis thus apply to very complex hospitals. The research site in Essay II is among the most complex hospitals in Norway. In Essay III the largest and most complex hospitals in the Nordic countries were

investigated. The selected Norwegian hospital in Essay III is also a complex hospital. The research site in Essay IV is the same as that in Essay II. This should be kept in mind when practical consequences of the findings are investigated. It may be the case that the conclusions of this thesis also apply to hospitals with less complexity.

It is important to understand that national average prices (for example DRG-prices) do not reflect the local costs of very complex hospitals. The use of national average prices for financing very complex hospitals, and in particular, for allocating resources to units within a very complex hospital, may introduce dilemmas concerning what these prices represent in the control of the hospital or the internal unit. Despite this, national average cost (for example, per DRG) may in a hospital with less complexity represent useful cost information in managing the hospital. This study has indicated that a very complex hospital may benefit from developing its costing systems and in particular by designing a process-costing system that calculates the local standard cost per service. Such changes may provide better insight into the transactions related to each patient's contact with the hospital. Local cost information may provide a basis for better understanding the funding system and its relationship with the hospital's cost structure. This may also be an important input to the local budget control process, providing a basis for exploring alternative actions and consequences.

The findings from this thesis indicate that a local costing system seems to be a central element in changing the mix of cost accounting models and thus the management accounting praxis in very complex hospitals. Two of the Nordic university hospitals that were investigated had found it useful to develop their mix of cost accounting models towards an advanced package. The thesis may indicate a general direction for management accounting system development in very complex hospitals. I have not, however, investigated the mix of cost accounting models in hospitals with less complexity. Such hospitals may not need to develop an advanced package. The purpose of the use of the system should direct the management accounting system development (Bjørnenak & Olson, 1999).

Yet if one develops a local costing system in a very complex university hospital, there are challenges related to the design process. This thesis has provided findings from a process of developing an advanced costing system in such a hospital. Many forces may drive the design process. The design process is surrounded with uncertainty. There is a danger that the system becomes too large. The design process, as well as the costing system, may then become

irreversible. Such design processes should therefore be given particular attention and careful consideration; otherwise there is a risk of only increasing the indirect costs (Olson et.al., 2001). I have not yet investigated how such a development process can be conducted at a less complex hospital.

6 Suggestions for future research

The Nordic study indicates that complex hospitals have a mix of costing systems in packages and that the use of particular costing systems varies even within similar political contexts. This central finding from this thesis motivates a formulation of two proposals for further research. The perspective is lifted from a consideration of costing system to the mix of costing systems, from the mix of costing systems to effects of their use, and from focus on university hospitals to hospitals in general further extending the research scope by including the healthcare system-level. These concepts are wider than those focused in this thesis (Figure 1).

The financial results of the Nordic hospitals investigated in Essay III did vary. Two of the investigated hospitals, which had an advanced local costing system, had been operating with positive financial results for years¹¹. The cause and effect relationship for this is unclear at best. This motivates these follow-up questions: What is the relationship between a hospital's mix of cost accounting models and the financial results, for example, income¹²? Are there any explanations for the correlations between costing systems and financial control?

This thesis has indicated that the link between overall governance (of the healthcare sector) and management accounting (within a hospital) should be given more attention by research in a public sector context. Funding systems (for example, national DRG-prices) may influence the local design and use of management control systems. In a healthcare system-context this can be formulated as a research question: What is the relationship between the model for allocating resources to the hospitals and a given hospital's mix of cost accounting models?

The high level of financial resources involved when operating hospitals motivates investigation of these research questions. Healthcare systems are large hierarchical

¹¹ Rigshospitalet, København, Denmark & the HUS-organization, Helsinki, Finland

¹² Revenue – Expenses is Income. The concepts used in the public sector are surplus and deficit.

organizations involving many hospitals. One level is the operating level within the hospitals. Another important level is the hospital level. A third strategic level is at the level of the particular healthcare system. Both suggested research questions listed immediately above address the financial language within and between the different hierarchical levels in a healthcare system. The use of more relevant cost information may strengthen the processes of democratic governance of hospitals. To investigate whether the output from a hospital's mix of costing systems contains information that politicians, service recipients, providers and other actors can and may want to talk about is thus very important (Guthrie et.al., 1999). Previous research from a Norwegian context has indicated a need for developing such a language (Nyland & Østergren, 2008). The relationships formulated in the two research questions are thus important to explore.

Our two research questions can be addressed with a variety of qualitative research methods. Qualitative studies are useful when exploring complex social phenomena. Managing a public healthcare system represents such a complex social phenomena. Interpretive studies may enhance our understanding of the relationships one chooses to investigate (Jankowicz, 2005). Scapens (2006:10) argues that by spending a long time in organizations one may better capture the dynamics of processes in order to understand "*how management accounting practices evolve*". This motivates a qualitative research approach with the possible use of the case study method and longitudinal studies. A comparative study may help the researcher to become aware of important factors in the context that may influence the investigated relationships. The first of our research questions may best be addressed by making use of a longitudinal comparative case study. To investigate the second research question examination of one case - a healthcare system - is needed. A longitudinal case study may be a useful research method in this instance.

Essay I Costing systems in healthcare: A literature review

Abstract

The need for more advanced costing systems in the business sector has been advocated over the past 25 years. In the same period reforms involving the design and use of new costing systems have been introduced in public organizations including healthcare. When van Helden reviews public sector accounting research, he concludes that there still seems to be a general gap in the knowledge of the effectiveness of the newly adapted accounting techniques (van Helden, 2005). A natural follow-up question may be: Is this also the case for accounting research on the design and use of costing systems in healthcare and hospitals? The research question of this study is: What has been published in the scientific accounting literature about the design and use of costing systems in hospitals and in healthcare?

Ten international scientific accounting journals were searched for articles about “*hospital*” and “*health care*”. This search process resulted in 62 relevant articles, which were classified and analyzed. Three conclusions were reached.

The first conclusion from this study is that costing systems involving the Diagnosis Related Groups (DRG), and particularly the use of funding systems involving DRG-prices, have received much attention. The second conclusion is that there has been little focus on the design and use of local costing systems. The third conclusion is that case studies have reported that the introduction of the new cost information has had unintended consequences for the control of the hospitals.

The main finding of this study is that, to a great extent, accounting researchers have focused on national costing systems and the use of national prices to allocate resources to hospitals. Little attention has been paid to local costing systems in hospitals.

This review suggests the need for rethinking the conventional studies of healthcare practices. We know little about the actual design and use of costing systems at the local level. There is a need for more empirical studies of these topics.

1 Introduction

During the past 25 years public organizations have been introduced to innovations from the private sector where accounting “*plays a key role in these technical innovations*” (van Helden, 2005:99). This has meant the introduction of ever-more explicit cost categorization “*into areas where costs were previously aggregated, pooled or undefined*” (Hood, 1995:93). These changes came as a reaction to the previous decade’s expansion of government involvement in economic and social life. In the industrialized countries the healthcare-sector’s share of the gross domestic product has increased markedly¹³. This development has been driven by advances in technology, demographical changes and growth in national wealth (Schwartz, 1998). The expansion brought cost control issues to a prominent place on the public agenda in these countries. “*These developments have given increased standing to costs and to new systems and symbols of accountability within the public sector*” (Broadbent & Guthrie, 1992:4). This motivates a closer look at accounting research on the healthcare sector.

2 The research problem and research question

Costing techniques are important parts of cost accounting systems (Horngren, Foster, & Datar, 2000). “*A costing system accounts for costs in two basic stages - accumulation and then assignment*” (Horngren et.al., 2000:28). A cost model refers to a general scheme of how costs are accumulated and assigned (Arwidi & Samuelson, 1993; Bjørnenak & Olson, 1999). A costing system is a cost model that is installed within an organization, and any given model may consist of many sub-systems. The term “cost management” also includes the use of cost information. “*A product cost is the sum of the costs assigned to a product for a specific purpose*” (Horngren et.al., 2000:43). The application of the costing principles to the situation at hand is described as an “*art*” due to all the choices that have to be made when costing products (Demski, 1997:86). Thus, “*judgment is frequently required when measuring costs*” (Horngren et.al., 2000:41). The conventional wisdom of cost accounting is to assign “*different costs to different purposes*” (Horngren et.al., 2000:11). A more modern perspective is described as “*different systems to different purposes*” (Bjørnenak & Olson, 1999:334). Whatever the particular perspective, there is considerable ambiguity related to the design and use of costing systems.

¹³ In the US: 5.1% of gross domestic product in 1960; 17.4% in 2009: <http://oecd.org/health/healthdata>

The need for more advanced costing systems in the business sector has been intensely advocated during the past 25 years (Cooper & Kaplan, 1987; Cooper & Kaplan, 1988; Cooper & Kaplan, 1992; Johnson & Kaplan, 1987; Kaplan & Anderson, 2004). Product diversity and the increasing level of indirect costs have been used as arguments for more sophisticated costing systems. The intuitive argument is that estimates may be improved by identifying better cost drivers and increasing the number of cost pools. In their study, Abernethy, Lillis, Brownell and Carter inquired about the broad costing system design choices along three dimensions: the nature of the cost pools, the number of cost pools and type of cost pool (Abernethy et.al., 2001)¹⁴. They observed that, in general, advanced activity-based (ABC) systems have not been extensively implemented in business settings despite their proponents' active support (Abernethy et.al., 2001). The rate of ABC-implementation failures has been reported to be high (Anderson & Young, 1999; Gosselin, 2007).

Abernethy et.al. concluded that even in the private sector the relationship between the contextual factors and the characteristics of the product costing system are not well established (Abernethy et.al., 2001). Al-Omiri and Drury supported this conclusion (Al-Omiri & Drury, 2007). They observed that costing systems within business organizations vary in sophistication along a range of dimensions rather than between the discrete alternatives of ABC and traditional systems. *“This is surprising considering the vast amount of publicity given to developing more sophisticated product costing systems”* (Al-Omiri & Drury, 2007:400). If this is the case in for-profit companies, what is the situation in public organizations?

In public sector accounting research, the distinction “central – local” is important (Mellempvik et.al., 2005). The concept “*central*” often refers to the central government and its agencies (i.e., the entire healthcare system) while “*local*” may refer to municipalities or, for example, a single hospital within a healthcare system (Broadbent & Guthrie, 1992:8). The invention of the DRG-system, the introduction of new product costing systems placed centrally in healthcare systems¹⁵ and the subsequent introduction of new funding systems¹⁶ represents major changes in the costing systems in the healthcare sector (Preston, 1992; Samuel et.al.,

¹⁴ Activity vs. responsibility, single vs. multiple and whether the system had hierarchical cost pools.

¹⁵ Calculating the national average cost per service (e.g., per DRG).

¹⁶ As for example, prospective payment systems (PPS). I.e., the US Medicare program (for the elderly) introduced in 1983. www.cms.hhs.gov/home/medicare

2005). DRG-systems, often labeled “Case-mix systems”, are programs that group the medical coding of what has been done with the patient along with administrative data into one so-called resource homogeneous patient-group (DRG) (Fetter & Freeman, 1980). The DRG-system has been adapted to the national circumstances throughout the world¹⁷. In the UK they have developed an alternative: the Health Resource Group-system (HRG¹⁸). A costing system placed centrally in a healthcare system may calculate national average service costs for many purposes such as formulating health policy, funding and benchmarking. A national costing system may consist of many sub-systems making use of data from local hospitals. A local costing system makes use of a national or a local costing model with local data. In hospitals one may thus find both local costing systems (local data) and funding systems (national average costs).

When reviewing public sector accounting research, van Helden concludes that there still seems to be a general gap in the knowledge of the effectiveness of the newly adapted accounting techniques (van Helden, 2005). In particular, “*issues related to costing and cost management are less intensively researched*” (van Helden, 2005:113). A natural follow-up question may be: Is this also the case for accounting research in healthcare and in hospitals? This motivates a closer look at cost management in hospitals and in the healthcare-systems where hospitals operate. Reviewing the literature is a natural first step in a research process. My research question is: What has been published in the scientific accounting literature about the design and use of costing systems in hospitals and in healthcare?

The next section will describe the chosen research method of this study. The data will then be presented and the features of the literature classified and analyzed. The conclusions from the study and the suggestions for further research will be presented.

3 Method

This section will describe the procedure for addressing the research question. A scheme for classifying articles will be applied. The selection of the dimensions in this scheme, type of research publications, journals and relevant articles will be described (Ch. 3.1-4).

¹⁷ The DRG-family: <http://www.fischer-zim.ch/textk-pcs/index.htm>.

¹⁸ The HRGs aggregates clinical activities by procedures. The DRGs do this by diagnosis.

3.1 The selection of a classification scheme

A review of scholarly literature may be carried out through a variety of strategies. Some researchers do not use a classification scheme. This strategy may be a valuable approach in some instances, but it has been criticized (Broadbent, 1999; Guthrie et.al., 1999). Other reviewers find it useful to employ classification schemes (Mellempvik et.al., 2005; Scapens & Bromwich, 2001; Shields, 1997; van Helden, 2005). A classification scheme may be viewed as the lens the researcher employs to organize and present the data (Ghauri & Grønhaug, 2005).

Within the field of management accounting, one large review (152 articles) of North American research was conducted on articles that were published in six journals in the 1990s (Shields, 1997). Shields made use of a classification scheme with the main criteria: topics, research settings, theories, research methods and results. These criteria were organized into sub-criteria. An argument for choosing Shields' scheme is that others have applied it. Scapens and Bromwich used Shields' scheme and classified 178 articles from the first 10 years (1990-2000) of the journal *Management Accounting Research* (Scapens & Bromwich, 2001). They made use of Shields' main criteria, but introduced some deviations to the sub-criteria. The Scapen and Bromwich findings were contrasted with Shields' results. Shields' framework has been further refined (van Helden, 2005). Van Helden examined the role of management accounting in public sector transformation, as evidenced in 55 articles in international accounting journals during the years 1999-2001. Mellempvik, Gårseth-Nesbakk and Olson presented the dominating trend in all the peer-reviewed published research of Nordic accounting scholars in the period 1980-2003 (Mellempvik et.al., 2005) and related this research to the ideas of New Public Financial Management (Olson et.al.,1998)¹⁹. Table 1 illustrates the criteria used by Shields, Scapens and Bromwich, van Helden and Mellempvik, Gårseth-Nesbakk and Olson.

¹⁹ Fifty articles published in 6 international scientific journals and 31 PhD-dissertations.

The main criteria	Sub- criteria	Shields, 1997	Scapens & Bromwich, 2001	van Helden, 2005	Mellembvik et.al., 2005
Journal	Name				X
	Publication year		X		X
Researcher	Location (nationality)		X		X
	Gender				X
Settings	Country where the research is done			X	
	Year when the research started				X
	Business branches / public sectors	X	X	X	X
	Level within the public sector				X
Topics		X	X	X	X
Theory	General theories	X	X	X	X
	More specific theories			X	
Research methods	Standard categories	X	X	X	X
	Other categories			X	
Results		X		X	X

Table 1 The classification schemes of relevant comparable reviews

When the purpose of reviewing the literature is *exploration* some find it useful to define the general criteria and describe what is encountered in the papers (Mellembvik et.al., 2005). Exploration is central in this study. When the purpose of the review also involves *contrasting* the findings with other studies a firmer definition of the classification scheme is useful (Scapens & Bromwich, 2001; van Helden, 2005). In terms of Scapens and Bromwich (2001:246) “*the categories used and the classification given to each paper are based on our readings of the papers, and as such are somewhat subjective*”. There is thus variation in how the researchers construct their categories. Table 1 illustrates that the researchers do not simply copy Shields’ classification scheme, but adapt it to their research question. This insight guided my decisions when constructing my classification scheme.

The editorial style differs between journals. This may influence the reported research. The “publication year” may give an indication of the distribution of the papers and focus on specific topics during the chosen time period. The research question of this study does not involve a focus on individual researchers. The criterion is thus not relevant. “Settings” are the next main criteria. The “country where the research is done” may be relevant to identify. The “year when the research started” is not. All the reviews referred to in Table 1 make use of “business branches/public sectors” as a sub-criterion. This study focus on one sector of the economy: healthcare. Unlike in the business sector, you may find costing systems at different “levels” (local – central) in the public sector. This may thus be a relevant sub-criterion. Yet “topics” is *the central* criterion of this study. It is divided into the sub-criteria: “design of costing systems” and “use of cost information”. Within the first group each article will be

classified into one of the sub-groups: “product costing issues”, “funding system issues” and “not specified”. The last group will be divided into the sub-groups including: “cost management”, “financing”, “benchmarking”, “other topics” or “not specified”. If additional topics are focused together with design and use of costing system, this will be presented. All the reviews referred to in Table 1 make use of the criterion “theory”. The articles will be classified as economics, organizational theory, sociology, other theories and no explicit theory. The criterion “research methods” will be divided into archival study, case/field study, survey, literature review, multiple methods and other methods. The last criterion “results” will be stated. Even though an article has been classified into one particular sub-group, there may be degrees of focus on the categorized subject. For example, a “funding system issues”-article may also focus on some aspects of a product costing system. My chosen classification scheme contains the main criteria: journal, settings, topics, theory, research methods and results.

This classification scheme was tested on all the relevant articles (7) from the journal *Accounting, Auditing and Accountability Journal*²⁰. The test revealed that the sub-criteria “use” needed a category for articles addressing financing *and* cost management. The category: “different purposes” was selected. The criterion “results” turned out to be difficult to handle. The reported results may not be relevant to the purpose of this review. The criterion “result” was thus excluded from the selected classification scheme. The final classification showed a need for some structure in the classification of the group of “other topics”. The majority of the articles were related to general “change” and “contracting”. The test also revealed that some articles addressed more than one criterion. Scapens and Bromwich and van Helden’s solution to this situation was to let the different numbers given a certain criteria to add up to 1²¹. Due to the low number of articles in this review, this approach will not be used. The selected classification scheme is presented in Table 2.

²⁰ Van Helden applied the same approach when he tested Shields’ categorization of criteria’s by a pilot study of 15 papers, randomly chosen from his research domain.

²¹ If two topics are addressed in the article, then each topic counts for 0.5.

The main criteria	Sub- criteria
Journal	Name
	Publication year
Settings	Country where the research is done
	Level in the healthcare system
Topics	Design of costing systems
	Use of cost information
	Other
Theory	
Research method	

Table 2 The selected classification scheme

3.2 The selection of type of research publications

All the reviews referred to in Ch. 3.1 focused on published articles. Mellemvik et.al. included PhD-dissertations. PhD-dissertations will not be included in this study because key findings from research normally later will be published in articles. Working papers or text-books could have been alternatives. Including working papers provides a more updated view on the research. The problem is to get a representative sample. Attending research conferences and getting hold of the relevant working papers is also a costly and thus a risky research strategy. One alternative – reviewing textbooks – would, however, not give an updated picture of the contemporary research within the field. This review will focus on published articles. The selection of journals to search for the relevant articles is the focus of the next section of this chapter.

3.3 The selection of journals

There are both national and international journals. The search will be restricted to articles written in English. This may favor research done by Anglo-Saxon researchers and represent a bias towards the challenges facing healthcare in Western countries. The challenges encountered in healthcare attract the attention from different scholarly societies in academia. Accordingly, one will find articles that use of cost information in healthcare in many journals representing many academic fields²². These journals may report interesting findings, but are not regarded as relevant in this review. Only accounting journals will be searched. Accounting articles may be published in the applied research and practice journals²³. The latter literature

²² For example, medical-, health policy- and health economics journals (i.e., *The Lancet*, *Health Policy* and *Health Economics*).

²³ For example, *Accounting Horizons*, *Journal of Cost Management*, *Management Accounting*, *Harvard Business Review*.

has also been excluded. The review will only include articles that have been through a peer review and published in international scientific accounting journals. These journals will have as the general purpose of their existence the goal of contributing to accounting theory. One way to select journals is to study other researchers' similar choices. This is the selected approach in this study. Four particular reviews have been the focus of this study. These reviews have been chosen because they are comparable. The journals that have been searched for these reviews are displayed in Table 3.

Journal		Published in country	Shields, 1997	Scapens & Bromwich, 2001	van Helden, 2005	Mellemvik et.al., 2005
Accounting, Auditing and Accountability Journal	AAAJ	AUS			X	X
Accounting Review	AR	USA	X			
Accounting, Organizations and Society	AOS	UK	X		X	X
Contemporary Accounting Research	CAR	CA	X			
European Accounting Review	EAR	NL			X	X
Financial Accountability & Management	FAM	UK			X	X
Journal of Accounting and Economics	JAЕ	USA	X			
Journal of Accounting Research	JAR	USA	X			
Journal of Management Accounting Research	JMAR	USA	X			
Management Accounting Research	MAR	UK		X	X	X
Scandinavian Journal of Management	SJM	S				X

Table 3 The journals searched for previous relevant reviews

Shields restricted his review to journals that were homogeneous regarding editorial styles and preferences. He also argued that there had been much overlap among these journals in the reviewers used in the process of selecting articles for publication. Given these criteria, the 6 journals seem to be obvious candidates for this review. Van Helden examined 5 accounting journals with only one overlap to those reviewed by Shields. Scapens and Bromwich focused on one journal. This journal was also included in van Helden's review.

Many management accounting researchers publish their research in the journal: *Financial Accountability & Management (FAM)*. This journal publishes research in governmental and other non-profit organizations and services. Hospitals are often large organizational units within the public sector. We thus would expect to find more papers focusing on hospitals in this journal than in general accounting journals. In FAM interdisciplinary in approach is emphasized. The journal includes contributions from economics, political science, social and public administrations, and management sciences, as well as accounting and finance. Van

Helden as well as Mellemvik et.al. included this journal in their reviews. Public sector accounting is of particular interest in this review. To investigate what accounting researchers have published about healthcare and hospitals is central in this study. This journal is thus included in my review. In contrast to *FAM Accounting Review (AR)* is a “pure” accounting journal publishing articles reporting the results of accounting research from all types of organizations. *Scandinavian Journal of Management (SJM)*, although not an accounting journal, represents a journal in which many Nordic accounting scholars publish their research. This journal has been excluded from this review because it is not an accounting journal. The selected journals are: *Accounting, Auditing and Accountability Journal (AAAJ)*, *Accounting Review (AR)*, *Accounting, Organizations and Society (AOS)*, *Contemporary Accounting Research (CAR)*, *European Accounting Review (EAR)*, *Financial Accountability & Management (FAM)*, *Journal of Accounting and Economics (JAE)*, *Journal of Accounting Research (JAR)*, *Journal of Management Accounting Research (JMAR)* and *Management Accounting Research (MAR)*.

3.4 The selection of articles

The first issue to address was what time-period to search. The context of this study is a research process in which this literature review is the first step. The time-period 1990-2007 has thus been chosen. The rationale for starting the search in 1990 is that the healthcare sector in many countries was subject in the 1990s to reforms involving costing techniques and the new use of cost information. By choosing this period the review may capture possible changes in the focused topics. The journal, *EAR*, started in 1992. Access to the journal *MAR* restricted the search (from 1995).

The second issue to consider was: which articles to include and exclude. Research articles and research notes have been included. Editorials, discussions, comments, reflections and replies have not been included.

The third issue was the selection of keywords. Having selected accounting journals “*costing system*” were not relevant keywords. “*Hospital*” and “*health care*”²⁴ are. The first search of “*hospital*” provided 207 hits. The second search with “*health care*” provided 168 hits. Reading the title of an article is a procedure referred to as “*manual*” (Mellemvik et.al.,

²⁴ Applying Elsevier Science Direct-, EBSCO-EJS-, Blackwell Synergy-, Emerald- and ProQuest- databases.

2005:302). A manual search of the titles revealed that 117 articles appeared in both searches. The search thus resulted in 258 articles. Healthcare includes a wide range of topics from general practitioners to psychiatric hospitals. The search also resulted in articles that used healthcare as an illustration but not as the focus of the research. The outcome from this manual procedure motivated to take a second manual look at all articles (4.342). This resulted in 15 new articles. Next the abstract of the selected articles was read in order to ensure the articles focused costing system design and use. This reduced the number of articles to 72. When in doubt the article was read. This process finally resulted in 62 relevant articles (Appendix 1). Table 4 displays the results of the procedure.

Journal	Access from	Articles in total (1)	Search of databases (2)	Search title by title (3)	Articles related to healthcare (4)	(4) as % of (1)	The relevant articles (5)	(5) as % of (1)
AAAJ	1990	473	25	9	34	7 %	6	1,3 %
AR	1990	635	6	1	7	1 %	3	0,5 %
AOS	1990	614	18	1	19	3 %	9	0,5 %
CAR	1990	476	2	0	2	0 %	2	0,4 %
EAR	1992	443	9	1	10	2 %	1	0,2 %
FAM	1990	356	171	0	171	48 %	24	6,7 %
JAE	1990	439	4	0	4	1 %	2	0,5 %
JAR	1990	484	3	0	3	1 %	2	0,4 %
JMAR	1990	160	6	2	8	5 %	4	2,5 %
MAR	1995	262	14	1	15	6 %	9	3,4 %
Total		4.342	258	15	273	6 %	62	1,4 %

Table 4 The number of articles in the chosen journals step by step

4 The categorization of the findings

The purpose of the classification of the articles is to give “*an indication of the overall nature*” of the selected articles (Scapens & Bromwich, 2001:246). This represents only one description of the research and because of this, is vulnerable to the choices made to categorize the articles. The classification of each article is based on one researcher’s work (Appendix 2). The classification is thus subjective and the number of articles low. Both factors may reduce the validity of the data. This is no unique situation. “*In any categorization scheme there is a potential difficulty in “fitting” some work neatly into the scheme*” (Broadbent & Guthrie, 1992:5). Caution should thus be taken when conclusions are reached from the findings. This applies particularly to any possible cross-sectional relationships.

The data will be presented according to the criteria: journal and publication year, topic: costing system design issues & use of cost information, theory and research method (Ch. 4.1–4.5). The criterion “*setting*” with the sub-criteria “*level in the healthcare system*” will be useful to ascertain the level in healthcare systems on which the article has focused. This study has a particular focus on design and use of costing systems in hospitals and healthcare. This makes the criterion – Topic – *the* central focus of this study. The text will reflect this. The criteria theory and research methods are interesting, but will not be extensively explored. Yet the findings will be presented and compared with other studies (Scapens & Bromwich, 2001; Shields, 1997; van Helden, 2005). The motivation for this approach is that many of the articles reviewed in this study are included in these reviews. The central findings on these two criteria (i.e., theory and research methods) may thus already have been reported in the literature. A summary of the findings will be provided (Ch. 4.6).

4.1 The distribution of relevant articles: journal and publication year

The distribution of the relevant articles according to journal and publication year is shown in Figure 1.

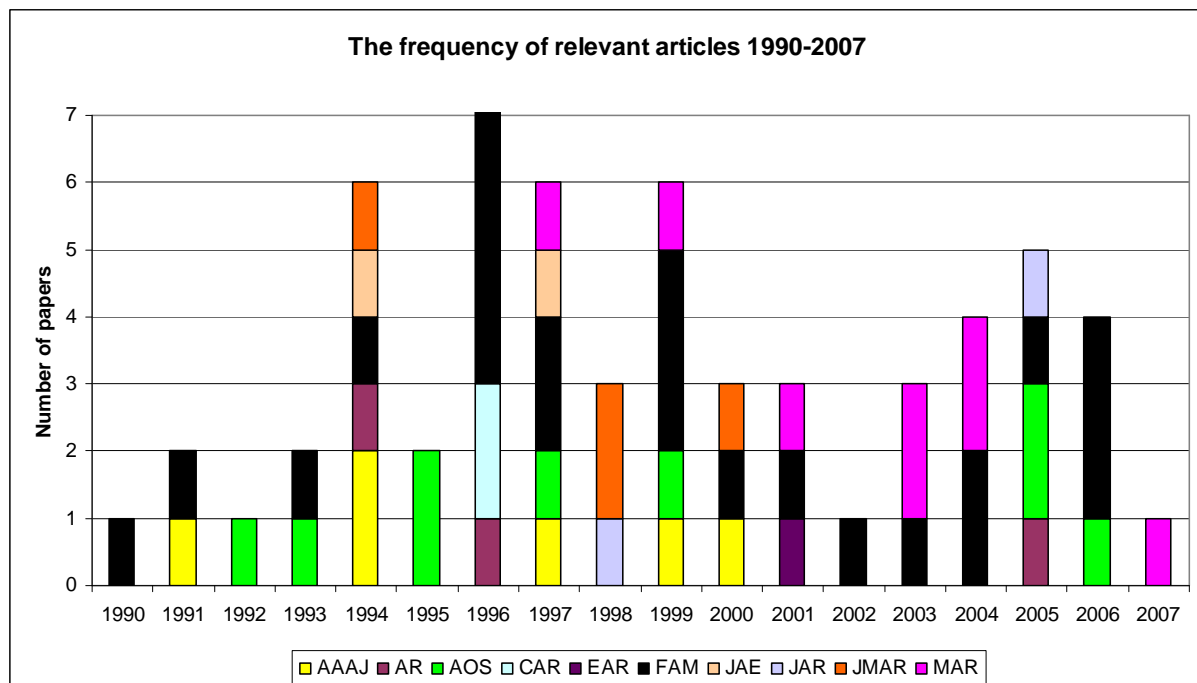


Figure 1 The distribution of the articles according to journal and publication year

The focus on healthcare increased during the 1990s and decreased upon entering the new century. The number of relevant articles then had a new high in 2005. On the average 3.5 relevant articles have been published every year. AAAJ published 6 relevant articles in the 1990s, but no relevant articles during the last 7 years. AOS has had a steady publication rate of close to 1 relevant article every second year. My access to MAR was from 1995. This journal published 10 relevant articles over the next 13 years. FAM published approximately 1.5 relevant articles per year in the chosen period. Together these four journals contribute with 78% (48) of the relevant articles. This is about 3% of the published articles in these journals (Table 4). The focus on hospitals in the rest of the journals is more than 5 times lower.

4.2 Topic: design of costing system issues

Each article has been classified into one group of general “design of costing systems”- issues. The results are displayed in Table 5.

Design of costing systems	Focused level in the healthcare system;			TOTAL	%
	Central	Both	Local		
Product costing issues	2	9	8	19	30,5 %
Funding system issues	4	11	9	24	39 %
Not specified		8	11	19	30,5 %
TOTAL	6	28	28	62	
%	10 %	45 %	45 %		100 %

Table 5 The distribution of articles into the sub-criteria of “design of costing systems”

The majority of the research has focused on local (45%) and both (45%) levels in healthcare systems. Funding system issues have attracted much attention (39%). The rest of the articles have been classified into product costing issues (30.5%) and not specified (30.5%). The category “Topic – Other” is used to structure the presentation. Articles will be presented as examples of the issues that have been focused on.

Product costing issues

Five articles have been classified as focusing on *cost drivers* in healthcare. Noreen and Soderstrom investigated if overhead costs are strictly proportional to activity (Noreen & Soderstrom, 1994)? Using cross-sectional data from Washington State hospitals, they indicated that the average cost per activity on the average overstated marginal costs by about 40% and in some departments by over 100%. The authors caution against the dangers of

making use of simplistic costing systems. The average cost per activity should be used with a great deal of caution in decisions. Balakrishnan, Gruca and Nath investigated the effect of service capability (i.e., complexity of operations) on operating costs (i.e., in surgery, laboratory and laundry) (Balakrishnan, Gruca, & Nath, 1996). Complexity was found to be a significant determinant of overall operating costs. MacArthur and Stranahan investigated the drivers of overhead costs as volume and complexity variables in hospitals (MacArthur & Stranahan, 1998). In the study, complexity was identified in terms of “breadth” (i.e., number of services provided) and “depth” (the intensity of individual services). Both volume and complexity were reported to be significant drivers of hospital overhead costs. In a field experiment Maher and Marais investigated how a change in anesthetics would reduce the demand for nursing services in the recovery room of a hospital’s outpatient surgery facility (Maher & Marais, 1998). The results indicated that conventional costing understates and linear ABC overstated the estimated saving in expenditures on nursing services. In a study making use of data from a small German hospital, possible learning effects in knee surgeries were investigated (Ernst, Ernst, & Szczesny, 2003). Procedure time was used as a cost driver for procedure cost in an ad-hoc costing model. Reduced operating time (a small learning effect) and less complication were identified. One characteristic of these studies was a research strategy involving the use of an archival research method. Another characteristic was the use of economic theory to explain the findings. A third characteristic was that all studies, except one, originated from a North American setting.

Three articles were categorized to focus on *cost allocation* and *cost behavior*. Eldenburg and Kallapur investigated how Washington State hospitals responded to changes in hospital reimbursements (1983) (Eldenburg & Kallapur, 1997). The change involved fixed rates for in-patients and reimbursement based on reported costs for the out-patient activity. The hospitals changed their patient mix and cost allocations to maximize hospital cash flows. Balakrishnan and Soderstrom investigated if congestion in the system (proxy: the rate of Caesarian sections in maternity wards) may lead to expense (prevents timely processing of jobs) (Balakrishnan & Soderstrom, 2000). Their findings from Washington State hospitals indicated that there was no overall effect of congestion, however, they found a significant effect for the “at risk” patients (those for whom physician discretion was highest). Kallapur and Eldenburg also made use of data from Washington State to investigate how hospitals responded to changes in their regulatory environment (Kallapur & Eldenburg, 2005). Real-option theory suggests that increased uncertainty leads firms to prefer technologies with low-fixed-and-high-variable

costs. The evidence supported this proposition. They also argued that cost behavior (fixed/variable) was not fully determined by technology but subject to managerial actions that was affected by uncertainty. These studies used an archival research method and economic theory, and they originate from a North American setting.

There is one article addressing, on a general level, the *potential for the ABC method in healthcare* (King, Lapsley, Mitchell & Moyes, 1994). The authors conclude that such a complex production environment favors the use of more sophisticated costing models.

Ten articles have been categorized into the group: product costing issues and contracting, change and no particular product costing design issue. A common characteristic for these studies is that they only refer to product costing systems. The main focus in the articles is use of cost information.

Funding system issues

Twenty-four articles have been classified as focusing on the following topics: *change* – 8 articles, *contracting* – 6 articles, *no particular funding system issue* – 9 articles and 1 *cost driver* study. A common feature of these studies is that they discuss various aspects of the introduction of new funding systems in healthcare - not the funding system per sé. One motivation for this is provided by Krishnan: the data is difficult to obtain (Krishnan, 2005). One article provides a brief introduction to the Yale Costing Model (YCM²⁵) when studying the introduction of a new funding system in Australian hospitals (Chua, 1995). The use of the length-of-stay and service weights per general hospital service (i.e., radiology), are the key elements when allocating costs to the individual DRG. This model uses number of patients' pr DRG and patient days as cost drivers. One article has been categorized as focusing on funding system issues and *cost drivers* (Hwang & Kirby, 1994). Hwang and Kirby investigated possible distortions in Medicare reimbursements. The in-patient costs of the hospitals that were investigated were driven by multiple drivers (number of patients and patient days), but these were allocated and reported based on a single cost driver (patient days). The study cautions against the use of simple costing systems as a basis for financing hospitals. It will lead systematically to reimbursement cross-subsidizations between insurers.

Not specified

The categorization of the articles have given the following results: *change* – 2 articles, *contracting* – 6 articles and *no particular costing system issue* – 11 articles. These studies discuss various aspects of the use of cost information in healthcare. This will be the focus in the next section of the chapter.

4.3 Topic: use of cost information

The articles have also been classified into one sub-criterion within the topic: “use of cost information” (Ch. 3.1). The results are presented in Table 6.

Use of cost information	Focused level in the healthcare system;			Number of articles	%
	Central	Both	Local		
Benchmarking	1	3		4	6 %
Cost management	1	4	9	14	23 %
Financing	2	3	2	7	11 %
Different purposes	2	15	12	29	47 %
Not specified		3	5	8	13 %
TOTAL	6	28	28	62	100 %

Table 6 The distribution of articles into the sub-criterion of “use of cost information”

When studying use of cost information, the researchers have focused primarily on “different purposes”. 47% of the papers have this double focus²⁶. If all articles focusing on one or both of these areas of use are included, 81% of the articles are captured. 6% of the articles have focused on benchmarking, and 13% of the articles have not specified a particular use of cost information. The focused level in the healthcare system (central – both – local) and the selected sub-criteria (for example, benchmarking) will be used to structure the presentation. Articles will be presented as examples to illustrate the research.

Six articles have been classified as focusing on use of cost information at *central* levels in healthcare systems. Llewellyn and Northcott discuss the dangers of benchmarking the activities and processes of hospital life and how these “*becomes average*” as they are transformed to comply with a national cost accounting average (Llewellyn & Northcott, 2005). Other researchers have discussed possible distortions from using a too simple cost model when calculating the national average cost of health services (Hwang & Kirby, 1994;

²⁵ A top-down costing approach allocating cost to individual DRGs (invented in the 1970s).

²⁶ A focus on both cost management & financing.

Noreen & Soderstrom, 1994). Inequities in absolute and relative levels of reimbursement have been reported (Hwang & Kirby, 1994). Accordingly, accounting choices are important: “because of the large absolute level of healthcare expenditures, even small percentage changes may produce significant economic consequences” (Hwang & Kirby, 1994:128). The use of national average costs as prices has been labeled “government at a distance” and as a technique of rationing healthcare (Preston et.al., 1997). Possible effects on financing and cost management when introducing funding systems have been reported (Abernethy & Stoelwinder, 1995; Chua, 1995). Researchers have reported that the role of professional control was challenged when a new funding system was introduced in Australian hospitals (Abernethy & Stoelwinder, 1995).

Twenty-eight articles have been classified focusing *both* levels in healthcare systems. Three articles focus on *benchmarking*. Jones discussed possible effects of the “New Labour” reform (Jones, 2002). He concluded that the national reference costing initiative was more suited to the formulation of macro healthcare policy than to facilitate meaningful change at grass roots level. Researchers have reported that the variances of the reference costing index within the NHS have been great at both the hospital and the HRG-level (Northcott & Llewellyn, 2003). The absence of a standard, a non-comparability of many hospitals and a lack of standardization in costing practices may explain these variances. “The ladder of success” indicates that the “average hospital” does not exist (Northcott & Llewellyn, 2003). Banker, Chang and Das argues that there is a need for a model (Stochastic Data Envelope Analysis) for estimating benchmarks of hospital services (Banker, Chang, & Das, 1998). These standards should not be average, nor best practice frontier, but attainable when benchmarking against best practice organizations.

Another 3 articles focus on the *financing* of hospitals. The studies caution that a change in regulatory incentives imposes changes in hospitals. At the outset of the NHS-internal market reforms, it was argued that both purchaser and provider should be interested in new cost information (Bryan & Beech 1991). Researchers have concluded that after 1983 US hospitals changed their patient-mix and cost allocations to maximize hospital cash flow (Eldenburg & Kallapur, 1997; Forgione, Vermeer, Surysekar, Wrieden & Plante, 2005).

Four articles focus on *cost management*. The introduction of new costing systems in market-based reforms has been the subject of study in various geographical settings. Eldenburg concluded that price information was not enough to manage the cost of treatment (Eldenburg, 1994). To align hospital and physician goals around cost management became more important

than it had been prior to 1983, when Medicare-PPS was introduced. Eldenburg reported that provision of physicians with their own case costs and some comparison information had a significant effect on hospital costs. Krishnan reported from California hospitals that there was a positive association between the demand for accounting information and price-competition (Krishnan, 2005). When hospitals compete on quality, there was no such association. The motivation for introducing local cost information may vary. The introduction of prices generated different responses (legitimizing and economic purposes) in hospitals regarding the adoption of local costing systems (Jarvinen, 2006). Arai reports from Japan that hospitals have been reluctant to implement local costing systems due to doubts over its cost-effectiveness and medical staff indifference (Arai, 2006). Cost information was confined to top executives and mainly used for examining department profitability.

A majority of the articles (15) focus on *different purposes*. Preston reviewed the literature on the birth of clinical accounting in US hospitals (Preston, 1992). The potential for case-mix accounting systems to penetrate and alter the internal operating processes of hospitals has been reported (Covaleski et.al., 1993). Rea questioned if better information of the cost on the individual patients will lead to better resource management in the NHS (Rea, 1994). Ellwood investigated how the NHS internal market operated after a “market-based reform (Ellwood, 1996b). *“The reality appears to be similar to that found in many industrial markets. Contracts are negotiated and long term relations developed. Appropriate market incentives do not exist to ensure that economic efficiency is facilitated through the price mechanism”* (Ellwood, 1996b:300). Jones reported that the development of the costed HRGs has been a step forward in understanding how costs are incurred (Jones, 1999a). Full-cost estimates may be a basis for directing attention. Jones point out that it is disaggregated accounting information and the study of the cost implications that may release improvements in cost/quality (Jones, 1999a). Charpentier and Samuelson studied a PPS-reform in a Swedish county (Charpentier & Samuelson, 1996). The politicians were faced with challenges to reduce the physical capacity. This type of decision-making turned out to be difficult. The politicians solved the problem by asking the hospital to save money, but they gave no instructions how this should be done. Kurunmaki reported from the market-based reforms in Finland in the 1990s (Kurunmaki, 1999). *“Ways of thinking, talking and acting within health care settings had altered. ... Cost accounting ... had established its position in hospital life”* (Kurunmaki, 1999:122). Carey and Burgess reported on a process of changing how the US Veterans Health Administration allocated costs from central levels to specific patient programs (Carey & Burgess, 2000). Siverbo compared the experiences from market reforms in Sweden with Britain (Siverbo,

2004). Both countries have found it difficult to make use of the market mechanism. The owners do not want to set priorities, avoid discussing the content of the purchases and seldom evaluate the outcomes. A crossover to “soft contracts” and limited competition was reported. There was no indication that the purchaser-provider split has increased efficiency within healthcare. Samuel et.al. explored professional rivalries as one force driving the recent healthcare reforms (Samuel et.al., 2005). Lehtonen reported from Finland that the introduction of prices along with a local accounting system (ABC) was a “*success story*” (Lehtonen, 2007). Three articles were categorized into the group *not specified*.

The last 28 articles have focused *local* levels in healthcare systems. Two articles have been categorized into the group *financing*. Ellwood’s research on the market reforms in the NHS did not support the proposition that “*contracts can be priced on a full-cost basis in a manner which will facilitate the achievement of productive efficiency in the NHS internal market*” (Ellwood, 1996a:25). The findings were further investigated (Ellwood, 1997). The response of fund holding family doctors to price signals on their referral patterns was small.

Nine articles have been categorized into the group *cost management*. Abernethy and Chua reported that introducing a Clinical Costing System in an Australian hospital resulted in a redesign of the local control model (Abernethy & Chua, 1996). The longitudinal study demonstrated how the design of the control-package was actively shaped by the strategic choices of the reforms dominant coalition. Jegers reported the cost accounting procedures of Intensive Care units in 12 European countries (Jegers, 1996). The general impression was non-systematic diversity with rather under-developed procedures. Kurunmaki, Lapsley and Melia carried out a comparative study of intensive units in UK and Finland (Kurunmaki, Lapsley, & Melia, 2003). The Finish ICU teams had absorbed calculative practices into their daily routine. The UK teams had not. Pizzini reported from a US-setting (survey) that cost systems should provide greater detail, and that classifying costs according to behavior and reporting cost information frequently to be useful (Pizzini, 2006).

Twelve articles have been categorized into the group *different purposes*. Five studies have reported on the market reforms in New Zealand. People’s actual use of the cost systems was context-dependent (Lawrence, Alam, Northcott & Lowe, 1997). The links between the quotas and the new financial budgets were weak (Jones & Dewing, 1997). An emphasis upon quantities remained dominant. The reforms were met by rationalization and resistance (Doolin, 1999). The reforms were perceived as providing a new controlling technology (Lowe & Doolin, 1999). The construction of a network was carried out to get the reforms through

(Lowe, 2000). Pettersen reported how the Norwegian government’s PPS-reform got lost in its implementation (Pettersen, 1999). There was limited evidence of improvements of efficiency. Despite this, the government of Norway launched a new financing reform (PPS) in 1997 (Pettersen, 2001b). Modell studied this reform in one hospital (Modell, 2001). He found evidence of legitimacy-seeking and efficiency-enhancing rationales forming part of the senior management’s rhetoric. Nyland and Pettersen investigated the link between budgets, accounting information and the decision-making processes in a large Norwegian hospital (Nyland & Pettersen, 2004). The study revealed a loose coupling between budget decisions and activity consequences.

Five articles have been categorized into the group *not specified*. Jacobs, Macron and Witt investigated the provision and use of cost information by doctors in the UK, Germany and Italy (Jacobs, Marcon, & Witt, 2004). Such types of information were only available to clinical staff at the most senior level. Scarparo investigated the possibility of integrating cost and quality data (Scarparo, 2006). Swedish Clinical directors considered cost information as an important and complementary aspect necessary for managing clinical activity. This finding was in contrast to their Scottish counterparts’ views.

4.4 Theory

The types of “Theory” used in the study are the next criterion that describes the research (Table 7). Because only a few articles were used, only the dominating trends will be commented in Ch. 4.4 and Ch. 5.

Design of costing systems	Theory;					Number of articles	%
	Economics	Organisation theory	Sociology	Other theories	No theory		
Product costing issues	11		7		1	19	30.5%
Funding system issues	7	2	10	1	4	24	39.0%
Not specified	7		5	3	4	19	30.5%
TOTAL	25	2	22	4	9	62	
%	40 %	3 %	36 %	6 %	15 %		0 %

Table 7 The distribution of articles into the criteria of “theory” and design issues

In the reviewed studies the most popular theoretical frame of reference are “economics” (40%) and “sociology” (36%). Within the group of “economics” we find studies taking on a rational perspective in the economic analysis of the allocation and use of resources in e.g., newly created healthcare markets. Other studies take a functional perspective on management control inside hospitals. The efficiency of the newly introduced accounting techniques is

investigated. We find many studies investigating factors that drive costs in hospitals. A few studies are making use of principal-agent theory. “Sociology” is another popular theoretical basis for understanding accounting praxis in healthcare organizations. Within this group we find studies making use of institutional theory, translation theory and models of professional rivalry. This diversity in theoretical frameworks was part of the motivation for presenting the statistics within the selected general groups. See also the discussion in chapter 5. These results are next compared with the frames of reference in the other reviews²⁷.

The theories employed;	Number of articles	%	Shields, 1997	Scapens & Bromwich, 2001	van Helden, 2005
Economics	25	40 %	52 %	24 %	20 %
Organizational theory	2	3 %	22 %	20 %	33 %
Sociology	22	36 %	6 %	22 %	16 %
Other theories	4	6 %	0 %	0 %	13 %
No theory	9	15 %	20 %	34 %	18 %
TOTAL	62	100 %	100 %	100 %	100 %

Table 8 The results compared with other reviews of accounting research

“Sociology” has been far more used by accounting researchers when studying healthcare (36%) than in the other reviewed literature. It is particularly interesting to notice that this theory has been far less employed when studying public sector (16%). “Economics” has been more used when making sense of the observations from healthcare (40%) than from general public sector research (20%). Van Helden’s review included many studies from healthcare.

4.5 Research method

The last criterion used for describing the selected research is “research method”. The results are displayed in Table 9.

Design of costing systems	Research method;						Number of articles	%
	Archival study	Case/field study	Survey	Literature review	Multiple methods	Other methods		
Product costing issues	8	10			1		19	30.5%
Funding system issues	3	12	3	1	3	2	24	39.0%
Not specified	1	11	3	2		2	19	30.5%
TOTAL	12	33	6	3	4	4	62	
%	19 %	53 %	10 %	5 %	6.5%	6.5%		0 %

Table 9 The distribution of articles into “research method” and design issues

²⁷ Mellemvik et.al.’s review has not been included in this comparison due to its focus on Nordic research.

53% of the published research has employed case/field study research methods. 19% of the articles have employed an archival study approach. The findings are in Table 10 compared with the other reviews.

Research methods;	Number of articles	%	Shields, 1997	Scapens & Bromwich,	van Helden, 2005
Archival study	12	20 %	14 %	6 %	5 %
Case / field study	33	53 %	7 %	37 %	53 %
Survey	6	10 %	18 %	15 %	7 %
Literature review	3	5 %	9 %	8 %	8 %
Multiple methods	4	6 %	0 %	0 %	14 %
Other research methods	4	6 %	52 %	34 %	13 %
TOTAL	62	100 %	100 %	100 %	100 %

Table 10 The results compared with other reviews of accounting research

A case/field study approach is particular popular in public sector research (53%). This method is seldom seen in North American accounting research (Shields, 1997). Archival study is more frequently used in healthcare research than in the other reviewed research (20% vs. 5%). The use of surveys is in line with the comparable reviews. The next table (Table 11) displays the research method and country. All comparative research has been grouped as “multiple countries”.

Research methods;	Country where the research was carried out;										Multiple countries	Number of articles
	US	CA	UK	NZ	AUS	FIN	NOR	SWE	GER	JP		
Archival study	10	1							1			12
Case / field study	1		10	6	2	3	5	2		1	3	33
Survey	1		2		2						1	6
Literature review	1										2	3
Multiple methods	4											4
Other research methods	2		2									4
TOTAL	19	1	14	6	4	3	5	2	1	1	6	62
%	31 %	2 %	23 %	10 %	6 %	5 %	8 %	3 %	2 %	2 %	10 %	100 %

Table 11 The distribution of articles into “research method” and country

Half of the research carried out in the US has used archival study. Case/field study is a popular research method in countries with a tax-based healthcare system.

4.6 Summary of the findings

The scientific accounting literature has not focused much on healthcare (1.4% of the published articles). When healthcare has been the subject of study, the focus has been on local

(45%) and both (45%) levels in healthcare systems. The majority of the studies have focused on the use of cost information. When studying the use of cost information, 81% of the articles have focused on financing and/or cost management. 53% of the published articles have employed a case/field study research method. 19% of the articles have employed an archival study approach. Theories categorized as “economics” (40%) and “sociology” (36%) have been frequently used to explain the observations.

In general, costing system design issues have not been focused on very frequently. One article briefly describes the YCM-costing methodology when studying other issues. In some studies, aspects of costing system design have been studied by using an archival research method. These studies conclude that complexity is one important driver of costs in healthcare. Researchers caution against using a too-simplistic costing system in such an environment. Costing systems installed locally in hospitals are labeled “clinical costing systems” and “ABC-systems”. The characteristics of these systems, however, have not been described. The costing systems in healthcare have most often been referred to only when studying the use of cost information.

A particular focus has been on the introduction of funding systems as DRG-prices and on various effects of these reforms. Researchers report that the introduction of a price mechanism alone is not sufficient to facilitate production and allocation efficiency in hospitals. There is one success-story about the introduction of prices along with a local accounting system (ABC). Unintended consequences of the use of average national costs for benchmarking and financing purposes have been reported. Changes in service mix and cost allocation procedures to maximize cash flow have been reported. In the NHS-internal market reforms, contracts were negotiated and long-term relations developed – as was the praxis prior to the reforms. Resistance to reforms has been reported. Researchers have been concerned about possible negative effects on hospital life when making use of simple costing systems. There is a danger that the use of national average costs in funding systems may promote “averageness” in hospital activities and processes as they are transformed to comply with national cost accounting average.

5 Discussion

The presentation of the data has provided *one* picture of the research. I will focus this discussion on what have been reported about costing systems and use of cost information in healthcare. Then I will comment on issues that seem to have been less frequently researched. The use of research methods and theories in the reviewed studies will be commented.

Managing hospital costs requires an understanding of factors that lead to expense (Balakrishnan & Soderstrom, 2000). Researchers have pointed to non-volume drivers such as complexity as an important driver of overhead costs in hospitals (Balakrishnan et.al., 1996; Hwang & Kirby, 1994; MacArthur & Stranahan, 1998). Complexity may be defined as “breadth” (the number of services provided) and “depth” (the intensity of individual services) (MacArthur & Stranahan, 1998). These studies have used mandatory aggregated data reported to the healthcare authorities that is accessible to researchers. Researchers, however, caution that such full-cost estimates may be a basis for directing attention, but only disaggregated accounting information and the study of the cost implications may encourage improvements in cost/quality (Jones, 1999a). It is reasonable to expect that hospitals have more detailed insight into the factors that cause costs, but there are as yet no empirical studies of costing systems in hospitals. There is, therefore, still considerable ambiguity related to the design and use of costing systems in hospitals. The one costing model in healthcare described in the literature in some detail is the YCM (Chua, 1995). This model makes use of the length-of-stay and the number of patients, that is, two cost drivers, when allocating costs to the individual DRGs (Chua, 1995). These cost drivers have been used for decades as proxies for the factors that drive hospital costs. Some researchers characterize systems that use few cost drivers as “simplistic” (Hwang & Kirby, 1994; Noreen & Soderstrom, 1994). These researchers caution against the use of simplistic product costing systems. In particular, average cost per activity should be used with great deal of caution in decision making (Noreen & Soderstrom, 1994). Costing procedures are particularly important when national average service costs are used in funding systems: *“Even small percentage changes may produce significant economic consequences”* (Hwang & Kirby, 1994:128). There is need for more studies that discuss factors that lead to expense in healthcare.

The review has illustrated that the use of new funding systems in market-inspired reforms (accounting change) has created opportunities for research in many countries. The

appropriateness of the use of the new costing systems placed centrally in healthcare systems for the purposes healthcare policy formulation, financing and benchmarking has been discussed (Jones, 2002; Northcott & Llewellyn, 2003). The output from such systems indicates that “*the average hospital*” does not exist (Northcott & Llewellyn, 2003). There are thus challenges when making use of national average costs for benchmarking and financing hospitals (Llewellyn & Northcott, 2005). The use of such average service costs for financing purposes has been described as “*government at a distance*” and as a technique of rationing healthcare (Preston et.al., 1997). Jones concludes that the use of national average costs is not useful for facilitating meaningful change at grass roots level (Jones, 2002). The process of introducing such systems has been studied. The role of professional control in hospitals has been challenged when reforms have been introduced (Abernethy & Stoelwinder, 1995). An Australian hospitals’ entire control-package has been reported to have been redesigned according to the leading coalitions’ strategic priorities (Abernethy & Chua, 1996). The market-based reforms introduced in New Zealand hospitals met rationalization and resistance (Doolin, 1999). A network of stakeholders was constructed to carry the reforms through (Lowe, 2000). Other experiences from market-based reforms during the 1990s have been reported. Focus on full-cost prices and contracts alone do not facilitate the achievement of productive efficiency in the NHS-market (Ellwood, 1996a). Siverbo reports that there is no indication of increased efficiency effects from the introduction of purchaser-provider split in Sweden and Britain (Siverbo, 2004). “Soft” contracts and long term relationships prevailed in both Sweden and Britain – as before (Ellwood, 1996b; Siverbo, 2004). The reforms in Finland are reported to have changed the ways of thinking, talking and acting in hospital life (Kurunmaki, 1999). Lethonen reports on a success story involving both prices and local ABC-cost estimates (Lehtonen, 2007). Despite this single success story, the research literature has reported many unintended consequences of the various reform initiatives.

The introduction to this review pointed out that accounting research in the public sector has not focused much on costing issues (van Helden, 2005). This review has confirmed this insight also to be valid for research carried out in the healthcare-sector. Only one article has briefly described the costing methodology (YCM) used in the costing system installed centrally in healthcare systems (Chua, 1995). There are very few articles referring to local costing systems (Abernethy & Chua, 1996; Lawrence et.al., 1997; Lowe, 2000). No article describes the new costing systems per sé. In the 1980s technical positivistic accounting research was criticized (Broadbent & Guthrie, 1992). Critics argued that contextual issues and

the power of accounting to achieve change in organizations should be given attention (Hopwood, 1983). This review indicates that accounting researchers have responded to this call for a new research focus. When accounting researchers have focused on the use of cost information, they have not described the design elements of the product costing systems. Accounting researchers have therefore not discussed the link between costing system design and use.

The majority of the articles have addressed the use of cost information involving the DRG-system. One explanation for this may be the high expectations allocated to the DRG-system (Fetter, 1991; Fetter & Freeman, 1986). The DRGs “*have a potential to penetrate and alter the internal operating processes of hospitals*” (Covaleski et.al., 1993:65). In the 1970s the introduction of the DRGs along with a new costing methodology (YCM) represented major innovations (Preston, 1992). These innovations were adopted by governments throughout the world as new tools for improving the allocation and production effectiveness in healthcare (Samuel et.al., 2005). In a situation with large governmental reforms involving new costing systems and motivated by the call for less positivistic research, a fruitful research strategy seem to have been to investigate the various effects of using the new accounting technology. The accounting technology (the design) was taken for granted. The frequent use of the case/field research method and sociology supports this finding. Another explanation may be found in the complexity, time and costs involved when costing hospital services. Detailed costing in hospitals has been reported to be technically difficult and expensive (Ellwood, 1996b; Jones, 1999b). A third explanation may be limited access to research sites (hospitals) and relevant data (costly to access) for analysis (Krishnan, 2005). There are some studies that use the archival research method and economic theory to investigate cost drivers in healthcare (Appendix 2). It is common for these studies to use statistical methods for analyzing large time-series. The data used is the mandatory reported data to the government. The data is standardized and accessible to the researchers.

The data indicate that there is a relationship between where the research has been done (country), theory and research methods (Table 11). The majority of the case/field studies have been carried out in countries with public health care systems. Few studies carried out in the US and/or published in US-based journals make use of this research method. To be able to make use of case/field research methods you have to be granted access to organizations. In the US many hospitals are private companies or charities. The data accounting researchers seek

may in such an environment be regarded as sensitive. Access may thus be denied. The situation in countries with public healthcare systems is quite different. The observation of these differences is not new. As such this review does not add new knowledge to the present insight. Broadbent and Guthrie (2008:131) label this “American Mainstream” versus “Contextual”²⁸ research. Scapens and Bromwich (2001:249) observe that “*economics remains the primary theoretical basis for much management accounting research*”. In terms of Scapens and Bromwich (2001:251): “*Underlying much of this North American research is the notion of decision-making and control by senior managers. As a result, management accounting is seen as the process of providing information for senior management to enable them to take decisions and to control their businesses*”. Thus in “American Mainstream”-research we find studies with much emphasis on the information passed up the hierarchy, particularly in the analytical studies which use economic theory (e.g., agency-theory and transaction cost economics). “Contextual” research approaches do not take the nature of management accounting for granted and seek to better understand the management accounting practices they observe. These researchers often use case/field studies and sociology or organizational theories to make sense of their observations. The observation may motivate e.g., Nordic accounting researchers to carry out empirical research in organizations.

6 Conclusions and further research

The first conclusion from this study is that costing systems involving the Diagnosis Related Groups (DRG), and particularly the use of funding systems involving DRG-prices, have received much attention. The second conclusion is that there has been little focus on the design and use of local costing systems. The third conclusion is that case studies have reported that the introduction of the new cost information has had unintended consequences for the control of the hospitals.

The main finding of this study is that, to a great extent, accounting researchers have focused on national costing systems and the use of national prices to allocate resources to hospitals. Little attention has been paid to local costing systems in hospitals.

²⁸ The term “Alternative” was used in their 1992- public sector research review (Broadbent & Guthrie, 1992).

We know that costing and cost management have not been the focus of much public sector management accounting research (van Helden, 2005). This review of the scientific accounting literature supplements van Helden's conclusion by pointing out that the design of local costing systems in hospitals has not been the focus of many accounting researchers. The main focus has been on costing systems placed central in healthcare systems and the effects of their use. Because this is the only literature review in the actual area, we label the contribution "the *literature gap*-contribution".

This review suggests the need for rethinking the conventional studies of healthcare practices. We know little about the actual design and use of costing systems at the local level. There is a need for more empirical studies of these topics.

APPENDIX 1

The reviewed articles are;

Abernethy, M. A. 1996, "Physicians and resource management: the role of accounting and non-accounting controls", *Financial Accountability & Management*, vol. 12, no. 2, pp. 141-156.

Abernethy, M. A. & Stoelwinder, J. U. 1995, "The role of professional control in the management of complex organizations", *Accounting, Organizations and Society*, vol. 20, no. 1, pp. 1-17.

Abernethy, M. A. & Wai, F. C. 1996, "A Field Study of Control System "Redesign": The Impact of Institutional Processes on Strategic Choice", *Contemporary Accounting Research*, vol. 13, no. 2, pp. 569-606.

Arai, K. 2006, "Reforming hospital costing practices in Japan: an implementation study", *Financial Accountability & Management*, vol. 22, no. 4, pp. 425-451.

Balakrishnan, R., Gruca, T., & Nath, D. 1996, "The Effect of Service Capability on Operating Costs: An Empirical Study of Ontario Hospitals", *Contemporary Accounting Research*, vol. 13, no. 1, pp. 177-207.

Balakrishnan, R. & Soderstrom, N. S. 2000, "The Cost of System Congestion: Evidence from the Healthcare Sector", *Journal of Management Accounting Research*, vol. 12, pp. 97-114.

Banker, R. D., Chang, H., & Das, S. 1998, "Standard Estimation, Standard Tightness, and Benchmarking: A Method With an Application to Nursing Services", *Journal of Management Accounting Research*, vol. 10, pp. 133-152.

Bates, K. & Brignall, T. J. 1993, "Rationality, politics and healthcare costing", *Financial Accountability & Management*, vol. 9, no. 1, pp. 27-44.

- Bryan, S. & Beech, R. 1991, "Cost information in a provider market for health care: a note", *Financial Accountability & Management*, vol. 7, no. 2, pp. 99-105.
- Carey, K. & Burgess, J. F. 2000, "Hospital Costing: Experience from the VHA", *Financial Accountability & Management*, vol. 16, no. 4, pp. 289-308.
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- Chua, W. F. 1995, "Experts, networks and inscriptions in the fabrication of accounting images: A story of the representation of three public hospitals", *Accounting, Organizations and Society*, vol. 20, no. 2-3, pp. 111-145.
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- Doolin, B. 1999, "Casemix Management in a New Zealand Hospital: Rationalisation and Resistance", *Financial Accountability & Management*, vol. 15, no. 3&4, pp. 397-417.
- Eldenburg, L. 1994, "The use of information in total cost management", *The Accounting Review*, vol. 69, no. 1, p. 96.
- Eldenburg, L. & Kallapur, S. 1997, "Changes in hospital service mix and cost allocations in response to changes in Medicare reimbursement schemes", *Journal of Accounting and Economics*, vol. 23, no. 1, pp. 31-51.
- Eldenburg, L. & Soderstrom, N. 1996, "Accounting System Management by Hospitals Operating in a Changing Regulatory Environment", *Accounting Review*, vol. 71, no. 1, pp. 23-42.
- Ellwood, S. 1996a, "Full-cost pricing rules within the National Health Service internal market - accounting choices and the achievement of productive efficiency", *Management Accounting Research*, vol. 7, pp. 25-51.
- Ellwood, S. 1996b, "Pricing services in the UK National Health Service", *Financial Accountability & Management*, vol. 12, no. 4, pp. 281-301.
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- Forgione, D. A., Vermeer, T. E., Surysekar, K., Wrieden, J. A., & Plante, C. C. 2005, "DRGs, Costs and Quality of CARE: An Agency Theory Perspective", *Financial Accountability & Management*, vol. 21, no. 3, pp. 291-308.
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APPENDIX 2

#	I Journal	Year	Article	Authors	Ia Setting: Country where the research was done	Ib Setting: Level in the health care system	III a Topic: Design of costing systems ²⁹	III b Topic: Use of cost information ³⁰	III c Topic: Other ³¹	IV Theory ³²	V Research method ³³
1	AAAJ	1991	Contingency Theory and the Impact of New Accounting Technology in Uncertain Hospital Environments	Rayburn,J.M., Rayburn,L.G.	USA	local	Funding system issues	Not specified	change	sociology	survey
2	AAAJ	1994	The Great Experiment: Financial Management Reform in the NZ Health Sector	Lawrence,S., Alam,M., Lowe,T.	NZ	both	Product costing issues	different purposes	change	sociology	field study
3	AAAJ	1994	Better informed judgements: Resource Management in the NHS	Rea,D.M.	UK	both	Not specified	different purposes	change	no theory	field study
4	AAAJ	1997	Accounting systems and systems of accountability in the New Zealand health sector	Lawrence,S., Alam,M., Northcott,D., Lowe,T.	NZ	local	Product costing issues	different purposes	change	sociology	case study
5	AAAJ	1999	Hierarchies, networks and management accounting in NHS hospitals	Stuart Jones,C.	UK	local	Funding system issues	different purposes	governance	org.theory	case study
6	AAAJ	2000	The construction of a network at Health Waikato. The "towards clinical budgeting" project	Lowe, A.	NZ	local	Product costing issues	different purposes	change	sociology	case study
7	AR	1994	The Use of Information in Total Cost Management	Eldenburg,L.	USA	both	Funding system issues	cost management	-	economics	multiple methods
8	AR	1996	Accounting System Management by Hospitals Operating in a Changing Regulatory Environment	Eldenburg,L. Soderstrom,N.	USA	both	Funding system issues	Not specified	contracting	economics	archival study
9	AR	2005	The Effect of Changes in Regulation and Competition on Firms' Demand for Accounting Information	Krishnan,R.	USA	both	Funding system issues	cost management	competition / need for cost information	economics	archival study
10	AOS	1992	The Birth of Clinical Accounting: A Study of the Emergence and Transformations of Discourses on Costs and Practices of Accounting in U.S. Hospitals	Preston, A.M.	USA	both	Not specified	different purposes	accounting in general in hospitals	multiple theories	literature review
11	AOS	1993	An Institutional Theory Perspective on the DRG Framework, Case-mix Accounting Systems and Health-Care Organizations	Covaleski,M.A., Dirsmith,M.W., Michelman,J.E.	USA	both	Funding system issues	different purposes	accounting in general in hospitals	sociology	multiple methods
12	AOS	1995	The Role of Professional Control in the Management of Complex Organizations	Abernethy,M.A., Stoelwinder,J.U.	AUS	central	Funding system issues	different purposes	change	sociology	survey

²⁹ Product costing issues, funding system issues and not specified.

³⁰ Benchmarking, financing, cost management, different purposes and not specified.

³¹ For example, change, contracting, cost behaviour, cost driver, cost-allocation, and no particular other topics.

³² Economics, organization theory, sociology, other theories and no theory.

³³ Archival study, case/field study, survey, literature review, multiple methods and other methods (as for example reflections).

13	AOS	1995	Experts, Networks and Inscriptions in the Fabrication of Accounting Images: A Story of the Representation of Three Public Hospitals	Chua;W.F.	AUS	central	Funding system issues	different purposes	-	sociology	field study
14	AOS	1997	The Diagnosis-related Group-Prospective Payment System and the Problem of the Government of Rationing Health Care to the Elderly	Preston, A.M., Chua,W.F., Neu,D.	USA	central	Funding system issues	financing	government at a distance	sociology	case study
15	AOS	1999	Professional vs financial capital in the field of health care - struggles for the redistribution of power and control	Kurunmaki,L.	FI	both	Not specified	different purposes	change	sociology	field study
16	AOS	2005	The average hospital	Llewellyn,S., Northcott,D.	UK	central	Product costing issues	benchmarking	-	sociology	field study
17	AOS	2005	Monetized medicine: from the physical to the fiscal	Samuel,S., Dirsmith,M.W., McElroy,B.	USA	both	Funding system issues	different purposes	professional rivalries	sociology	multiple methods
18	AOS	2006	The relation between cost-system design, managers' evaluations of the relevance and usefulness of cost data, and financial performance: an empirical study of US hospitals	Pizzini,M.J.	USA	local	Not specified	cost management	-	economics	multiple methods
19	CAR	1996	The Effect of Service Capability on Operating Costs: An Empirical Study of Ontario Hospitals	Balakrishnan, R., Gruca,T. Nath,D.	CAN	both	Product costing issues	different purposes	cost driver	economics	archival study
20	CAR	1996	A Field Study of Control System "Redesign": The Impact of Institutional Processes on Strategic Choice	Abernethy,M.A., Chua,W.F.	AUS	local	Product costing issues	cost management	change	sociology	field study
21	EAR	2001	Implementing management accounting reforms in the public sector: the difficult journey from intentions to effects	Pettersen,I.J.	N	local	Funding system issues	different purposes	change	multiple theories	field study
22	FAM	1990	Medical audit and resource management: lessons from HIP fractures	Craig,M., Price,C., Backhouse,A. Bevan,G.	UK	local	Funding system issues	cost management	medical audit	no theory	case study
23	FAM	1991	Cost information in a provider market for health care: a note	Bryan,S. Beech,R.	UK	both	Product costing issues	financing	contracting	economics	case study
24	FAM	1993	Rationality, politics and healthcare costing	Bates,K., Brignall,T.J.	UK	both	Not specified	Not specified	contracting	economics	reflections
25	FAM	1994	Costing needs and practices in a changing environment: the potential for ABC in the NHS	King,M., Lapsley,I., Mitchell,F., Moyes,J.	UK	local	Product costing issues	Not specified	The potential for the ABC method	economics	case study
26	FAM	1996	Performance based compensation in health care - a Swedish experience	Lindkvist,L.	S	local	Funding system issues	different purposes	budget contracts	economics	case study
27	FAM	1996	Physicians and resource management: the role of accounting and non-accounting controls	Abernethy,M.A.	AUS	local	Not specified	Not specified	accounting control	multiple theories	survey
28	FAM	1996	Effects of new control systems in Swedish health care organizations	Charpentier,C., Samuelson,L.A.	S	both	Funding system issues	different purposes	contracting	economics	field study
29	FAM	1996	Pricing services in the UK national Health Service	Ellwood,S.	UK	both	Funding system issues	different purposes	contracting	economics	survey
30	FAM	1996	Budgeting and cost accounting in European intensive care units: a note	Jegers,M.	multiple countries	local	Not specified	cost management	contracting	economics	survey

31	FAM	1997	The attitudes of NHS clinicians and medical managers towards changes in accounting controls	Jones,C.S., Dewing,I.P.	UK	local	Not specified	different purposes	contracting	sociology	case study
32	FAM	1997	The response of fundholding family doctors to price signals	Ellwood,S.	UK	local	Not specified	financing	contracting	no theory	field study
33	FAM	1999	Developing financial accountability in British acute hospitals	Jones,C.S.	UK	both	Funding system issues	different purposes	contracting	no theory	reflections
34	FAM	1999	Accountable management reforms: Why the Norwegian Hospital reform experiment got lost in implementation	Pettersen,I.J.	N	local	Funding system issues	different purposes	change	org.theory	field study
35	FAM	1999	Casemix Management in a NZ hospital: rationalisation and resistance	Doolin,B.	NZ	local	Funding system issues	different purposes	change	sociology	case study
36	FAM	2000	Hospital costing: experience from the VHA	Carey,K., Burgess,J.F.	USA	both	Funding system issues	different purposes	-	no theory	reflections
37	FAM	2001	Decentralization and reliance on the controllability principle in the public sector	Modell,S., Lee,A.	N	local	Not specified	different purposes	responsibility accounting	sociology	case study
38	FAM	2002	The attitudes of British national health service managers and clinicians towards the introduction of benchmarking	Jones,C.S.	UK	both	Not specified	benchmarking	-	economics	field study
39	FAM	2003	Does learning matter for knee replacement surgeries? Data evidence from a German hospital	Ernst,C., Ernst,G., Szczesny,A.	G	both	Product costing issues	Not specified	cost driver	economics	archival study
40	FAM	2004	The control gap: the role of budgets, accounting information and (non-) decisions in hospital settings	Nyland,K., Pettersen,I.J.	N	local	Not specified	different purposes	responsibility accounting	multiple theories	case study
41	FAM	2004	The purchaser-provider split in principle and practice: experiences from Sweden	Siverbo,S.	multiple countries	both	Not specified	different purposes	contracting	economics	literature review
42	FAM	2005	DRGs, costs and quality of care: an agency theory perspective	Forgione,D.A., Vermeer,T.E., Surysekar,K., Wrieden,J.A., Plante,C.C.	USA	both	Product costing issues	financing	contracting	economics	archival study
43	FAM	2006	Institutional pressures for adopting new cost accounting systems in Finnish hospitals: Two longitudinal case studies.	Jarvinen,J.	FI	both	Product costing issues	cost management	contracting	sociology	field study
44	FAM	2006	The integration of clinical and costing information: a comparative study between Scotland and Sweden	Scarparo,S.	multiple countries	local	Not specified	Not specified	integrating quality and costing info	sociology	field study
45	FAM	2006	Reforming hospital costing practices in Japan: an implementation study	Arai,K.	JP	both	Not specified	cost management	costing practices	no theory	field study
46	JAE	1994	Are overhead costs strictly proportional to activity?	Noreen,E., Soderstrom,N.	USA	central	Product costing issues	cost management	cost driver	economics	archival study
47	JAE	1997	Changes in hospital service mix and cost allocations in response to changes in Medicare reimbursements schemes	Eldenbug,L., Kallapur,S.	USA	both	Product costing issues	financing	cost-allocation	economics	archival study
48	JAR	1998	A Field Study on the Limitation of ABC When Resources are provided on a Joint and Indivisible basis	Maher,M.W., Marais,M.L.	USA	local	Product costing issues	cost management	cost driver	economics	other research methods

49	JAR	2005	Uncertainty, Real options, and Cost Behavior: Evidence from Washington State Hospitals	Kallapur,S., Eldenburg,L.	USA	local	Product costing issues	Not specified	cost behaviour	economics	archival study
50	JMAR	1994	Distorted Medicare Reimbursements: The Effect of Cost Accounting Choices	Hwang,Y., Kirby,A.J.	USA	central	Funding system issues	financing	cost driver	economics	archival study
51	JMAR	1998	Cost driver analysis in hospitals: A simultaneous equations approach	MacArthur,J.B., Stranahan,H.A.	USA	both	Product costing issues	different purposes	cost driver	economics	archival study
52	JMAR	1998	Standard estimation, standard tightness, and benchmarking: A method with an application to nursing services	Banker,R.D., Chang,H., Das,S.	USA	both	Not specified	benchmarking	-	economics	archival study
53	JMAR	2000	The cost of system congestion: Evidence from the healthcare sector	Balakrishnan, R., Soderstrom,N.S.	USA	local	Product costing issues	cost management	cost behaviour	economics	archival study
54	MAR	1996	Full-cost pricing rules within the NHS internal market - accounting choices and the achievement of productive efficiency	Ellwood,S.	UK	local	Not specified	financing	contracting	economics	survey
55	MAR	1997	The role of accounting in the processes of health reform: providing a "black box" in the costing of blood products	Lowe, A.	NZ	local	Product costing issues	cost management	-	sociology	case study
56	MAR	1999	Casemix accounting systems: new spaces for action	Lowe,A., Doolin,B.	NZ	local	Funding system issues	different purposes	contracting	sociology	case study
57	MAR	2001	Performance measurement and institutional processes: a study of managerial responses to public sector reform	Modell,S.	N	local	Funding system issues	different purposes	change	sociology	case study
58	MAR	2003	Accountingization v. legitimation: a comparative study of the use of accounting information in intensive care	Kurunmaki,L., Lapsley,I., Melia,K.	multiple countries	local	Not specified	cost management	management practices	sociology	field study
59	MAR	2003	The "ladder of success" in healthcare: the UK national reference costing index	Northcott,D., Llewellyn,S.	UK	both	Product costing issues	benchmarking	contracting	no theory	field study
60	MAR	2004	Cost and performance information for doctors	Jacobs,K., Marcon,G., Witt,D.	multiple countries	local	Not specified	cost management	management practices	no theory	field study
61	MAR	2004	From bookkeeping to strategic tools? A discussion of the reforms in the Nordic hospital sector	Pettersen,I.J.	multiple countries	both	Funding system issues	different purposes	change	sociology	literature review
62	MAR	2007	DRG- based prospective pricing and case-mix accounting - Exploring the mechanisms of successful implementation	Lehtonen,T.	FI	both	Funding system issues	different purposes	change	no theory	case study

Essay II National prices and local cost estimates in a university hospital: A correlation analysis

Abstract

In recent years product costing systems have been established centrally in healthcare systems for formulating healthcare policy, benchmarking and financing purposes (Kjøllestad, Essay I). Researchers have reported that the use of cost information from such systems may promote “*averageness*” (Llewellyn & Northcott, 2005). Yet we know that the average hospital does not exist. Little empirical evidence has been reported on the dilemmas in the local control of hospitals when they are promoted to be cost average (Kjøllestad, Essay I). This motivates the present study. The research question in this empirical study is: To what extent is there coherence between national prices and local cost estimates?

An empirical study was carried out at a Norwegian university hospital (tertiary care). This involved the construction of local ad-hoc cost estimates and comparing these estimates with the corresponding national prices. The study led to three conclusions.

The first conclusion is that there was low correlation between the national prices and the local cost estimates. The second conclusion is that much of the variation was explained when using categorical cost estimates. Categories of hospitals (primary – secondary – tertiary care) may reflect a different cost structure than the national average. The last conclusion is that local product cost information may be one important input to ascertain profitability or loss and to provide a basis for exploring alternative actions and consequences.

The main finding of this study is that the statistical analysis showed that there was low correlation between the national prices and the local cost estimates.

This quantitative analysis of an explicit relationship has illustrated that hospitals with a low correlation between national average prices and local cost estimates may benefit from having a local costing system. This finding may motivate further studies on the design and use of local costing systems in university hospitals.

1 Introduction

In recent years the healthcare sector worldwide has been subject to various reform initiatives that involve the implementation of costing techniques (van Helden, 2005). The use of prices has been central in these reforms to mimic the market mechanism (Samuel et.al., 2005). Medicare`s DRG-prices (Diagnostic Related Groups) is an example of cost information from a costing system placed centrally in the healthcare sector³⁴. This model uses the Yale Costing Model where the length of stay and the number of cases per DRG are the central allocation bases (Fetter, Brand, & Gamache, 1991; Samuel et.al., 2005). American hospitals did not install elaborate costing systems before Medicare introduced their DRG-model in 1983 (Demski, 1997). Now years after this, only a minority of the US-hospitals have installed advanced local costing systems (Carey & Burgess, 2000; Hill, 2000). Such systems are called “Clinical Costing Systems” (Abernethy & Chua, 1996) or “patient-based cost system” (Lowe, 2000). What is common to such local costing systems is that they are costing the services provided to the single patient (Jarvinen, 2006). Thus in healthcare systems we will find costing systems at different levels designed for different purposes (Kjøllestadal, Essay I). At central levels average service costs are used for formulating health policy, financing and benchmarking purposes. In hospitals local service cost estimates may be compared with the relevant prices and used for management purposes.

Homogenous cost pools and allocation bases are important to enable “*computing more accurate costs of a given cost object*” (Horngren et.al., 2000:504). “*In a homogenous cost pool all of the costs have the same or similar cause-and-effect relationship with the cost-allocation base*” (Horngren et.al., 2000:504). The art of designing a costing system is in choosing a limited number of activity measures and thus the number of cost pools (Noreen, 1991). In such a process both activity measures and cost pools are aggregated. When aggregating, though, details are lost. This process affects both the homogeneity of the cost pools and the activity measures as well as the usefulness of the cost estimates (Demski, 1997). The literature has reported that collecting the costs of treating every patient within a healthcare system (for example, NHS³⁵) are thought to be complicated and expensive (Llewellyn & Northcott, 2005). National costing systems have less homogenous cost pools due to the costs involved with handling a multiple cost pool system from many hospitals. We thus know *a-priori* that there will be differences between national prices and local unit costs.

³⁴ www.cms.hhs.gov/home/medicare

It would be a surprising finding if national prices are perfectly correlated with local cost estimates. Why then investigate the correlation between such product estimates?

In the business sector you normally find costing systems only within the firms. The firm calculates its product costs to support local decision making. The in-put and out-put prices are set primarily in markets. Based on such signals, firms “*select the best production plan*” (Demski, 1997:13). The firm transforms the price signals to local action.

In some aspects, healthcare systems work in contrast to this general picture. The relationships between actors within a healthcare system have not evolved naturally from the existing factors of supply and demand (Ellwood, 1996b). The government is heavily involved in the financing, the provision and the regulation of the services (Preston, 1992; Alexander, 1994). One such recent initiative introduces an incentive-structure involving prices confronting the providers of care (Ellwood, 1996a; Oliver, 2005; Propper, 2005). The government wants to influence the hospitals and the selection of their production plan. One rationale for this approach is that prices may enable the parties within a healthcare system to negotiate contracts “*in a manner which will facilitate the achievement of productive efficiency*” (Ellwood, 1996a:25).

The construction of such internal healthcare markets is a challenge. For example, within the National Healthcare Service of the UK (NHS) the intention of the market’s “*invisible hand*” was soon replaced by the “*invisible handshake*” (Ellwood, 1996b:298). The use of prices, however, still persists. Another rationale for the introduction of prices may be to support the core objectives of the healthcare system (Larsen, 2007)³⁵. “*Securing equal access for equal need remains the overriding objective of the system*” (Oliver, 2005:576). The funding systems for the providers of care “*has always focused more on dividing the cost of providing services equally ... than promoting efficiency*” (Häkkinen, 2005:111). The use of prices in the healthcare sector is thus a more challenging task than is the selection of the best production plan.

Economists recommend that incentives should not be strong when healthcare providers have many different activities to perform and when these are difficult to measure (Propper, 2005).

³⁵ National Healthcare Service (UK)

³⁶ www.nhs.uk/aboutnhs/CorePrinciples

This is often the case in university hospitals with respect to activities related to patient treatment, teaching and research. One solution to this challenge is that chosen in Norway. The piece rates of these funding systems are not 100% of the estimated national average cost. The percentage of the estimated national average full-cost of production has been debated (Pettersen, 2001b). The debate has centered on the negative influence of a high rate on the overall cost control, the allocation efficiency between providers and the hospital's focus on profitable diagnoses (Hagen & Kaarbøe, 2006). Research has also pointed to external effects (i.e., increasing labor costs) of the introduction of activity-based funding systems (Bjørnenak & Pettersen, 2000). The national prices may have unintended effects (Larsen 2007). Accordingly, in healthcare markets it is a special challenge to construct an incentive structure to support the intended purpose(s). By investigating the correlation between national prices and local cost estimates new insight into the factors that influence the differences in product costs may be created. With such insight the financiers of healthcare services may be able to construct more precise incentive structures. This is one motivation for the study.

In 1990 when creating the internal market within the NHS, the government required that the prices should be “cost-based”, related to activity (volume), comparable, with no cross-subsidy and represent the long-run average “true” costs (Ellwood, 1996b). The existence of national prices and the benchmarking of hospital costs signal that there is an average cost of production in healthcare (Northcott & Llewellyn, 2003; Anell, 2005; Häkkinen, 2005). Such use may position “*averageness as an ambition for the hospital as a social institution*” (Llewellyn & Northcott, 2005:567). “*The activities and processes of hospital life “become average” as they are transformed to comply with the cost accounting average*” (Llewellyn & Northcott, 2005:555). To provide empirical evidence of the dilemmas “*averageness*” may create in the control of a hospital is another motivation for the study.

Experiences from the Norwegian healthcare system have also motivated this study. In the early 1990s experiments in some hospitals were carried out with a Prospective Payment System (PPS) based on the DRG-system (Pettersen, 1999). Each hospital was expected to produce a service mix of 470 different DRGs. A standard reimbursement price was calculated for each DRG based on historical national average costs. The hospitals were reimbursed by these standard prices times a piece-rate of 40%. The rest of the hospitals' budgets were mainly bloc-grants. Despite the negative experiences, a full scale PPS was introduced in 1997 to all hospitals (Pettersen, 2001b). Pettersen indicated that clinical leaders made different

conceptualizations of the new funding system than those of the government. Due to these differences in the perception of the prices, more ambiguity was introduced to the control of the hospital's activity and costs. *“Reforms then become signals, which the individual member in the organization has to interpret and understand”* (Pettersen, 2001b:563). To investigate the relationship between national prices and local cost estimates may provide a basis for better understanding the funding system and its relationship with a hospital's cost-structure. This is valuable information in all organizations. Having such insight may be even more important if the correlations are low. This is a third motivation for the study.

2 The research question

To those in charge of the local production in hospitals, national prices are an important exogenous input to their planning processes. When exposed to national prices a natural question for a local manager (hospital, clinic, department, section, laboratory etc.) may be: what are the costs of my services? Differences exist between hospitals in the local activity-mix and cost-structure³⁷. We thus know that an average hospital does not exist (Northcott & Llewellyn, 2003; Llewellyn & Northcott, 2005). It is reasonable to presume that local cost estimates – reflecting insight into the local production processes – will more precisely reflect the local hospital's cost structure than do national average prices. When comparing a national price with a local service cost-estimate, therefore it is likely there will be a small correlation. The literature review indicated that no statistical evidence has been reported about the dilemmas in the local control of hospitals when they are supposed to be controlled by using national DRG-prices (Kjøllestad, Essay I). In this management accounting context we ask: To what extent is there coherence between national prices and local cost estimates?

3 Method

The research involves estimating the local product cost and comparing these with the relevant national price. This study originates from a Norwegian context; therefore relevant background information about the Norwegian healthcare system will be provided (Ch. 3.1). The available national costing systems at the time of capturing the data will also be described in some detail.

³⁷ For example, Norwegian data: www.sintef.no/SAMDATA & www.helsedirektoratet.no/statistikk/samdata

Several decisions regarding the research design have to be made in order to investigate the research question. The various research design choices will be accounted for in section 3.2.

3.1 Contextual information

3.1.1 The Norwegian healthcare system

The Norwegian healthcare system is often characterized as a decentralized NHS-model (Oliver, 2005; Maynard, 2005). The system is dominated by public healthcare providers and is financed by a centralized tax-based funding model (Hagen & Kaarbøe, 2006). The Norwegian hospitals have been financed by a combination of block-grants and various national activity-based funding systems (Kaarbøe, 2005; Larsen, 2007).

3.1.2 National costing systems in Norway

The relationship between the two general levels in the healthcare system (central – local) and the organizational levels is illustrated in Appendix 1. A hospital in the Norwegian healthcare system represents the 3rd organizational level. The patient approaching the healthcare system receives a hospital's various services at the 7th organizational level i.e., the physical location (e.g., a ward, an out-patient clinic or a laboratory). The relationship between the general groups of hospital services and the different cost objects often encountered in costing models and price-lists - is illustrated in Appendix 2. Within each general group of hospital services there may be a hierarchy of different categories of services provided the patient. The actual mix of services the patient receives during his/her hospital stay may vary even within a given DRG. Appendix 2 illustrates that there is a hierarchy of available cost objects in hospitals that may influence the design of a given costing system. The DRGs are aggregated cost objects. Hospital services are disaggregated cost objects. These differences are reflected in the two general groups of Norwegian national costing systems.

One national costing system for in-patients is based on the DRG-system (Fetter et.al., 1991; Samuel et.al., 2005). This system has been adjusted to the Norwegian context (Buhaug, 1999; Pettersen, 2001b; Larsen, 2007). The costing system uses ten different aggregated allocation bases (services) to calculate the average cost per patient in each DRG-group. At each selected service the relevant labor costs, the operating costs and the allocated internal service costs from the hospital level are aggregated into one cost pool. The system thus calculates the full-

costs. The costs from the cost pool per service (many) are then allocated to the cost objects (DRGs), making use of one allocation base (number of hospital stays per DRG). Another important group is the one that uses the length of stay (LOS) per patient as the allocation base. Radiology services are one among several broad medical service categories in this costing system. Weight systems per medical service and per DRG have been developed. The cost weights are periodically, but not frequently, updated (Kvæl, 2006).

There are different national costing systems that calculate the costs of the services for out-patients in both public and private providers³⁸. There are different systems for out-patient clinics, laboratories and radiology services (Larsen, 2007). The system for radiology services may serve as an example of the general costing methodology³⁹. The service(s) that have been provided the patient are described by one or several NORAKO-codes (NOrsk RAdiologisk KODE) in the local activity database⁴⁰. The prime use of this information is for reimbursement purposes. The NORAKO-codes give a good description in medical terms. The combination of codes may describe more than 240,000 radiology-“products”. In praxis about 60,000 combinations are used on a daily basis. The identification of homogenous services (products) in this sector is thus a challenge. The term “investigations” has been introduced to get a more aggregated level above the NORAKO-codes. The combinations of NORAKO-codes have been grouped into approximately 350 investigations. The patient’s visit in a laboratory (for example, CT-scanner) is called a session. Per session the time (patient in – out in minutes) is registered in the local activity database (RIS). One session may result in several investigations. The hierarchy of cost objects of radiology services is illustrated in Figure 1⁴¹.

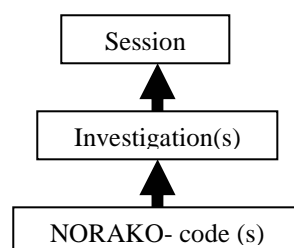


Figure 1 The hierarchy of cost objects of radiology services

³⁸ http://www.shdir.no/kodeverk_og_pasientklassifiseri/drg

³⁹ <http://www.kith.no>

⁴⁰ Radiology Information System (RIS)

⁴¹ The DRG is a more aggregated cost object (see also Appendix 2).

Every NORAKO-code is related to one of 38 (in 2003) primary weight groups. The cost-weight expresses the national average consumption of resources in this group of cost objects. The primary weights of the NORAKO-codes are aggregated into the relevant investigation and session. Price rules restrict this aggregation. Only the weights of the NORAKO-codes registered by a unique booking number on the identical date are aggregated. This aggregation may provide a considerably higher (than the 38 primary weight groups) number of weight estimates describing the activity per session. The sessions involving demonstrations of old pictures or pictures sent from other hospitals are often not given a primary weight (=0). This results in a complex reimbursement system. The actors at the clinical level have to test out different combinations of NORAKO-codes to determine the reimbursement per session. The primary weights have been established through a detailed costing exercise in 2000 with a revision in 2002. The price per unit weight (1.0) is decided by the Ministry of Health each year. This unit price may also be changed within a given year.

Generally, the available national costing systems work according to this formula per chosen cost object⁴²:

$$\text{Weight}_{\text{National}} \times \text{Unit price}_{\text{National}} = \text{Cost}_{\text{National}}$$

3.2 The research design

In this section my choices of research site, hospital service, costing system and tests are discussed.

3.2.1 Research site

The first choice involves choosing a research site. A generally held assumption at the Rikshospitalet HF, Oslo was that the national prices do not reflect the “true” costs of production. The hospital’s role in the healthcare system of Norway is providing tertiary care. The case-mix (more adverse cases) thus deviates from a national average. The activity at this hospital involves many services that are performed only at this hospital. The hospital is the only site in Norway that carries out transplants (i.e., kidney transplants). The hospital is the largest transplant center in the Nordic countries. Special medical services have been established to serve the hospital’s position within the healthcare system. This involves a

⁴² For example, DRG, session or investigation (see also Appendix 2).

specialized cost structure of machines and highly knowledgeable personnel. The hospital is also a university clinic. One argument for the choice of this hospital was its deviating cost structure from those other Norwegian hospitals. The average cost per in-patient at Rikshospitalet HF in 2003 was 27,400 NOK⁴³. The national average was 25,000 NOK. The average expense level was thus 9.6% above the national average. The second argument for the choice of this research site was one of convenience and costs. Being an employee the researcher had access to Rikshospitalet HF. A third argument is the one of relevance. Due to its position within the healthcare system, questions on the financing of Rikshospitalet HF are frequently debated. Finally, involving but one research site was assessed to be a sufficient first step in the research process.

3.2.2 Hospital service

The next step in the research process was the choice of hospital service. In the fall of 2003 the director at Rikshospitalet HF initiated a project to calculate internal prices for radiology services. This was an ad-hoc costing exercise. The situation at hand was a steady increase in the demand for radiology services, but limited extra resources allocated to this department. The rationale for the project was that the use of internal prices may make the clinical users (doctors) of the services more sensitive to the costs of production at the Radiology department that were incurred outside the normal working hours (8-16). The initiative appeared as an opportunity to address the research question. The choice of hospital service was the radiology service. The selected activity was the total number of sessions carried out in the first 6 months of 2003. This activity was regarded to be representative for this hospital and hospital service. The purpose of the study is not to generalize to other hospitals, but to explore the situation at one hospital.

3.2.3 National prices and local costing system

The third choice to make was to decide upon which national price-list and local costing system to focus. There were within the field of radiology services two national costing systems in Norway. The national costing system for in-patients uses a weight system (for radiological services) per DRG. The fact that these weights only reflected the physician's

⁴³ Corrigated for the average cost weight per DRG. See: www.SAMDATA.no 2003 table 5.4.

workload pr DRG was a major argument against the selection the national DRG-prices (Nyland, 1999). This study will thus not focus on the DRGs as cost objects.

In the discussions with the local managers we observed that a national weight is routinely attached to every session (both the in- and the out-patients) in the local RIS⁴⁴. This made it possible to compute the relevant price per session. The session is the cost objects identified at the organizational level were the patient is provided the service (Appendix 1). This insight led to the choice of this costing model as the national costing system. An ad-hoc system, informed by the ABC-technique, was chosen as the local costing system. The ambition for the construction of this local costing system was to estimate the full costs of every patient's contact (i.e., every unique session) with the hospital's Radiology department.

The situation at this hospital was thus that nobody knew the costs of their radiology services. Yet the national prices per session were known at the operating level and accounted for at the Radiology department. These prices were exogenous to the local planning and control procedure. Accordingly, in the context of this study the national prices will also be regarded as exogenous.

3.2.4 Test levels

The fourth choice to address was a decision on which dimensions to investigate. We want to study to what extent there is coherence between national prices and local cost estimates. This involves two sources of variation: model⁴⁵ and data. This is illustrated in Figure 2.

The investigated dimensions		Cost model	
		National	Local
Data	National	1	2
	Local	3	4

Figure 2 The investigated dimensions

Two types of analysis will be carried out: analysis of the cost level and the cost structure.

⁴⁴ Radiology Information System (RIS)

⁴⁵ I view a costing system as a model (a set of allocation-rules) installed in an organization.

The first investigation focuses on the national costing system and introduces only variation in the data. The investigation of the *cost level* will be carried out by comparing the national average price per session with the corresponding local average cost estimate. The work with the local costing system will give an estimate of the full-costs (D_1) involved in producing the hospitals radiology services. This will give an estimate of the average full-cost per sessions. The constructed ad-hoc costing system can thus be seen as the local costing system for the hospitals radiology services. The national weight system uses a unit price (D_2) that only affects the cost level but not the cost structure of the cost-estimates. When investigating the cost level, the national unit price (D_2) (position 1) will be divided by the average local full-cost estimate (D_1) (position 3).

The second type of investigation focuses on the national costing system with national data (D_2) and compares this with the local costing system with local data (D_1). The investigation will focus the *cost-structure* between the out-put from the two costing systems (position 1 vs. 4).

The Department of radiology serves two groups of patients: out- and in-patients. Given this background, the tests will be conducted on both the out-patients (test A) and the in-patients (test B). The data will be further partitioned into different categories of services.

A correlation-test measures the joint variation in two variables. The Pearson correlation (-1 to +1) examines the strength of the linear relationship between two variables (Altman, 1991; Shadish, Cook, & Campbell, 2002; Ghauri & Grønhaug, 2005)⁴⁶. The size of a correlation does not per se indicate relevance. It only indicates the strength of the association between the pairs of variables as a single number. Graphical methods are important for examining the variability of data⁴⁷. The interpretation of the size of a correlation coefficient depends on the context and purposes of a study. 0.8 may be very low if one is verifying a physical law using high quality instruments, but may be regarded as very high in the social sciences where there may be greater contribution from complicating factors. The ad-hoc costing system is constructed to capture the cost differences between sessions carried out in (8-16) and outside normal working hours (Ch. 3.2.2). There are large pay differentials between these working hours. Few sessions are carried out outside normal working hours too. The specification of the

⁴⁶ The formula for the Pearson correlation coefficient for a population. See Appendix 3.

⁴⁷ E.g. scatter-plots may enhance our understanding of the data. See Appendix 4.

local costing system may thus result in extreme values and outliers (as illustrated in Appendix 4 for the MR-section). Yet in a management accounting context such estimates may be *“important for evaluating performance, and providing feedback and learning to help future decision making”* (Horngren et.al., 2009:36). The size and direction of the relationship will be measured. The tests will be further specified.

When the estimated-costs of every patient (high variance) are compared with a national average price, it is expected that the correlations of these tests will be low. The comparison is, however, relevant because this estimation is often done by people involved at the operating level when other estimates are not present. Their reasoning may be that average prices do not reflect the “true costs”. This explanation of their estimates might be true. But another explanation may be that their views are biased and their memory selective. The psychological error underlying this bias is that individuals tend to remember only (or focus on) the extreme cases.

Given the possibilities of such bias, the proper basis for comparison might then be categorical data where an average local product cost is compared with a price (the average national product cost). This comparison is done by focusing on each national price as one category. Every single type of the national price-rates is thus expected to represent the same consumption of resources. An average local cost estimate per price-category will be calculated. Following that, the tests will be repeated (average local cost per national price vs. the national price) on both the out-patients (test C) and the in-patients (test D).

The rationale behind the different tests may be further motivated. The ambition of first set of tests (A and B) is to cost every session (a unique estimate) and compare it with the relevant national price. In e.g. a brewery the equivalent would have been to estimate the production cost of every bottle and compare it with the price obtained in the market. In such a situation the procedure would have resulted in many unique cost estimates and few prices. In the next type of tests (C and D) the average cost per national price category is estimated and compared with the relevant national price. In the brewery-context this would have been a comparison of the average production cost per price-category and the relevant price. This example also illustrates important differences between a hospital- and a factory environment. In contrast to the situation in an industrial setting the individual patient may in some instances be viewed as

a relevant cost object in hospitals. Hospital services are customized the unique patient. The different tests (A-D) reflect this variation. Figure 3 illustrates how the tests will be carried out.

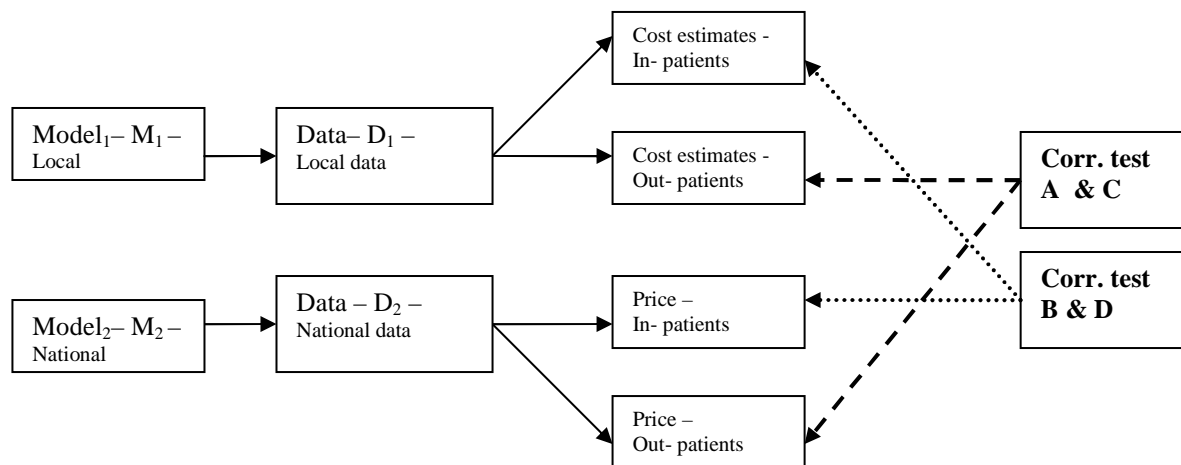


Figure 3 The different tests of the cost structure of the product costs.

4 Data

In this chapter the activity data will be described (Ch. 4.1). The central design choices of the local ad-hoc costing system will be accounted for (Ch. 4.2). In section 4.3 the local cost data involved in the costing exercise are described in some detail.

4.1 A description of the activity data

An ABC-costing exercise starts with studying the production process. The production process at the hospital goes as follows: The doctor in charge of treating the patient (working in a clinical department) orders one (or several) investigations from the Department of radiology. The order includes administrative data of the patient, clinical questions, the urgency of the order and the requested investigation. This request is reviewed by a senior doctor (radiologist) at the Department of Radiology. He/she decides what type of investigation(s) shall be conducted. The session(s) is then scheduled at one of the 29 laboratories (30 including the Angiolab). The section in charge of conducting the investigation (doctors) is also identified (6 units). The doctor(s) may not be present during the session. Their workload is primarily related to the planning, directing, description and demonstration of the investigation. Demonstrations of old pictures or pictures sent from other hospitals are the only aspects that involve doctors. The order is identified by a booking number in the local activity database (RIS).

The total activity during the first 6 months of 2003 was 43,570 sessions. In total 4,635 sessions (10.6%) were related to demonstrations of pictures received from other hospitals (second opinion) and new demonstrations of old pictures (T/NE). The number of sessions per modality is presented in Table 1.

Descriptive statistics								
		Number of sessions per Modality;						
		Total	Angio	CT	MR	RAD	T/NE	UL
Sections								
	Children section	6,856	146	262	130	3,946	743	1,629
	General section	19,750	252	1,966	15	12,740	2,128	2,649
	Angiolab section	3,376	3,376					
	MR- section	732			550		182	
	Muscle/skeleton section	6,605		262	98	5,709	134	402
	Neuro- rad. section	6,251	358	1,792	2,250	403	1,448	
	TOTAL	43,570	4,132	4,282	3,043	22,798	4,635	4,680

Table 1 The number of sessions per modality and sections

Table 1 illustrates that the internal matrix-organization reflects in part a particular production technique (Angiolab), production knowledge (MR) or customer focus (clinical unit or group of patients: The Children section). The latter group uses many modalities (production technology). Some of the units have many sessions that involve second opinion-evaluations and demonstrations of old pictures (T/NE).

The activity involved 520 different types of investigations within the chosen time period. 268 were conducted in conjunction with other investigations at the same session, and 252 alone. Every session was described by identifying one or several investigations. An investigation may be described by one or many NORAKO-codes. The 43,570 sessions resulted in 54,075 investigations described by 69,206 NORAKO-codes. The activity at this research site resulted in 714 different unique national prices (categories). If the categories with fewer than 10 sessions are removed ($1,215 / 43,570 = 2.7\%$) the number drops to 171. Five categories describe 50% of the sessions. The activity total is dominated by many sessions with a unique price. A description of the activity data is provided in Table 2.

	In-patients	Out-patients	TOTAL
The number of:			
NORAKO-codes	43,716	25,490	69,206
Investigations	33,242	20,833	54,075
Sessions	27,641	15,929	43,570
Averages:			
Investigations pr session	1.21	1.31	1.24
NORAKO-codes pr session	1.58	1.6	1.59
Price- weight pr session	1.6	0.7	1.3
Minutes pr session:			
Minimum	0.25	0.5	
Average	20	18	
Maximum	499	498	

Table 2 Describing statistics of the activity data

The average number of NORAKO-codes and investigations per session do not vary much between the two groups of patients. There are on the average slightly more investigations for out-patients than for in-patients. A national weight is attached to the session in the local activity database (RIS). This national price-weight is used for reimbursing the hospital (the revenue) for the out-patient activity. This motivates the department to follow-up on the information very closely. For the first half of 2003 the unit price was 590 NOK. The average weight per in-patient is larger than that for the out-patients. The average registered time per session seems not to vary much between the two groups of patients. The number of session minutes also seems to be homogeneous across the two main groups of patients⁴⁸.

4.2 The design of the local ad-hoc costing system

The first choice to make, building an ad-hoc local costing system, was to use as much direct cost as possible. The selected approach to allocating the indirect costs to the cost objects was inspired by the ABC-technique. The next step in the costing procedure was the choice of cost object. Specific investigations were chosen. The number of investigations chosen was regarded to be manageable compared to, for example, the number of combinations of NORAKO-codes. This cost object was also meaningful to the various groups of personnel at the Department of radiology. The third step in the specification process was the choice of cost pools. The different groups of personnel at the department contribute in a wide variety of ways to the production process. Their contribution is structured in a matrix-organization. In costing terminology: the workload related to the investigations varies. The cost data was

⁴⁸ The registered period the patient is in the laboratory.

allocated into the selected cost pools and activity centers⁴⁹. The expenses related to the personnel were allocated to the labs and sections according to the number of man-years working in these units⁵⁰. The personnel were divided into 5 main groups. In the normal working hours the radiotherapists were distributed to the 29 labs. The number of man-years needed for preparedness per groups of labs was used to allocate these expenses. The doctors were distributed according to the sections where they worked⁵¹. The fourth step in the costing procedure was to define a relevant cost driver for every cost pool⁵². The relevant cost drivers were identified in dialogue with the local leaders. The time-period the patient is in the laboratory per session (“session-time”) is registered in the RIS-system. The radiotherapists label this “machine-time”. The doctors (radiologists) refer to this as “investigation-time” (in Norwegian: “undersøkelsestid” or abbreviated as: “us-time”). In this study the label “us-time” will be used. The doctors’ workload related to the investigations is primarily before and after the patient has been present in the lab. To capture this, a standard per group of doctors, section and investigation was developed by senior radiologists. This resulted in a considerable number of standards. These standards reflected the average workload and the number of doctors involved before, during and after the investigations have been conducted. The Department of Cardiology, Angiolab has a very homogeneous activity and use of resources. There are primarily two types of investigations carried out at this section. All groups of personnel work together during the sessions. Session-time was thus chosen as cost driver for all the cost pools at this unit. Table 3 displays the various choices.

⁴⁹ Step I in the ABC-costing approach.

⁵⁰ The allocation key for step I in the ABC-costing approach.

⁵¹ Children, MR, General Radiology, Neuro, M/S.

⁵² Step II in the ABC-costing approach.

The cost pools:		Cost drivers:
Wages:		
Doctors (per section):		
Senior doctors	Normal hours (7-16)	Standard * us-time
	Preparedness	Standard * us-time
Assistant doctors	Normal hours (8-1530)	Standard * us-time
	Preparedness	Standard * us-time
Radiotherapists (per laboratory)	Normal hours (8-1515)	us-time
	Preparedness	us-time
Apparatus- leaders per group of patients	Normal hours (8-1515)	us-time
	Preparedness	us-time
Administrative personel		us-time
Other expences:		
Contrast medium		NOK per patient
Coils and other implant tissues		NOK per patient
A residual		us-time
Other cost elements:		
Allocated Internal Service costs		us-time
Depreciation and costs of capital		us-time

Table 3 The cost pools and cost drivers

4.3 A description of the local cost data

The cost information was captured from the pay-system, the general ledger and the RIS-system⁵³. The costs of contrast fluids, coils and other implant tissues were traced to the single patient and session (direct costs). The actual use of these resources was registered in the RIS-system. The type of contrast fluids and the milliliters used were registered per session. The average cost per type of contrast was supplied from the pharmacy department. The same applied for the implant tissues. 29% of the calculated full-costs of the activity turned out to be direct costs (31.9 mill. NOK)⁵⁴. The indirect costs were identified at different levels in the organization. 48.5% at the departmental and 22.5% at the hospital level. The costs identified at the hospital level were internal service costs, depreciation costs and calculated rent (13+11+0.5 mill. NOK). The use of personnel outside the normal working hours is expensive in the Norwegian context. In fact, the hospital owner buys another “product” from the groups of employees⁵⁵. All costs exceeding the regular pay were in this exercise defined to be such costs⁵⁶. The pay expenses are based on the single employee’s pay adjusted for the employer’s social costs: 14 mill. NOK for preparedness and 32.9 mill. NOK as regular pay expenses. In total 109.3 mill. NOK was involved in the costing exercise. 85 mill. NOK of the full-costs of

⁵³ A sub-system to the general ledger.

⁵⁴ 1 EURO = 8.2 NOK (kr)

⁵⁵ Preparedness – independent of the production volume.

⁵⁶ Ref. the tariffs and identified in the pay-system.

producing the services was thus accounted for at the production level (department). Table 4 displays the cost data.

		Mkr	%
Direct costs		32	29 %
Indirect costs allocated to the patients from ;			
	the departmental level:		
	Wages expenses	47	43 %
	Other expenses	6	5.5%
	the hospital level:		
	Internal service costs	13	12 %
	Depreciation costs	11	10 %
	Calculated rent	0.5	0.5%
Full- costs		109.3	100 %

Table 4 The cost data

The cost-structure related to the two main groups and the average patient is illustrated in Figure 4. The main difference relates to more use of direct costs per in-patient.

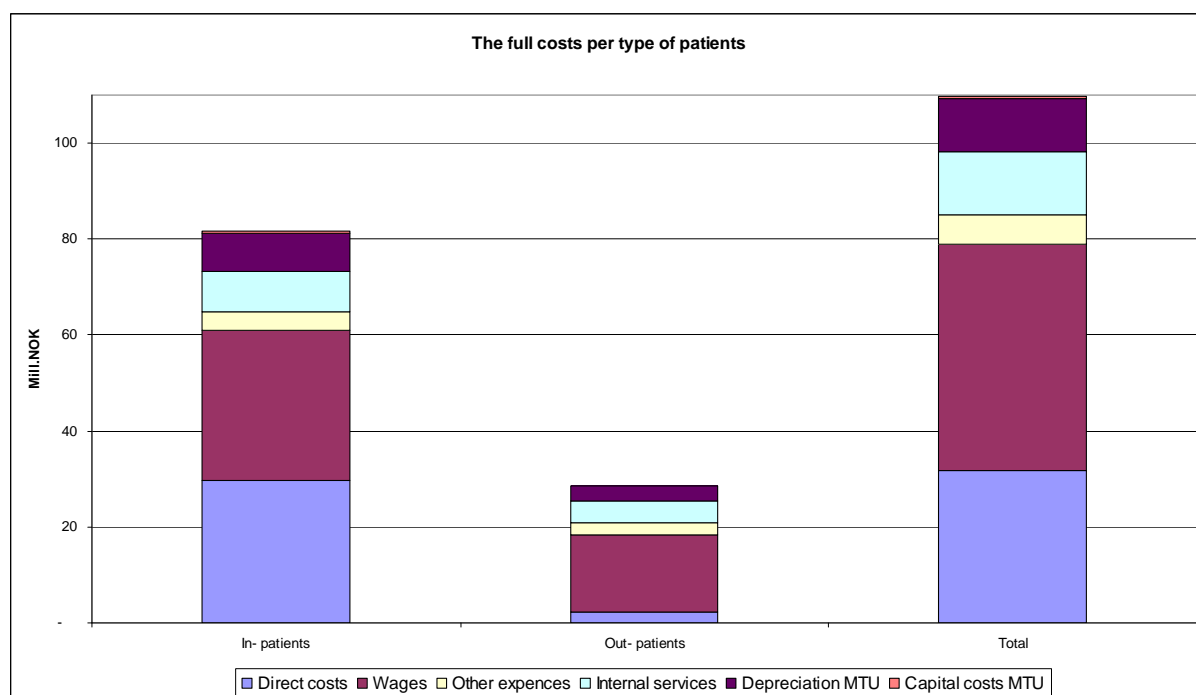


Figure 4 The full-cost per type of patients estimated by the local model.

5 Analysis

The first task at hand was to investigate the relationship between the national price and the local product cost estimates (Ch. 5.1). The second issue was to analyze factors that may explain a possible variance in product costs (Ch. 5.2). In the last section the potential the national prices have to influence the local production plan will be investigated (Ch. 5.3).

5.1 To what extent is there coherence between national prices and local cost estimates?

The price level is important because it affects the hospital's "bottom-line". However, the owner/financier may ensure that the full-costs of the local production are covered by other financing measures. At the researched site these include block-grants and activity-based prices. If the activity-based revenues are to cover the full-costs of the local production, the average national price per session should have been 2,509 NOK⁵⁷. The national prices thus cover only 30% of the estimated full-costs⁵⁸.

The general problem is that there is no information of which costs these national prices are intended to cover (marginal costs, variable costs or total costs)⁵⁹. This is not a big issue if the *cost-structure* captured by the costing system is more or less the same at the different hospitals. If the cost-structure is different, there is a problem, but as long as the total financing of the activity is supplemented with block-grants, this is not a problem when financing the hospital⁶⁰. The results from the chosen tests are displayed in Table 5.

Descriptive statistics and correlations			
	Number of sessions		Correlation coefficients
	Out- patients	In- patients	
A	15,929		0.429**
B		27,641	0.527**
C	15,929		0.726**
D		27,641	0.721**

** ,*. Indicates that the correlations are significance at the 1%, 5% level (2-tailed)

Table 5 The results of the analysis of the cost structure

⁵⁷ The estimated average full-costs of the local production: 109.3 mill NOK / 43,570 sessions= 2,509 NOK

⁵⁸ Price * average weight per session/estimated average cost of the local production: 590*1.3 / 2,509

⁵⁹ The national price-list

⁶⁰ The correlation is low

There is a low correlation between the product estimates (A&B). The modest correlation can not be explained by the general type of activity (in/out-patients). The good news is that when categorical data (C&D) is introduced, a considerable part of the variation is captured⁶¹.

The investigations provided a clear answer to our research question. There is a low correlation between the national prices and the local product cost estimates⁶². The follow-up question is: What may explain the variance in product costs?

5.2 What factors may explain the variance in product costs?

At first, the status of the patient's (emergency investigations vs. elective care) influence on the cost estimates will be investigated. Next, the time when the session is conducted will be treated⁶³. Table 6 displays the results of the investigations.

Descriptive statistics and correlations				
		Number of sessions	Correlation coefficients	Correlation coefficients: Categorical data
Emergency - Elective	Emergency sessions	13,122	0.487**	0.758**
	Elective	30,448	0.548**	0.709**
Ordinary working hours - Preparedness	Ordinary working hours	30,693	0.548**	0.711**
	Preparedness	12,877	0.516**	0.803**

**.*. Indicates that the correlations are significance at the 1%, 5% level (2-tailed)

Table 6 Investigating the influence of special operating conditions

The emergency sessions seem to have a better fit between the two cost estimates than do the elective sessions. The correlations are also higher for the sessions conducted outside normal working hours⁶⁴. These findings may be tentatively explained by the high level of direct costs (29%. Ref. section 4.3), that are not reflected in the national prices. The activity at this hospital is dominated by elective care carried out during ordinary working hours. The sessions conducted outside normal working hours seems to have a cost structure more in common with the national average despite the fact that some sessions are extreme cases as illustrated in Appendix 4⁶⁵.

⁶¹ The average local cost estimate per national price category. Ref. Ch. 3.2.4

⁶² Low coherence.

⁶³ When analyzing the data the ordinary working hours is 0800-1515.

⁶⁴ 0800-1515. If the session starts within these limits it is included in the group "ordinary working hours".

⁶⁵ The one emergency MR- investigation carried out the 14th of March 2003 between 2100 and 2230 received all the pay-expences for preparedness for the doctors at this section. This resulted in the estimated cost of 156,780 kr. The revenue (that is the national price-category) for this session was: 1,143 kr and the calculated average cost per national price-category: 4,572 kr.

A third line of investigation will be to explore certain operational cost drivers. The sections reflect which general group of patients (i.e., Children section) or which clinical unit they are set up to serve (i.e., Neuro-rad-section). Another approach is to select a particular radiology technique (Angiolab), knowledge (MR section) or internal customer focus (Children section). This internal organization reflects a particular mix of in-put factors needed to serve the hospital's patient-mix. The combination of production resources influences the costs of provided radiology services. The local costing system allocated the wage expenses for the various groups of personnel to the sections and laboratories. These allocations reflect how the local leaders use the personnel. This may, in turn, reflect the workload across the organizational units. It is reasonable to assume that, for example, the doctor's workloads are similar across the different sections. Marked differences in workload may over time create tensions between colleagues that the local manager must solve. Differences in product costs may thus reflect differences in the complexity factors (breadth and/or depth) between the national average cost of production and the costs at this hospital.

Descriptive statistics and correlations				
		Number of sessions	Correlation coefficients	Correlation coefficients: Categorical data
Local cost structure - doctors	Children section	6,856	0.430**	0.662**
	General section	19,750	0.630**	0.771**
	Angiolab section	3,376	0.219**	0.209**
	MR- section	732	0.313**	0.633**
	Muscle/skeleton section	6,605	0.289**	0.635**
	Neuro- rad. section	6,251	0.361**	0.657**
Local cost structure - radiotherapists	Angio/Intervention	821	0.074*	0.239**
	CT/MR	7,325	0.323**	0.670**
	General radiotherapy	27,413	0.334**	0.796**
	Angiolab section	3,376	0.219**	0.209**

** ,*. Indicates that the correlations are significance at the 1%, 5% level (2-tailed)

Table 7 Investigating operational cost drivers^{66, 67}

In general, the correlations are low but are improved when using categorical data. The gap is small at the General section. The correlation is very low at the Angiolab section.

⁶⁶ The correlation between a price that is 0 and local estimates is 0. This applies to the second-opinion pictures and the demonstrations of old pictures (the radiotherapist section/modality: T/NE: 4,635 sessions). The local costing system captures the resource consumption: the national costing system does not.

⁶⁷ Scatter-plots may improve the understanding of the different tests (A,B,C&D) carried out. The data from the MR-section is provided in Appendix 4. This section was selected due to the low number of sessions (732).

The correlations are particularly low at the Angio/Intervention and Angiolab sections. The analysis will be brought one step further by investigating the correlations between the prices and the wage and implant expenses at these sections. Table 8 displays the results.

Descriptive statistics and correlations					
		Number of sessions	Correlation coefficients		
			Wages	Implants	Total
Local cost structure - radiotherapists	Angio/Intervention	821	0.163**	-0.028	0.074*
	Angiolab section	3,376	-0.043*	0.196**	0.219**

**,* . Indicates that the correlations are significance at the 1%, 5% level (2-tailed)

Table 8 Investigating operational cost drivers

The implant spending per session at the Angio/Intervention section is not significantly correlated with the price. In general the use of the two investigated types of resources does not explain much of the variation in the price per session at these sections. There are differences between these sections that may influence these results. The Angio/Intervention section has a considerable lower volume and a more heterogeneous service-mix (special cases). The Angiolab section is set up primarily to provide two types of investigations.

A fourth approach is to investigate the use of direct costs. The use of particularly expensive implants (direct costs) may explain the low correlation (0.209) at the Angiolab section. At this section the personnel work together in providing only three types of investigations. The chosen cost object, cost pools and cost driver are thus homogenous. 97% of the sessions involve the use of implants. The total implant costs makes up 74% (22/30 mill. NOK) of the estimated full-costs at this section. 81% of the implants are used during the normal working hours at the Angiolab section (88% at the Neuro-rad. section). At the other sections, the use of implants makes up a smaller portion of the estimated full-costs. At the Angiolab section, there are three categories of implant costs per session (NOK) 1,154, 2,799 and 16,706. The number of sessions per category is 257, 2,042 and 961. Only 116 sessions did not involve implants.

	Number of sessions;			The costs of implants	% of the full- costs
	Total	with implants	%		
Children section	6,856	203	3 %	558,411	4 %
General section	19,750	830	4 %	2,466,632	9 %
Angiolab section	3,376	3,260	97 %	22,065,773	74 %
MR- section	732	2	0 %	-	0 %
Muscle/skeleton section	6,605	1	0 %	1,300	0 %
Neuro- rad. section	6,251	363	6 %	4,332,744	20 %
SUM	43,570	4,659	11 %	29,424,860	27 %

Table 9 The use of implants per section

A fifth approach is to calculate the correlations per modality. This may capture the changes in medical praxis that are not reflected in the national cost model. At this hospital there is a particular focus on research and the implementation of new medical procedures. The modalities are general radiotherapy (RAD), computer tomography (CT), ultrasound (UL), magnetic resonance (MR) and angio-therapy (Angio).

Within modalities where the changes in the medical praxis have been high, the correlations are very low (i.e., Angio/intervention, where the correlations are not significant). The correlations are improved with categorical data (correlation 0.134). The best correlations are obtained with the general radiotherapy sessions (0.83). This is the modality that has experienced the least change in the medical technology in recent years.

Descriptive statistics and correlations				
		Number of sessions	Correlation coefficients	Correlation coefficients: Categorical data
Modality	RAD	22,798	0.415**	0.83**
	CT	4,282	0.257**	0.751**
	UL	4,680	0.117**	0.459**
	MR	3,043	0.171**	0.407**
	Angio	4,132	0.011	0.134**

**.*. Indicates that the correlations are significance at the 1%, 5% level (2-tailed)

Table 10 Investigating the effect of modality

The last approach is to investigate the effects of the national price-rules. The aggregation of the single primary weight per NORAKO-code into the session in question may better reflect the resource consumption. Table 11 displays the results.

Descriptive statistics and correlations				
		Number of sessions	Correlation coefficients	Correlation coefficients: Categorical data
Effect of price rules?	Weights corr. for price- rules	43,570	0.519**	0.729**
	SUM primary weights per session	43,570	0.523**	0.725**
**,*. Indicates that the correlations are significance at the 1%, 5% level (2-tailed)				

Table 11 Investigation the effect of the price rules

Table 11 illustrates that the price-rules do not affect the results.

The use of implants, the number of second opinions and demonstration of old pictures along with the local organizing of the personnel into sections are factors that may explain some of the gap in product costs. The best correlation (0.83) is obtained with the traditional radiotherapy sessions.

5.3 What potential do the national prices have to influence the local production plan?

This depends very much on how the price signal is presented in the different management control functions within the hospital. Management control is carried out at different levels in an organization. One such management level is the hospital level. Another is the operating level. In practice there will be several organizational levels in between these two levels (see also Appendix 1). In this study the focus will be on hospital- and operating -level (i.e., the 3rd and 7th levels illustrated in Appendix 1) to illustrate possible consequences of the findings. The presentation represents only one of many ways for describing what is going on inside this hospital.

If the national prices are to have any possibility of influencing the local production-plan, the average price per session must exceed the relevant estimated cost. The national average price is 590 NOK. The average weight per session in this hospital registered in the local activity database is 1.3⁶⁸. Thus to be profitable the average cost per session must not exceed 753 NOK. How many sessions cover the estimated costs? If standard management accounting terminology is applied, there are three situations to investigate⁶⁹;

⁶⁸ Average price-weight per session: out-patient: 0.7 and in-patient: 1.6

- operating margin ≥ 0 (price – total costs),
- contribution margin I ≥ 0 (price – direct variable costs) and
- contribution margin II ≥ 0 (price – variable costs).

The definition of a cost object is central when classifying costs. A cost object is “*anything for which a measurement of costs is desired*” (Horngren et.al. 2009:53). The selected costs object in this study is the session (i.e., the single patient. See Figure 1). The common costs at hospital level, the costs of depreciation and the costs of capital may then be classified as fixed costs (FC). The costs for preparedness may also be classified as fixed costs. The costs of implants and contrast fluids are the marginal costs (MC) of production. The variable costs (VC) involve the pay expenses at normal working hours and other expenses at production level. Table 12 illustrates this classification for the average session.

The cost structure for the average session		Kr	%
MC	Direct costs	732	29 %
VC	Variable costs	893	36 %
FC	Fixed costs	884	35 %
TC	Total cost per session	2,509	100 %

Table 12 The classification of the costs for the average session

This classification of the costs of production may enable us to better understand the incentive structure facing the different management functions within the hospital. At the hospital level the incentive structure is: Price (753 NOK) \geq TC. At the operating level the prices must at the minimum cover the marginal costs (MC) and possibly some of the variable costs (VC). How many sessions fulfill these requirements?

How many sessions have a positive operating margin? Table 13 illustrates the results.

⁶⁹ Although these concepts are not used in the management of Norwegian hospitals.

Descriptive statistics				
		Number of sessions;		
		Total	Operating margin ≥ 0	% of the total
Sections				
	Children section	6,856	340	5 %
	General section	19,750	907	5 %
	Angiolab section	3,376	1,123	33 %
	MR- section	732	230	31 %
	Muscle/skeleton section	6,605	37	1 %
	Neuro- rad. section	6,251	531	8 %
	TOTAL	43,570	3,168	7 %

Table 13 The number of profitable sessions

Only 7% of the sessions cover the total estimated costs of production. Despite the low correlation obtained at the Angiolab section (0.219**), this unit has the highest number of profitable sessions (33% of the activity).

How many sessions have a positive contribution margin I? Table 14 illustrates this.

Descriptive statistics				
		Number of sessions;		
		Total	Contribution margin I ≥ 0	% of the total
Sections				
	Children section	6,856	6,704	98 %
	General section	19,750	18,864	96 %
	Angiolab section	3,376	2,400	71 %
	MR- section	732	732	100 %
	Muscle/skeleton section	6,605	6,603	100 %
	Neuro- rad. section	6,251	5,924	95 %
	TOTAL	43,570	41,227	95 %

Table 14 The number of sessions with positive contribution margin I

In general, the activity-based prices cover the marginal costs of production.

How many sessions have a positive contribution margin II? Table 15 illustrates this.

Descriptive statistics				
		Number of sessions;		
		Total	Contribution margin II ≥ 0	% of the total
Sections				
	Children section	6,856	2,173	32 %
	General section	19,750	7,373	37 %
	Angiolab section	3,376	1,853	55 %
	MR- section	732	288	39 %
	Muscle/skeleton section	6,605	554	8 %
	Neuro- rad. section	6,251	3,839	61 %
	TOTAL	43,570	16,080	37 %

Table 15 The number of sessions with positive contribution margin II

Many of the fixed costs are not accounted for and visible at the operating level. At some sections a high number of the sessions have a positive contribution margin II. The national prices cover on the average 37% of the estimated cost of the activity in the normal working hours. There is large variation among the sections.

On the average only 7% of the sessions are profitable. 33% of the sessions at the Angiolab section are profitable. If the price is compared with the variable costs of production, 95% of the sessions are profitable. 55% of the sessions at the Angiolab section have a positive contribution margin II. These findings illustrate the importance of adjusting the signals sent by the national prices. The full exposure of a national price at the operating level may encourage the local management to believe that their activity is more profitable than it really is. The analysis also illustrates that there may be incentives among the sections to increase the activity. A standard classification of the costs, according to management accounting terminology, may be useful in moderating the national price signals.

How may we understand the finding at the Angiolab section: the highest number of profitable sessions and the lowest correlation? The implant costs make up 74% of the total costs at this section (22/30 mill. NOK). Thus the procurement and use of this in-put is important. As a result, the unit has put a former senior section leader in charge of procurement at this clinic (heart, thorax and thorax surgery). The direct costs of the two investigations conducted are estimated every year (since 1995) and used in the control procedure (planning and follow-up). The unit makes extensive use of public tenders and price negotiations. As a result of this activity the direct cost per medical procedure (“V.kat.”⁷⁰) has as a result of this dropped from

⁷⁰ Venstre hjerte kateterisering (left heart catheterization)

3,018 NOK (2003) to 2,687 NOK (2004) and to 1,600 NOK (2009). The direct cost of the other procedure (“PCI”⁷¹) has dropped from 16,198 NOK (2003) to 15,455 NOK (2004) and to 9,600 NOK (2009). In the same period the activity has expanded. The national prices seem not to have captured these trends.

There are three different combinations of implants in use at the Angiolab section costing respectively 1,154 NOK, 2,799 NOK and 16,706 NOK. Focusing on these categories the average “contribution margin I” and average “operating margin” is displayed in Table 16.

Descriptive statistics						
MC	Average TC per session			Price	Contribution margin I ≥ 0	Operating margin ≥ 0
	Out- patients	In- patients	Total activity			
1,154	5,413	4,560	4,639	3,681	2,527	(959)
2,799	5,211	4,884	4,892	4,670	1,871	(222)
16,706	21,460	19,149	19,247	5,231	(11,475)	(14,016)
-	1,506	2,687	2,595	1,631	1,631	(964)

Table 16 The average full-costs per category of implants at the Angiolab section

The price is less than the implant costs (MC) for the most expensive implant. Based on this information, no such medical procedures (PCI) should be carried out. The other treatments have a potential to be perceived as profitable at the operating level (the contribution margin I is positive). To the hospital they are not profitable (negative operating margin). How many sessions have a positive operating margin per category of implants? Table 17 illustrates this.

Descriptive statistics							
SUM implant- cost	Profitable sessions			Sessions with a loss			TOTAL
	Out- patients	In- patients	Total	Out- patients	In- patients	Total	
1,154	10	116	126	14	117	131	257
2,799	21	928	949	31	1,062	1,093	2,042
16,706		1	1	41	919	960	961
0	2	45	47	7	62	69	116
Total	33	1,090	1,123	93	2,160	2,253	3,376

Table 17 The number of sessions with at profit or loss in each category of implants

For every patient given the expensive implant (960) the loss is estimated to be 11,475 NOK. This accumulates to 11 mill. NOK for these 6 months. This may explain the low correlation at this section. About 50% of sessions involving the other types of implants are profitable. They

⁷¹ Percutaneous Coronary Intervention

contribute with a small positive margin when the cost of the implant has been covered. The total net effect is that this unit must have additional financing to cover the full-costs of production (a bloc-grant of 14.3 mill. NOK).

Turning to the radiotherapist section: Angio/intervention, there are almost no profitable sessions (15). Doctors from three sections are involved in the sessions. There are more than 630 different unique implant cost categories. This may explain the low correlation (0.239**) at this section. The total cost of implants is 6.6 mill. NOK. This is in strong contrast to the situation at the Angiolab section (not standardized vs. standardized products). The cost structure of the production also differs. The costs of personnel (specialized knowledge) are more important than the direct costs. The implant cost data is displayed in Table 18.

Descriptive statistics				
	Children section	General section	Neuro- rad. section	TOTAL
SUM implant costs	509,011	1,765,932	4,332,745	6,607,688
Number of sessions	162	296	363	821
Average cost of implants per session	3,142	5,966	11,936	8,048

Table 18 The use of the implants at the Angio/intervention section

This data may reflect the special activity (severe cases) at this hospital. The provision of the services to these patients requires highly specialized contributions from different groups of personnel. The use of implants (and personnel) are clearly more “tailor- made” to the single patient at this section than at the Angiolab section. One patient was given implants totaling about 68,000 NOK during one session. This may explain that the correlation at this section between the implant costs and the price was not significant (-0.028).

6 Discussion

When allocating indirect costs to a cost object all types of errors is involved (Datar & Gupta, 1994). Thus, no one knows “*the unobservable true costs*” of production at the investigated hospital (Labro & Vanhoucke, 2007:941). The estimated product costs are only one attempt to envision the involved resource consumption when providing the services. Yet the ad-hoc cost estimates were the result of a very detailed effort to measure the services provided the individual patient (Cooper & Kaplan, 1988). The gap in cost-level was 70%. The average revenue per session covered only 30% of the estimated average cost (753/2,509).

The correlation between the estimated costs for the individual patient and the relevant national price for out-patients was 0.429 and for in-patients 0.527. There were also large variations between the different investigated dimensions. This study thus provides empirical data that illustrates that *“product costing techniques have a striking effect on the way in which costs are estimated and used”* (Demski, 1997:79). The local costing system provides more precise cost estimates than a national costing system. A hospital with a deviating cost-structure from the national average may find it useful to have local cost estimates.

The use of a national funding system with average prices may be regarded as a convenient tool by the owner for allocating a given amount of money to local providers of services (Pettersen, 1999; Carey & Burgess, 2000; Oliver, 2005; Larsen, 2007). The challenge with this approach is that hospitals within a healthcare system may have different activity (patient-mix) and cost-structures. This study has illustrated that there may be a large gap in cost-level between the “average” hospital and this university hospital. The use of average prices has been characterized as “government at a distance” (Preston et.al., 1997). The problem with the use of national average prices as incentives is that they may have unintended effects. The “average” hospital does not exist (Llewellyn & Northcott, 2005). If the financing of the activity is based on the national average prices, the hospitals within a healthcare system then may be confronted with adverse incentives. Some hospitals will win and others lose. Some hospitals may have the possibility of adjusting the activity to the price signals. Other actors may not have this possibility because the different roles and tasks they perform within a healthcare system. Some actors may only focus on profitable diagnoses at the expense of other purposes within the healthcare system (Hagen & Kaarbøe, 2006). We know that changes in payment mechanisms give an incentive to shift costs, quality, patient mix and services in hospitals (Eldenburger & Kallapur, 1997; Forgione et.al., 2005). Cost shifting among those who pay particular fees, carried out by hospitals to increase the hospital’s revenues has been reported (Eldenburger & Soderstrom, 1996). Such unintended effects may be made as small as possible by reducing the price/cost-ratio of the incentive. In this study the price/full-cost ratio has been estimated to be 30%, but by reducing this ratio the effectiveness of the price-signals may be eroded. The literature supports this approach when healthcare providers have many different activities to perform (patient treatment, teaching and research) and when these activities are difficult to measure or observe (Propper, 2005). This is the case at the researched site. At this hospital the combination of activity-based financing and block-grants solved the

financing challenges. At private institutes the national prices may cover the costs of production⁷². As long as the gap affects only the cost level, adjusting the price/cost-ratio of the incentive may solve the problem.

The results of the different tests that have been performed (A-D) indicate that the costing systems (national – local) have a co-variance along a linear trend. We may not conclude that the price and cost estimates do not reflect any common cost structure. The problem is that the national prices do not explain much of the variation in the local cost estimates. This was expected because the cost per session is compared with a price. Naturally there is high heterogeneity in the calculated individual patient's costs and low variation in prices. When the problem was addressed, the correlation increased markedly (C-D). A categorizing of the local cost estimates into the relevant group of national prices contributed markedly to explain much of the variance.

This study has illustrated an important point by displaying the relationship between the local cost estimates per patient, categorical cost estimates and national prices. The introduced of the concept of “categorizing” may be useful when financing the activity at hospitals that have a different cost structure. The correlation increased from 0.429 to 0.726 for out-patients and from 0.527 to 0.721 for in-patients. If there is large heterogeneity in the cost structure between the providers of care, one solution might be to have different prices for the different categories of hospitals. The activity at tertiary care hospitals may then have a different price per investigation than that at the private radiology institute. The possibilities for unintended consequences of a financing system may then be reduced.

The various analyses indicate that the use of implants, the number of second opinion sessions and demonstration of old pictures, as well as the local organizing of the personnel into sections, influence the variance in product costs. These subjects may capture the special cost structure necessary to perform the investigations conducted at this tertiary care hospital. For example, private radiology institutes do not carry out second opinion investigations or complicated interventions. Highly specialized competences and equipment are needed in tertiary care. Private institutes do not have costs related to preparedness. These differences in cost-structure reflect the agreed upon division of labor within a healthcare system. The

⁷² No bankruptcies have been reported.

capacity set up to take care of the patients reflects the special cost structure at this hospital, and its cost structure deviated from the national average⁷³. The Angiolab section is unique among Norwegian hospitals with respect to the high volume of production. Another characteristic of the local activity is the more specialized services provided by the Angio/Intervention section. This modality has the lowest correlations (0.134). By contrast, the best correlations are obtained with the ordinary radiotherapy sessions (0.83). This finding may indicate that the national price system may work well for the financing of such an activity.

The role of variance is emphasized differently when designing a costing system for different purposes⁷⁴. When calculating a national price list, outliers and extreme values are often removed (Llewellyn & Northcott, 2005). The work with calculating the Norwegian national price list for in-patients may serve as an example (Buhaug, 1999). At first, the activity data is examined. The DRGs with fewer than 5 stays are removed. The hospital stays with longer LOS than two standard deviations within the single DRG are also removed. In this manner, the prices are calculated to better reflect the activity it is intended to cover: the average national activity (Jones, 1999). By contrast, when the purpose is local cost control, high variance in the cost estimates through more precision in the estimations may help local managers to make better decisions (Cooper & Kaplan, 1987). The problems with aggregating costs into less homogenous cost pools have been illustrated in this study. These contradictory relationships may also explain some of the low correlations.

Textbooks claim that studying cost behavior is a key to good management decisions (Horngren et.al., 2000). The accounting literature has reported that a classification of costs may provide useful information to managers in hospitals (Pizzini, 2006). Implementing such a classification consistently across hospitals may be challenging (Ellwood, 1996b). Full-cost prices may provide a convenient means of directing attention, but only a detailed study can reveal the local cost implications (Jones, 1999). In this study few sessions were profitable to the hospital (7%), but the national prices covered almost all the marginal costs of production. The activity at some sections did not. Only 37% of the estimated full-cost of production covered the variable cost of production. Without adjustments to the price signal, the local manager may perceive that their activity is more profitable than it really is. Acting on this mistaken impression, an increase in the activity (volume) will then create a deficit. This has

⁷³ The costs of the production facilities (labs) and the personnel organised into the various sections.

⁷⁴ For example financing and cost control.

been reported as one of the adverse effects of the introduction of the Norwegian PPS-system (Pettersen, 1999; Pettersen, 2001b). This study has illustrated that national prices are not precise signals for imposing changes in the local activity and service production. The findings moderate the reported potential for PPS-systems to penetrate and alter the internal operating processes of hospitals (Covaleski et.al., 1993). The success of PPS-reforms may depend on the hospital's ability to translate "the reforms inherent management-logic" to the "hospitals clinical-logics" (Pettersen, 1999). This study has illustrated how a classification of costs may moderate the price signal and make it more decision-relevant for the local managers.

A key management accounting guideline is: "*different costs for different purposes*" (Horngren et.al., 2000:11). A more modern view is: "*different systems for different purposes*" (Bjørnenak & Olson, 1999:334). The different organizational contexts in the Norwegian healthcare system (Appendix 1) may have different criteria for information relevance. We know that a cost concept used for the external reporting purpose "*may not be an appropriate concept for internal routine reporting to managers*" (Horngren et.al., 2000:11). Cost estimates from a local costing system may provide relevant information for the local managers. Such information may help these managers "*to make wise economic decisions*" (Horngren et.al., 2000:11). This study has illustrated how the local activity and its relationship to national funding systems can better be understood.

One rationale behind a national activity-based funding system may be that it will have an effect on the local production plan (Ellwood, 1996a). At the researched site the average national price did not signal a general increase in the activity. Despite the low price/cost ratio, one section with a very high number of profitable sessions was identified (Angiolab section: 33%). 54% of its sessions had a positive contribution margin II. This section has two standardized treatments and a high production volume. A further investigation found a particularly close cost control regime of the direct costs at this section⁷⁵. Over the years the indicated profit margin has induced the local leaders to expand the activity⁷⁶. At this unit the funding system seems to have provided the intended effect with activity-based financing by lowering the costs from economies of scale and reducing input prices (Ellwood, 1996a). The activity at the other sections was dominated by more specialized treatments with low

⁷⁵ One former manager of this unit has been working as procurement officer for years at this section.

⁷⁶ "Vkat": 4,626 sessions in 2003. +26% (2008) and "PCI": 1,905 sessions in 2003. +18% (2008).

production volumes combined with more ordinary investigations (high volume). There were a very low number of profitable sessions at these sections. Despite the indicated effect at one section, the low price/cost-ratio combined with few profitable sessions represents a problem. What do the national prices represent? Shall the activity be reduced or the cost-structure (and thus the quality) altered to become national average? In the Norwegian healthcare system the prices neither represent any national priority between the various medical procedures nor (as this study has illustrated) capture the local cost structure very well. According to the national DRG-pricelist: “*the national estimates (prices) are not enough solid to be made use of for the financing of individual patients and departments.*”⁷⁷ Given this background, it is difficult to avoid asking: what is the point with such signaling? One motive may be to improve the quality of the activity registrations. The economic rationale behind the existence of national prices with a low price/cost ratio is a paradox.

7 Conclusion and further research

The first conclusion is that there was low correlation between the national prices and the local cost estimates. The second conclusion is that much of the variation was explained when using categorical cost estimates. Categories of hospitals (primary – secondary – tertiary care) may reflect a different cost structure than the national average. The last conclusion is that local product cost information may be one important input to ascertain profitability or loss and to provide a basis for exploring alternative actions and consequences.

The main finding of this study is that the statistical analysis showed that there was low correlation between the national prices and the local cost estimates.

Accounting researchers have pointed out how national average prices may promote “*averageness as an ambition for the hospital as a social institution*” (Llewellyn & Northcott, 2005:567). This study has provided empirical evidence of a low correlation between cost estimates from costing systems placed centrally and those placed locally in a healthcare system. No previous analysis has been made of the explicit relationship between national price and local service cost (Kjøllestadal, Essay I). This study has also provided empirical evidence of the dilemmas in the local control of a hospital when promoted (financed by

⁷⁷ See for example, http://www.helsedirektoratet.no/publikasjoner/regelverk-innsatssturt-finansiering-2012/Sider/default.aspx_paragraph_1.1 page 7.

national average prices) to be cost average. This is labeled “the *price-cost low-correlation* contribution”.

This quantitative analysis of an explicit relationship has illustrated that hospitals with a low correlation between national average prices and local cost estimates may benefit from having a local costing system. This finding may motivate further studies on the design and use of local costing systems in university hospitals. The conclusions encourage us ask new questions. What local costing systems have university hospitals designed? How is the cost information used? Is there a variation in design and use between comparable hospitals operating in different contexts?

APPENDIX 1

General levels in a healthcare system	Organizational levels in the Norwegian healthcare system
National	1 Ministry of Health and care services
	2 Regional Health Authority
Local	3 Hospital Enterprises
	4 Division
	5 Department
	6 Section
	7 The physical location (e.g. ward, laboratory)

Appendix 1 The two general levels in a healthcare system and the organizational levels.

APPENDIX 2

General groups of hospital services	The general groups of patients with often encountered cost objects		
	In-patients		Out-patients
	National DRG		The relevant national cost object
	Hospital DRG		
	Departmental DRG	Departmental DRG	
Clinical services (provided at wards & out-patient locations)	Length of stay	Length of stay	Sessions
Anaesthesiology services	Anaesthesiology sessions		
Surgery services	Surgery sessions		Day-surgery sessions
Intensive Care Unit services	Length of stay		
Radiology services	Sessions		
Laboratory services	Tests		
Radioteraphy services	Sessions		

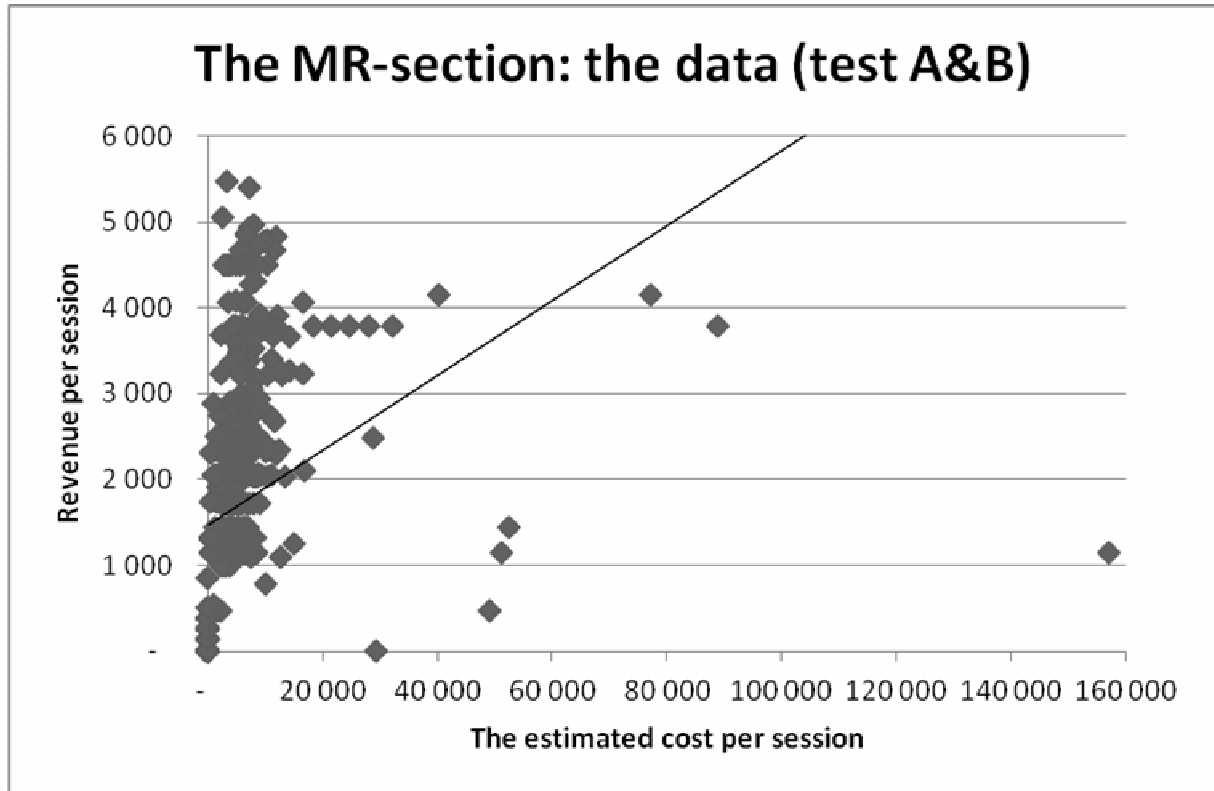
Appendix 2 The general groups of hospital services and different cost objects.

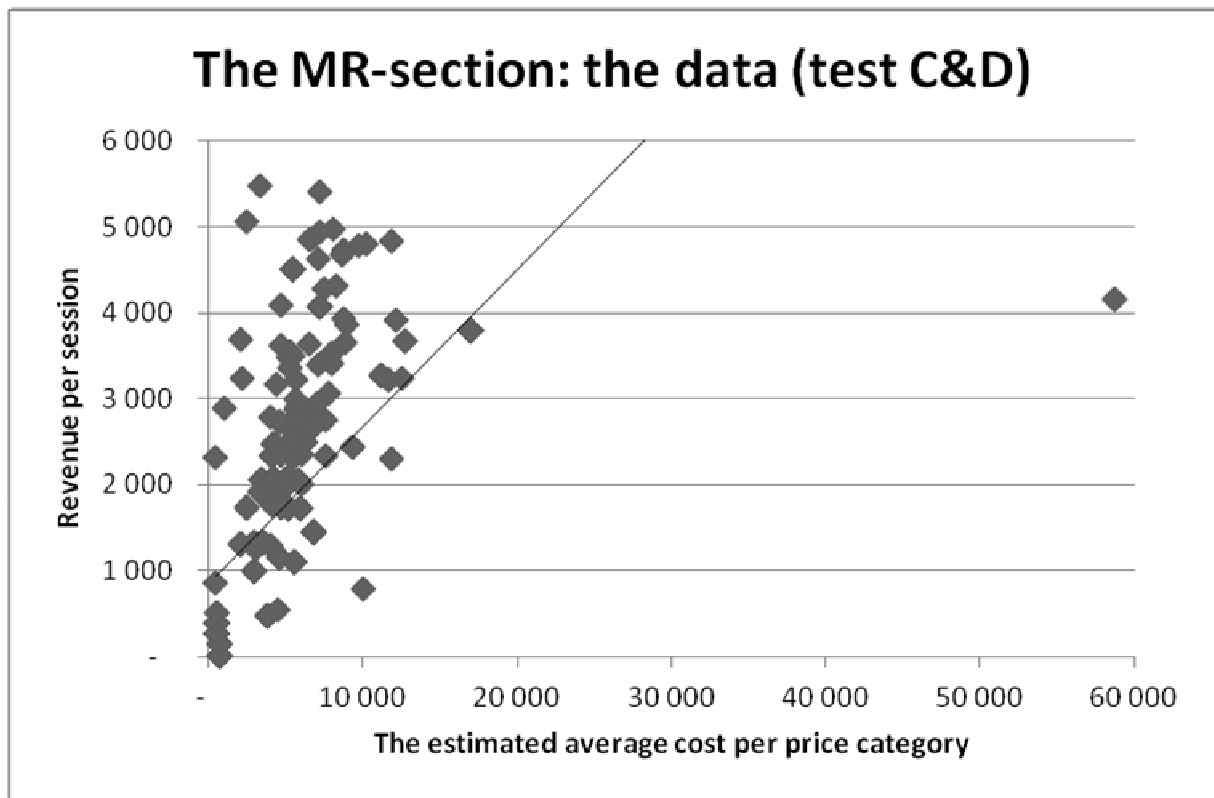
APPENDIX 3

$$\rho_{X,Y} = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y} = \frac{E[(X - \mu_X)(Y - \mu_Y)]}{\sigma_X \sigma_Y}$$

Appendix 3 The Pearson correlation coefficient for a population.

APPENDIX 4





Appendix 4 Illustrations of the data involved at the MR-section.

Essay III Design and use of cost accounting models in Nordic university hospitals

By

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and

Trond Bjørnenak

Abstract

The review of the literature indicated that accounting researchers have discussed very little about the actual design and use of cost accounting models in hospitals (Kjøllesdal, Essay I). This represents a research problem. The research question in this third study is: What is the actual design and use of cost accounting systems in major Nordic hospitals? The theoretical frame of reference of the study focuses on the link between the cost accounting data and the management control system in a hospital (Anthony & Young, 2003; Horngren et.al., 2009; Kjøllesdal, Essay I). A comparative case study of Nordic university hospitals was conducted to address the research question. Three conclusions were made.

The first conclusion is that there is diversity in how the hospitals design their cost accounting models. The second conclusion is that the different configurations seem to form different “packages” with distinctive characteristics. On the one extreme, rather simple systems are designed as more mechanistic and arbitrary allocation models. In other cases more advanced tools are used for planning, allocating resources and to measure performance. The third conclusion is that we have observed on a more speculative basis a link between the design and use of systems and the funding model.

The main knowledge gained from this study is that a university hospital may have a mix of cost accounting models and that one of these costing systems may be advanced. Some hospitals calculated the local standard cost per service by an advanced costing system.

These findings motivate rethinking of traditional contingency studies and suggest that the link between overall governance and management accounting in the public sector context should

be given more attention. We have seen the importance of funding and governance and their impact on the design and use of management control systems.

One important observation is that a major university hospital can manage and survive with a very simplified version of actual cost information. In such a version only volumes and total costs are used and compared to the budgets. Arbitrary allocations seem to be handled by ad-hoc procedures of “taking back” surpluses and by subjective assessments for block-grants. Compared with the other Nordic hospitals, the hospital with the simplified and arbitrary system is a success story in terms of growth and increased resources. The rationale for not using advanced systems in rich organizations should be addressed by further research.

Another observation is the adoption of more advanced systems, but not using these systems to control the local activity as observed at one of the investigated hospitals (Karolinska). Attention is given to increased resources in all the cases, but only two of them use local cost information on services and patients to control the activity. At Karolinska increased resources were not linked to systems for services or patient costs. Other types of use do not seem to be strong enough to legitimize the systems. This observation suggests that more research attention be given to the hierarchy of multipurpose systems, for example, costing systems.

Two of the cases seem to be strongly informed by their advanced costing systems. In both cases, they also seem to be well-controlled in terms of keeping spending within their budget limit (a surplus). We do not claim that there is a cause and effect relationship between the use of more advanced systems and financial performance or control. Yet in both cases the systems are used to control activity, and they clearly inform decision making in the organization. This link between actual decision making and cost accounting information should be given more attention.

1 Introduction

The introduction of advanced costing systems in US hospitals has been associated with “*the advent of cost-based pricing procedures*” (Demski, 1997:4). When the prospective payment systems (PPS) were introduced in the US in the early 1980’s, it significantly decreased the US hospital’s control of its revenues (Samuel et.al., 2005). When prices were set by external parties, profit planning had to be achieved through cost control and patient mix decisions. It was reasonable to assume that hospitals operating under these conditions implemented and would use advanced cost accounting systems; but by the early 1990’s 38% of the US-hospitals still lacked a costing system that provided data on the costs of their patients (Hill, 2000). System complexity, including the production of unnecessary information and the integration with other systems (patient related data), seem to be among the most important barriers for effective control system design (Carey & Burgess, 2000; MacArthur & Stranahan, 1998). These findings are consistent with problems related to implementing advanced cost accounting system in other industries and can be understood as one of the key reasons for the “ABC-paradox”, for example, increased need for more refined costing data, but still low rates of adoption of, for example, Activity-Based Costing systems (Gosselin, 1997; 2007).

This perceived gap between the need for relevant cost accounting information and the lack of relevant information for control and decision making also seems to have reached the Health Care sector in the Nordic countries. Assessing the implementation of a PPS in Norway, the authorities said: “*Hospitals (still) lack knowledge about how much (their) patient treatments costs*” (Larsen, 2007:21)⁷⁸. A review of the literature indicated that accounting researchers have discussed very little about the actual design and use of cost accounting systems in hospitals (Kjøllestadal, Essay I). In this study we try to investigate different configurations of cost accounting systems in major Nordic university hospitals. Thus, our research question is: What is the actual design and use of cost accounting systems in major Nordic hospitals? This leads us to the second aim of the study. The Nordic countries “*have strong common platforms geographically, in politics and in culture*” (Pettersen, 2004:325). In terms of Pettersen (2004:325) these countries are “*well developed welfare states where hospitals have been owned by the state or counties and financed on global budget schemes.*” Yet the hospitals are founded and organized different in all the Nordic countries (Pettersen, 2004). What may explain possible differences?

⁷⁸ This is still the situation in 2013 according to the Office of the Auditor General of Norway:

The rest of this essay is organized as follows. The next chapter presents a framework for the design of cost accounting systems and how it is linked to the management control systems in a hospital setting. Chapter three presents the research method, followed by the presentation and discussion of the four different cases. The last chapter includes some general conclusions and a call for further research.

2 Budgets and cost accounting in hospitals

Cost accounting measures, analyzes, and reports financial and nonfinancial information relating to the costs of acquiring or using resources in an organization (Horngren et.al., 2009). Traditionally, cost accounting combined with budgets has played an important role in public organizations (Anthony & Young, 2003). A budgetary control-procedure for a hospital can be described in four principal phases: strategic planning, budget preparation, operating and measurement, and reporting and evaluation (Anthony & Young, 2003). The work with the budget takes place at different organizational levels at different points of time. It starts early in year X-1 with the board giving the financial limits for the total budget (year X). This is input to the budget processes and discussions in the organizational units (departments), ending with a budget decision by the board. During year X the actual accounting numbers are followed, compared to the budgets, and reported in monthly and quarterly reports. Figure 1 illustrates a budgetary control-procedure in a hospital.

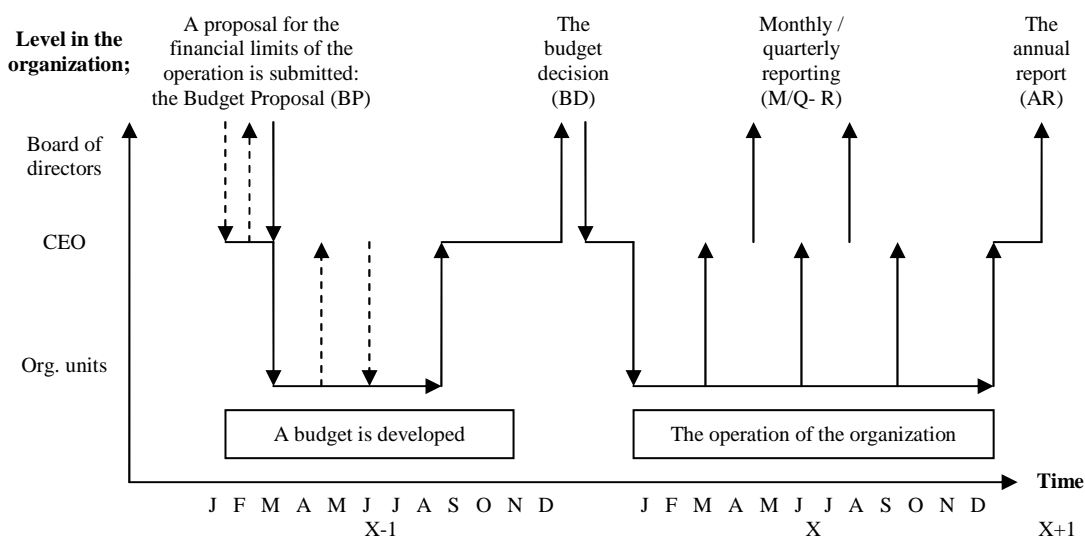


Figure 1 A typical budgetary control-procedure in a hospital⁷⁹

http://www.riksrevisjonen.no/Rapporter/Documents/2013-2014/Dokumentbase_3_4.pdf

⁷⁹ The dotted lines indicate informal contact.

The cost accounting and budgeting system has two major purposes in this setting: a planning and resource allocation purpose and a control and performance evaluation purpose.

In order to describe these differences in the design of cost accounting systems we need to be as specific as possible in highlighting the important dimensions. In this chapter, we develop a framework for describing what we see as the most important dimensions of a cost accounting system in hospitals. We have structured the presentation in accordance with the most important processes in the control system:

- How budget and accounting are used in the planning and resource allocation processes?
- How are accounting numbers used to make the units accountable (control and performance measurement)?

The perspective is the formal design of the accounting systems and how it is used as a common platform for controlling all units within the hospital. However, we are also interested in what kind of accounting numbers that are used locally to follow up on the activity.

2.1 Planning and resource allocation

Ideally *the planning procedure* should include selecting organizational goals, predicting results under various conditions, deciding how to reach the goals and communicating how to obtain them within the organization. Integrated with a planning procedure is setting financial limits for the next period activity, a communicative procedure between organizational units and administration on the goals and need for resources. The cost accounting system is a vital tool in this communication, providing the information on cost consequences of different choices of action.

The resource allocation procedure follows the budget decisions. In the public sector the budget decision often involves a spending authorizing mechanism, for example, the freedom to use the allocated resources within a specific period. In addition, in hospitals within public healthcare systems (i.e., as in the Nordic countries) the resource allocation models are strongly linked to the revenue models based on formula funding systems where resources are allocated (at least partly) based on measures of production. Thus, resources are both allocated

up front as a fixed budget and during the budgeting period based on a pre-defined formula according to measures of production. The mix of fixed and variable resources varies in different settings (i.e., countries) and over time.

The introduction of the DRG-system⁸⁰ has had a major effect on the diffusion of formula-based resource allocation models. This system is regarded to have a potential to “*penetrate and alter the internal operating processes of hospitals*” (Covaleski et.al., 1993:65) and has been linked to a number of healthcare reforms, also including some in the Nordic countries. The motivation for these reform initiatives has been to induce financial accountability into hospital management (Doolin, 1999; Jones, 1999a; Rea, 1994). A major part of management accounting research on hospitals has focused on studying the effect of such activity-based financing reforms on hospitals’ performance (Kjøllestad, Essay I). One reported effect has been that changes in payment mechanisms have effects on the operating decisions within hospitals (Eldenborg & Kallapur, 1997; Eldenborg & Soderstrom, 1996; Forgione et.al., 2005; Rayburn & Rayburn, 1991). Researchers have also characterized such reforms as “accounting colonization” (Chua, 1995; Doolin, 1999; Lowe, 2000b), “government at a distance” (Preston, Chua, & Neu, 1997) or as an effort to “monetize medicine” (Samuel et.al., 2005). A low sense of ownership of the new activity-based contracts has been reported (Ellwood, 1996a; Jones, 1999a; Jones, 1999b), and studies conclude that reforms have failed to induce efficiency in the provision of care (Doolin, 1999; Ellwood, 1996a; Jones, 1999a; Jones, 1999b). The image of the hospital as a market-driven and a flexible organization responding to changes in prices has been reported to be insufficient (Ellwood, 1996b; Lindkvist, 1996). Researchers have tried to explain why such reforms have failed by pointing at the different control logics - administrative and clinical - that are present in hospitals (Abernethy & Stoelwinder, 1995; Nyland & Pettersen, 2004). A weak link between prices and the physicians’ quotas may have perpetuated a decoupling between these logics (Jones & Dewing, 1997). Different conceptualizations of the reforms may explain such a decoupling between plans and action (Pettersen, 2001b).

Differences between countries have also been given attention by researchers (Jegers, 1996; Pettersen, 2004; Siverbo, 2004). Jegers investigated the budgeting and cost accounting procedures of Intensive Care Units (ICU’s) in 12 European countries (Jegers, 1996). His

⁸⁰ Diagnosis Related Groups. The DRG-family: <http://www.fischer-zim.ch/textk-pcs/index.htm>. In Norway, Sweden and Finland: NordDRG: www.nordclass.uu.se and in Denmark: www.sst.dk

survey provided an impression of non-systematic diversity. Budgeting and cost accounting procedures were absent in most of the investigated units. Jegers concluded that the cost calculation methods in ICUs were rather under-developed. Siverbo reviewed the published experiences from the purchaser-providers split in Sweden and contrasted these with those from Britain (Siverbo, 2004). Both countries experienced difficulties in making use of the market mechanism. The idea of competition was soon replaced by ideas of co-operation and co-ordination. In both countries “soft” contracts were the final course of action. Pettersen has discussed the recent reforms in the Nordic hospital sector (Pettersen, 2004). She reported that the initiative, content and implementation of the reforms have varied (Pettersen, 2004).

Resource allocation models can be studied at different levels. The majority of the reported studies focus on resource allocation models at a national level, for example, how the resources are allocated in a public health care system and how reforms in allocation models effects efficiency and effectiveness (Kjøllestadal, Essay I). Others have studied how resources are allocated at a regional level, for example, between hospitals within a region (Doolin, 1999; Jarvinen, 2006). In this study we are interested in allocation models within particular hospitals (Jegers, 1996; Lehtonen, 2007; Lindkvist, 1996).

The focus on the local models for allocating resources involves an attempt to understand how different hospitals translate the resource allocation model from a national level to a local level. This may be done by transferring the national or regional model directly to the local units. Alternatively, hospitals may use local allocation models within a hospital in order to increase precision in the description of cost variations.

As a part of the framework in this study, we explicitly investigate the way resources are allocated within the hospitals as a part of the budget process. Of special interest is the link between the way a hospital receives its (external) funding and to what extent this informs the internal allocation model.

2.2 Control and performance evaluation

Accountability is a key word when designing an organization’s responsibility accounting model as a part of the management control system (MCS). Organizations design their MCS to enhance the probability that the organization’s goals will be achieved (Merchant, 1998).

Managers are assigned the responsibility of coordinating the organization's efforts.

“Responsibility accounting is a model that measures the plans (by budgets) and actions (by actual results) of each responsibility centre” (Horngren et.al., 2009:223).

Financial performance measures can be applied to five types of decentralized units (see e.g., (Kaplan & Atkinson 1998)):

- 1 *Standard cost center – responsibility is related to efficiency*
- 2 *Revenue center – responsibility is related to selling, distribution and marketing*
- 3 *Discretionary expense center – responsibility is related to spending*
- 4 *Profit center – responsibility is related to profit*
- 5 *Investment center – responsibility is related profit and investments*

The principal factor in the selection of one type over another is controllability (Anthony & Young, 2003). The key question is over what inputs and outputs can the manager exercise a reasonable amount of control? In the public sector there is an important distinction between discretionary expense center and standard cost center (Anthony & Young, 2003). The first is used when there is no easy way of measuring the output. The manager is held responsible for a given cost-budget (a static budget) and thus the total spending. The use of discretionary expense centers has traditionally been the dominating model for controlling the operations within the public sector (Anthony & Young, 2003). The control and responsibility is mainly focused on the level of spending, with the budget as a line of special interest. Overspending is seen as a negative and a mark of low performance.

The second type of cost center is used when the output can be identified. The manager is held responsible for a cost budget dependent on the actual volume of the output times a pre-determined cost per unit of output (a flexible budget). A prerequisite for the use of such a model is that the standard use of resources per output has been determined. Important features with these standards are that they can exclude past inefficiencies and take into account changes expected to occur in the budget period. The use of standard cost centers is often regarded as an effective way of controlling an organization (Ax & Ask, 1995) and the model is recommended because it is easy to use and provides additional information (variance analysis) for the evaluation task (Demski, 1997). The use of standard costs is reported to be widespread among manufacturing companies (Horngren et.al., 2009).

In recent years an important change in controlling public organizations is the introduction of profit centers, where organizational units are given responsibility for both production and “sales” (Guthrie et.al., 1999). Accounting researchers have warned against this trend (Olson et.al., 1998). In Norway a recent hospital-reform has decentralized the responsibility for investments (a responsibility for the total assets) (Robbestad, 2011). Given these various changes, we may find standard cost centers, discretionary cost centers, profit centers and investment centers in the hospitals that we investigate.

2.3 The use of local cost accounting data for planning and control

As a response to the various healthcare reforms and in order to improve the planning and control procedures, one may expect that hospitals have refined their local cost accounting models. Recent accounting research literature has not focused much on the design and use of local cost accounting systems in hospitals (Kjøllesdal, Essay I). The development of local cost accounting data can be described at three different levels. In all three levels local accounting data are combined with other local data to provide information for planning and control purposes.

The first level of refinement is to add volume numbers (i.e., the number of patients) to cost data (Jones & Dewing, 1997). This type of data may be used to highlight efficiency both in the target setting and in the control process. The financial responsibility is spending (discretionary expense center).

A second level is to cost different services within the organizational units. Such models are labeled standard cost per service (SCPS) systems. Data on cost per service (i.e., clinical tests, radiology investigations, patient days) may be used for planning purposes. This data may also be used for performance control related to standard cost centers. Using volume and cost data, responsibility is moved from spending (discretionary expense center) to cost efficiency (standard cost center). A SCPS-system may provide cost information from every organizational unit and thus be a basis for deciding the local standard costs for the next budget period.

A third level of refinement is to use local patient costing systems, typically called Clinical Costing Systems (CCS) (Abernethy & Chua, 1996) or patient-based cost system (Lawrence et.al., 1997; Lawrence et.al., 1994; Lowe, 2000a). Such models have been reported to have a potential to link the PPS to the local operational control (Jones, 1999a). Such detailed information has also been reported to be costly to produce and maintain (Jones, 1999b). CCS typically accumulate cost to patients based on the services provided to patients, and thus are based on a form of cost per service system and individual information on patients' use of these services (Jarvinen, 2006). Higher level of refinements in the systems, for example, systems that better classify costs according to behavior and report cost information more frequently, is evaluated by American hospital managers to be more useful (Pizzini, 2006). A few comparative studies have reported the use of local product cost models in hospital management (Jacobs et.al., 2004; Kurunmaki et.al., 2003; Scarparo, 2006). Finish intensive care units-(ICU) teams were reported to have absorbed calculative practices such as costing, pricing and budget control into their daily routine, while the UK ICU-teams had not (Kurunmaki et.al., 2003). In UK, German and Italian hospitals only the senior clinical managers had access to detailed cost information (Jacobs et.al., 2004). Their findings led Jacobs et.al. to question the extent of penetration the recent reforms have had at the clinical level in hospitals. Scarparo indicated that there may be differences between countries that have an influence on the use of cost information: Swedish clinical directors made more use of local cost information than did their Scottish colleagues (Scarparo, 2006).

2.4 The frame for describing differences in cost accounting

This paper addresses the link between the cost accounting data and the management control system in four different hospitals in four different countries. Our focus is on describing the design and use of cost accounting models within a given hospital, including:

What kind of resource allocation models are used within the hospital?

- The national model
- The regional model
- A local model

What kind of financial performance data are related to organizational units?

- Discretionary expense centers
- Standard cost centers

- Profit / Investment centers

What kind of local systems are added to the local planning and control systems?

- Volume (i.e., patients, tests)
- Standard cost per service (SCPS)
- Clinical costing system (CCS)

These dimensions are linked to the perceived effects and actual financial performance in order to understand the differences between systems and the effects of the systems.

3 The research method

This study is a comparative study of four different hospitals in four different countries. The general environment surrounding an organization may influence how it is managed (Wildavsky, 1975). According to Wildavsky, societies that are relatively wealthy and operate within a predictable financial situation, generally budget by increments. By contrast, the “poor and uncertain” recalculate their budgets more often and follow-up the operations more carefully. He predicts that they most likely will adopt different kinds of aids to calculation. Thus, the wealth of the country may influence the design and use of management control systems in that country, and differences in the wealth of countries may have different influences on the design and use of their management control systems.

The development in GDP per capita, GDP spent on healthcare per capita, and total expenditure on healthcare as percentage of GDP are indicators of the financial environment⁸¹ of the Nordic countries. These are shown in figures 2, 3 and 4.

⁸¹ www.oecd.org/WBOS/index.aspx

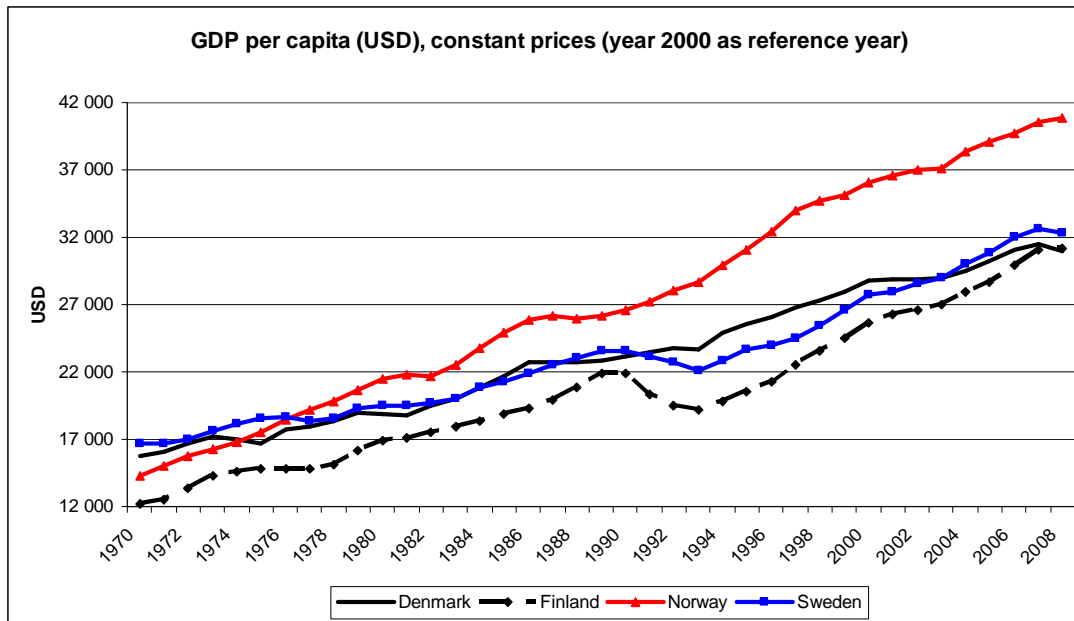


Figure 2 GDP per capita (USD) in constant prices (2000 as a reference year)

All the selected countries have experienced a growth in their GDP since 1970. In 1970 Denmark had the highest GDP per capita of the Nordic countries. In 2008 Norway had a GDP that was 27% higher than the country in the second place (Sweden). Yet all four countries have high GDP per capita relative to other European countries. Thus, we are studying major hospitals in relatively rich countries.

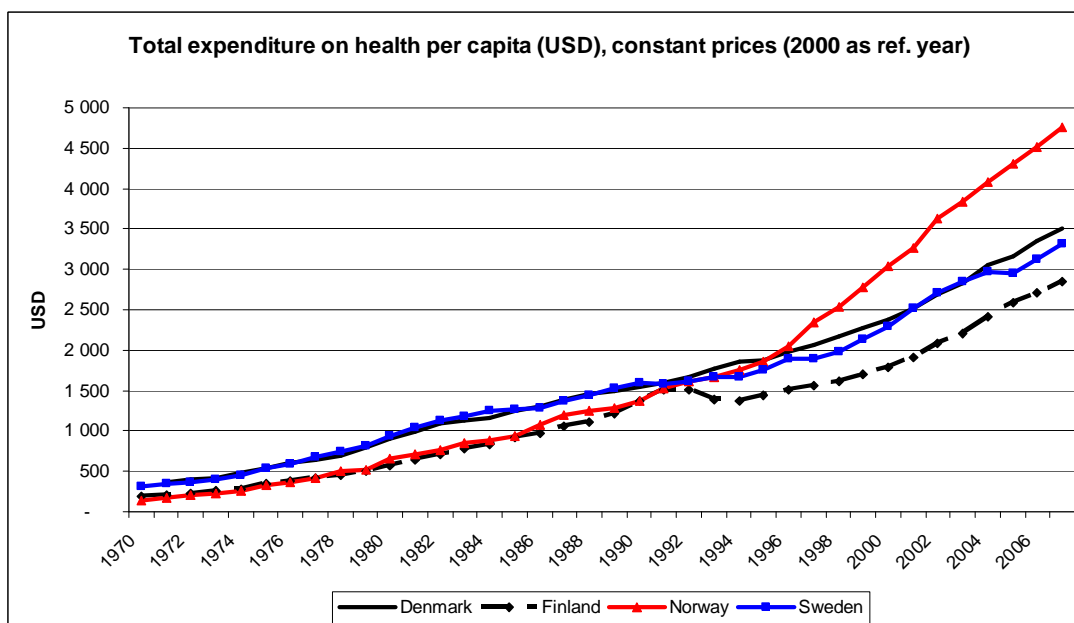


Figure 3 Total expenditure on health per capita

All the Nordic countries have had an (almost monotonic) increase in their spending on healthcare. Since 1996 Norway has had a marked increase in its expenditure on healthcare per capita. This is clearly linked to the booming oil economy and a corresponding increase in GDP per capita.

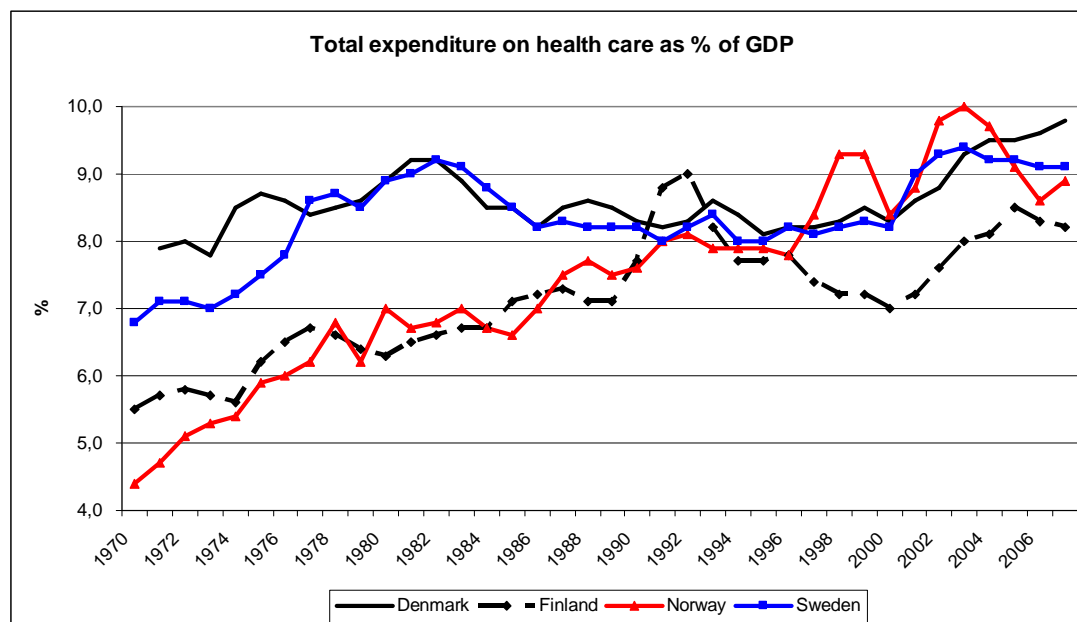


Figure 4 Total expenditure on healthcare as percentage of GDP

In the past 35 years, the level of expenditure on healthcare in Denmark has been stable and high (8-9.5%). Since 1977 Sweden has followed Denmark closely. In Norway there has been some variation, which can partly be related to the fluctuations in oil prices. Finland experienced a marked drop in GDP in the 1990s. The country seems to have returned now to the general trend in the Nordic countries: more spending on healthcare as the national wealth increases.

The hospitals and selection of respondents

The Nordic perspective was chosen because all countries have had relatively stable economic and political development, their healthcare systems are tax-based and they share clear similarities in culture. *“The more similar the units being compared, the more possible it should be to isolate the factors responsible for differences between them”* (Lipset, 1990:xiv). Possible culture differences at country-level were regarded to be small. Findings from the literature review supported this approach (Kjøllestad, Essay I). Näsi and Rhode (2006) also make this conclusion when examining the historical development of the theory and praxis of

cost and management accounting in the Nordic countries. This does not imply that the culture do not have any influence on the design and use of cost accounting in Nordic hospitals, and differences in accounting systems may be attributed partly to these differences. However, this is not addressed specifically in our study.

Within a given healthcare system we may find private clinics, local hospitals and university hospitals. We focus on the major university hospitals, which are all public. These hospitals are expected to have similar goals, activities, mix of patients, services, medical technology and cost structure; therefore one may expect their control systems to be similar to one another. Contrasting hospital reforms in the Nordic countries Pettersen (2004:333) observe that “... *the professional norms, which guide actions inside the hospitals, seem, however, to be more consistent than any common traditions at the national levels*”. The four hospitals are described in Table 1.

Country	The selected hospital	Name used in this study
Norway	Bergen Hospital Trust AS, Haukeland University Hospital	Haukeland
Finland	Hospital District of Helsinki and Uusimaa including;	The HUS- org.
	Helsinki University Central Hospital and Helsinki Medical Imaging Center	
Denmark	Copenhagen University Hospital	Rigshospitalet
Sweden	Karolinska University Hospital AB	Karolinska

Table 1 The selected hospitals⁸²

The study draws on both secondary and primary data. Secondary data include macro data of the selected countries’ healthcare sectors, organizational charts, annual reports and information available on the hospitals’ web-sites. This information was important for understanding the context (i.e., ownership, financing) of the selected hospitals.

The primary data is based on interviews with key informants in the hospitals. The questions were planned and asked in a relatively open-ended way, focusing on the budgetary control-procedure in which the respondents participated (Appendix 1). We experienced during the interviews that the clinical managers were not very interested in the accounting concepts presented in the interview guide. Yet they had insight into their personal use of cost information. The goal for the interview was to get hold of their theory of praxis. Two

⁸² Medical imaging services at all 23 hospitals within the HUS-organization were organized into one center. All product cost calculation was also centralized into one unit. Due to these particularities *this* organization was selected as the “hospital” representing Finland.

researchers attended each interview, which was taped. The interviews were carried out by Kjøllesdal together with a senior colleague from Rikshospitalet HF, Department of finance. This persons' responsibility was to collect written information submitted from the hospitals. This approach would secure the interviewers' full attention on the respondent during the session. All transcriptions were sent to the respondents for comment. 8 persons had comments to the transcripts. Their main response was to provide more factual information (e.g., the correct unit names). The average interview lasted one hour. In total 23 interviews involving 26 respondents were conducted. At Haukeland (department of radiology) and Rigshospitalet (heart center) the directors at the level decided to represent also the section level. Table 2 shows the interview statistics.

Level in the organization;	Positions;	A Haukeland	B The HUS org.	C Rigshospitalet	D Karolinska
Top level;	CFO	1	1	1	1
Unit level;					
1 Clinic / department / division	Director / manager	2	2	2	2
2 Section	Head of section	1	2	1	2
	Chief controller / manager		2	2	1
	Controller	1		1	1
	SUM	5	7	7	7

Table 2 Interview statistics

Our purpose was to understand the design and use of the budgets, resource allocations and cost accounting systems at different levels. Thus, respondents from different groups and organizational levels were selected to secure access to the relevant data. The CFO represents the top management team, the department /division is the second level and the section is representing the operating level. The controller represents the operator of the local budget and cost accounting models. To capture a possible variation in the experiences (with the individual hospitals' cost accounting models) two types of units were selected:

* Clinical department – department for heart diseases with a heart surgery section

* Medical service department – radiology department with a section.

Figure 5 describes the structure of the chosen respondents. If we had focused more on functions of accounting within hospitals, we may have chosen more respondents from each hospital. However, our main focus was on the differences between countries, and we tried to choose respondents with similar functions from each of the hospitals.

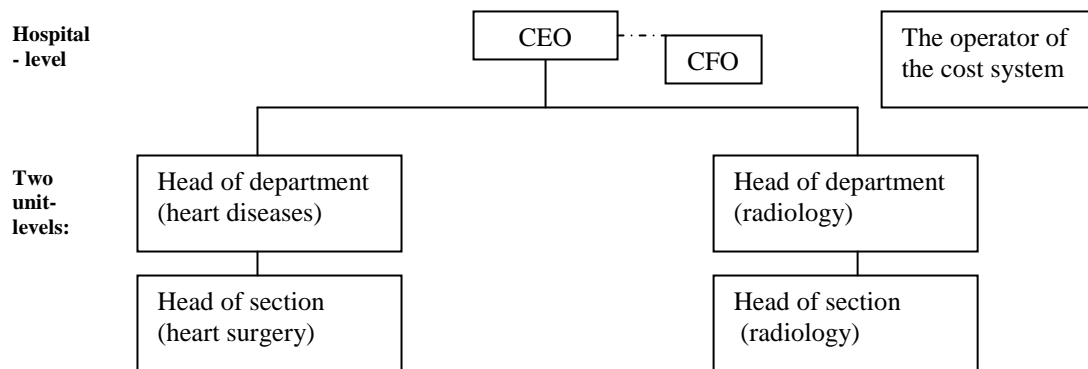


Figure 5 An illustration of the different groups of respondents

4 The four cases

4.1 Case A – Haukeland University Hospital

General information

Haukeland University hospital is one of the largest health entities in Norway⁸³. The hospital serves a population of approximately 0.4 million in the local area and about 1 million within the region (Helse Vest). HelseVest RHF is one of four regional hospital owners and health care providers in Norway. The Haukeland University hospital provides services both to somatic and psychiatric patients. The hospital is financed by a mixed model involving one national revenue model for in-patients (DRG), three national revenue models for the out-patient activity and bloc-grants (Kaarbøe, 2005). The hospital was in financial distress in the period of this study, as indicated by the numbers in Table 3 showing the deficit for 2005. Yet the period was also characterized by an increase in activity and resources. In the period 2002-2008 the hospital's operating expenses increased by 59% from 530 mill EURO. The increase in the number of man-years was 17.2% from 6,500 in 2002.

	2005
Operating Revenue	616 mill EURO ⁸⁴
Operating Expenses	663 mill EURO
Deficit ⁸⁵	47 mill EURO
The deficit as a percentage of the Operating Expenses	7.1% ⁸⁶
Man- years	6,983

Table 3 Accounting information, Haukeland

⁸³ www.helse-bergen.no

⁸⁴ 1 Euro = 8.2 NOK

⁸⁵ Revenue – Expenses is Income. The concepts used in the public sector are surplus and deficit.

⁸⁶ 2002: 4%, 2003: 9.2%, 2004: 9.4%, 2006: 9%, 2007: 7% and 2008: 2.3%

The control system

At a hospital level, Haukeland is a profit center with a full Profit and Loss statement and Balance reported according to the norms of the Norwegian accounting law (the same as for a private company). The departments (divisions) and sections, however, are controlled as discretionary expense centers where responsibility is related to static variance between budgets and actual spending. The control-procedure starts in September and the budget is decided in December (X-1). The national price lists for year X, however, are not available before February (X). Changes in prices may affect the decided budgets of the different organizational units. The follow-up on the budget starts in March/April (X). Every fourth month the heads of departments have a separate formal meeting with the CEO. Every month the leaders of sections, wards and out-patient clinics have follow-up meetings within their departments. The budgeting and reporting process is illustrated in Figure 6.

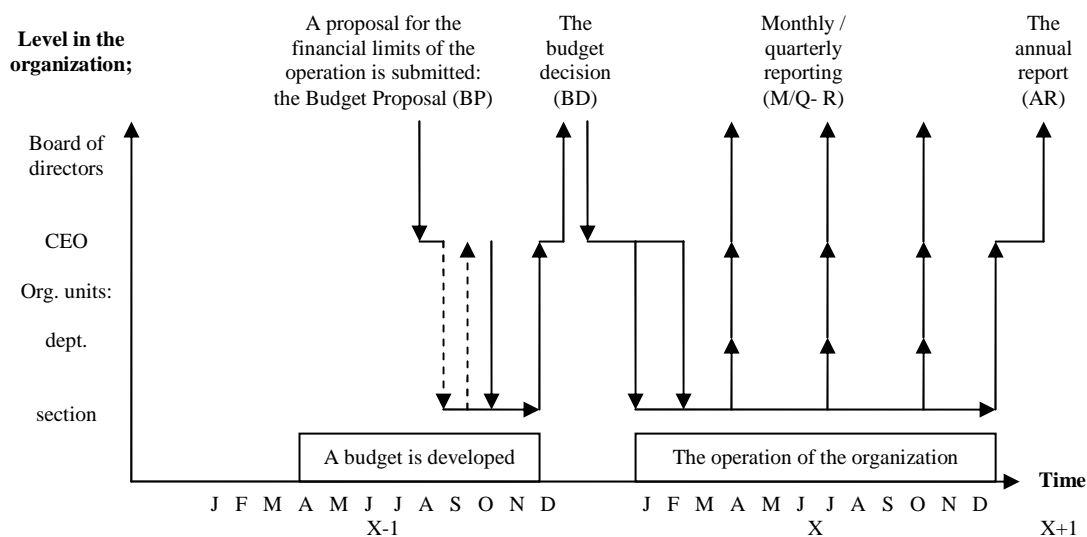


Figure 6 The budgetary control-procedure at Haukeland

The hospital relates to 4 national revenue models, which are also used for internal resource allocation. The national price lists from year X-1 and the planned volumes (year X) are used to calculate the volume-dependent part of the budget. The other major input are last year's budget and discretionary changes based on strategic decisions. Resource allocations are not based on local standard cost per service (SCPS) or local clinical costing systems (CCS), i.e., internal cost estimates for services or patients. Only the national resource allocation models (broad national averages) and local estimates for volume are used.

Information on spending in each department and local volumes related to the national model is available for all units in a drill-down function on the intra-net.

Experiences with the control system

The departments and sections are subject to various national revenue models. When the national prices change, the budget is also changed. These changes are not controllable for the department and may thus introduce an element of luck:

“We have delivered the services every year the last five years – no deficits. We have studied our own operations and carried out changes on our own. This has turned out very well. In 2005 we increased our revenue without increasing our costs. The surplus was turned over to the management. In 2006 we were lucky and our DRG- prices increased considerably.”

The Head of the Heart department

The comment reflects a willingness to respond to the changes in the financial environment of the department. Such willingness has, however, resulted in different actions. The first three years their own operations were studied closely and changes made. The last year the national prices increased *“considerably”*. The resulting surplus was turned over to *“the management”*. This reflects an attitude that *“we finance other department”*. The understanding of the resource allocation is limited. The controller at the Heart department has worked at the unit for 10 years. Her experience with the national revenue models was representative:

“I do not understand how the prices are calculated. If the method and input data had been more available, I could have benchmarked them with my own calculations. In sum the financing of our activity is in a constant flux!”

The national revenue models are a “black-box” to the actors within the hospital. This frustrates her because she calculates the local (i.e., her organizational units) costs of every procedure every year. The comment from the Head of the Thorax surgery section supports this praxis:

“We calculate the budget based on last year’s activity and this year’s wages and price-lists for various items. To me, it is important to specify the correct volume and prices for items as expensive vents and implants.”

This frustration is shared with the other respondents – the Head of radiology department:

“I would like to know what the cost of my services is!”

The respondents did not have any information of the cost of services from other units. The CFO calls for this type of information:

“I wish to have information about in- (DRG) and out- patients (national prices) related to the departments where the patient has been. With such local cost information the dialogue with the clinical departments will be better supported. The general issue is: When changes in the hospital’s activity are planned to take place, what is the related costs? ”

The Head of the Thorax surgery section has his own approach to the similar problem:

“If it had been possible to compare the revenue per patient with the estimated costs of my patients, I would certainly be interested.”

The control system at Haukeland has been in use for many years. Resources are allocated to sub-units in the same way as they are received by the hospital. This clearly simplifies the budgeting process and the evaluation of units, but the local costs are not reflected. The national prices are only partly related to the actual cost for a university hospital (Kjøllestad, Essay II). Treating in-patients (classified by the DRG-system) often requires services from many organizational units within a hospital. A heart surgery procedure (i.e., DRG 108) involves services from many organizational units as for example, ward(s), operating theater, anesthesiology, radiology and laboratories. This is not taken into account in the allocation model, and national pricelists (which is based on the total cost) are used to allocate cost to a particular unit (i.e., the Thorax surgery section). Thus, surplus and deficit are more or less arbitrary consequences of the allocation model. Yet there is a sense of profit-center thinking introduced to the discretionary cost centers by the use of national price lists.

4.2 Case B – The HUS Hospital District

General information

In Finland, the municipalities are responsible for both the funding and supply of health services (Häkkinen, 2005). The Hospital District of Helsinki and Uusimaa County (the HUS-organization: www.hus.fi) is providing specialist care to the residents of its 32 member

municipalities (1.4 million inhabitants). This organization was established in 2000 and operates 23 hospitals. Some central accounting information is provided in Table 4. In the period 2003-2007, the operating expenses increased by 22.8% from 1,075 mill EURO. The number of man-years increased with 6% from 19,993 in the same period.

	2005
Operating Revenue	1,296 mill EURO
Operating Expenses	1,207 mill EURO
Surplus	89 mill EURO
The surplus as a percentage of the Operating Expenses	7.4% ⁸⁷
Man- years	20,773

Table 4 Accounting information, the HUS- organization

The control system

The HUS-org. is a profit center with full Profit and Loss statement and Balance reported according to the norms of the national accounting law. The 23 hospitals, however, are controlled as standard cost centers (flexible budgets), for example, with standard local costs and actual volumes. The largest hospital within the HUS-org. is the Helsinki University Central Hospital (HUCH) with 8,424 employees in 2005. It is organized in seven divisions which are controlled as standard cost centers. The actual costs are compared with standard cost per service (the local planned estimates) and actual volumes (flexible budgets). For some units standards and volumes are hard to estimate. These units are controlled as discretionary expense centers.

The control-procedure starts in March/April (X-1) with a dialogue with the owner. The discussions are ended in June. From September to December, the detailed budget per hospital is developed. As long as the financial target is met, the central administration in the HUS-organization does not intervene in the follow-up on the operations of the single hospital (X). The CEOs have to make a report to the HUS administration every month and explain variances from the plan. This applies also inside the hospital for the divisional directors.

In the dialogue with the owner in the budget proposal-phase, the discussion includes an analysis of last year's results and the calculated product costs (from year X-2) from the local standard cost per service system (SCPS). The expected development in input-prices and volume of the services (i.e., per DRG) are important factors in these calculations. The

⁸⁷ 2002: 6.1%, 2003: 7%, 2004: 7%, 2006: 6.9% and 2007: 6.4%

discussions are finally ended in June with a plan per hospital (volume per DRG and the financial consequences as a lump-sum per municipality). In December the final external and internal budgeted prices are calculated by the local SCPS. The actual volume per DRG times the budgeted price is made available to the decision makers through the CCS-system every month (X). Inside the HUS-organization, it is primarily the controllers who look into the figures and interpret the possible consequences for their superiors. Forty to sixty buyers of the services within the municipalities also have access to the cost per patient data (the CCS). The member municipalities are billed four times a year according to their actual use of the hospital services. The contracts are settled in February (X+1). This involves some bargaining on deviances (paying/payback) from the planned lump-sum cost per hospital per municipality. The budgetary control-procedure at the HUS-org. is illustrated in Figure 7.

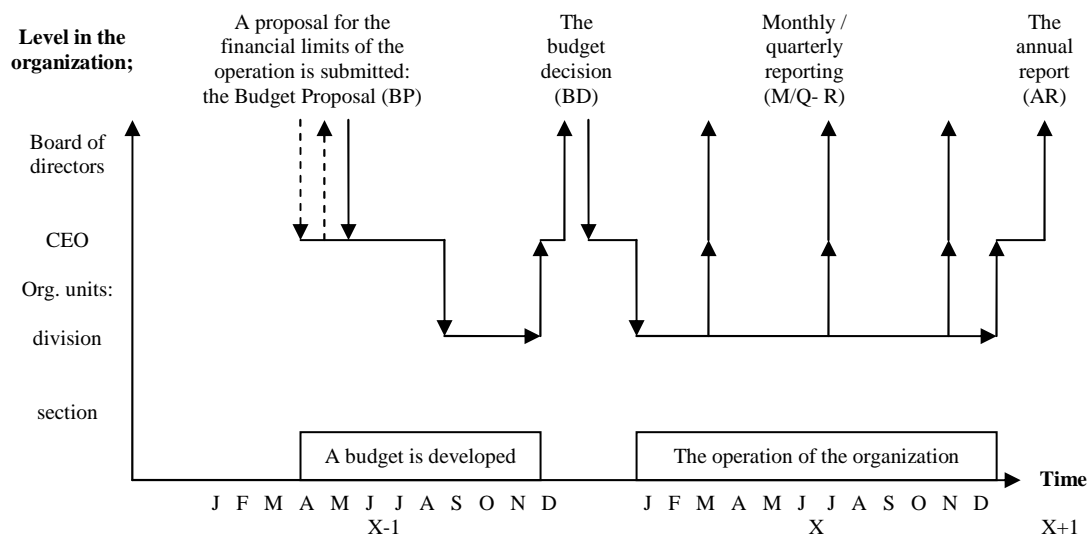


Figure 7 The budgetary control-procedure at the HUS-organization

Each hospital within the HUS-org. has local costing systems as a SCPS-system and a CCS. The full-cost of each hospital's services are calculated (by a central unit) twice a year by the SCPS-system. This system thus provides the member municipalities with estimates of their planned and actual hospital service costs. The CCS-information is updated every month and available to internal and external users.

Experiences with the control system

The budgetary control-procedure focuses on planning the next year's capacity at the different hospital-units as described by the Head of HUS Röntgen:

“We start in March/April. The process is controlled by the HUS- administration. We are approaching the hospitals to discuss their planned level of activity (volume) for the next year. We focus on the major changes in activity. The economic planners in the different HUS- units are interacting and working out the budget. This way we receive the needed information for our planning of the capacity (personnel and equipment). Normally the changes are not that big and we are able to handle it. Then we consider the need for investment, recruitment and shifting personnel between our sites. We have our plan ready in May.”

The changes in capacity have been minor within the local hospitals, but large at HUCHs:

“In the Helsinki area... there have been major changes. These changes have been initiated and carried out by the HUCH-division managers. We at HUS have not been involved unless it had investment or budgeting consequences.”

The Chief Financial Officer

The need for doctors is one such issue when discussing the capacity. Changes in medical procedures (more percutan cardiovascular interventions and less open heart surgery) may illustrate this, according to the Head of Thorax surgery department:

“Two years ago I had to fire 3 experienced thorax-surgeons and reduce the number of open beds in our ward with 10 beds. These discussions were very tough and developed over several years.”

There are more than 20,000 different internal prices as per ward-day, lab-tests, radiology services etc. This detailed information makes the calculations easy:

“To calculate the costs of the single patient is then more like being a cashier in a supermarket. We have about 800 DRGs. Everything is prices (every year) and counted (every month). Then it is only for the system to sum up”.

The operators of the costing systems

The systems providing estimated product costs are central elements in the HUS-organization's total control system, according to the Chief Financial Officer:

“We use estimated product costs extensively for planning and billing purposes. We eventually get our money depending on the actual activity and the related billing. Our experience is that the municipalities accept deviations from one year to another (+/- 3%). The last six years they have accepted all our bills with some arguing.”

The respondents with a budget responsibility (the top management) thus express *satisfaction* with the cost accounting models in the different phases of the budgetary control-procedure, but at the operating level the relationship between the prices and costs are not that obvious:

“I do not have any budget responsibility. We have a price list, but I am not sure how these prices have been calculated. These calculations are more like a “black-box” to me.”

The Head of Thorax surgery department

Notwithstanding this comment, the new insights into the differences in costs have made it possible to move away from one uniform HUS-org. pricelist toward separate pricelists per hospital (from 2007). The buyers of the services are informed of the changes that are taking place and are provided explanations to deviations from plan, according to the operators of the costing systems:

“The municipalities understand that the cost levels differ between the hospitals. Some municipalities want to pay extra for patients treated at their local hospital. Even within some specialties there are such deviations. The provision of cost information enables the buyers of our services to see what happens inside the hospitals.”

The operators of the costing systems

The local costing systems are used both for decision making (i.e., capacity decisions) at a local level and central level (part of the funding discussions). It is also important for the controlling procedures, but the controlling task is mainly an internal task within the organizational units.

4.3 Case C – Rigshospitalet, København

General information

Rigshospitalet, Copenhagen is providing specialist care to the inhabitants of the city of Copenhagen and the surrounding municipalities⁸⁸. It is a referral hospital for specified diagnoses for residents in some of the surrounding counties. About half the patients come from the local area (HS: “Hovedstadens Sykehusområde”). From the 1st of January 2007, Rigshospitalet was included in one of the five new regions that substituted for the 14 counties in Denmark⁸⁹ (Pedersen, Christiansen, & Bech, 2005). The hospitals were financed by a national financing system (DRG)⁹⁰. Accounting information for Rigshospitalet for 2005 is provided in Table 5. The operating expenses increased with 49% from 445 mill EURO in 2002 to 660 mill EURO in 2008. In the same period, the number of man-years increased 13.2% from 6,751 in 2002. The hospital has been operated with a surplus the last twelve years (1996-2008).

	2005
Operating Revenue	539 mill EURO ⁹¹
Operating Expenses	538 mill EURO
Surplus	1 mill EURO
The surplus as a percentage of the Operating Expenses	0.3% ⁹²
Man- years	7,274

Table 5 Accounting information, Rigshospitalet

The control system

The hospital is a public entity responsible for a given activity level and budget, but the hospital is controlled as a standard cost center. The variance between budgets and actual spending is observed at the end of the year. If there has been an increase in the productivity and extra costs have been involved, then a marginal financing is discussed. The discussions may not result in additional funding; however, the possibility to discuss this with the owner is reported to be important. In 2005 49% of its revenue was a bloc-grant from the owner. The hospital is providing highly specialized services to patients referred from the other regions. For these services, it is allowed to calculate local prices and charge these regions⁹³. The 6 clinical centers and the Diagnostic center are controlled as standard cost centers. Standard

⁸⁸ www.rigshospitalet.dk

⁸⁹ www.regionhovedstaden.dk

⁹⁰ www.im.dk

⁹¹ 1 EURO = 8.94 DKK

⁹² 2002: 0%, 2003: 0.2%, 2004: 0.4%, 2006: 0.2%, 2007: 0.2% and 2008: 0%

⁹³ www.fm.dk ; Takststyring på sygehusområdet (“Control through prices in health care”).

prices (i.e., per ward day, lab-investigation etc.) are used. The internal service center is treated as a discretionary expense center where costs are compared to the yearly budget (no volume adjustments).

The block-grant and the total sale of services to other regions define the total expense-limit for the hospital. It is thus important to link the available resources to the costs of relevant capacity (number of beds, doctors, etc.). This overall expense-“base-line” indicates the ceiling for how much can be spent. This concept is central in the control procedure at all organizational levels in the hospital. The control procedure starts in January/February with internal discussions (X-1). There are negotiations in March through May between the hospital and the buyers about the volume per specialty. The final price estimates for the budget year are calculated in June (X-1)⁹⁴. A detailed budget is then developed from August until December. Every fourth month the CEO reports to the owner. The monthly internal follow-up reporting starts in March/April. The budgeting and reporting process is illustrated in Figure 8.

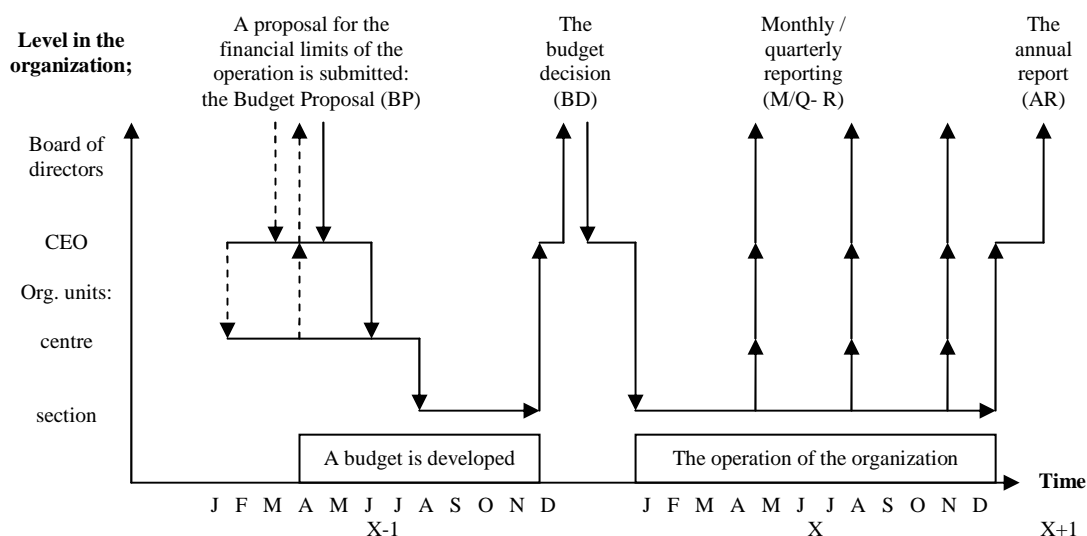


Figure 8 The budgetary control-procedure at Rigshospitalet

The hospital relates to a national DRG-model for the in-patients from the local region. The owner receives revenues from the state, based on the activity at the hospital. The hospital, however, has to control the activity according to the planned bloc-grant. The counties outside the HS:-org. are billed every month according to their actual use of services times the hospitals budgeted prices. There is an opening to discuss co-payment for increased activity

⁹⁴ The prices for 2007 are based on 2005-data (to be cost-based).

and, correspondingly, a pay-back of funds for less than planned activity. The internal resource allocation is, however, based on the planned volumes and costs. The hospital calculates the cost of its services (SCPS-system) in March (X-1). The final estimates for the budget year (X) are re-calculated in June. The details in the internal budget are then developed during the fall. Every month (X) the hospital's data-warehouse makes a mechanical prognosis of the volumes, the expenses and the revenues. Every month the planned average cost per service is multiplied by the actual volume and presented to both internal and external users (CCS). This information is important in the internal follow-up of the divisions.

Experiences with the cost models

The respondents had positive experiences from their use of the cost accounting models. They explained in detail their interaction with the mix of costing systems. The Head of the Radiology department commented on his experiences with the concept "base-line":

"You have to argue very good to increase your "base-line". This was not the case before 1996. Everybody started up what they thought was the best for the patients. That led to economic disaster. Now we have a system of "early-warning"⁹⁵ calculations and evaluations at different levels."

Clinical managers are involved in the calculation of the internal prices:

"We may move around on the resources (per procedure) and thus the prices, but the total must be within the "base-line". I.e., if a by-pass operation costs 10 kr one year and next year 8 kr, this gives room for an increase in the price for other procedures to 12 kr."

Director of the Heart center

The use of a fixed "base-line" involves certain challenges. At this hospital these challenges have found a solution, according to the Head of the Radiology department:

"The last 10 years we have had our fixed "base-line". Within this budget our department has tried to make the best out of it. We succeeded until 2-3 years ago. Then the growth in the demand turned out as a deficit of 20 mkr. . We could not handle this anymore. The control-logic is so that we should handle this problem ourselves. The

⁹⁵ Early warning of projects with a total effect on the hospitals expenses of more than 125,000 EURO

CFO understood the situation and covered the deficit and adjusted our budget. The economy-function (department) sees the relationships between costs, activity and prices. ... Now the clinicians must pay us a share of their increased income. This year the Diagnostic center has spent 7 mkr more than the budget. At the same time we have had a production 10 mkr above “base-line”. This new model evens things out. We get 7 mkr in income from the clinicians.”

The clinicians emphasized that having internal cost estimates is important when confronted with national prices, according to the Director of the Heart centre:

“The DRG- information focuses on the hospital level. Such averaging does not reflect the use of resources where the action is. This is why we use our own prices... My centre has about 10-16 mkr in surplus using our own prices. Using the national DRG- prices this turns to a deficit of 7 mkr.”

Having been involved in developing the budget-proposal and the costing of his services, the Director of the Heart center describes how he controls his center’s activity and costs:

“I allocate my activity budgets to each month at every unit. This means that I control this center with a small reserve all the time. Then every week I study how many beds that were in use, the number of surgery procedures carried out, how many investigations ordered etc. . This is straight-forward pro-active production control. This gives me control at the lowest level within my organization. I do not have formal control-meetings with the CEO. There is no need for this – because there are no problems.”

He continues:

“Last year (2004) we reduced the number of by-pass operations by 150. Our work with the internal prices gave us insight into what resources this implied... So we reduced our need for personnel, beds, etc. and moved the resources to activities where there was a rise in the demand... The process did not take much time... The trend became evident for everybody and then we made the changes in the budget.”

The existence of internal prices is more important to some actors than others. Their uses affect the internal dialogue about the use of resources within the hospital as evidenced by comments from two managers:

“By pricing our services and billing the clinicians we get a sort of acknowledgement of our work. The job we do is seen. This is important.”

The Director of the Diagnostic center

“The prices of the services of the Diagnostic Center can be improved. Their prices do not work well ... We have a contract with a given number of tests, for example, with a given average price. Above this level we are to pay 70% of the price. But to run one more analysis on a machine costs 1/1 000 of the price! ... They are unfair. The prices may lead us to focus on the wrong things. If we take 100 or 200 blood tests it does not matter. But it does matter if you take one more expensive test.”

The Director of the Heart center

The cost accounting praxis at this hospital has taken years to develop. This is commented by the Head of the Radiology department:

“I have been involved in calculating internal prices in Malmö, Sweden (1992/3). The goal was to save money by influencing the “buying” of our services. Our budget was removed and allocated to the clinical departments. This philosophy was and still is wrong. Quite other mechanisms control the use of our services. Two years later the activity was up 30%! This was really fun to us at the department of radiology! It proved difficult to find this money. We had many discussions going on these years about what to do. You have the costs related to your capacity – that is for sure. The machines and the personnel are there. The question that really matters is how to make the best use of these resources! This is no ordinary firm. We cannot fire people and stop the maintenance of the machines.” He continues:

“One mechanism of controlling the hospitals in Denmark seems to be a standing order to cut the cost-level or increase the productivity by 2%. This is what I would call “a death spiral”. I see this as noise! Yes, it is important to control the growth of the sector (keep it down). But this should be done by letting the hospitals define projects that will reduce the spending level. This is the model we are following. The described way of budgeting and controlling our hospital is good for the hospital and for the society.”

A system with fixed “base-line” does not give an incentive for doing more. If the “cost per service calculations” show that the estimates have fallen due to improvements in the productivity, then a marginal financing will be discussed with the owner:

“If there is positive (negative) productivity, our budget is increased (decreased) by 50% of the national DRG-price.”

The Head of the Finance department

4.4 Case D – Karolinska University Hospital

General information

The Karolinska University Hospital AB provides specialist care to the inhabitants of the city of Stockholm and the 25 surrounding municipalities (the County of Stockholm (SLL)⁹⁶) (Anell, 2005). There are 1.9 mill inhabitants in this geographical area. In the period 1998-2002, the county’s hospitals had a negative development in the productivity of about 2% per year. This put new focus on the development of various forms of owner-control (the hospitals owned by SLL) and better contracts (also with private hospitals). On January 1, 2004 Huddinge University Hospital AB and the Karolinska Hospital merged. Accounting information for this hospital (Karolinska AB) is provided in Table 6. The operating expenses increased 24% from 1,387 mill EURO in 2003 to 1,724 mill EURO in 2008. The number of man-years declined by 0.65 % from 15,387 in 2003.

	2005
Operating Revenue	1,401 mill EURO ⁹⁷
Operating Expenses	1,407 mill EURO
Deficit	5 mill EURO
The deficit as a percentage of the Operating Expenses	0.4% ⁹⁸
Man- years	14,184

Table 6 Accounting information, Karolinska

The control system

At a hospital level, Karolinska AB is a profit center with a full Profit and Loss statement and Balance reported according to the norms of national law (the same as for a private company). Karolinska is organized into 8 divisions with 69 medical specialties (sections)⁹⁹. These divisions and sections are controlled as discretionary expense centers. The control-procedure starts in March/April (X-1) when the hospital receives a budget directive from its owner. A negotiation then commences about production volume (with the SLL Order-office) and the available financing (with the SLL Owner-office). From the hospital the division and staff

⁹⁶ Stockholm Läns Landsting (SLL) www.sll.se

⁹⁷ 1 Euro = 7.38 SEK

⁹⁸ 2003: 1.1%, in 2004 a surplus: 1%, in 2006 and the next years deficits: 1.6%, 2007: 2.9% and 2008: 1.8%

⁹⁹ www.karolinska.se

leaders are involved. The final budget is submitted to the SLL by the 1st of September. The hospital has to report the result and a prognosis to the owner 8-9 times a year (X). Every month the CEO has follow-up meetings with the 8 divisions. One to two weeks before these meetings, similar follow-up meetings are carried out within each division.

In negotiations concerning the budget proposal the three allocation and local volume models are important. The budgets at the internal units are based on last year's numbers adjusted for the planned changes. The internal control-procedure builds upon two principles: the financial result and the activity-ceiling. At the CEOs monthly follow-up meeting with each division all deviations, the prognosis and action-plans are discussed and decisions are made. The control-procedure is illustrated in Figure 9.

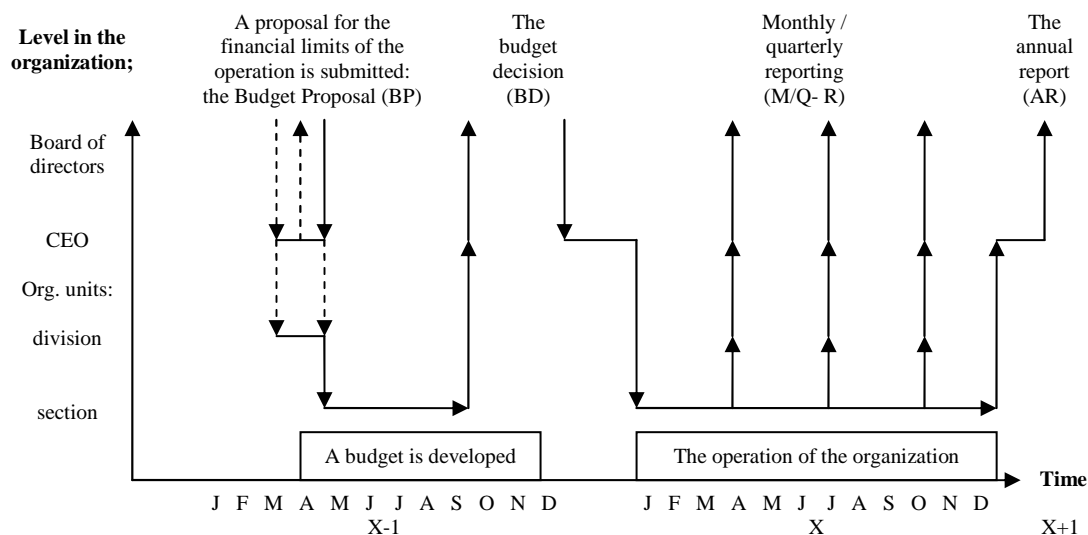


Figure 9 The budgetary control-procedure at Karolinska

The hospital has a complex financing arrangement consisting of two regional and one local revenue models. If the patient from the SLL-area is a cost-outlier, then the calculated cost from the hospital's own costing system is refunded from the SLL. In 2006 7% of the patients from the SSL-area were such outliers. These patients consumed 30% of the hospital's resources. The patients from the county of Stockholm who turn out not to be cost outlier are refunded according to SLL's B- price list. The patients from other parts of Sweden are refunded by the A- price list. These models are also used for internal resource allocation. The hospital's local costing systems (SCPS & CCS) are available but are not used in the internal

follow-up reporting. The estimates are used for billing the owner and for making regional price-lists.

Experiences with the control systems

The hospital has 20 years experience with costing its services (SCPS). The comments from the chief-controller reflect the main use of this system:

“We do not use SCPS-information much in the internal control of the hospital. The most important use of the SCPS-information is for the billing of the outliers.” She continues:
“I would not claim that we use the SCPS-information when we are budgeting. The revenue models are used to simulate the hospital’s income for the coming budget-year.”

The chief-controller

The organization has a local costing system, but it does not use the cost information in the internal control of the hospital. The volume models and the revenue models are important in the daily operation of the internal units. To study the income – not the costs – per patient are important to the clinical leaders:

“I have to consider the financing system when running the clinic. It matters if a patient comes from SLL, or if the patient comes from outside the county.” He continues:
“I believe the SCPS- information is accessible. In my daily work I make use of other sources of information.”

The Director of the Cardiovascular and respiratory diseases-division

This frustrates the leader of the DRG/SCPS-unit as he reflects about this situation:

“We have had this cost information for 20 years! The information is far too little used within the hospital! Karolinska is too income-focused!” He continues:
“Our organizational position outside the finance-department has probably influenced ... the limited use of the SCPS in the control of the hospital. Another explanation may be that the model is too complicated. Managers like to have user-friendly reports. A third explanation may be that the pricelist reflects the history. The price list for 2008 is based on data from 2005 and 2006. This is a problem: all the time the activity changes in accordance with the changes in medical technology.”

The discussions with the owner do not always balance the available funding to the job expected to be done. The owner- and the order-offices within the SLL do not always coordinate their actions, but it is possible to “make a deal” with the owner:

“This was illustrated in 2006. The order-office complained to us that we did not manage to reduce the queue that had developed. At the same time the owner-office had not provided us with sufficient funds (the tools) to do the job! For the year of 2007 my department has got a deal with no upward limits on our production (the target is 1,400 operations). This is an attempt from SLL to get rid of the queue.”

The Head of the Thorax-surgery department

Other respondents were critical of the existing model of controlling the hospital. A director of a division reflects about how this should be changed at Karolinska:

“My managers get a slap on their fingers if they deliver more services (production) than ordered. One does not ask if this production was well-spent resources!” He concludes: *“I believe we - with a new model of control will spend a little more money, but get a far better development in the productivity.”* To make such a new model work: *“We have to have internal prices, a system (rules) of marginal prices together with productivity measures at different levels.”*

The Director of the Emergency Medicine division

5 Discussion

Our finding shows that there is great diversity in the design and use of cost accounting information in the four university hospitals. The concept “package” is informed by Malmi and Brown (2008), but we are limiting our focus to the accounting systems and how it is used. This may of course be too simplistic. Also note that the study is inductive and that the configurations are driven by the data. Four different control-packages were identified. The labels of these packages are chosen to highlight main features of the systems, and are not meant to be general descriptions of control packages. Table 7 shows the main dimensions of the accounting systems in the hospitals investigated.

	Haukeland	HUS	Rigshospitalet	Karolinska
System description	The ARIBITRARY	The ADVANCED	THE BASE-LINE	The UNUSED
Context (national)	Rapid growth	Growth (-)	Rapid Growth	No Growth
Hospital funding	National models	Local models	National + Local models	Regional + local models
Resource allocation (internal)	National models + discretionary	Local models + discretionary	Local models	Regional model + local models + discretionary
Responsibility centers	Discretionary expense centers	Standard cost center (discretionary expense center)	Standard cost center (discretionary expense center)	Discretionary expense centers
Local systems	Volume	Volume SCPS CCS	Volume SCPS CCS	Volume SCPS CCS

Table 7 The different control-packages

Two of the hospitals do not use local cost estimates, but these decision take place in very different contexts and for different reasons:

The arbitrary system

The arbitrary system is found in the context where budgets are growing very fast. The owner is wealthy and revenues of the booming oil economy are also pumped into the hospital. Resource allocations are based on national models that do not control for the workload outside the department. The label arbitrary is related to the way resources are allocated and to the high level of uncertainty in the measures of profit and loss in each unit. This praxis is not supported by the Ministry of Health: “*The regional thrusts are free to adjust the total financing of the local hospitals ... in accordance to the various needs and decisions made within the regional-area. The national estimates (prices) are not solid enough to be made use of for the financing of individual patients and departments.*”¹⁰⁰ Still, it is used within the hospital.

The unused system

In the Karolinska case, they have the system but do not seem to use it. In this case the context is very different. The owner is relatively “poor” (compared to the case above) and funding is dropping relative to the other hospitals. They have had the SCPS system for many years, but it is not used for allocating resources or for controlling costs. One could expect the system to be more important when resources are limited, but the focus is on getting more income from providing services for the particular expensive patients and from the patients from outside the county.

This shows that the sites with the highest and the lowest increase in total spending are not using local cost information. The lack of such use seems to be strongly linked to the resource allocation model and the funding decision. As long as local costs are not used in this discussion, it is not implemented at lower level. In the Norwegian case, this result in choosing the “easy way out”, just passing the resource allocation model at a central level to the local units. The model has clear weaknesses at a central level, not taking into account variances between hospitals. Yet at a local level it does not take into account cost from other departments and becomes totally arbitrary. To “fix” this, budget surplus are “taken back”. In the Swedish case, the focus on costs is replaced with a focus on getting more resources from the other sources. The organization becomes “income-focused”. This shows how important the funding system is for the design and use of local costing systems.

The more advanced systems are found in two different versions:

The advanced system

The HUS-organization was using a very advanced costing system for calculating the cost of different services and patients. This can be attributed to the use of this information in the negotiations with the owner.

The base-line system

This system is similar to the advanced system, but less focus is paid to the individual prices. The focus is on the base-line that is given from a fixed volume and the local costs. Altering the resources within the base-line is important. The measurement of the different units as well as the hospital’s productivity is important for discussing a possible marginal financing/payback. Possible consequences for the base-line are discussed. A routine for defining projects that may have consequences for the base-line (i.e., changes in the medical technology) has been established.

In both cases the format of the funding discussions informs the design and use of the cost accounting data.

¹⁰⁰ See, for example, <http://www.helsedirektoratet.no/publikasjoner/regelverk-innsatsstyrt-finansiering-2012/Sider/default.aspx> paragraph 1.1 page 6 & 7.

Two types of “packages” were thus identified; “the traditional” and “the advanced”. The label “traditional” covers what we may expect to find in public hospitals (Anthony & Young, 2003). A traditional package includes the use of discretionary expense centers, the national model for allocating resources and has a small number of locally adapted costing systems. The “advanced” package includes the use of standard cost centers, local resource allocation models and higher number of locally adapted costing systems. This may be seen as a trend in a modern public sector entity.

Theories on the design and use of control systems are rich on how systems are designed to fit organizational structure and other contingency factors (Otley, 1980). *“The design of the “package” is actively shaped by the strategic choices of its dominant coalition”* (Abernethy & Chua, 1996:569). In the case of costing systems, competition, production complexity, product heterogeneity and cost structure are often used to explain variations in the complexity of costing systems (Horngren et.al., 2009). Researchers have pointed out, however, that the relationships between the contextual factors and the design elements of costing systems in business organizations are not well established (Abernethy et.al., 2001; Al-Omiri & Drury, 2007). In our case all the hospitals are relatively similar in these dimensions. Yet their costing systems are very different. This prompts rethinking of the traditional explanations for fit. In our case, system diversity seems to be driven by the external funding systems. If the owner gives attention to cost per service or cost per patient in the way resources are allocated (i.e., in the funding decision), it is also given attention within the organization. At that point, it is not only used for resource allocation but also for cost control, decision making and planning purposes. One explanation seems to be that the hospital manager follows the owner’s example. At two hospitals (Haukeland & Karolinska) local cost estimates are not used. At the other two hospitals (the HUS-organization & Rigshospitalet) local cost estimates are central in the funding discussions and in the follow-up of the internal units. We do not claim there is a cause and effect relationship between external funding systems and a hospital’s mix of costing systems, but this relationship should be further studied. There may be other factors in the context of the hospital that better explain the diffusion of text-book ideas in management accounting to hospitals.

6 Conclusion and further research

The first conclusion is that there is diversity in how the hospitals design their cost accounting models. The second conclusion is that the different configurations seem to form different “packages” with distinctive characteristics. On the one extreme, rather simple systems are designed as more mechanistic and arbitrary allocation models. In other cases more advanced tools are used for planning, allocating resources and to measure performance. The third conclusion is that we have observed on a more speculative basis a link between the design and use of systems and the funding model.

The main knowledge gained from this study is that a university hospital may have a mix of cost accounting models and that one of these costing systems may be advanced. Some hospitals calculated the local standard cost per service by an advanced costing system.

The need for more refined costing data has been argued, but low adoption rates of more advanced costing systems are still observed (the ABC-paradox) (Gosselin, 1997). Low adoption rates of advanced costing systems in American hospitals have been reported (Hill, 2000). This study supplements the literature by providing empirical findings which indicate advanced costing systems in some Nordic university hospitals. In addition, Abernethy and Chua (1996) have reported that reforms (involving, for example, DRG-prices) forced an Australian hospital to change its control-package. This seems to be consistent with the findings of this study in the sense that different external funding models may form different control systems within hospitals. While reading the literature one may get the impression that cost accounting models are similar across hospitals and contexts (Kjøllestad, Essay I), the Nordic study indicates that complex hospitals have a mix of costing systems in packages and that the use of particular costing systems may vary even within similar political contexts. This is “the *costing system mix*-contribution”.

These findings motivate rethinking of traditional contingency studies and suggest that the link between overall governance and management accounting in the public sector context should be given more attention. We have seen the importance of funding and governance and their impact on the design and use of management control systems.

One important observation is that a major university hospital can manage and survive with a very simplified version of actual cost information. In such a version only volumes and total costs are used and compared to the budgets. Arbitrary allocations seem to be handled by ad-hoc procedures of “taking back” surpluses and by subjective assessments for block-grants. Compared with the other Nordic hospitals, the hospital with the simplified and arbitrary system is a success story in terms of growth and increased resources. The rationale for not using advanced systems in rich organizations should be addressed by further research.

Another observation is the adoption of more advanced systems, but not using these systems to control the local activity as observed at one of the investigated hospitals (Karolinska). Attention is given to increased resources in all the cases, but only two of them use local cost information on services and patients to control the activity. At Karolinska increased resources were not linked to systems for services or patient costs. Other types of use do not seem to be strong enough to legitimize the systems. This observation suggests that more research attention be given to the hierarchy of multipurpose systems, for example, costing systems.

Two of the cases seem to be strongly informed by their advanced costing systems. In both cases, they also seem to be well-controlled in terms of keeping spending within their budget limit (a surplus). We do not claim that there is a cause and effect relationship between the use of more advanced systems and financial performance or control. Yet in both cases the systems are used to control activity, and they clearly inform decision making in the organization. This link between actual decision making and cost accounting information should be given more attention.

APPENDIX 1:

This questionnaire is planned used in the explorative case study focusing on “*the use and usefulness of cost information in Nordic hospitals*”

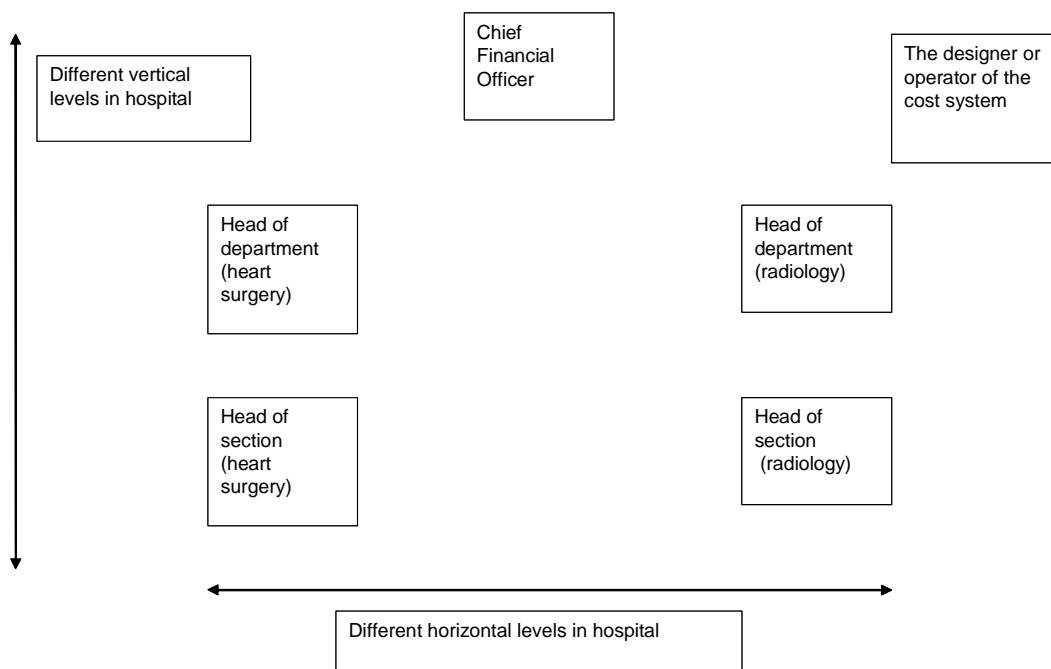
The goal is to describe the most important types of decisions managers in hospitals are facing in their work as ”recurring issues” (e.g. financing and budgeting & control) that have to be confronted. When you look back decisions have been made, but it is difficult to tell who and when it was made.

With the term ”decisions” I have in mind the admission of patients, diagnosis and treatment, change in treatment protocols, change in capacity, planning and budgeting, pricing, financing, the internal control of the operations, measuring of productivity issues, ”bottle-neck”- projects, reorganization of work processes etc..

The chief financial officer of the hospital will be interviewed.

The central area for decision- making in hospitals are “diagnosis and treatment”. This is why the study focus on both the head of clinical department (local resource- allocation and control of the physicians) and section (the prime decision-maker regarding patients) at clinical department- level. The provision of diagnostic information and care may also be provided in medical service departments. The interaction between the department of Heart surgery and the department of Radiology is also in focus in this study.

The organization of the provision of care and information may differ from hospital to hospital in the Nordic country, but the figure below illustrates the *functions* (persons) I would like to interview.



The Questions to the users of the Clinical Costing System (CCS)

General information

Name:

Position:

- 1 Focus on managers decisions in hospitals, and their use of cost-information.
 - 1.1 Describe (classify) the types of decisions you are involved in as a manager?
Type of decisions and frequency (Daily, Monthly, once a year etc.).
 - 1.2 What type of cost information do you use in these decisions?
Type of decisions and type of cost information (wages, estimated product costs, prices etc.)
 - 1.3 Where do you find the estimated costs (source)?
Type of decisions and the sources of cost information (Global Costing system (CCS), local costing system, ad-hoc costing exercises, other sources)
- 2 Focus on horizontal interaction between the heart surgery and department of radiology.
 - 2.1 Describe your interaction with this department?
Formal meetings / informal interaction
 - 2.2 Describe (classify) the types of decisions this interaction involves?
Type of decisions (and the frequency: daily, monthly, once a year etc.).
 - 2.3 What type of cost information do you use in these decisions?
Type of decisions and type of cost information (wages, estimated product costs, prices etc.)
- 3 Focus on the need for better cost information (What if...?).
 - 3.1 Have you experienced any situation where you felt the need for *better estimated costs*?
 - 3.2 What type of cost- information do you want to have that you do not have today?
 - *provide greater detail
 - #different cost objects as:
services (here: internal), patients, DRG (product lines), Departments, Sections (working units), payer etc.
 - *provide better classification of costs according to behavior:
direct / indirect, fixed / variable, controllable / non-controllable
 - *report cost information more frequently:
enables managers to expediently address problems and identify opportunities for improvement
 - *calculate and explain more variances (B-R):

expense variances, price and estimated costs variances, volume, price and productivity variances (standard costing technique), productivity indicators

The questions to the operator of the CCS:

General information

Name:

Position:

1 Background information about the ownership and financing of the hospital

Name of the hospital

Owner of the hospital

Financing system

Pricelist(s) (links, documents etc.)

2 General information of the hospital

There is a need some background information about the hospital and its units. The year of 2005 is chosen. The information can be forwarded by mail (to the designer of the CCS) and/or completed during the visit.

Info about the hospital: Number of employees/beds/in-patients/out-patients / the budget

Info about the Dept. of radiology: Number of employees/number of radiology sessions/out-patient sessions / the budget

Info about the Dept. of Heart surgery: Number of employees/number of beds/number of in-patients/out-patient patients / the budget

3 The different cost- and activity- systems

3.1 Identification of costs

3.1.1 What are the dimensions of the record of the general ledger?

3.1.2 What dimensions of the record of the general ledger are used in the CCS?

3.1.3 How are costs related to R&D& teaching identified and treated?

3.1.4 What type of costs is directly attached to the single patient?

3.1.5 Are information from the pay system utilized (info about the single employee)?

3.1.6 How is depreciation costs identified?

3.2 Identification of activities

3.2.1 What grouper system is used (NorDRG for all)?

3.2.2 How are out-patients treated / identified?

3.2.3 How are the quality of registrations secured (org.unit and processes)?

3.2.4 What feeder systems (activity databases) are used?

- LOS (consultation minutes)/Nurse workload/ANE/INT/OPR/RAD/PAT/LAB/others?
- 3.2.5 Describe the information that is extracted from the single feeder system:
LOS (consultation minutes)/Nurse workload/ANE/INT/OPR/RAD/PAT/LAB/others?
- 4 About the design of the CCS
- 4.1 Allocation of costs related to joint (internal) services
- 4.1.1 Are the CCS a standard program or specially designed for the purpose?
- 4.1.2 What is in case the vendor?
- 4.1.3 What type of costs is internally priced?
- 4.1.4 Which groups of costs are linked to what allocation keys?
Groups of costs, allocation key, level of aggregation of the key (dept/cost centre)
- 4.1.5 How often is these keys (to allocation bases) updated?
Allocation key, frequency of revisions
- 4.1.6 Are any of these keys weighted to reflect the intensity of the resource-utilization?
Groups of costs, allocation key, type of weighting (factor and definition)
- 4.2 The allocation model of costs to the single patient
- 4.2.1 What cost drivers have been chosen?
LOS/consultation minutes/Nurse workload/ANE/INT/OPR/RAD/PAT/LAB/others?
- 4.2.2 Has time-and-motion analysis been carried out?
- 4.2.3 What allocation method is used for the different types of costs?
- 4.2.4 What types of costs are directly attributed to the single patient?
- 4.2.5 What feeder systems (activity databases) are used?
LOS/consultation minutes/Nurse workload/ANE/INT/OPR/RAD/PAT/LAB/others?
- 4.2.6 How are the costs of depreciation allocated?
- 4.3 The presentation of CCS- information
- 4.3.1 How is the CCS-information presented? (Paper reports or at the intranet)
- 4.3.2 How often is the CCS-information presented?
Annually/half year/quarter/month ad-hoc
- 4.3.3 What type of standard reports is available in the CCS-system?
Cost per patient / drill-down possibility? / cost per product line (DRG) / various productivity indicators / others?
Rank the importance of the types of reports for you (low – high)
- 4.3.4 Who are the main targets for the CCS-information?
The board / Top-management / Division / Department / Section / Others?
Rank the importance of the types of reports for the various levels (low – high)

- 4.3.5 Is the submission of the CCS- information followed by particular analysis or certain presentations (standard – ad-hoc)?
- 4.3.6 Describe how the CCS-information is integrated in the control process of the hospital?
- 4.3.7 Does the cost system classify costs into direct / indirect costs?
- 4.3.8 Does the cost system classify costs into fixed / variable costs?
- 4.3.9 Does the cost system classify costs control / non- controllable costs?

Essay IV Developing an advanced costing system in a university hospital

Abstract

Advanced costing systems exist in some Nordic university hospitals (Kjøllestad, Essay III). The literature, however, has not reported how advanced costing systems in hospitals have been established and developed (Kjøllestad, Essay I). The research question in this empirical study is: What factors influence the process of developing an advanced costing system in a university hospital? The theoretical frame of reference is based on the ideas of Bjørnenak and Olson (Bjørnenak & Olson, 1999) about design elements in a management accounting model and Datar and Gupta's (Datar & Gupta, 1994) model of errors in a cost model. Possible lessons learned from the described process are discussed in terms of Mellemvik, Gårseth-Nesbakk and Olson's model of the accounting process (Mellemvik et.al., 2005). The study can be characterized as action research and an experience-based longitudinal case study. Three conclusions were made.

The first conclusion from this study is that two main forces influenced costing system development: new goals for development and the ambition to reduce errors in the costing system. Both these sources for change in costing system design resulted in an increase in the size and the complexity of the system. The second conclusion is that increasing the system size by including more details resulted in new errors. In addition during the process, the researcher's insight into costing system design in hospitals also increased, and solutions to correct these new errors were found by adding new details. The third conclusion is that these forces resulted in new development initiatives and new versions of the system. The development process became incremental. The CEO was not willing to reduce the ambitions for the use of the costing system. Both the process and the costing system had become irreversible.

The main finding from this study is that the studied process can be summarized as an incremental and irreversible development process, due to changes in the intended use of the costing system, the ambitions related to reducing errors in the system and other, external, factors. Consequently, the size and complexity of the system increased during the process.

To analyze the development process was an opportunity I faced after the process had started. The applied research method may have influenced my conclusions. Consequently another research design (for example, action research) may improve our understanding of the process of developing advanced costing systems in hospitals.

1 Introduction

There are different levels of complexity in costing systems¹⁰¹, but few studies treat how advanced costing systems are designed and developed (Kjøllestad, Essay I). Compared with simple systems, advanced systems have many cost pools, a variety of hierarchical cost drivers and activity cost pools (Abernethy et.al., 2001). Advanced systems have more descriptive objects, causal variability factors and time periods in the data than do simple systems (Bjørnenak & Olson, 1999).

In the hospital sector there are several additional challenges involved in developing product cost information (Llewellyn & Northcott, 2005; Northcott & Llewellyn, 2003). When reviewing the costing practices of UK-hospitals, these are seen as “...*inconsistent and crude costing approaches*” (Ellwood, 1996:25). Furthermore, the process of “*mapping costs to the highly differentiated activities of health care to create averages is difficult and problematic*” (Llewellyn & Northcott, 2005:556). In Norway, the question of costing is relevant because the health enterprises are paid partly in a retrospective manner by using the Diagnoses Related Group (DRG) system. This system classifies hospital stays into more or less resource homogenous groups. Based on this system, national standard cost prices are calculated every year. The use of national standard cost per DRG has been discussed in the literature, but we know little about how local costing systems in hospitals are designed (Kjøllestad, Essay I).

The challenges in developing relevant costing systems in hospitals are partly due to the ambiguity in the treatment procedures related to each patient and partly caused by the horizontal processes characterizing the care of patients across different organizational units. As accounting information most often follows the hierarchical, functional and vertical lines, horizontal coordination of transactions is organized without relevant costing information. One way (partly) to solve this information problem might be to define the transaction volume as a basis for estimating the average cost per service (Kjøllestad, Essay III). Such averages may be viewed as a standard cost constructed by a process-costing system. The cost per patient is calculated by multiplying the standard cost per service with the actual volumes in a job-order system. Such a system has been labeled Clinical Costing System (CCS) (Abernethy & Chua, 1996). To this point, however, the literature has not reported on how advanced costing

¹⁰¹ I view a costing system as a model (allocation rules) installed in an organization.

systems in hospitals have been established and developed (Kjøllestad, Essay I). The research question in this empirical study is:

What factors influence the process of developing an advanced costing system in a university hospital?

This study will report from a process where a standard cost per service (SCPS) system is developed in a large Norwegian hospital. The focus is on different phases as the development process evolves and changes are incrementally introduced. The study will clearly be explorative. The purpose is not to test a theory or generalize to other development processes. Prospects of learning may motivate reporting from the selected process. In terms of Broadbent and Guthrie (2008:153) "*learning from good practices ... prevents mistakes being repeated elsewhere*". Learning from others mistakes is always a wise strategy.

This paper is organized as follows. First, the theoretical framework of this study is described. Secondly, the selected research strategy is described and motivated. Next, the empirical data is presented. Finally, the paper ends with a concluding discussion.

2 The theoretical framework

Bjørnenak and Olson's (1999) framework for describing the design elements of a management accounting model is addressed in section 2.1. Next, Datar and Gupta's (1994) conceptual model of errors in product cost estimates is presented (Ch. 2.2). Mellempvik, Gårseth-Nesbak and Olson's (2005) generic accounting process model is described in the third section (Ch. 2.3). In section 2.4 the selected theoretical frameworks is presented.

2.1 The design elements of a management accounting model

The main challenges to costing are related to how the indirect costs are allocated to cost objects. A traditional (simple) product cost model allocates costs to products based on volume as the allocation base. During the 1980s the traditional costing practices were criticized (Johnson & Kaplan, 1987; Kaplan, 1983). The activity-based costing (ABC) technique was presented as a more advanced model for allocating the indirect costs to products and services (Cooper & Kaplan, 1987; Gosselin, 2007; Kaplan & Anderson, 2004). Research has shown that incremental changes in costing systems are often the norm rather than the exception (Labro & Vanhoucke, 2007). The costing systems approached in praxis may thus vary in

many dimensions: “*It is the design characteristics that form the system, not the label of the model*” (Bjørnenak & Olson, 1999:336).

Bjørnenak and Olson have developed a framework for describing and analyzing management accounting models (Bjørnenak & Olson, 1999), including the dimensions of scope and system¹⁰². By classifying the elements of a management accounting model, one may identify if the model is representing the “*conventional wisdom*” or “*innovations*” within the field of management accounting (Bjørnenak & Olson, 1999).

The scope dimension involves descriptive objects, causal variability factors, type of data, number of periods, division of time and time-perspective in data. “*Descriptive objects are thus more than cost objects*” (Bjørnenak & Olson, 1999:329). The capacity to handle more data has made it possible to record more details. Modern models thus include more and different types of both internal (i.e., processes) and external (i.e., customers, competitors) data. Accordingly, the variability described may be of a non-financial nature. Causality in models can be related to both costs and performance. Variability factors in the same model may be both descriptive and causal. The type of data in the model may be financial or non-financial, internal or external and aggregated or disaggregated, and the financial perspective of time has been extended with more differentiated reporting periods.

The system dimension focuses on the link between the users of the system and how the system is designed. Two aspects are emphasized in this dimension. One is the number and lifetime of systems. The other is the integration of user-involvement and the acceptance of information asymmetry in the design of the model. Modern technology has made it possible to link data from different sources and present it in reports. These developments allow for the design of more ad-hoc systems. The properties of temporary systems may be quite different from the systems that continue for a longer-term. “*As they are designed for a short lifetime, they may get more attention, they may include more complex data sources than traditional management accounting systems, and they may be designed and used on a trial and error basis*” (Bjørnenak & Olson, 1999:334). The user-involvement in the design of the model may be small or high, and relevance may be dependent on context as “*different organizational contexts have different criteria of information relevance*” (Bjørnenak & Olson, 1999:334).

¹⁰² Characteristics and elements are often used interchangeably in the literature. In this essay we will use the word: element.

The acceptance of information asymmetry in the model is another attribute. A more modern approach to system development is to allow for satisfying local needs (high asymmetric information). Table 1 displays Bjørnenak and Olson’s framework.

Dimension	Elements	Conventional wisdom	Innovations
Scope	Number of Descriptive Objects	Few	Many
	Number of Causal Variability Factors	Few	Many
	Type of data:	Financial	Non-financial
		Internal	External
		Aggregated	Disaggregated
	Number of periods	One	Many
	Division of time	Fixed	Variable
Time-perspective in data	Primarily ex-post data	More ex-ante data	
System	Number of systems	One or few	Many
	Lifetime	Continuous	Temporary
	User-involvement	Small	High
	Acceptance of information asymmetry	Low	High

Table 1 The design elements of a management accounting model (Adapted from (Bjørnenak & Olson, 1999)).

2.2 The errors in costing systems

When we do not have information about the true product costs, “...we can only infer distortions based on our intuition” (Gupta, 1993:181). Furthermore, “because a costing system is a model of an unobservable true cost, reported product costs likely contain biases and errors” (Labro & Vanhoucke, 2007:941). Datar and Gupta have introduced a conceptual model of errors in product cost estimates: specification-, aggregation- and measurement errors (Datar & Gupta, 1994). “Specification error arises when the method used to identify costs to products does not reflect the demands placed on resources by individual products” (Datar & Gupta, 1994:568). “Aggregation error occurs when costs and units of a resource are aggregated over heterogeneous activities to derive a single cost allocation rate” (Datar & Gupta, 1994:568). Measurement errors are related to problems with finding the exact data used by the individual activities. The typical approach when changing the content of a costing system seeks to improve the specifications and make use of more disaggregated data (Datar & Gupta, 1994).

In their analytical study, Datar and Gupta (1994) argue that “improved specifications of cause and effect relations and less aggregation could increase the problems of identifying costs with a particular cost pool and measuring the specific units of resources consumed by

individual products” (Datar & Gupta, 1994:568). In a field study Gupta concludes that in more aggregated systems the individual specification and aggregation errors may offset each other so that the total error becomes smaller (Gupta, 1993). A more recent simulation study concludes that a partial refinement of specification- and aggregation errors “*generally tends to increase the accuracy of reported product costs*” (Labro & Vanhoucke, 2007:946).

2.3 A generic accounting process model

Mellemvik et.al. (2005:313) presents “*a generic accounting process model*” in their review of Nordic public sector accounting research (1980-2003). Accounting involves many different types of activities. These can be divided into three different processes connected with the accounting norms, the accounting practice and the use of accounting. The accounting processes are influenced by and influence the environment. The processes connected to accounting norms include many activities, and most of these activities are talk, both as process and output. The accounting practice comprises the instrumental accounting activities, e.g. daily registration of transactions, monthly reporting and annual reporting, which in general are controlled by the accounting norms, time-schedules and required output (i.e., accounting reports). The use of accounting information about an organization may include internal users (i.e., managers) as well as external users (i.e., journalists, politicians, and shareholders). The use system may to a large extent be characterized, like the norm system, as processes of talk.

Mellemvik et.al. combines this insight with Levitt and March’s (1988) learning model. Organizations can learn from their own experiences and/or from the experiences of others (Levitt & March, 1988). The thin arrows in Figure 1 indicate that within each accounting process, learning from the own experiences of the people involved can take place. The thick and open arrows indicate three different learning situations. There are learning links between the sub-processes, from the environment to each sub-process, and from each sub-process to the environment. This implies that this is a very open model of the accounting process in which each sub-process may be influenced by its own experience and by the experiences of other sub-processes, and that the actors in the environment of accounting also learn from the experiences in the accounting processes. The model is illustrated in Figure 1.

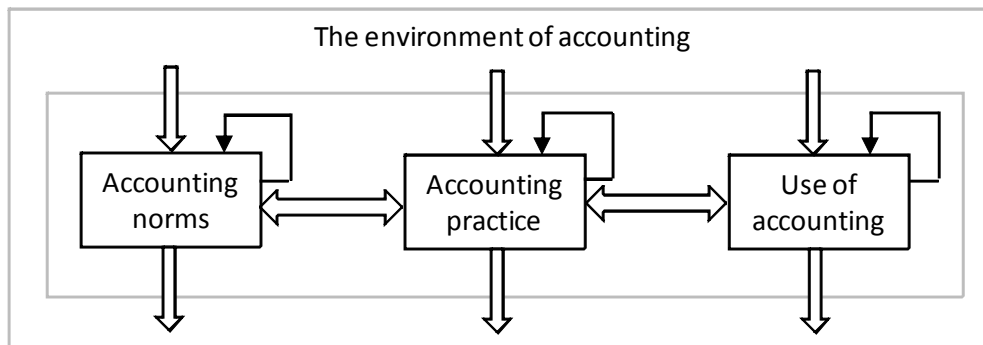


Figure 1 The accounting process (Adapted from Mellemvik et.al., 2005).

2.4 The selected theoretical framework

An assumption motivating the selected development process was that it is possible to increase the accuracy of a costing system by introducing more detailed design elements. The empirical study focuses the design elements which have been central in the development process. The design elements with the largest change during development process have been selected. Datar and Gupta's model for classifying errors in calculated product costs will be applied for identifying and evaluating errors in the different versions of the costing system. By focusing the relationship between design elements and errors in costing system development the process of change may be described. The developed framework is displayed in Table 2.

<i>The focused design elements of the costing system:</i>
Descriptive Objects
Causal Variability Factors
Type of data: Aggregated - Disaggregated
<i>Errors in the product costs:</i>
Specification error
Aggregation error
Measurement error

Table 2 The selected framework for analyzing a costing system

The selected framework will be used as a tool to translate insight gained from the development process to text. The text will subsequently be analyzed in order to identify factors which influenced the process of developing the costing system at the research site. Mellemvik et.al.'s (2005) model of the accounting process will be applied for formulating possible lessons learned from the study. The strategy for the empirical study will be further described in the next chapter.

3 The empirical study

In this chapter the selection of research method will be addressed (Ch. 3.1). Next, the empirical data is described (Ch. 3.2). Finally, the role of the researcher in the research process is discussed (Ch.3.3).

3.1 The research method

This research is based on several data sources. Mainly, the longitudinal study has been developed as an action research initiative, as the costing system developments were managed by the researcher during his work from 2000 as an internal consultant at a Norwegian university hospital (Rikshospitalet). In 2004 the researcher became a project leader for the establishment of a clinical costing system at the hospital. University hospitals have the most complex activity and thus, the most complex cost structure of hospitals. This context for studying the development processes of implementation of the costing system is therefore highly relevant. A case study approach was applied to focus on understanding the dynamics present within single settings (Eisenhardt, 1989). As stated by Ghauri and Grønhaug (2005:114): *“Many phenomena cannot be understood if removed from their social context”*, and a case study *“investigates a contemporary phenomenon within its real-life context”* (Yin, 2003:13).

The choice of frameworks referred to above are used as *““lenses”, that is, some conceptual or theoretical “glasses” that can help people make sense of their observations and experiences”* (Ghauri & Grønhaug, 2005:212). The research design is a *“holistic-single case design”* (Yin, 2003:40), and this design is chosen because the aim of the study is to be revelatory: it provides useful insight not previously accessible (Ghauri & Grønhaug, 2005).

The development process of the costing system started in the fall of 2000 with translation of a national cost model into the local context. The work with the costing system ended in April 2010. Long-term observation has a potential to yield insight that cannot be won from short-term studies of single cases. In a longitudinal case study *“time is captured in our work through a combination of retrospective and real time analysis”* (Pettigrew, 1990:271). Such a study has a potential for describing patterns of change and establishing the direction and magnitude of the relationships. A longitudinal case can be viewed as a sequence of linear events or “phases” that occur over time to produce a given result (Langley, 1999).

There is a need to identify the phases of the process. The existence of errors in product costs may drive the process of changing the content of the costing system. The initiatives to solve the identified errors are used to define the phases of the process. Each phase is given a label that characterizes the main efforts taking place within the phase. At the end of each phase a new costing system had been constructed. In this process, new errors were identified and new development initiatives taken. Four phases and four versions of the costing system were identified. The first phase began in 2000 (CS₁), the second 2001-03 (CS₂), the third 2004-05 (CS₃) and the last phase is 2006-09 (CS₄). The relationships between phases and costing systems are illustrated in Figure 2. The arrows between each phase indicate that action has taken place to change the content of the previous costing system.

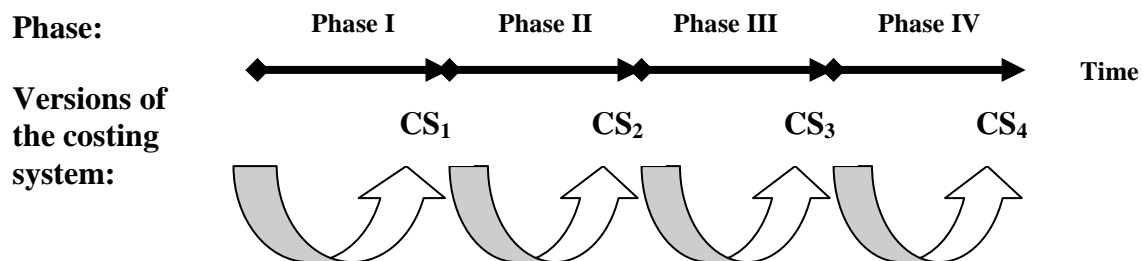


Figure 2 The different phases of the process and versions of the standard cost per service-system

3.2 The empirical data

In this study the researcher's experience of leading the development process is combined with direct observation, participation with other actors, relevant archival records and physical artifacts that are analyzed. In addition, interviews were conducted with key decision makers late in the process. The most important archival records are internal reports, the hospital's annual reports and the researcher's portable electronic calendar. The development process itself was characterized as having periods with both action and non-action. Many dialogues have taken place for solving the various problems encountered during the development process. These dialogues and other aspects of problem solving are reflected in the constructed costing systems. The costing systems themselves can be classified as both physical artifacts and archival records, as they are based on classifications of observed situations. The first physical versions of the costing systems were made in spreadsheets. The versions from 2004 and thereafter involve patient- sensitive information presented only at the hospital's intranet.

The interviews included in this study were made at the research site in Norway in June and August 2007. At that time costing system CS₄ was available with 2006-data. The CEO of the hospital was included, as he was the main sponsor behind the costing initiative. In addition, the intended use of the constructed costing system was explored in interviews with four directors/managers. The two interview-guides are presented in Appendix 1. The costing system was presented to the informant directly before the interview was conducted. Table 3 displays the interview-statistics. The average interview lasted 32 minutes. The interviews were taped, transcribed and made available for comments. No one had comments about the transcripts.

Level in the organization;	Positions;	Organizational unit	Interviewed date	Duration: minutes
Top management	Chief Executive Officer	Top management	13.06.2007	25
Top management	Chief Financial Officer	Top management	29.08.2007	20
Clinic	Professor and director	Imaging and intervention clinic	20.06.2007	47
Department	Professor and manager	Thorax-surgery department	05.06.2007	36
Section	Head of section	Nevroradiology section, Imaging and intervention clinic	04.06.2007	32

Table 3 Interview-statistics

The decision to carry out the research project was taken some years after the development process started; therefore the complete research process is not being thoroughly documented. Consequently, the research strategy can be labeled: *experienced-based longitudinal case study*. The researcher's tacit knowledge was based on the longitudinal participation and observation during the development process, and this knowledge is the main analytical source for describing and analyzing the empirical context.

One main method used here to translate the researcher's observations into text was to categorize the observations. Thus, the researcher was able to develop values in order to standardize the presentation of the findings into quantifiable qualitative data. "*It is quite possible to quantify qualitative data*" (Ghauri & Grønhaug, 2005:109). The value reflects the researcher's own valuation of the development process. Within the development process the value will indicate the change that has taken place. This evaluation of the design elements of the costing system (i.e., Descriptive Objects and Causal Variability Factors), based on the developed framework, was done by the researcher when using values between 1 (few) to 10 (many). A high value will indicate that it is a more advanced costing system. A higher value

will also indicate that the size of the system has increased. The level of aggregation in the data will be evaluated on a basis of 1 (aggregated) to 10 (dis-aggregated). The values may also provide an indication of the efforts involved in each phase. A large change in value indicates that much work has gone into the creation of the new version of the costing system. The researcher's evaluation of the errors in the cost estimates can thus be indicated on a scale 1 (few) to 10 (many).

This research method is subject to some reliability and validity problems. First, the evaluation is based on one person's subjective assumptions. Another researcher might decide on different values. Furthermore, evaluation of the first three phases in the development process is done some years after the changes were made, and this has introduced a time-lag into the evaluation process.

The data used in this research approach can be summarized in this table:

Data	Phase I	Phase II	Phase III	Phase IV
Archival records	-	v	v	v
Physical artifacts	v	v	v	v
Interviews	-	-	-	v
The researchers own experience	v	v	v	v

Table 4 The data sources in this study

Table 4 illustrates that physical artifacts and the researchers own experience are made use of as data in every phase of the development process. The different versions of the costing system are *the* central data in this study. The researchers' insight into the ten year long process made it possible to find these physical artifacts. The role of the researcher in the research process is special and thus needs a further comment.

3.3 The role of the researcher in the research process

"The idea of "scientific rigor", understood as following a strict and impersonal protocol, is not fruitful when applied to studies of complex human conduct" (Tengblad et.al., 2005:10). According to Tengblad et.al. (2005:11), "This does not mean that anything goes. It is still crucial that the research is trustworthy and credible, but good research should preferably also be theoretically interesting and practically useful". In terms of Corbin and Strauss (2008:32), "Data collection and analysis have traditionally called for "objectivity". But,

today we all know that objectivity in qualitative research is a myth". They suggest replacing the concept "objectivity" with "sensitivity". According to these researchers, "*Sensitivity means having insight, being tuned into, being able to pick up on relevant issues, events, and happenings in data*" (Corbin & Strauss, 2008:32). Corbin and Strauss (2008:41) point out that "*Sensitivity ... is derived through what the researcher brings to the study as well as through immersion in the data during data collection and analysis*". Professional experience can enhance sensitivity. Such experience can enable the researcher to understand the significance of some things more quickly. There is, however, a danger that in the interpretation process the researcher may force his/her ideas on the data. Corbin and Strauss (2008:33) thus provide the advice that the more we are aware of the subjectivity involved in data analysis, "*the more likely we are to see how we are influencing interpretations*". These concerns motivate the focus in this section on the role of the researcher in the research process.

The story in this study is based on the researcher's experiences. This kind of research is thus based on the subjective experiences by the researcher, and the empirical data is gathered in his role as the researcher. The researcher could use his experiences to obtain and analyze the secondary data as the different versions of costing system. One possible solution to the eventual dilemma is to discuss the participation in order to enable the reader to make up her/his mind of the implications for the validity of the findings. "Participation" and "observation" are central in case studies (Yin, 2003). When engaged in a problem-solving process, one may learn a great deal. The experiences may be useful for both practitioners and researchers. The issue at hand is how best to capture these experiences.

Three situations involving the time-dimension of a process can be identified: before, in the middle of, and after the action has taken place. The researcher's prime role in the process may be either as observer or actor. Traditional mainstream business research is often based on phenomena that *have* taken place. This first approach is illustrated in Figure 3 marked as position "1". The researcher may then as a visiting observer interview the actors who have participated, asking about their experiences of the action. According to Ghauri and Grønhaug (2005:109), in business studies "... we normally use techniques such as structured, semi-structured or unstructured interviews, surveys and observations". "*Typically the academic (accounting) literature has merely analyzed and interpreted the innovations constructed elsewhere after the fact*" (Kasanen et.al., 1993:243).

Research can also be initiated before a process or in the middle of the process. If the process can be identified before the action commences, the action research approach is suitable (Lewin, 1946). In this second approach (i.e., position “2”), the researcher can participate in the process and gain his/her own experiences. The researcher will be an observer with only modest involvement in the action. A variant of action research is performed when the researcher constructs a solution to an identified practical problem and implements the solution within an organization (Kasanen et.al., 1993). In each of these approaches, the researcher participates primarily with his/her experience as a researcher.

A third approach (i.e., position “3”) is used when an actor in the selected process decides to report on the action in which he/she is going to participate. As an employee of the organization he/she then has to have the firm’s authorization to report on the process after the action has ended.

A fourth approach (i.e., position “4”) is when the actor decides to report from the process when the action is finished (Eden & Huxham, 1996). In these last two approaches the researcher has to approach the academic community to obtain a sufficient insight about doing research to be able to report on the local action. Figure 3 illustrates the different approaches available to researchers to capture experiences from action in a process. Two approaches (“1” & “2”) is available for the visiting observer, while the other approaches (“3” & “4”) may be used by a member of the organization.

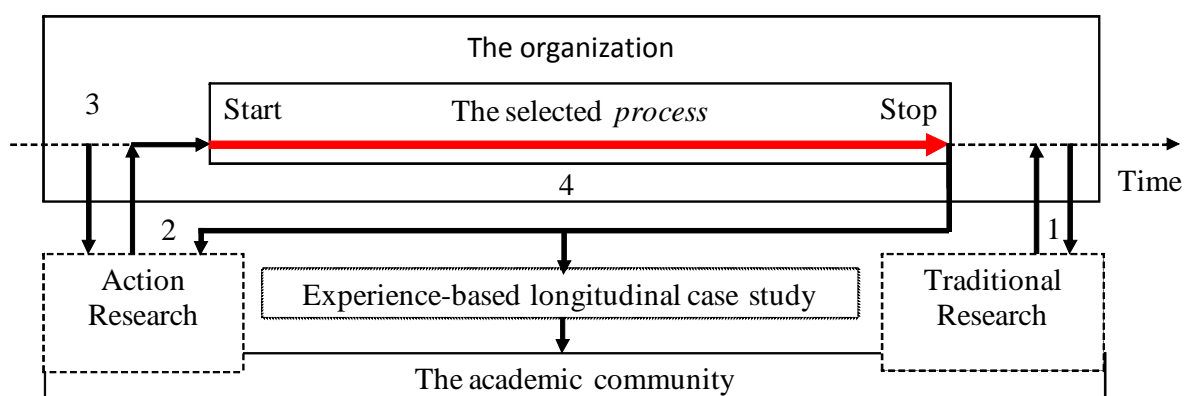


Figure 3 Research approaches for capturing experiences from action in a process

The research presented in this study is not traditional research. Because the decision to carry out research was taken years after the development process began, the researcher cannot make use of the second or the third approach. The study will make use of the last approach. The researcher has, in a ten-year period, participated in a process (as a project leader and main

actor) of developing an advanced costing system in a university hospital. *“The focus in a longitudinal study is on changing, catching reality in flight”* (Pettigrew, 1990:268). Action and knowledge creation need not be separate worlds. In terms of (Hopwood, 2005:6), *“It is also a knowledge that emerges from those who both engage in and reflect on practice, where using knowledge follows the act of creating it”*. The research may partly be understood as an action research project, but a more appropriate label may be that it is an experience-based longitudinal case study.

One characteristic of the whole process was long periods (years) of in-action. If a visiting researcher should study a process of establishing and changing a costing system at the research site he/she would have interviewed the project leader. In such a situation the focus may have been on a phase with much action (e.g., phase 4). The story would then have been a different one. The researchers’ experiences from the development process as well as insight gained late in the process (Kjøllestad, Essay I & III) influenced his “sensitivity”. In retrospect I understood that the experiences might be useful for others. This motivated reporting from the entire process despite the challenges in methodology. In the next chapter the selected development process will be described.

4 The development process

4.1 Phase I (2000): Translating a national model into the local context

During Phase I in 2000 the university hospital was paid by a combination of frame budget and various activity-based national revenue-systems¹⁰³ (Larsen, 2007). These national costing systems did not capture the cost and activity structure at this university hospital (Kjøllestad, Essay II). Central actors at the hospital perceived this as a problem. This perceived problem motivated the development of a local costing system for in-patients. The intended use of this system was to calculate local prices for the hospital. As the CEO said in an interview late in the process:

¹⁰³ Per case payment system for in-patients and several systems for out-patients depending on what hospital service the patient received.

“We must be able to calculate our prices and try to force or encourage our owner and purchasers to relate to the fact that there is a price-tag attached to every service they purchase”. The CEO, June 13, 2007.

As stated here, the goal for the implementation process was to develop a SCPS-system. A costing system was constructed (CS₁, 2000). The calculations and the results were presented in a spreadsheet. The work involved adopting the model from the economists working with the national costing system for in-patients. The data was extracted from the general ledger, grouped according to the national costing guidelines (Buhaug, 1999), and extracted from the official data-file sent the national health authorities. This data-file included every in-patient discharged from the hospital that year. The construction of the system took 3-4 days work.

The new costing system

The costing system (CS₁) was based on the DRGs.¹⁰⁴ It identified 58 activity centers. 26 of these were clinical centers, and 6 activity centers represented medical services. The costing system had one cost pool per activity center. The number of periods was one (year) and the division of time was fixed. The costing system allocated the hospital facility sustaining costs (approximately 25% of the total costs) to the clinical departments and the selected medical services (i.e., radiology) (Buhaug, 1999). The primary allocation bases were the number of man-years and square meter per cost center¹⁰⁵. The costing system had one cost pool per activity center.

The allocated hospital facility sustaining costs (step I in the ABC- costing procedure) was included. The total costs at the clinical centers were then allocated to the DRGs using the length of stay (LOS) per DRG per activity center as a cost driver. 40% (as a default) of the nurses' pay expenses at the centers were also allocated to the DRGs using national weights per DRG times the LOS per DRG per center. The total costs at 6 medical service centers were allocated to the DRG by national service weights (6 separate ones) multiplied by the number of hospital- stays per DRG. For these measures the costing system used aggregated data.

¹⁰⁴ NordDRG: www.nordclass.uu.se

¹⁰⁵ This method for allocating such indirect costs to activity centers has not changed during the process.

Errors in the costing system

The national service weights reflected the medical praxis and cost structure from other hospitals and other time periods (Buhaug, 1999; Nyland, 1999; Pedersen, 2002). For example, the surgery weights per DRG reflected the activity and cost structure (data from 1997) at another university hospital (Solstad & Pedersen, 1999). This hospital had a quite different mix of patients, services and cost structure from the mix of the case university hospital (Kjøllestad, Essay II). The costing system was thereby afflicted with specification errors. The use of one cost pool per activity center and aggregated CVFs indicated the existence of aggregation errors. Despite this, the system measured what it had been designed to measure, the average cost per DRG. The measurement errors, therefore, were low.

The costing system involved the three types of descriptive objects expected to be found in an ABC-system in a hospital: DRG, hospital service (activity) and department. The causal variability factors were volume indicators: the number of hospital stays and length of stays. The costing system produced data useful for external financing purposes, but the data was not relevant for local decision making. The evaluation of this system with regard to values put on the design elements was therefore low. The descriptive objects and the causal variability factors were given the value 2 by the researcher. The system used aggregated data and was given the value 1. The specification errors in the costing system were evaluated to be very high; 10. The aggregation errors in the costing system were assigned the value 8. The total measurement error was low and therefore evaluated to be about 2. The costing system measured what it was designed to do, that is, measure namely the average cost per DRG. The evaluation is displayed in Table 5.

Year	2000
Phase	I
The label characterizing the phase	Translating a national model into the local context
<i>The focused design elements of the costing system:</i>	
Descriptive Objects	2
Causal Variability Factors	2
Type of data: Aggregated - Disaggregated	1
<i>Errors in the product costs:</i>	
Specification error	10
Aggregation error	8
Measurement error	2

Table 5 The evaluation of the standard cost per service system (CS₁) in phase I

4.2 Phase II (2001 – 2003): Expanding the costing system

The CEO tried to change the hospital's financial context, but he experienced difficulties. The CEO explained this in an interview late in the process (June 13, 2007):

“The purchasers do not like to talk about this!”

Despite this problem with the payment system in general, the CEO was determined to continue the development of an internal costing system:

“We must make sure it is technically feasible to handle the purchasers through such a system”.

Despite these disappointing reactions from the buyers of the hospital's services (the other hospital enterprises within the Norwegian healthcare system), the development process did not stop. To the contrary, during phase II initiatives were taken to improve the costing system. The intended use of the costing system was not changed during the next three years.

In the period 2001–2003, projects for studying the local service production were initiated. Hospital-services including surgery, intensive care, anesthesiology, radiology and laboratory were explored. This activity involved ad-hoc costing exercises. According to internal documents, the purpose was the construction of local service weights per DRG (internal documents). This involved studying the local activity databases, discussing relevant cost drivers with the local managers, calculating the cost of all the local services provided a given time-period (normally 6 months) and linking these to the in-patients (and thus the DRG).

This approach turned out to be very time-consuming. To discuss and explain the potential use of the costing system was important when communicating with the local managers. These dialogues with managers identified areas of local use for the cost estimates, but the costing methodology and the spreadsheet-format of the costing system at that time restricted the consultant (the researcher) from exploring these possibilities.

The new costing system

The activity described above resulted in an expansion of the costing system. The central cost object in the system was still the DRGs. The activity was directed into reducing the specification errors by replacing the national with local service weights per DRG. This was done for four hospital services and three laboratories (internal documents). Only three more

activity centers (medical service departments) as descriptive objects were included in the costing system (CS₂, 2001).

Errors in the costing system

Maintaining the constructed costing system soon turned into a problem. In practice, the national price list was normally available in February of the budget year. There was thus every year a risk for a re-classification of patients into new DRGs. The service weights then had to be re-specified at short notice at the beginning of the year. The dialogue with the local managers in the hospital had identified the need for making more transparent the link between the local service processes and the DRGs. The average cost per DRG did not give any possibility for explaining the variation in the local service production. In brief: there were still errors in the costing system.

The efforts to change the costing system had not changed the content nor reduced the errors of the costing system very much; please see Table 6. The number of descriptive objects and the causal variability factors had been increased slightly. The researcher therefore assigned both elements to have a low value; 3. The type of data was still aggregated, and this is indicated with the value of 1. The efforts had only improved the specification of the costing system slightly, and this was evaluated to have a value about 9. The measurement error had not changed, and this was given the value 2.

According to the observations here, the impression was that the resources and efforts related to creating local service weights per DRG per hospital service and department had actually created over-specifications in the costing system. In addition, when it came to improving the content of the system, the observation was that the activities within the development project were wasted efforts which did not increase the relevance and quality of the data produced by the costing system. Later in the process, however, the new insights into the local production processes turned out to be valuable.

Year	2001 - 2003
Phase	II
The label characterizing the phase	Expanding the costing system
<i>The focused design elements of the costing system:</i>	
Descriptive Objects	3
Causal Variability Factors	3
Type of data: Aggregated - Disaggregated	1
<i>Errors in the product costs:</i>	
Specification error	9
Aggregation error	8
Measurement error	2

Table 6 The evaluation of the standard cost per service system (CS₂) in phase II

4.3 Phase III (2004 – 2005): New demands creating a CCS

On short notice in January 2004, the CEO of the university hospital announced that he wanted to develop a clinical costing system. He had seen such a system at another university hospital in Oslo. Phase III in the development process was begun by this initiative, and Phase III introduced the CEO's increased expectations and high ambitions with regard to the relevance and use of the cost estimates. These high expectations were described in the interview with the CEO (interviewed of June 13, 2007), when he stated that his goal was:

“to establish the total cost of the single patient discharged from the hospital. We must encourage the buyers of our services to face the fact that our services cost something,”

The CEO continues:

“The actors in the health system do not want to act as buyers of services. They do not want to be captured in their own rhetoric and be forced to pay what the services cost. The second reason for developing the reports is our own need for having a product-function for every service we make. The degree of change in our product-function is high. Cost-modeling with national DRG-weights is in such a situation not good enough! We need to have better insight into our product-processes.”

As can be seen from the quotation above, the CEO was occupied with the aim of developing local standard prices which the buyers (the other health enterprises/the Ministry) have to pay in order to face the “what the services cost”. His idea was that the national standard prices did not cover the real cost of services from this university hospital, which had a different cost structure than the average hospital in Norway.

But at that time, external decisions affected the internal development process. These decisions changed the direction of the development process because the CEO had to face other challenges. On January 1, 2005, the hospital merged with a large cancer hospital. This took the focus of the CEO away from the system development. Despite this, more details about costs and services were considered to be necessary and the development project continued. Extensive dialogues with the local managers about the local production processes had to be conducted, and this motivated the construction of an advanced costing system. A plan was developed in January 2004 (Project-description, 06.02.2004). The new costing system was designed and tested during the summer of 2004.

The new costing system

The greatest change in the system was the introduction of more disaggregated data (CS₃, 2004). This was related to another large change in the costing system, namely the introduction of more cost pools. The number of activity centers was expanded to 75 with 19 cost pools per center (in total 1,425 cost pools). The system identified per activity center, a separate cost pool for doctors, other personnel, other expenses and common costs from the departmental level. The other cost pools were related to the allocated facility sustaining costs and depreciation costs (both costs allocated from the hospital level)¹⁰⁶.

The number of causal variability factors was also expanded and for some services linked to the particular local service production (i.e., the local anesthesiology service). The number of hospital services was reduced to 9. Some costs were linked directly to the patients (blood-consumption and some particular expensive items). The introduction of a hierarchy in the descriptive objects now had the potential to make the internal service production more transparent. More disaggregated financial and non-financial data could be displayed in different reports on the intranet. To have a drill-down possibility from the hospital level to the single patient and service was regarded by the key decision makers as important for the further internal use of the cost estimates.

The identification of the calculated cost per group of employees (doctors and “others”) per activity center made it possible to monitor the development in the productivity per department (Kjøllestadal, 2000). The division of time in the reports was fixed (a year). The number of

¹⁰⁶ This made the presentation of the estimates complex (and resulted in a more simple solution in phase IV).

periods in the data was one (year). The primary source for activity data was still based on the official data-file sent annually to the national health authorities.

Errors in the costing system

Yet as expected, there were still errors in the costing system. In particular, these errors were related to the use of the local service weights per DRG-groups, which were developed during phase II. As the decision to expand the costing system was taken by the CEO at very short notice, the researcher had (as the leader of the project) to design the system by using the available data. Consequently, these service weights were afflicted with specification errors.

Another problem was that 164,671 out-patients were not included (The hospital annual report 2004). A third problem was to define what data the system should be based on. Should the data be based on the official file of the discharged patients presented once a year, or should we also include the patients who were still hospitalized? Some patients have extremely high length of stays due to the severity of their illness. These patients may be hospitalized for months. If the calculations were based on the discharged patients, the costing system would not reflect the costs of the actual service production. Consequently, the system could not be used in accordance with the intentions of the CEO.

Members of the project team argued that if the costing system were based on production data (actual service data), it could also be used to present reports more frequently (i.e., per month) and capture all changes in the registrations. These considerations were interpreted by the members in the project as indicating that the costing system could be improved by also running it on production-data. A fourth problem, however, was that the patients from the merged cancer-hospital were not included in the new system. In 2005 the CEO insisted that the inclusion of these patients was a condition for the further use and development of the estimates. Given this background, the researcher could not as the project manager, in 2005 and well into 2006, redesign the costing system. The reason was that the researcher (the project manager) did not have access to the necessary funding for the development costs or the necessary programmer competences. In effect, this became a fifth problem in the development process.

The most extensive change in the costing system was the introduction of more disaggregated data. More cost pools were introduced. More precision in the service description and the

inclusion of constructed measures per service (workloads) were also added. Of course, these improvements made the system more complex. Consequently, the design elements of the costing system were evaluated according to the value 5; please see Table 7. The development efforts in the project created a reduction in the specification and aggregation errors, which was evaluated according to a value 6. In addition, the problems of identifying costs with a particular cost pool and measuring the specific units of resources consumed by individual services had also increased; thus new errors were introduced. The measurement errors were increased, and these elements were judged according to the value 3; please see Table 7.

Year	2004 - 2005
Phase	III
The label characterizing the phase	New demands resulting in a CCS
<i>The focused design elements of the costing system:</i>	
Descriptive Objects	5
Causal Variability Factors	5
Type of data: Aggregated - Disaggregated	5
<i>Errors in the product costs:</i>	
Specification error	6
Aggregation error	6
Measurement error	3

Table 7 The evaluation of the standard cost per service system (CS₃) in phase III

4.4 Phase IV (2006 – 09): Consolidation of the costing system

From 2006 to the spring of 2010 the identified errors and challenges with CS₃ were addressed in the development project. This phase also involved many periods without any action with regard to the necessary re-programming of the costing system. The project manager (the researcher) experienced the lack of funding for an external programmer as a real problem, hampering the development of the system. During this period, much time was invested in dialogues with local managers identifying possibilities for a better specification of the local production processes. The possibilities for creating reports had expanded dramatically as the platform of the costing system was changed¹⁰⁷.

In the period, the largest buyer of the services was still not interested in negotiating new prices for financing the university hospital¹⁰⁸. Consequently, the estimates were not used for any financial purposes. Interviews with key stakeholders were carried out in 2007. None of

¹⁰⁷ From spreadsheets to SAS Institute and then to SAS Institute DI Studio. The output from the system was for the year 2009 described by using 45 million data-lines.

¹⁰⁸ This hospital thrust had strong financial incentive for this praxis (Bjørnenak, Nyland & Kaarbøe, 2007).

the respondents opposed the CEO's intended use of the estimates made by the costing system. The Head of the Thorax-surgery department (interviewed June 5, 2007) said:

“I believe my surgeons are very much aware of the (national) prices. I have done a job – what will the revenue be? We want to know the costs of our services”.

Another very important external decision affected the development process of the costing system. On June 1, 2007, a new merger took place between the regional health enterprises which organized the 11 hospitals in the south-east of Norway¹⁰⁹. This, in turn, resulted in a merger between the university hospital and the two other large hospitals in the Oslo region. The merged hospital enterprise was named the Oslo University Hospital (OUH), which came into operation from January 1, 2009. This new hospital enterprise became the largest hospital entity in Norway, including 23,003 employees and having a total annual budget of 17,261 Mill. Norwegian kroner (NOK) in 2010¹¹⁰,

Due to this huge merging process, the actual use of the local costing system did not come on the agenda, but several versions of the CS₄ and the clinical costing system were presented to the economists in charge of the national costing system, which is used for the production of the national standard prices in funding the hospital enterprises. The Ministry of Health has also formulated intentions for a future use of such a costing system in the National Budget (2010-2011) presented on October 5, 2010.

“The knowledge of the costs involved when providing services to the single patient is low. Clinical Costing System is a label used for a method that systematically presents the services a patient receives together with the resources these services require. The Ministry has initiated a work to establish a national standard for CCS. The purpose for this work is primarily to provide a comparable set of information for planning and control, including initiatives for improving the quality of the services, useful at different levels: hospital, trusts and national. The identical information may also be relevant for the construction of national cost standards and the improvement of the DRG-system. In 2009 a project for testing the new national standard for CCSs was carried out by the Directorate for Health and Social Affairs (DHSA) in a few hospitals. In 2010 DHSA has been assigned the task to establish CCS as a basis for good cooperate governance in regional health authorities and hospitals, as well as investigating how CCS can be

¹⁰⁹ <http://www.helse-sorost.no>

¹¹⁰ http://old.oslo-universitetssykehus.no/modules/module_118/view_case.asp?caseId=1027

incorporated in the basis for constructing new cost standards in the DRG-system (the ISF-scheme)”.

The financing of such a new costing system, however, was the responsibility of each single hospital.

One problem addressed in this phase was the inclusion of the out-patients. There were problems with the activity registrations, as these were not always complete. The registration-praxis also varied between the out-patient units. These challenges were detected when integrating information from the different feeder systems. In the project group we identified the patients that had been there, but the registrations of the hours when the patients had left the clinic were not always correct. A workload per type of out-patient consultation per out-patient activity center was developed and included in the data. This turned out to be an over-specification of the costing system, and in 2008 another solution was implemented. These patients were given 20 minutes as a length of stay (a default value). To have consistent activity registrations across the activity centers remains a challenge.

A second problem addressed was the difference in costs between normal working hours and on-call duty. The number of cost pools was further expanded per type of personnel groups. This is important when explaining variations in service costs. The identification of the costs from the many cost pools enabled us, when constructing reports, to decide what costs may be relevant to the decision at hand.

A third problem addressed was the inclusion of the activity from the merged cancer hospital.

A fourth initiative was to classify every cost pool as fixed/variable.

A fifth initiative focused on designing new reports in the CCS (Project-description, 17.01.2006). Potential internal expert users of the data simply did not accept a given cost estimate. Because of this, we then had to use much time for communicating the costing methodology as well as the content of the costing system, since we wanted to have as much of the calculations transparent as was possible, thus accessible for the key decision makers' investigation and verification. Accordingly, the estimates were presented from different perspectives, including the units in charge of the patients (“internal buyers” of the services) and the organizational units providing the different services (the “internal sellers”). Reports were developed to display what had been done with the financial accounts (CS₄, 2009). With

this, the reports now also displayed the costs of the patients not yet discharged. It was also considered important whether reports should reflect the “current conditions” and give an early warning to the local managers about the trend in the average product costs. An additional argument from the project group to include this information was that such a report was now easy to make.

A sixth initiative in the project attempted to better capture the cause-effect relationship of the local service production. Local systems with workload per service, cost pool and section were developed. The relationships between the local procedures were regarded to be stable by the local specialists. Another argument was that the clinicians could understand the local services, but the DRGs were considered as abstract concepts.

A final problem addressed concerned the issue of what kinds of service production the costing system should reflect. The system was now programmed to use data from the local production systems every month. The system recalculated all the estimates from the previous 6 months to capture the changes in the data due to new entries and corrections in prior registrations. The number of periods in the data was now many (months) and the division of time variable.

The new costing system

In 2010 the hospital ended up with a detailed costing system (CS₄) with ex-post data from 2006–2009. The model included 230 activity centers each with 19 cost pools (in total 4,370 cost pools) (CS₄, 2009). The number of patients included in 2009 was 293,637¹¹¹ (annual report of 2009). 74,537 of these were classified by the DRG-system. The costing system also included external DOs, indicating the community and county in which the patient was a resident. The number of CVFs had increased. A cost driver had been chosen for every cost pool per activity center. Consequently, the initiatives to improve the description of the production processes involved the use of much disaggregated data.

Errors in the costing system

A registration of the use of costly implants and an electronic ordination of medicines may improve the specification of the costing system. Secondly, more precise registrations of the presented process descriptions were observed as a means for further improving the estimates. This, in principle, could provide a better basis for selecting or constructing more precise cost

drivers and thus better to reflect the workload related to the service production. In the current costing system, length of stay (minutes) is used across all cost pools. For example, a better measure of activity for nurses working in the wards could have been used to weight the length of stay with a standard workload reflecting the services delivered by the nurses to the patient. This could be done if the workload per patient and time period were registered. For another example regarding doctors a solution could be to use different types of clinical score systems. This may involve registrations of the type of services that has been provided, standard categories of the status of the patient and the outcome of the treatment. The DRG, the length of stay and the mix of services may be identical, but the current costing system did not reflect such differences in the process descriptions as illustrated by these two examples. A third initiative could have been a registration of who provides the relevant service to the patients. Even with these improvements, there would still be errors in the costing system.

The discussion above confirms the assumption that including direct costing and improving the specification of the model will improve the cost estimates, but it may also introduce new errors. Much work had been put into securing a correct specification of the local service production. As a result, the content of the costing system had been further expanded; therefore the design elements of the costing system (CS₄) can be evaluated as a value 10. Yet such a valuation does not indicate that there is no potential for further improvement in the costing system, please see Table 8. The specification and the aggregation errors in the costing system had been reduced; therefore these elements are given the value 3. The measurement errors had increased, so the evaluation of this element is a value 4.

Year	2006 - 2009
Phase	IV
The label characterizing the phase	Consolidation of the costing system
<i>The focused design elements of the costing system:</i>	
Descriptive Objects	10
Causal Variability Factors	10
Type of data: Aggregated - Disaggregated	10
<i>Errors in the product costs:</i>	
Specification error	3
Aggregation error	3
Measurement error	4

Table 8 The evaluation of the standard cost per service system (CS₄) in phase IV

¹¹¹ There are out-patients (included in the costing system) also in laboratories and at radiology units.

5 Concluding discussion

In this chapter the main findings will be presented (Ch. 5.1). Next, a summary and suggestions for further research will be provided (Ch. 5.2). The scientific contribution will be presented.

5.1 Main findings

In this paper we have analyzed the longitudinal process of developing a costing system in a large university hospital. Four different versions of the costing system have been identified by quantification of the direct observations and documents during several years. The values given the design elements of the costing system indicate the comprehensive scope of the costing systems. The values given the design elements of the different phases indicate that all initiatives resulted in a larger costing system. The expansion of the costing system in phase II was modest compared to the other phases. The largest increase came in phase III with the introduction of costing the diverse services provided the individual patient. Throughout the process, both more costing concepts (breadth) and more details in the data (depth) were introduced.

Year	2000	2001 - 2003	2004 - 2005	2006 - 2009
Phase	I	II	III	IV
The label characterizing the phase:	Translating a national model into the local context	Expanding the costing system	New demands resulting in a CCS	Consolidation of the costing system
<i>The focused design elements of the costing system:</i>				
Descriptive Objects	2	3	5	10
Causal Variability Factors	2	3	5	10
Type of data: Aggregated - Disaggregated	1	1	5	10
TOTAL	5	7	15	30
<i>Errors in the product costs:</i>				
Specification error	10	9	6	3
Aggregation error	8	8	6	3
Measurement error	2	2	3	4
TOTAL	20	19	15	10

Table 9 The development-process described with the selected framework

As can be seen from the table above, advanced costing system in the university hospital is characterized as having many descriptive objects and causal variability factors (breadth). The costing system also involves the use of much disaggregated data (depth). Such costing systems are large systems integrating many local sub-systems, because they are designed to

reflect the local production processes using a process-costing approach. The direction of the changes in the costing system is illustrated in Figure 4.


		The number of costing concepts (breadth)	
		Few	Many
The level of details (depth)	Few		
	Many		

Figure 4 The direction of the changes in the content of the SCPS- system

In the first costing system (CS₁) many errors in product costs were identified. The scope of the costing system was limited. In the large detailed costing system (CS₄) the level of errors in product costs had been reduced. To achieve this change, the scope of the costing system had been expanded. The relationship between the design elements of the costing system and errors in product costs is *size*.

One important factor influencing the content of the costing system was change in the intended use, initiated by the CEO of the university hospital at the time. Throughout the process, the CEO asserted that the primary intended use of the estimates was to support an external transfer price-list. The introduction of a clinical costing system in phase III illustrates the CEO's intentions also to use the costing system for internal purposes.

Another factor influencing the content of the costing system was the expressed ambition by the CEO to reduce errors in the product costs. This research has illustrated how errors in the existing costing system initiated changes in the costing system in the next phase. More detailed data improved the specification of the costing system, but the size of the costing system increased. The use of more detailed data also increased the measurement errors in the product costs¹¹². The relationship between these two factors is illustrated in Figure 5.

¹¹² It is possible to also reduce these errors, but the complexity of the costing system will increase further.

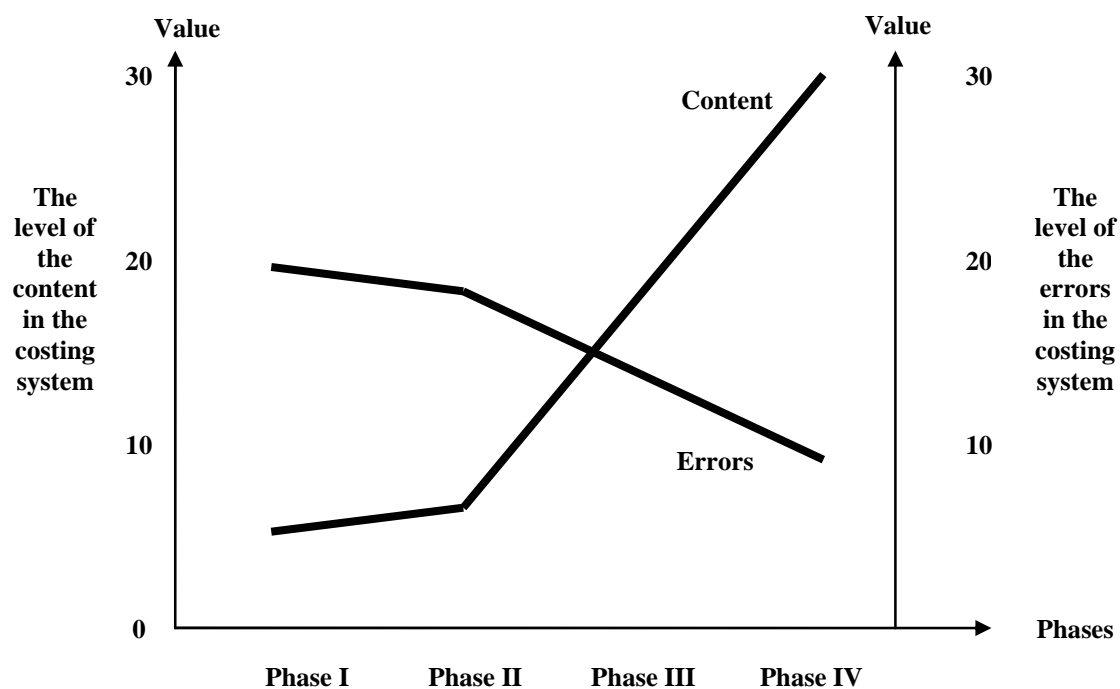


Figure 5 The direction and magnitude of the changes in the SCPS-system

The motivation for this study was to understand more about the relationship between costing concepts (breadth) and details in the data (depth) in the costing system. One assumption behind the development efforts was the possibility of increasing the accuracy of the reported product costs by introducing more-detailed design elements. The findings in this study support this assumption as errors in the existing costing system were reduced by expanding the content in the sub-systems. These processes generated an advanced costing system with more accurate product costs.

Yet our findings also suggest that external elements had high impact on the size of the costing system, as the CEO expressed clear intentions to use the cost estimates for introducing external transfer prices. In addition, this CEO used this costing system in his initiatives for changing the hospital's payment system. These initiatives were, in fact, directed toward changing the contracts between the owner (The Ministry) and the university hospital. The CEO did not succeed in these initiatives. In sum, the development processes of the costing system were affected by the CEO's internal focus (the internal transfer system) and external focus toward using the costing system to change the contract with the Ministry. As shown above, when the areas of intended use of the costing system were increased, the costing

system was extended¹¹³. Consequently, both the costing system and the development process itself had become irreversible.

The incremental development process described above generated a large costing system which became irreversible. This irreversibility was supported by the CEO's intentions to use the costing system both for internal and external purposes. The size of the costing system increased during the process, partly due to the changes in the intended use of the costing system and partly due to the focus on reducing errors. Both these factors affected the content of the costing system during the four phases described in the empirical part of this paper. As shown here, the costing system expanded, which in the next step produced new errors.

The development process may be seen as a learning process. Obviously the researcher learned a lot from his own experiences of costing hospital services (i.e., accounting practice). It was technically feasible to estimate the costs of the services very detailed in a complex hospital. The new cost information was presented in appropriate new reports. Yet the different versions of the systems were not used (i.e., use of accounting) despite the efforts to reduce errors in the cost estimates by adding new details. The interaction with the context of the hospital and the other sub-process of the accounting process (e.g., accounting norms) may explain this outcome of the development process. The owner and the buyers of the services did not want to talk about the costs of the hospital's services. The constructed costing system was used neither in the external financing nor in the internal management of the hospital. As we have seen the Ministry of Health formulated their ambitions (i.e., talk) for the use of such detailed cost information¹¹⁴. Yet the financing of the new costing systems was the single hospital's¹¹⁵ responsibility. Mellemvik et.al. (2005:314) point out that in Norway "*the municipalities have been regarded as state agents, which has generated a clear hierarchical relationship*". In such a setting the accounting norms have been cases for the principal (i.e., the State) to decide. Mellemvik et.al. (2005:314) continues: "*this structure implies a coercive exploitation of the accounting norms in accounting practice, and does not focus on the use of accounting at the local government level. The problem is, therefore, that ideas developed at the local government level are not easily absorbed in the accounting norms. The effective process of*

¹¹³ When the CEO retired in 2008, support for a further local use of the costing system in praxis gradually vanished. However, no formal decision about this was made.

¹¹⁴ See also a recent report from the Office of the Auditor General of Norway:

http://www.riksrevisjonen.no/Rapporter/Documents/2013-2014/Dokumentbase_3_4.pdf

¹¹⁵ At Oslo University Hospital - in 2013 - there is no local costing system estimating the costs of the services.

exploration seems, therefore, to trap exploration". Mellemvik, Gårseth-Nesbakk and Olson (2005) label such a situation as a "closed learning process". This theory may explain the outcome i.e., no use of the ever more detailed service cost information. The strong hierarchical relationship in the Norwegian public sector (state – municipalities) is also evident in the Norwegian healthcare sector (state – hospital). In such a context the national accounting norms seems to dominate the local accounting practice and thus the use of accounting information.

5.2 Summary and further research

The first conclusion from this study is that two main forces influenced costing system development: new goals for development and the ambition to reduce errors in the costing system. Both these sources for change in costing system design resulted in an increase in the size and the complexity of the system. The second conclusion is that increasing the system size by including more details resulted in new errors. In addition during the process, the researcher's insight into costing system design in hospitals also increased, and solutions to correct these new errors were found by adding new details. The third conclusion is that these forces resulted in new development initiatives and new versions of the system. The development process became incremental. The CEO was not willing to reduce the ambitions for the use of the costing system. Both the process and the costing system had become irreversible.

The main finding from this study is that the studied process can be summarized as an incremental and irreversible development process, due to changes in the intended use of the costing system, the ambitions related to reducing errors in the system and other, external, factors. Consequently, the size and complexity of the system increased during the process.

In a hospital setting detailed costing represents collecting the costs of treating every patient (Abernethy & Chua, 1996; Jarvinen, 2006; Lowe, 2000). The design elements of such costing systems have not been reported in the literature (Kjøllestadal, Essay I). The design elements are important when evaluating whether a costing system and its use is advanced (Bjørnenak & Olson, 1999), but we know that detailed costing systems in hospitals have been thought to be complicated and expensive to develop and maintain (Jones, 1999; Llewellyn & Northcott,

2005). This study supplements the literature by describing the elements of an advanced costing system in a university hospital. The process of increasingly more detailed costing of the many services of a complex hospital is analyzed. The study illustrates that the change of the design elements of a costing system is contingent on more factors than have been previously examined in the literature (Bjørnenak & Olson, 1999; Datar & Gupta, 1994). These factors may influence the design process so it becomes incremental and irreversible and thereby resulting in an increasingly larger and irreversible costing system. This is “the *development-contribution*”.

To analyze the development process was an opportunity I faced after the process had started. The applied research method may have influenced my conclusions. Consequently another research design (for example, action research) may improve our understanding of the process of developing advanced costing systems in hospitals.

Archival records

Internal documents;

Internal reports describing how the *local* service weights per DRG had been calculated;

Service weight per DRG for Intensive care- services, March 2002

Service weight per DRG for Anesthesiology- services, March 2002

Service weight per DRG for Operation theatre- services, March 2002

Service weight per DRG for Radiology services, February 2004

Service weight per DRG for the Immunological Institute, April 2002

Service weight per DRG for the Microbiology Institute, March 2002

Service weight per DRG for the Biochemistry Department, June 2002

The cost per DRG (year 2000) with local service weights, April 2002

Project-description, 06.02.2004

Project-description, 17.01.2006

Project-description, 23.10.2007

Annual reports;

The annual reports for Rikshospitalet (2001) and for Rikshospitalet HF for the years 2002, 2003 to 2004 are available at this website:

http://www.rikshospitalet.no/ikbViewer/page/no/pages/hygiene/om/rapport?p_dim_id=43828

The annual reports for Rikshospitalet HF for the years 2005, 2006, 2007 and 2008 are available at this website:

http://www.rikshospitalet.no/ikbViewer/page/no/pages/hygiene/om?p_dim_id=32368

The annual report for 2009 (Oslo University Hospital HF) is available at this website:

<http://www.oslo-universitetssykehus.no/omoss/rapporter/Sider/side.aspx>

Personal electronic calendar (from December 14, 2006 – May 2010)¹¹⁶

Physical artifacts

The SCPS- model¹¹⁷:

CS₁, 2000 (spreadsheet model)

CS₂, 2001 - “ -

CS₂, 2003 - “ -

¹¹⁶ The first registration available is from December 14, 2006. The calendar had a crash short time before this. Registrations before this date are thus not available.

¹¹⁷ The SCPS- system was not run on 2002- data due to my MBA- studies that year.

CS₃, 2004 + CCS (the data is available at the hospitals data- network¹¹⁸)
CS₃, 2005 - “ -
CS₄, 2006 + CCS (available at the hospitals data- network¹¹⁹)
CS₄, 2007 - “ -
CS₄, 2008 - “ -
S`CS₄, 2009 - “ -

Interviews¹²⁰

The head of the Neuro-radiology section, Imaging and Intervention clinic interviewed June 4, 2007.

The head of Thorax surgery department interviewed June 5, 2007.

The CEO interviewed June 13, 2007.

The head of the Imaging and Intervention clinic interviewed June 20, 2007.

The CFO interviewed August 29, 2007.

APPENDIX 1

Questions to the director/CFO:

Name:

Position:

1 The *motivation* for developing new reports.

1.1 What was your problem in 2004?

- External focus (strategic)?
 - Financing
 - Legitimizing / building thrust
 - Legal requirement or at the boards request?
- Internal focus (management control)?
 - Better basis for planning (budgeting)
 - Better basis for control

¹¹⁸ The data is available, but the presentations in the CCS have not been updated since the spring of 2006.

¹¹⁹ The presentations in the CCS were updated in the spring of 2010.

¹²⁰ Transcripts are available at request.

- internal measurement (internal prices)
- productivity indicators
- provide more explanations.

1.2 What level in the organization did you anticipate would benefit the most from having the new reports?

Top- management (strategic) / Middle management (tactical – resource allocation) / Operational level (product line management (DRG) & clinical guidelines) / Day-to-day operations (treating the individual patient).

1.3 How come that you saw a Cost per Patient or a Clinical Costing System (CCS) as a *solution* to this problem?

Read about such systems / Seen such reports at other hospitals / Discussed the topics with colleagues at other hospitals.

1.4 What reports / presentations did you (back in 2004) have in mind?

Cost per medical service / Cost per internal services / Cost per patient / Cost per DRG

2 Comments on the solution – suggestions for improvement?

Cost per medical service / Cost per internal services / Cost per patient / Cost per DRG / The responsibility centres cost structure / Productivity indicators

3 Would you make use of the solution (the market test)?

One thing is the *technical* solution (the costing model). Another is the *presentation* of the new information in useful reports. Quite another issue is the *changes* needed in the *management practices* of the hospital to make use of the new information. All three steps have to be handled successfully to improve the hospitals decision making.

4 If - yes - on question 3, then: How will you organize the *change processes*?

- * Influence the hospitals strategic situation?
- * Change the internal management control processes?
 - budgeting
 - control
 - Buyer – Seller schemes (changes in the capacity: resource allocation)
 - The horizontal cooperation inside the hospital (product line management (DRG) & clinical guidelines)

Questions to the managers:

Name:

Position:

1 What decision- making processes are you involved in?

Financing / Budgeting / Control / Internal Buyer – Seller processes (change in capacity) / Horizontal processes / Product line (DRG) management / Clinical guidelines / Operative control of a hospital department / unit / Admission / discharging of patients / Decisions concerning the single patient: diagnostics and treatment.

2 What decision issues do you spend your time on (%)?

Financing / Budgeting / Control / Internal Buyer – Seller processes (change in capacity) / Horizontal processes / Product line (DRG) management / Clinical guidelines / Operative control of a hospital department / unit / Admission / discharging of patients / Decisions concerning the single patient: diagnostics and treatment.

3 How will the new information influence your decision making?

Cost per medical service / Cost per internal services / Cost per patient / Cost per DRG / The responsibility centres cost structure / Productivity indicators / Others?

4 Would you make use of the solution (the market test)?

5 What type of information will be of particular relevance – if at all – to your decision making (and in what situation)?

Cost per medical service / Cost per internal services / Cost per patient / Cost per DRG / The responsibility centres cost structure / Productivity indicators / Others?

6 How should the information / reports be changed to be more useful?

One thing is the technical solution (the costing model). Another is the presentation of the new information in useful reports. Quite another issue is the changes needed in the management practices of the hospital to make use of the new information. All three steps have to be handled successfully to improve the hospitals decision making.

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