Antecedents and consequences of cost system design choices

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ANTECEDENTS AND CONSEQUENCES OF COST SYSTEM DESIGN CHOICES

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geboren te Wormerveer

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Contents

Preface

As is the case with any dissertation, many people have directly or indirectly contributed to the realization of this one. To them, I owe many thanks.

First, I thank my supervisor Tom Groot for his enthusiastic support, both prior to and during my PhD project. This dissertation would never have been written if Tom would not have encouraged me to write a proposal and apply for a PhD project at the time. After my proposal was approved and a PhD project granted, his support, comments and suggestions over the years have helped me to conduct my research, and to improve and finish my dissertation.

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Martijn Schoute, Wormer
January 18, 2009

Chapter 1
Introduction

1.1 Introduction

The central topic of this dissertation is the antecedents and consequences of cost system design choices. This topic already has a long history in the field of management accounting (or cost accounting, as the field was originally referred to). After an extensive period of few worldwide developments[1], in the second half of the 1980s, the design of cost systems regained much interest from both academics and practitioners. This interest appears to have been triggered by two major, interrelated factors (Drury and Tayles, 2006). First, the environment in which costing is undertaken had undergone substantial change with respect to, for example, information technology, cost structures, and market competition. Second, partly because of these changes, traditional cost systems were heavily criticized (e.g., Johnson and Kaplan, 1987), and an alternative cost system, activity-based costing (ABC), emerged.
The remainder of this chapter is structured as follows. First, Section 1.2 provides a concise overview of the fundamentals of activity-based costing (ABC). Next, Section 1.3 presents and discusses the research objective of, and the research questions examined in, this dissertation. Section 1.4 discusses its main contributions to the literature. Finally, Section 1.5 outlines the structure of the dissertation.

1.2 Activity-Based Costing (ABC)[2]

This section provides a concise overview of the fundamentals of ABC. The section first discusses the origins and basic characteristics of ABC. Next, activity-based management (ABM) and the difference between resource spending and resource usage are discussed. Finally, ABC usage in practice, and the so-called ABC-paradox, is discussed.

1.2.1 Origins of ABC

Activity-based costing (ABC) emerged in practice in the mid-1980s, as many (mainly Anglo-Saxon) companies had increasingly become dissatisfied with their management accounting systems. The information provided by these systems was considered to be produced too late, too aggregated, and too distorted to be relevant for managers' planning and control decisions. In most instances, managers needed reliable total cost information on cost objects (e.g., products, services, departments, business functions, regions, and customers). Total cost

[1] Note that there *have* been more *local* developments in the design of cost systems during this period (see, e.g., Groot, 1996, for a discussion of such developments in the Netherlands).
[2] The content of this section was earlier (with some adaptations) published as Groot and Schoute (2002). See, for example, Kaplan and Cooper (1998) and Miller (1996) for more comprehensive discussions of ABC.

information is, for example, needed for valuating stocks, for product pricing decisions, for selecting (groups of) customers, and for deciding on which product assortment to offer. Total costs are comprised of direct costs and indirect costs. Direct costs are costs that can be identified specifically and exclusively with a given cost object in an economically feasible way. Common direct costs are direct labor and direct material costs. Indirect costs, on the other hand, are costs that cannot be identified specifically and exclusively with a given cost object in an economically feasible (i.e., cost-effective) way. Examples are maintenance costs, costs of R&D, marketing costs, and General & Administration costs. In calculating total costs of a cost object, it was generally felt that the method used to allocate indirect costs may be distorting total cost information. Cost allocation is the process of assigning indirect costs to a chosen cost object. In most (Anglo-Saxon) companies, indirect costs are traditionally allocated to cost objects by the so-called two-stage cost allocation method. In the first stage, indirect costs are accumulated in cost pools by some 'natural' classification such as materials or labor. In the second stage, the accumulated costs in the cost pools are traced and reassigned to one or more cost objects. The relation between indirect costs and cost objects is determined by cost drivers. In the two-stage cost allocation system, these cost drivers are mostly related to volume or direct costs (e.g., direct labor costs or direct material costs) of operations.

In the late 20th century's companies, the importance of reliable cost allocation procedures increased. The proportion of indirect costs to total costs rose considerably as a consequence of cost increases in R&D, marketing, information systems, and production automatization. At the same time, companies offered a larger array of different products, complicating the cost allocation problem. Therefore, while the indirect costs to be allocated have become larger, their (direct costs related) allocation bases have become smaller. This of course considerably increases the chances of distortions in, for example, product cost information. As at the beginning of the 1980s (international) competition increased considerably, some 40 forward-looking companies united in the Consortium for Advanced Manufacturing-International (CAM-I) decided to develop an alternative cost accounting system which has become known as activity-based costing. Later, in the years 1988 and 1989, the basic principles of ABC have then been introduced in the management accounting literature in a series of papers by Robin Cooper and Robert Kaplan (e.g., Cooper, 1988a, 1988b, 1989a, 1989b; Cooper and Kaplan, 1988), as well as in a number of Harvard Business School cases (e.g., Cooper and Weiss, 1985).

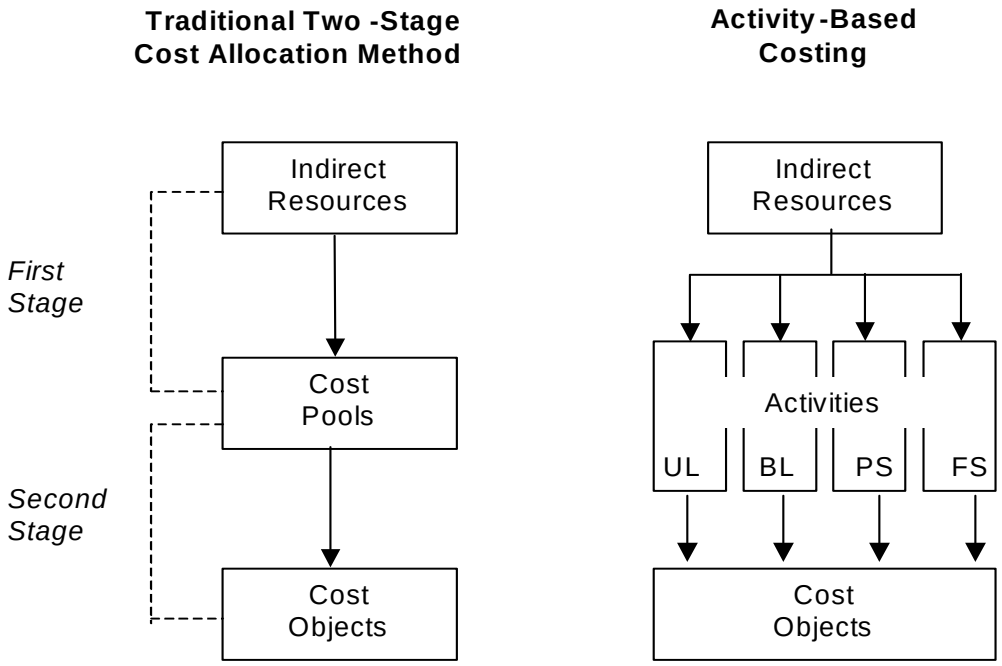
1.2.2 Characteristics of ABC

The fundamental characteristic of ABC systems is their focus on activities performed by supporting units as the basis for assigning these units' costs to cost objects. ABC systems try to identify the causal relations between cost objects and the indirect costs they generate by measuring cost objects' demand for supporting activities. Activity-based costing (ABC) is a method that measures the cost and performance of activities and cost objects. Resources are first assigned to activities. In a next phase, the nature and amount of activities demanded by each cost object determine the indirect costs attributed (cf. CAM-I, 1992). As implied by this definition, two assumptions underlie ABC. The first assumption is that activities cause costs, whereas the second assumption is that cost objects create the demand for activities. These two assumptions are reflected in the ABC two-stage allocation procedure. In the first stage of this

procedure, resource expenses are assigned to activities, using so-called resource cost drivers. In the second stage, each activity's expenses are then assigned to cost objects, using so-called activity cost drivers.

Compared to the two-stage cost allocation method, ABC has at least two important distinctive features (see also Figure 1.1).[3] First, instead of accumulating indirect costs in traditional, so-called 'natural' cost categories, ABC accumulates indirect costs to activities. Second, instead of using a single (mostly volume-related) cost driver, ABC aims at establishing a causal relationship between the size and composition of these activity cost pools and cost objects. In this way, ABC provides additional insights into the factors that drive indirect costs by defining cost drivers. These cost drivers may represent a linear relation between cost objects and their demand for indirect costs, as is the case in most traditional two-stage allocation systems, but this relation can also be non-linear.

Figure 1.1: The traditional two-stage cost allocation method versus activity-based costing



UL = unit-level activities

BL = batch-level activities

PS = product-sustaining activities

FS = factility-sustaining activities

[3] It is important to emphasize that this depiction of cost allocation methods as consisting of only two stages is somewhat limited. Both traditional and activity-based cost systems may also consist of multiple stages, in which the accumulated costs of particular cost pools are not directly traced and reassigned to one or more cost objects, but indirectly via other (so-called 'support' or 'secondary') cost pools (e.g., Cokins, 2001; Kaplan and Cooper, 1998).

1.2.2.1 Development of an ABC system

ABC systems are developed through a series of four sequential steps (cf. Kaplan and Cooper, 1998):

1. Identification of the organization's cost objects.
   It should be clear to which cost objects the overhead costs will eventually be attributed to. Specific cost objects need to be defined, such as products, services, departments, functions, regions, and (groups of) customers. The choice of cost objects may influence the decisions in the following steps.
2. Development of the activity dictionary.
   An overview of the organization's overhead activities being performed by its indirect and support resources needs to be made. Activities are described by verbs and associated objects, e.g., 'inspect incoming purchased parts', 'set up machines', and 'design new product'. All overhead activities are listed and defined in an activity dictionary. The number of activities is a function of the purposes of the model and of the activities' size and complexity.
3. Calculation of each activity's costs.
   Resource expenses are assigned to each activity in the activity dictionary. This can be done by the use of resource cost drivers. Resource cost drivers link spending and expenses, as captured in the organization's financial and general ledger system, to the activities performed.
4. Attribution of activity costs to the organization's cost objects.
   In this final step, the activity costs established in step 3 are traced to the cost objects that were defined in step 1. This is done by applying activity cost drivers. An activity cost driver is a quantitative measure representing a cause of the level of activity (for example, number of batches, of customers, and of changeovers in production).

1.2.2.2 Hierarchy of activities

ABC systems aim to reduce the distortions inherent in traditional systems by capturing the different types of relations between overhead costs and the demand placed by cost objects. This is done by defining four mutually exclusive categories of activities (Cooper, 1990; Kaplan and Cooper, 1998):

1. Unit-level activities: these activities are performed for every unit of product or service produced (e.g., drilling holes in metal parts, inspecting every product, and servicing each customer). The quantity of unit-level activities performed is proportional to production and sales volumes.
2. Batch-level activities: this type of activity is only needed once when a group of related design, production or service activities commences. For instance, when a different batch of goods will be produced (e.g., setting up a machine for a new production run), or when design activities for a common product group start.
3. Product-sustaining activities, which are performed to support the production of each different product or service category (e.g., maintaining and updating product specifications, and developing special testing routines for individual products).

4. Facility-sustaining activities, which sustain a facility's general manufacturing process (e.g., lighting and cleaning the facility, general management, finance and accounting, and insurance). Neither in the traditional cost allocation systems nor in ABC systems can this activity category meaningfully be related to particular cost objects, because facility-sustaining activities have no particular causal relationship with specific cost objects. Assignment of these activities' costs to cost objects will always be somewhat arbitrary.

Some scholars use the term *cost allocation* for cost assignment when there is little or no information about cause and effect, such as with facility-sustaining costs. The term *cost attribution* (or *cost tracing*) is used for the assignment of costs based on a cause-and-effect relationship as in the first three categories of activities.

ABC systems take advantage of this hierarchy of activities by assigning the costs of the first three categories to cost objects by using activity cost drivers that vary in proportion to the consumption of the activities. Thus, a full ABC system contains (at least) three different types of cost drivers: unit-level, batch-level, and product-sustaining cost drivers. Well-designed ABC systems match the level of the underlying activity and cost driver, thus avoiding the distortions inherent in the traditional systems that rely entirely on unit-level (i.e., volume-based) cost drivers.

1.2.2.3 Types of activity cost drivers

During the fourth step in building an ABC model, the activity cost drivers to be used need to be selected. This selection depends on a trade-off between accuracy of the cost object's total cost information and measurement costs. Activity cost drivers identify different relationships between cost objects and their related activity costs. Transaction drivers, for instance, count how often an activity is performed. They can be used when all outputs make essentially the same demands on the related activity. However, demands may vary, because of variation in the duration and in the amount of activity required by different cost objects. Duration drivers represent the demand in terms of length of time placed by cost objects on an activity.[4] Intensity drivers indicate the demand in terms of magnitude of activities needed by cost objects. In practice, often a combination of transaction, duration and intensity drivers is needed to attribute activity costs to cost objects.

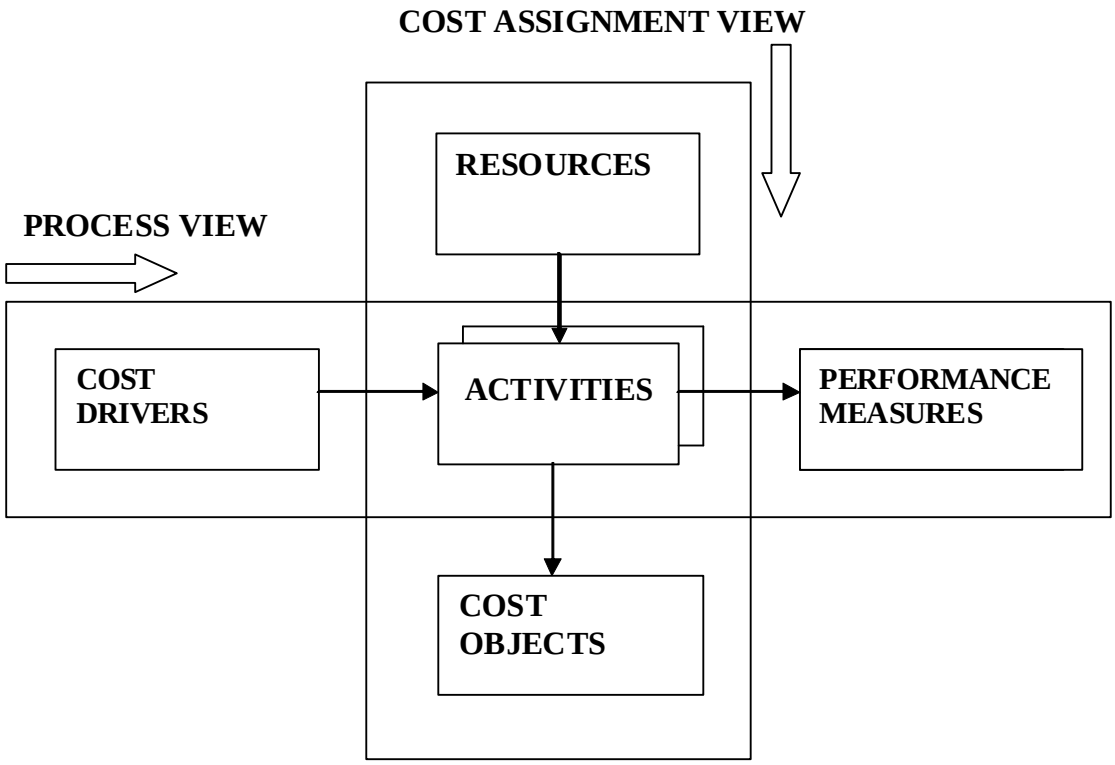
1.2.3 Activity-Based Management (ABM)

ABC information provides insight into cost objects' total cost figure, as well as into the activities responsible for the overhead attribution. The causal information between demands for overhead activities and overhead costs makes these activities and costs manageable and controllable. Activity-based management (ABM) focuses on the management of activities as the route to improving the value received by the customer and the profit achieved by providing this value. ABM includes cost driver analysis, activity analysis, and performance measurement. ABM draws on ABC as its major source of information (CAM-I, 1992). A relatively simple model in which the foundations of ABM are shown, is the CAM-I ABC

[4] The latest major development in ABC systems, Time-Driven ABC, appears to have developed from the usage of duration drivers (see, e.g., Kaplan and Anderson, 2007, for more information on Time-Driven ABC).

Basic model (the so-called ABM cross), developed by Peter Turney and Norm Raffish (see Figure 1.2).

Figure 1.2: The CAM-I ABC Basic model (Source: Miller, 1996)



This model suggests that two different, complementary points of view characterize ABM. The first of these – the so-called cost assignment view – is being used for strategic purposes and in fact comprises the ABC system as discussed so far. The second point of view – the so-called process view – on the other hand is mainly used for operational purposes. It starts with a cost driver analysis by examining, quantifying and explaining the effects each of the cost drivers generates. This analysis focuses on the question what factors determine the demand for overhead activities. Results of cost driver analyses can be used in continuous improvement programs to help reduce throughput time, improve quality, and reduce cost. Instead of looking at the demand for overhead support, one may also look at the supply side. Activity analysis is commonly used for the identification and description of overhead activities. Activity analysis involves determining what type of activities are carried out, what resources are required to perform the activities (in terms of material used, human resources dedicated, and time spent), and what value the activity has contributed to the organization. Activity analysis is accomplished by means of interviews, questionnaires, observations, and reviews of physical records. Finally, performance measures are indicators of the work performed and the results achieved in an activity, process, or organizational unit. Performance measures may be financial or non-financial.

In a general sense, operational ABM takes the demand for organizational activities as given and attempts to meet this demand with fewer organizational resources. Operational ABM is mainly concerned with improving efficiency of operations. Strategic ABM, on the other hand, takes the efficiency of activities as given while attempting to alter the demand for activities. In this way, strategic ABM tries to increase profitability by improving effectiveness of strategy and operations. In strategic ABM, decisions are made related to issues such as product mix and product pricing, customer relationships, and customer and supplier selection.

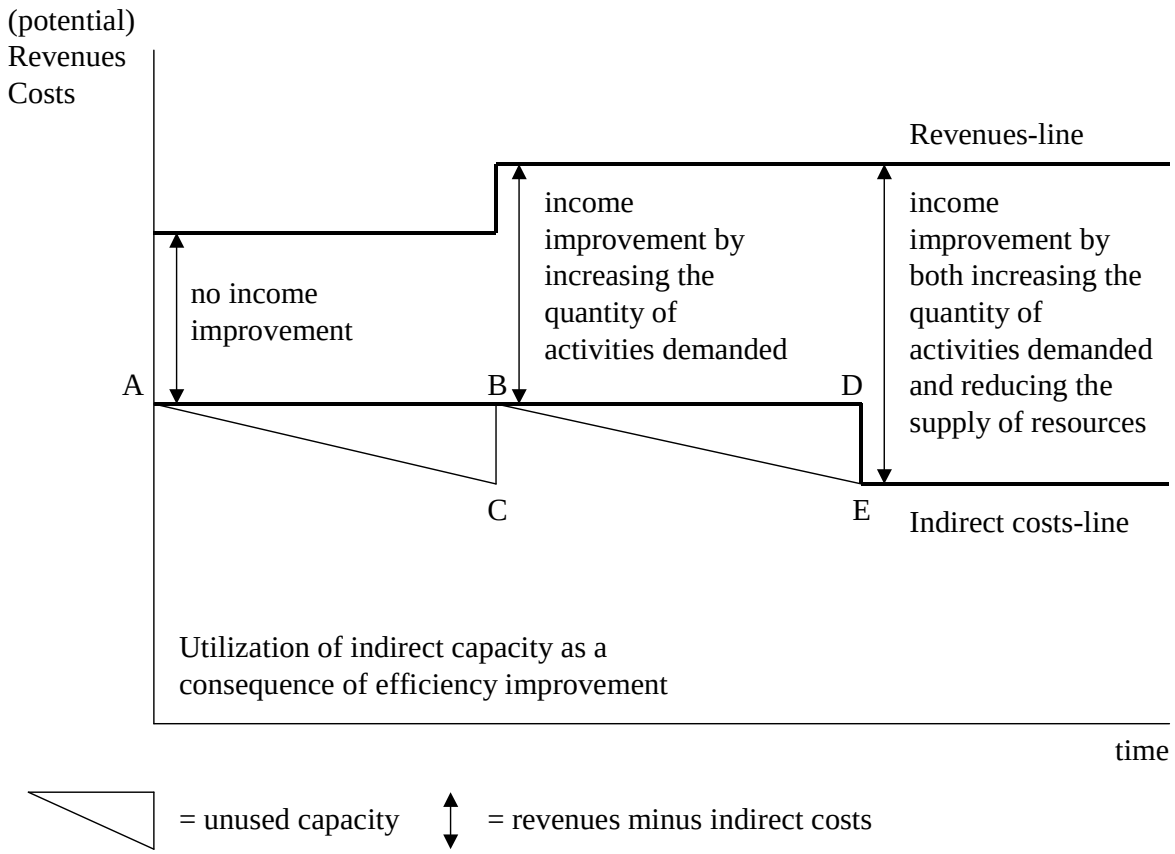
1.2.4 Resource spending versus resource usage

Generally, demands on overhead activities and overhead costs vary. However, in most situations overhead capacity is fixed and cannot therefore be instantaneously and flexibly be adjusted to changing demands. ABC information leads to insights into variations in demand for overhead support. Operational ABM is concerned with taking measures to close the gap between resource usage (the cost of resources actually used) and resource spending (the cost of resources supplied). The difference between resource spending and resource usage is the cost of unused capacity. This can be written in the following equation:

Cost of resources supplied = Cost of resources used + Cost of unused capacity

Unused capacity is a signal of underutilization of overhead capacity, or, stated differently, it is an indication of overcapacity in support functions. ABC information detecting the existence of unused capacity opens the opportunity to lower total production costs (refer to Figure 1.3). Suppose the demand for support activities has gradually diminished as time passed. This is indicated by the line AC. Meanwhile, however, the costs of overhead capacity (personnel contracted, machines installed, etc.) remain unchanged (indicated by line AB). Although the demand for support activities has decreased, overhead costs remain unchanged and thus no income improvement has occurred in this period. In order to free the unused capacity (depicted by triangle ABC), two different but not mutually exclusive measures may be taken. The first one is to increase the demand for support activities, putting support personnel back to work. The additional work may consist of, for instance, improvements in product design or innovations of production systems, which all lead to increased value for the customer. If the customer is willing to pay for this added value, higher prices charged to customers will eventually improve the firm’s income. An alternative solution is to lower support capacity by selling off machines or reducing numbers of personnel in support functions. No product added value will be reached, but the firm’s income will nevertheless improve by short-term reductions in overhead costs.

Figure 1.3: ABC information on behalf of control of indirect costs and activities



1.2.5 ABC usage in practice

Empirical research shows that ABC is mainly used in Anglo-Saxon countries (i.e., Australia, the United Kingdom, and the United States)(Gosselin, 2007). The adoption rates in, for example, North-European countries tend to be much lower.[5] A country where relatively much descriptive survey research has been conducted in the area of ABC, is the United Kingdom (U.K.). Therefore, the U.K. is one of the few countries for which it is possible to have grounded statements on the development over time in the extent to which ABC is used in practice. For this purpose, Table 1.1 shows some results of four British survey-studies.

[5] A possible explanation for this tendency is the impressions held in these countries that ABC does not provide much additional insights compared with the traditional analytic cost accounting systems, which are grounded in German cost theory. For instance, Friedrich Schmidt (1930; in Groot and Schoute, 2002) made the following remark concerning cost allocation: *"Eine Kostenstelle braucht nicht immer ein Raum zu sein: es kann darunter auch eine Tätigkeit [an 'activity'], z.B. die Hausverwaltung oder das Fuhrwesen, verstanden werden."* See Boons et al. (1992) for an analysis of the similarities and differences between ABC and the German/Dutch cost pool method, which is grounded in German cost theory.

Table 1.1: Some figures on the extent to which ABC is used by British firms (in percentages)

Researchers (Year of publication)	Currently using ABC	Currently implement-ting ABC	Currently considering ABC adoption	No conside-ration of ABC to date	Rejected ABC after assessment
Innes and Mitchell (1991)	5.9%	-	33.1%	51.9%	9.1%
Innes and Mitchell (1995a)	15.7%	-	48.3%	16.9%	19.1%
Innes and Mitchell (1995b)	21.0%	-	29.6%	36.1%	13.3%
Innes et al. (2000)	17.5%	-	20.3%	46.9%	15.3%

The figures shown in Table 1.1 indicate that the extent to which ABC is used by British firms has shown a clear increase. However, the increase has gone relatively slowly, and the level of adoption one may expect according to propagators of ABC had not nearly been reached yet at the moment at which these studies were conducted. Moreover, the study of Innes et al. (2000) also shows signs of stagnation or even a (small) decrease in the number of users of ABC. Another issue suggested by these figures is that not only the extent to which ABC is used by British firms has increased, but also the extent to which ABC has been rejected after assessment. In two of the four studies the percentage of firms that have rejected ABC is even (considerably) higher than the percentage of firms that actually use ABC. Moreover, part of the firms that have rejected ABC according to these studies have not only assessed it, but have also actually used ABC for some time. More recent research in the U.K. (e.g., Al-Omiri and Drury, 2007) and research in other countries shows a similar picture: the percentage of firms that actually uses ABC usually varies between 0 and 20 percent (see, e.g., Gosselin, 2007, for a more extensive overview of the results of descriptive survey studies in the area of ABC).

To date, little research has been conducted on the extent to which ABC has been adopted by Dutch firms. One exception is a survey-study conducted in 1995 among 117 Dutch firms from the food and beverages industry (Groot, 1999). This study shows, among others, that fourteen (12,0%) of the studied firms were using ABC at the moment of research. Also, four firms (3.4%) were conducting a pilot-project, and twenty-five firms (21.4%) had planned such a project. In a more recently conducted survey-study among 80 large, internationally active Dutch firms by Van Leeuwen en Wemmenhove (2001), 43.0% of the studied firms argued to be using ABC. Furthermore, as much as 68.0% expected to be using ABC within the next three years. The results of these two studies (as well as those of other studies) give rise to two comments. First, as a continuation of the study by Groot (1999), five of the fourteen firms that argued to be using ABC have been investigated further using case studies (Dekker and Groot, 2000). Of these firms, two were found to have discontinued their ABC system, one had discontinued part of its system, one had thoroughly revised its system, and only one was using ABC successfully. This suggests that ABC usage as reported in survey-studies not nearly always means that ABC systems are actually used and successful (Dekker and Groot, 2000). Second, the number of planned pilot-projects reported in Groot (1999) and the expectations for the next three years reported in Van Leeuwen and Wemmenhove (2001) are probably (partly) the result of socially desirable answering behavior.

Overall, the contents of this section gives rise to the so-called ABC paradox: the phenomenon that ABC, despite its clear theoretical benefits, is actually used by only a relatively small number of firms (Gosselin, 1997, 2007).

1.3 Research objective and questions

The overall objective of this dissertation is to provide empirical evidence on the antecedents and consequences of cost system design choices. This objective translates into the following two research questions, which each will be dealt with in a separate chapter in the empirical part of the dissertation:

1. **What is the relationship between environmental, organizational and technological factors, and ABC adoption and use?**

2. **What is the relationship between cost system sophistication, purposes of use, and cost system effectiveness?**

Since its introduction in the management accounting literature, several streams of research on ABC have developed, of which research on the determinants of the adoption and use of ABC is a major one (e.g., Bjørnenak, 1997; Gosselin, 1997). The results of this research, in which the influence of many potential determinants has been studied, are generally inconclusive. On the one hand, this has led researchers into arguing that more research in this area is necessary (e.g., Abernethy et al., 2001; Drury and Tayles, 2005). The source of the inconclusive results may, according to these researchers, not only be substantial, but may also be methodological, as most previous studies have used inconsistent definitions of and measurement instruments for both ABC adoption (or use) and its (proposed) determinants, and have used rather simple, bivariate statistics (Al-Omiri and Drury, 2007). With bivariate statistics it is not possible to control for the influence of other variables or to examine the joint (or interactive) effects of certain determinants on the adoption and use of ABC. Several researchers have suggested that examining such interaction effects, such as the joint effect of product diversity and usage of advanced manufacturing technology (AMT) on ABC adoption and use (Abernethy et al., 2001), would be a fruitful avenue for future research in this area (e.g., Al-Omiri and Drury, 2007; Brown et al., 2004). By examining *the first research question*, this study aims to provide more insight into these, and related, issues.

On the other hand, it also has led researchers into broadening the scope of their research by, instead of focusing on adoption (or use) versus non-adoption (or non-use) of ABC, focusing their studies on either the stages towards ABC implementation (e.g., Krumwiede, 1998), or on the determinants of the level of sophistication or complexity of cost systems (e.g., Abernethy et al., 2001; Drury and Tayles, 2005). Another major stream of research in this area has empirically examined the effectiveness of cost system design, in particular the effects of using ABC on firms' financial performance (e.g., Cagwin and Bouwman, 2002; Ittner et al., 2002). Using a broader conceptualization of cost system design, Pizzini (2006) examined the effects of cost system design on the relevance and usefulness of cost data, and on the financial performance of hospitals. As it is very difficult to isolate and show the financial performance effects of using different cost systems, Al-Omiri and Drury (2007) recently suggested that a

more productive approach may be to use outcome measures relating to, for example, the level of satisfaction with the cost system as proxies for its effectiveness. Furthermore, they indicated that cost system sophistication and contextual factors may have a joint (or interactive) effect on the effectiveness of cost system design, and suggested that future research should be conducted to examine these interaction effects. A contextual factor that to date has not been examined yet, is the purposes for which the cost system is used.[6] This is surprising considering the fact that the normative literature strongly argues that the design (i.e., the level of sophistication) of a cost system should differ, depending on its intended purposes, in order to be optimal (e.g., Cokins, 2001; Kaplan and Cooper, 1998). Empirically, this leads to various interesting questions, such as: For which purposes do firms mainly use their cost system, and for which do they consider their cost system to be the most important?; Are cost systems that are used for a broader range (scope) of different purposes, more (or less) effective?; and Do cost system sophistication and cost system usage for different purposes have a joint (or interactive) effect on cost system effectiveness? By examining *the second research question*, this study aims to provide more insight into these, and related, issues.

1.4 Main contributions to the literature

This dissertation contributes to the literature in at least three ways. First, this study extends the literature on the determinants of ABC adoption and use. Specifically, comprehensive models, simultaneously examining the influence of major environmental, organizational and technological factors, of ABC adoption and use are tested. The results show that firms with a higher level of competition, vertical differentiation and product diversity, and a lower level of centralization are more likely to adopt ABC, whereas firms with either a heterogeneous mass production process or a serial unit production process are less likely to adopt ABC than firms with a homogeneous mass production process. Similarly, firms with a higher level of competition, vertical differentiation and product diversity, more production lines, and a lower level of centralization are more likely to use ABC, whereas firms with a serial unit production process are less likely to use ABC than firms with a homogeneous mass production process. Also, the influence of product diversity on a firm's likelihood of using ABC is found to be negatively moderated by the extent to which the firm uses advanced manufacturing technologies.

Second, this is one of the first empirical studies in which the underlying dimensions of cost system purposes of use, which refers to the range (scope) of purposes for which the cost system is used, are examined.[7] Factor analysis identifies two dimensions among nine widely used purposes: cost system usage (and importance) for strategic purposes and cost system usage (and importance) for operational purposes.

Third, building on these two dimensions, this study extends the literature on the alignment between the sophistication of cost systems and their purposes of use. Specifically, the joint (or

[6] Some studies actually did measure cost system purposes of use, but used them to operationalize variables different from this study, such as 'number of primary applications' (Foster and Swenson, 1997) or (as part of) 'ABC use' (Cagwin and Bouwman, 2002).

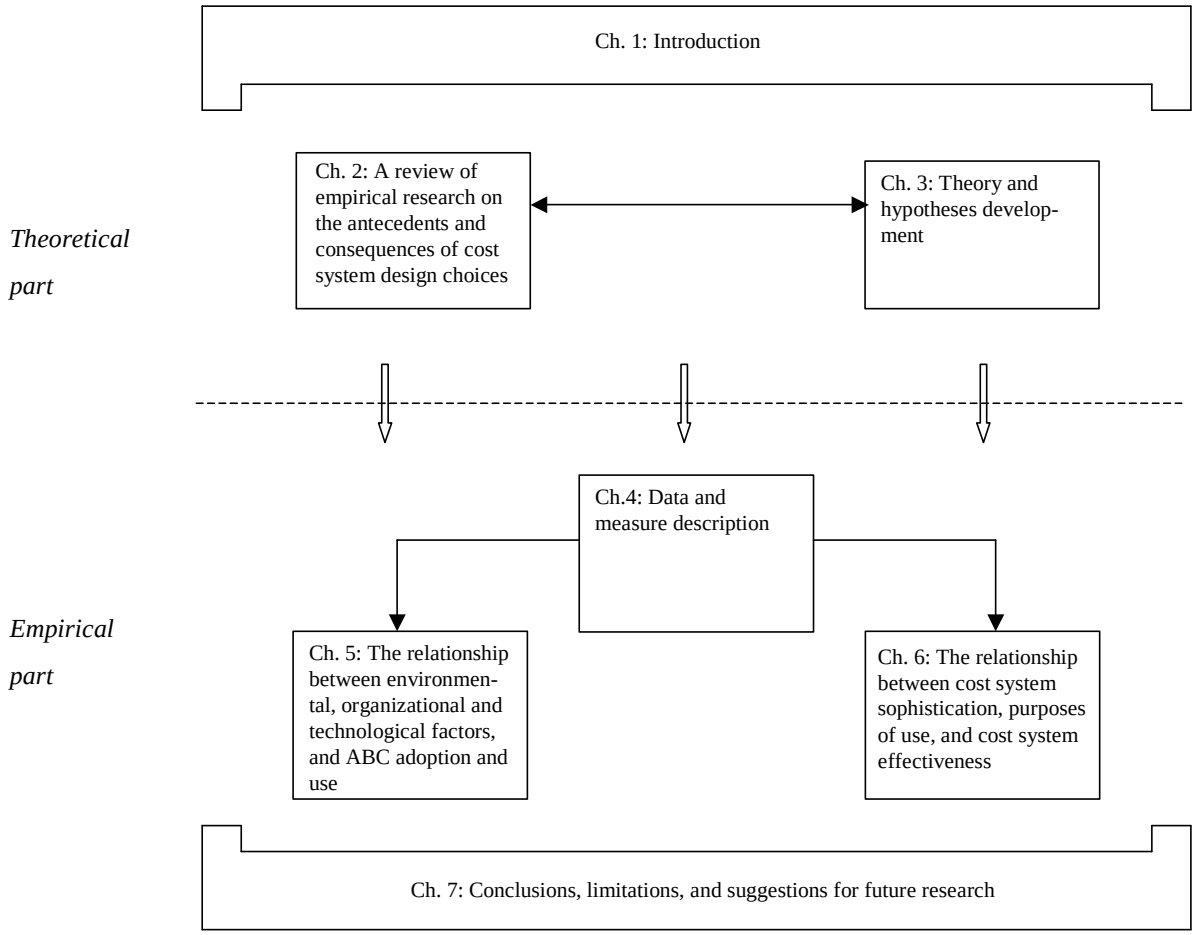
[7] In an earlier study, Chenhall (2004) has identified two dimensions of usefulness of ABCM, which *in terms of clustering of the items* are almost identical to the two dimensions of cost system purposes of use identified in this study.

interactive) effect of cost system sophistication and cost system usage (and importance) for strategic and operational purposes on cost system effectiveness is examined, controlling for the influence of environmental, organizational and technological factors. The results show that when cost system usage (and importance) for strategic and operational purposes is higher, cost system effectiveness is higher. More specifically, at the average level of cost system sophistication, the more strategic and/or operational purposes a firm's cost system is used for, the more intensive the system is used for decision making and the more satisfied are its users. Also, and more important, the results robustly show that cost system sophistication and cost system usage (and importance) for strategic purposes interact negatively to affect the intensity of use of the system, while cost system sophistication and cost system usage (and importance) for operational purposes interact positively. Similarly, cost system sophistication and cost system usage (and importance) for operational purposes also interact positively to affect the level of satisfaction with the system. Additional analysis shows that these interaction effects are non-monotonic. Accordingly, overall the results imply that at higher (lower) levels of cost system usage and importance for strategic purposes, cost system sophistication negatively (positively) affects cost system intensity of use, while at higher (lower) levels of cost system usage and importance for operational purposes, cost system sophistication positively (negatively) affects cost system intensity of use and satisfaction. This implies that when cost system sophistication and its purposes of use are better aligned, the cost system is more effective.

1.5 Structure of the dissertation

The remainder of this dissertation is structured into two main parts, a theoretical part and an empirical part (see also Figure 1.4). The first part consists of two chapters. Chapter 2 presents an overview of the research conducted to date on the antecedents and consequences of cost system design choices. Chapter 3 develops the hypotheses that will be tested in the empirical part of the dissertation. The second part of the dissertation consists of three chapters. Chapter 4 describes the data and measurement instruments used in the empirical part of the dissertation. Chapter 5 presents and discusses the results of the analyses for the research question on the relationship between environmental, organizational and technological factors, and ABC adoption and use. Chapter 6 presents and discusses the results of the analyses for the research question on the relationship between cost system sophistication, purposes of use, and cost system effectiveness. Finally, Chapter 7 concludes, discusses limitations, and presents some suggestions for future research.

Figure 1.4: Graphical presentation of the structure of this dissertation



Chapter 2

A review of empirical research on the antecedents and consequences of cost system design choices

2.1 Introduction

This chapter presents an overview of the research conducted to date on the antecedents and consequences of cost system design choices. Since most of this research has focused on the antecedents and consequences of the adoption and use of ABC, this will be the main focus of the chapter. The literature on ABC is quite extensive. This chapter will therefore concentrate on the results of empirical, predominantly extensive research on factors that determine the adoption of and/or success with ABC (see Gosselin, 2007, for an excellent, recent overview of all streams of research on ABC, and their results). A number of studies that have recently started to broaden the scope of cost system design studied by focusing on the distinguishing characteristics of cost systems, will also be discussed in this chapter.
The remainder of this chapter is structured as follows. Section 2.2 reviews the research on ABC adoption and its determinants. Section 2.3 reviews the research on ABC success and its determinants, and Section 2.4 the research on cost system sophistication and its determinants. Finally, Section 2.5 summarizes and concludes.

2.2 Research on ABC adoption and its determinants

The innovation diffusion-adoption theory is a suitable theoretical framework for studying ABC adoption and its determinants (Bjørnenak, 1997). Wolfe (1994) distinguishes three streams of research within the innovation diffusion-adoption literature: diffusion of innovation (DI)-research, organizational innovativeness (OI)-research and process theory (PT)-research**.** The objective of DI-research is to explain or predict the speed and patterns of adoption of an innovation in time and/or space, and its unit of analysis is an innovation. The objective of OI-research is to discover factors that determine an organization's propensity to innovate, and its unit of analysis is the organization. Finally, the objective of PT-research is to explain the nature of the innovation process, how and why innovations emerge, develop, grow and terminate, and its unit of analysis is the innovation process. Wolfe distinguishes two generations of PT-research, namely stage model (SM)-research and process model (PM)-research. The main difference between the two generations is that stage models assume that the innovation process brings along identifiable phases, whereas process models consider the innovation process as a complex, iterative process that brings along many feed-forward and feedback cycles. Because DI- and (to a large extent) PT-research are less relevant given the scope of this dissertation, this chapter mainly concentrates on the results of OI-research (see, e.g., Schoute (1999, 2003) for the results of DI- and PT-research in the area of ABC). This section first discusses the term 'ABC adoption'. Next, the results are discussed of research on

two categories of contextual factors that have been studied to date as determinants of ABC adoption. Finally, some methodological aspects of this kind of research will be discussed.

2.2.1 ABC adoption

In the ABC literature various definitions of the term 'adoption' are used. For example, Bjørnenak (1997) considers an innovation to be adopted if an organization has adopted the innovation as an idea. On the other hand, Innes et al. (2000), for instance, consider an innovation to be adopted if an organization has actually implemented the innovation. This already implies that there are various stages that organizations have to go through before being a user of ABC. Anderson (1995) and Krumwiede (1998) both use the IT implementation model developed by Kwon and Zmud (1987) in their studies of the ABC implementation process. This model distinguishes six implementation stages[8] that are influenced by five major categories of contextual factors: organizational, technological and environmental factors, and individual and task characteristics. In the organizational innovation diffusion-adoption literature, several researchers have studied the empirical validity of stage models of the implementation process of innovations. The results of these studies indicate that the empirical validity of such models is low, especially for innovations that are complex and/or radical (as ABC probably is for at least a subset of firms), or that have emerged within the organization itself. In such circumstances the degree to which identifiable stages occur in a predictable order is low; instead, stages tend to be muddled and overlapping (Wolfe, 1994). Figure 2.1 therefore presents an alternative ABC implementation model that is more aggregated and that is based on the idea that during the implementation of ABC an organization will experience three (reasonably) clear moments, namely:
Moment 1, at which it becomes knowledgeable about the ideas behind and validity of ABC;
Moment 2, at which it decides to invest resources for the implementation of ABC;
Moment 3, at which it actually starts using ABC.

The model presented in Figure 2.1 is completely consistent with (among others) Bjørnenak (1997) and Gosselin (1997), who also distinguished between adoption and implementation of ABC. It is important that firms may also remain in a certain stage, for instance by taking the decision to invest resources for the implementation of ABC, but never actually implementing it. Research by Gosselin (1997) indicates that this quite frequently occurs in practice.

[8] These six stages are: initiation, adoption, adaptation, acceptance, routinization, and infusion. The first two of these stages are part of the initiation stage of the alternative ABC implementation model presented in Figure 2.1, the next two are part of the implementation stage, and the last two are part of the utilization stage.

Figure 2.1: A model of the ABC implementation process

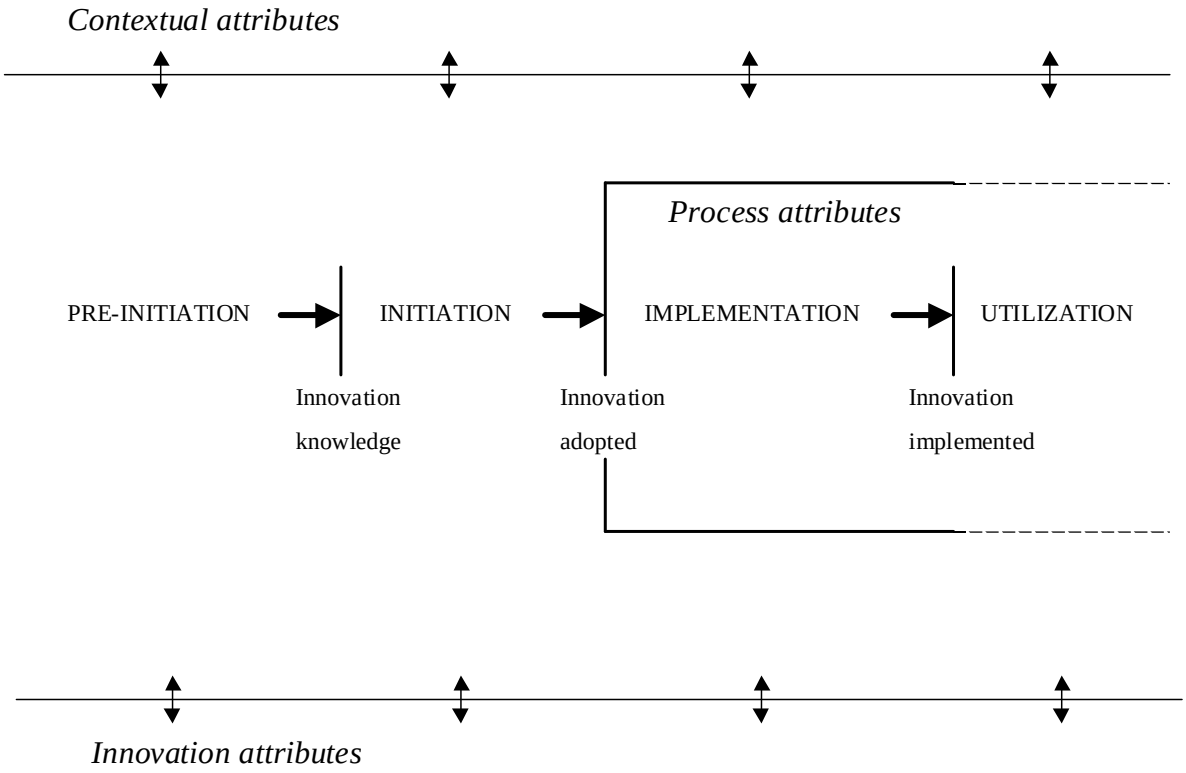


Figure 2.1 distinguishes three important categories of attributes (or factors) that influence the stages and their outcome(s): innovation, contextual and process attributes (as well as interdependencies among them). Innovation attributes refer to characteristics inherent in the innovation. In general, these characteristics are assumed to be homogeneous in the type of research on which this chapter focuses. Contextual attributes refer to characteristics of the firm's external and internal environment. These characteristics may affect both pre- and post-adoption stages (Anderson and Young, 1999; Krumwiede, 1998), and will be discussed in this section. Process attributes refer to characteristics of the actual process of implementation of the innovation. These characteristics may, together with the contextual attributes, affect post-adoption stages only (Anderson and Young, 1999; Krumwiede, 1998), and will be discussed in Section 2.3.

2.2.2 Determinants of ABC adoption

Based on their origin, the contextual factors studied to date as determinants of ABC adoption can broadly be divided into two categories: (1) contextual factors that are logically associated with the ABC theory, and (2) contextual factors that influence organizational innovativeness.

2.2.2.1 Contextual factors that are logically associated with the ABC theory

A widely used method to study the factors that determine the adoption of an innovation at macro-level, is to examine whether the adopters of an innovation in some way differ from the rest of the population. The management accounting literature suggests that ABC is more

suitable for certain kinds of organizations. If such organizations adopt ABC more often than other types of organizations, then we may assume that the adoption decisions have in general been fairly rational (Malmi, 1999). Cooper (1988b) has given guidelines on the circumstances which are receptive of ABC adoption. These circumstances are related to four factors:

- Cost structure: as ABC especially increases insights into the indirect costs, these have to account for a substantial part of the total costs;
- Competition: a high level of competition increases the importance of accurate cost information;
- Product diversity: disproportionate use of indirect activities by products is generally considered to be the most important cause of distortions of the true cost situation in traditional cost systems;
- Existing cost system: when an organization already uses a refined (traditional) cost system, the benefits of implementing ABC may be small.

The last few years a number of survey studies have been conducted that examine whether firms that have adopted ABC differ from firms that have not with respect to these (or similar) contextual factors. For example, Bjørnenak (1997), in a mail survey among 75 Norwegian production firms, examined whether several variables that are related to all four circumstances mentioned by Cooper are associated with ABC adoption. Only cost structure was found to be statistically significant. The 'percentage [of] indirect costs of the value adding costs' was significantly higher among ABC adopters than among non-adopters. In a series of surveys among 490 Finnish manufacturing firms, Malmi (1999) examined several variables that are related to three of the factors mentioned by Cooper – cost structure, competition and product diversity – as well as the size and strategy of organizations on their association with ABC adoption. The results suggest, among others, that a higher level of competition and greater product diversity distinguish between ABC adopters and non-adopters. However, the 'percentage of capital-related costs of total costs' (used as a proxy for cost structure) was found not to be associated with ABC adoption.

2.2.2.2 Contextual factors that influence organizational innovativeness

In various studies that have just been discussed, contextual factors are examined that are not so much logically related to the ABC theory, but that are argued to influence organizational innovativeness, especially the size, strategy and structure of organizations. The study of Bjørnenak (1997) shows that firms with ABC knowledge are significantly larger than firms without, whereas size (measured as number of employees) does not significantly discriminate between adopters and non-adopters within the group with ABC knowledge. Based on this finding, Bjørnenak concludes that the larger network of communication channels and information sources of larger firms can partly explain the difference between adopters and non-adopters. The study of Malmi (1999), however, shows that size (both measured as number of employees and turnover) does significantly discriminate between adopters and non-adopters of ABC. On the other hand, the strategy of an organization (having a cost leadership strategy or not) was found not to be associated with ABC adoption. This finding is contrary to the results of a survey-study among 161 Canadian manufacturing firms of Gosselin (1997). This study examined the influence of the strategy and structure of organizations on the adoption and implementation of three levels of activity management

(AM): activity analysis (the identification and description of activities), cost driver-analysis (the examination, quantification and explanation of cost drivers) and ABC (product costing based on activities). Gosselin considers the first two of these levels technical innovations and the third an administrative innovation. Gosselin tested three hypotheses:

1. A prospector strategy is positively associated with the adoption of one of the three levels of AM. Underlying this hypothesis is the distinction of Miles and Snow (1978) among four strategic types of organizations (prospectors, defenders, analyzers and reactors), of which prospectors are argued to have the highest level of innovativeness;
2. Among organizations that adopt at least one of the three levels of AM, a mechanistic structure[9] is positively associated with organizations that adopt ABC. Underlying this hypothesis is the so-called dual-core model (cf. Daft, 1978). This model is based on the distinction between technical and administrative innovations, and argues that mechanistic characteristics of organizations ease the adoption and implementation of administrative innovations, whereas technical innovations are more easily adopted and implemented by organistic organizations;
3. Among organizations that adopt ABC, a mechanistic structure is positively associated with organizations that implement ABC. This hypothesis is based on the so-called ambidextrous model (cf. Duncan, 1976). This model is based on the difference between initiation and implementation phases, and argues that initiation of innovations is easier in organistic organizations, whereas mechanistic characteristics of organizations make the implementation of innovations easier.

Based on the results of the study of Gosselin (1997) all three hypotheses should be accepted. Gosselin therefore concludes that during the implementation process of ABC organizations have several moments to revise their initial decision, and that organizations that both adopt and actually implement ABC are bureaucracies. Baird et al. (2004), in a mail survey among 184 Australian business units, extend the study of Gosselin by examining the association between the extent of adoption of the three activity management practices and several organizational factors and business unit culture dimensions. They find that business unit size and the business unit culture dimensions of innovation, outcome orientation, and tight versus loose control are associated with the extent of adoption of activity analysis and cost driver-analysis, while decision usefulness and the cultural dimensions of outcome orientation and tight versus loose control are associated with the extent of adoption of ABC.

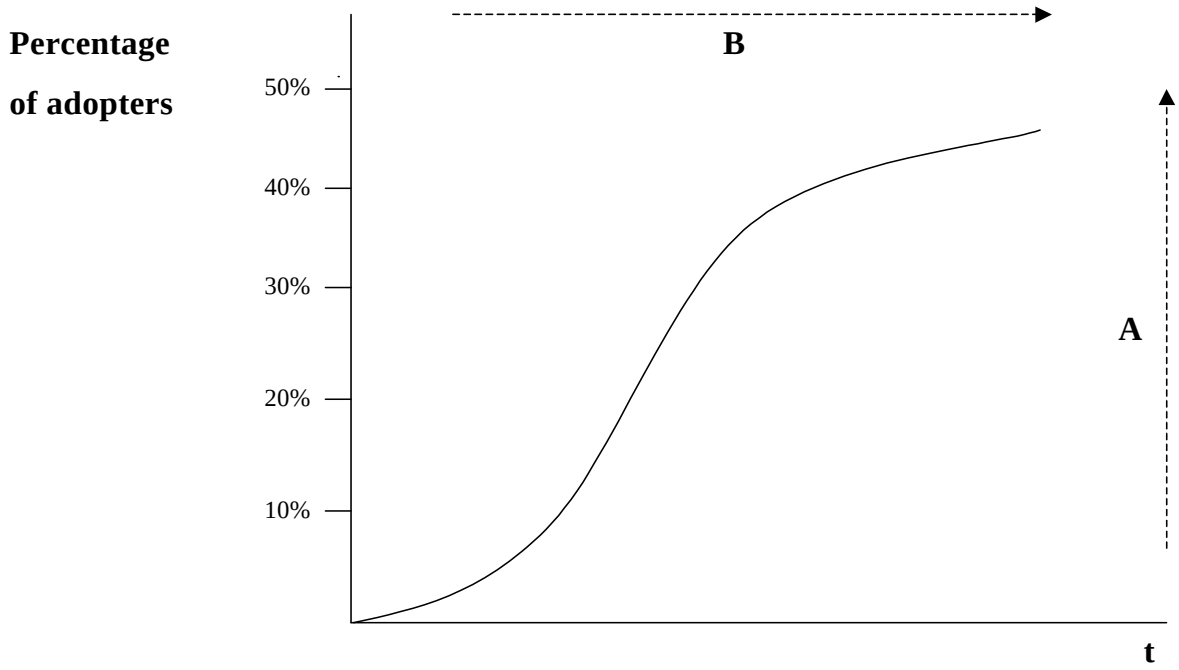
2.2.3 Some methodological aspects

The results of the studies that have been discussed in this section have, as is quite common in the management accounting literature, been interpreted based (only) on the criterion of statistical significance. Likely, the inconclusive results of these studies are at least to some extent due to differences in statistical power between the various studies. Statistical power refers to the probability of rejecting the null hypothesis when it is false and is mainly determined by two issues: (1) the size of the sample, and (2) the size of the groups (adopters versus non-adopters) within the sample. This last aspect has an optimum of 50/50. Various issues determine the size of the groups. In the first place the definition used for ABC

[9] Mechanistic (organistic) organizations are characterized by a high (low) level of vertical differentiation, formalization and centralization (see also Chapter 5).

adoption. In the ABC literature researchers have used at least three criteria: planning (e.g., Bjornenak, 1997), implementation (e.g., Malmi, 1999), and use (e.g., Innes et al., 2000). Usage of these criteria results in different percentages of adopters (and therefore sizes of groups). An additional problem with the usage of the criterion 'use' is that firms that are implementing ABC are considered to be non-users. However, such firms probably have more in common with users of ABC than with (other) non-users, which may distort observable differences between the groups. Second, the size of the groups is also determined by the time at which the study is conducted. In general, the later in the diffusion process the study is conducted, the higher the percentage of adopters (and therefore – until a 50/50 division is reached – the statistical power; see arrow A in Figure 2.2). A problem, however, is that a certain trade-off exists with another aspect that is associated with the time of research, namely distortion of (potential) differences caused by time variance of the adoption determining factors. This last point relates to the fact that the studies provide insights in (potential) differences between adopters and non-adopters at the moment of research. The theory concerns differences at the moment at which the adoption decisions are taken, however. Between the time of adoption and time of research, changes in the values of variables may have occurred, partly as a result of the adoption. If, for instance, as argued by the ABC theory, a relatively high level of product diversity indeed does have an influence on the adoption decisions, but firms use the results of their ABC analyses and implement major changes in their product assortment, then at the moment of research this influence possibly will have diminished. Therefore, the later in the diffusion process the study is conducted, the larger in general also the chances of distortions of (potential) differences as a result of time variance of adoption determining factors (see arrow B in Figure 2.2).

Figure 2.2: Statistical power versus time variance in research on adoption determining factors



Note: A 50/50 distribution is optimal, i.e. if the percentage of adopters becomes larger than 50%, statistical power decreases again.

2.3 Research on ABC success and its determinants

The research on the success of ABC can broadly be divided into two categories. The first category concerns studies in which the performance of ABC-using firms is compared to the performance of a benchmark (mostly the performance of non-ABC-using firms). These studies mainly use financial performance measures. The second category concerns studies of determinants of ABC success among firms that use ABC. These studies mainly use perceptual measures of ABC success. This section first discusses the term 'ABC success'. Next, the results of both categories of research are discussed. Finally, some methodological aspects of this kind of research will be discussed.

2.3.1 ABC success

The literature defines ABC success in various ways. Foster and Swenson (1997) identify four measures of ABC success in the empirical management accounting literature: (1) the use of ABC information in decision making, (2) the decisions and actions taken based on ABC information, (3) the financial improvements resulting from ABC, and (4) management's evaluation of ABC. These measures seem to suggest a certain causal logic. ABC information has to be used for decision making, which does or does not lead to decisions and actions taken, which do or do not lead to financial improvements. On top of that, management can perceptually evaluate the value of ABC information. Malmi (1997) argues that the decision making perspective on the value of information is too limited in the context of ABC, since mechanisms that generate information can be seen as resources for uncertainty reduction and the value of information as the extent to which uncertainty is reduced. This broader concept of the value of information has, if it is accepted, important implications for the analysis of the success or failure of ABC systems, as it implies that a cost system can be successful even if its results do not require decisions or actions to be taken, which is illustrated in the case study of Malmi (1997). Anderson and Young (1999) reveal two criteria for the evaluation of ABC systems: (1) whether ABC information is more accurate than information from traditional cost systems, and (2) whether ABC information is used for cost reduction. They identify these criteria based on analyses of interviews that were held with 236 employees of two American manufacturing firms. This study also shows that employees with a production-related function mainly evaluate an ABC system based on the first criterion, whereas employees with a support function mainly evaluate the same ABC system based on the second criterion. Overall, these studies therefore imply that ABC success is a dynamic, multidimensional concept, which is hard to measure objectively, and of which the dimensions are still somewhat ambiguous (cf. Cinquini and Mitchell, 2005).

2.3.2 ABC success in practice

To date, a number of studies have been conducted in which the performance of ABC-using firms is compared to the performance of non-ABC-using firms. Two of these studies have examined the effects of the use of ABC on firms' stock returns. Gordon and Silvester (1999) have examined whether the public announcement of the fact that firms have implemented ABC has an influence on their stock return. The results of this study suggest that the movements in stock return of a group of 10 ABC-using firms were similar to those of a group

of 10 comparable (in terms of industry and size, measured as total assets) firms in the days surrounding the moment of public announcement. The number of firms examined was very small, however. Moreover, the research method used by Gordon and Silvester required that investors immediately and fully understood the implications of ABC use after the moment of public announcement, which may have been a rather strong assumption.
Kennedy and Affleck-Graves (2001) have also examined whether implementing ABC has an influence on firms' stock returns. In their study the number of studied firms was much larger (37). Moreover, the period for which it is examined whether these firms have performed better than a group of (in terms of industry and size, measured as market value) comparable firms was much longer (three years, including the year in which they adopted ABC). A survey-study among the 853 largest British firms that were listed at the London Stock Exchange in 1996 was used to identify the ABC-using firms. This study suggests that the stock return of the ABC-using firms was 27 percent higher than the stock return of the group of comparable firms during the three-year period. During the two years preceding the year in which they adopted ABC, the return of the group of ABC-using firms did not significantly differ from the return of the group of comparable firms. Furthermore, the ABC-using firms did not only perform better in terms of stock return, but also in terms of changes in various accounting measures. In the three-year period, the ABC-using firms improved more in terms of operational profit, net profit and turnover. These improvements may have been the result of the implementation of ABC.

Four studies have so far been conducted on the effects of the use of ABC on the operational and/or financial performance of firms. In a survey conducted among 204 American firms, Cagwin and Bouwman (2002) examined the relationship between the extent to which these firms use ABC and (a perceptual measure of) improvements in financial performance. Furthermore, they also examined whether this relationship is moderated by various contextual factors. The results suggest that a positive relationship exists between the level of ABC use and improvements in return on investments, when ABC is used simultaneously with other strategic initiatives, when it is implemented in a complex and varied firm, when it is used in an environment in which costs are relatively important, and when the number of intra-firm transactions is limited.
In another survey, conducted among 2789 American plants, Ittner et al. (2002) examined the relationship between the plants' usage of ABC and their operational performance. This study shows, among other things, that the ABC-using plants had a higher quality level than the other plants. They also achieved larger improvements in both quality and throughput times during the preceding five years. The researchers found no direct relation between ABC use and return on assets. They did find an indirect effect with cost reductions during the preceding five years via improvements in quality and throughput times, however. This implies that the plants, by extensively using ABC, achieved improvements in terms of quality and throughput times, which then translated into cost reductions. In an additional analysis, Ittner et al. examined whether various contextual factors influence the relationship between ABC use and the performance of plants. The results suggest that this was not the case for quality and throughput times, but that it was for return on assets. This last finding implies that when ABC is implemented in a more suitable environment (i.e., with high levels of product diversity, etc.), its effects on the financial performance of firms will be larger, which is consistent with the findings of Cagwin and Bouwman (2002).

Banker et al. (2008), in a survey conducted among 1250 American plants, examined whether the relationship between plants' ABC usage and their operational performance in terms of changes in quality, time to market and manufacturing costs during the preceding three years, is mediated by their usage of world-class manufacturing practices (such as JIT and TQM). The results show that plants' ABC usage is positively associated with their operational performance in terms of changes in time to market and manufacturing costs. Similarly, they show that plants' usage of world-class manufacturing practices is positively associated with changes in all three operational performance measures. However, when included in a single regression model, the effects of ABC usage on operational performance are no longer significant, while the effects of usage of world-class manufacturing practices are. This implies that the relationship between ABC usage and the operational performance of the studied plants is indirect; i.e., the relationship is fully mediated by the plants' usage of world-class manufacturing practices.
Finally, Maiga and Jacobs (2008), in yet another survey conducted among 691 American plants that all used ABC for at least three years, examined whether the extent of ABC usage has a significant direct relationship with plant profitability and/or whether plant operational performance (in terms of quality, costs and cycle time) mediates this relationship, i.e., whether the relationship is indirect. The results show that (a) the extent of ABC usage is significantly associated with improvements in quality, cost and cycle time, (b) improvements in quality are significantly associated with improvements in cost, cycle time and profitability, (c) improvements in cycle time are significantly associated with improvements in cost and profitability, and (d) improvements in cost are significantly associated with improvements in profitability. The extent of ABC usage is not directly associated with plant profitability.

Besides these six studies of the effects of ABC usage in terms of financial improvements resulting from ABC, two studies have examined the effects in terms of the use of ABC information in decision making and the decisions and actions taken based on ABC information, without testing determinants of ABC success. Swenson (1995) presents the results of a telephone survey of 50 financial and operating managers at 25 manufacturing firms, measuring their satisfaction with ABC, as well as their use of ABC information to support decision making. The results indicate that the managers view ABC as an improvement over their old cost management system, and that those managers who are relatively more satisfied with their ABC systems are also more likely to actually use the ABC information to support strategic and operational decisions.
In a field study of a producer of small metal products (cables, nails and the like), Narayanan and Sarkar (2002) examined whether ABC provides managers with new information and whether it influences product- and customer-related decisions. The study shows that in this firm ABC seemed to have influenced both operational and strategic decisions. The firm was found to have made a number of process improvements after the ABC analyses, which had led to significant cost reductions. Both the managers of the firm and the researchers attribute these improvements to the use of ABC. In addition, the propensity to discontinue or increase prices of products and discontinue customers was found to be relatively stronger when the analyses showed them to be relatively unprofitable.

2.3.3 Determinants of ABC success

The last decade a number of studies have been conducted on factors that determine the success or failure of implementations of ABC. This research has mostly been conducted using surveys. The variables that have been examined are mostly derived from a theoretical model developed by Shields and Young (1989). This model distinguishes seven behavioral and organizational factors (the seven C's) that are proposed to determine the level of success of implementations of cost management systems: culture, controls, champion, change process, commitment, compensation, and continuous education. These factors are proposed to be reinforcing and supplementary. Determinants of ABC success have been examined on both the organizational and individual level of analysis.

Shields (1995), in a mail survey of 143 American ABC-using firms, examined the degree to which seventeen behavioral, organizational and technical variables are associated with the success of ABC implementation. The results suggest, among other things, that there is considerable variation in the degree of success firms have with ABC. Also, ABC success is found to be associated with behavioral and organizational variables, but not with technical variables. More specifically, five variables are found to be significantly and positively associated with ABC success: top management support, linkage to quality initiatives, implementation training, linkage to performance evaluation and compensation, and resource adequacy. This suggests that the fact that firms pay a lot of attention to the architecture and the software for ABC, but much less to behavioral and organizational factors, may be an important reason for non-successful implementations of ABC.
Using survey data from a sample of 166 organizational units of 132 American ABC-using firms, Foster and Swenson (1997) examined the effect of using alternative success measures in models testing ABC success determinants. The results suggest that the explanatory power of these models is highly affected by the choice of a success measure. Broad-based ABC success measures are shown to yield the highest explanatory power. Furthermore, the tests for the Shields (1995) model show that the same five variables also in this study are significantly and positively associated with ABC success. This is also the case for two variables that are introduced by Foster and Swenson: the number of primary applications of ABC and the number of years these are in use. The tests for the Shields and Young (1989) model show that four variables are significantly and positively associated with ABC success: controls, champion, commitment and compensation, whereas the other variables are not.
In a mail survey of 225 American manufacturing firms, Krumwiede (1998) tested Anderson's (1995) hypothesis that success factors differ and vary in importance during the various stages of the ABC implementation process. He examined how several contextual factors influence the initiation stage of the model presented in Figure 2.1, and how several contextual and process factors influence the implementation and utilization stages. The results indicate that different factors indeed become important as higher stages of ABC implementation are reached. Also, the direction and level of importance for many factors is found to vary by stage. Therefore, the results of this study imply that prior studies that combine ABC firms from several implementation stages to test certain success factors may distort their significance levels or reject other factors that are only important for certain stages.

In a field survey of 53 preparers and users of ABC information across four sites, McGowan and Klammer (1997) examined the degree to which employees' satisfaction with ABC implementation is associated with several variables describing characteristics of the implementation and of the ABC system. The results indicate that employees' perceptions concerning the success of ABC implementation are, on average, favorable. Also, seven variables are shown to be significantly and positively associated with employees' satisfaction with ABC implementation: top management support, user involvement, objectives clearly stated ex ante, adequacy of training, adequacy of resources, linkage to performance evaluation system, and information quality. Finally, the results indicate that perceptions related to ABC may vary depending on the role of the individuals involved (preparers are shown to have higher satisfaction levels than users).
This last result is also found by McGowan (1998), who has conducted a field survey of 69 preparers and users of ABC information at four sites measuring their perceptions of the benefits associated with ABC implementation along four dimensions: attitudes toward the ABC implementation, technical characteristics, perceived usefulness, and organizational validity. The results indicate that respondents' perceptions concerning the benefits of ABC implementation along these dimensions are, on average, favorable (except for the item 'accessibility of information').
As was argued earlier, based on a content analysis of interviews held with 236 employees at two American manufacturing firms, Anderson and Young (1999) revealed two criteria for evaluating ABC systems: (1) whether ABC data are more accurate than traditional cost system data, and (2) whether ABC data are used in cost reduction. Next, Anderson and Young used survey data from 265 managers and ABC system developers from the same firms to examine relations between evaluations of the ABC system, and contextual and process variables. The results indicate that both contextual and process variables influence evaluations of the ABC system. However, the most critical variables are found to differ per evaluation criterion.

2.3.4 Some methodological aspects

The studies discussed on the level of success with ABC in which the performance of ABC-using firms is compared to the performance of non-ABC-using firms are all (so-called) nonrandomized studies. This means that the firms that use ABC have not been assigned based on chance, but instead have made the choice to implement ABC based on their characteristics and circumstances in the industry they operate in. Nonrandomized studies (much stronger than randomized studies) are characterized by a number of major methodological problems, of which selection bias is the most important. Selection bias refers to unwanted differences on other relevant variables between firms that use ABC and firms that do not use it with which the comparison is made. Such variables may disturb the results of studies of the effects of the use of ABC on the performance of firms in two ways.
First, it may be that a certain variable is associated with both the use of ABC and with the performance of firms. For example, Malmi (1999) shows that ABC adopters are characterized by a higher level of competition than non-adopters (see Section 2.2.2); but at the same time research of, for example, Capon et al. (1990) shows that the level of competition that firms confront influences their performance. If the level of competition is not measured and its

influence not statistically corrected, this may disturb any effects concerning the use of ABC on the performance of firms.
Second, it may be that a certain variable statistically interacts with the use of ABC in their influence on the performance of firms. This is, for example, the case when the influence of the use of ABC is stronger in an environment that is characterized by a high level of competition than in an environment that is characterized by a low level of competition. Therefore, selection bias is the direct relation between research on the effects of the use of ABC and research on the factors that determine the adoption (and non-adoption) of ABC, as this last type of research aims to identify the characteristics of firms and circumstances in the industry they operate in based on which they make the choice to implement ABC. In general, it seems that the studies of the level of success with ABC that were discussed earlier in this section have (possibly) insufficiently corrected for possible selection effects.

2.4 Research on cost system sophistication and its determinants

Recently, several studies have broadened the scope of cost system design studied by focusing on the distinguishing characteristics of cost systems. These studies examine the determinants of (what they refer to as) the level of cost system sophistication (or complexity). The reasons for this broadening of scope include the difficulty of operationalizing ABC usage (see also Section 4.5.1), and a desire to be able to distinguish between simple and complex ABC systems. This section first discusses the term 'cost system sophistication'. Next, the results of studies on the determinants of cost system sophistication are discussed. Finally, some methodological aspects of this kind of research will be discussed.

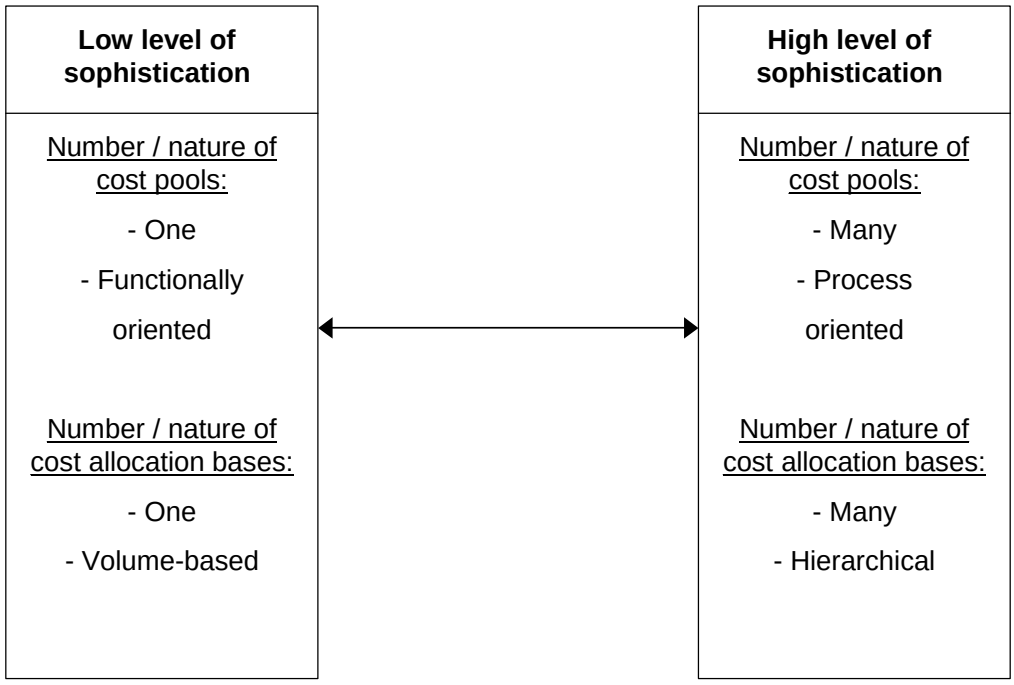
2.4.1 Cost system sophistication

A major issue in the design of cost systems is whether the system only assigns direct costs, or whether it also assigns indirect costs to the cost objects (e.g., products, services and processes) of an organization, and if so, how. Variable cost systems only assign direct costs, whereas absorption cost systems also assign indirect costs. In order to assign indirect costs, various cost allocation methods have been developed, of which ABC is the most recent (at least of the methods that are widely used in practice). In general, these methods consist of two stages (see also Section 1.2). In the first stage the homogeneous costs of resources are gathered in cost pools. Dependent on the type of allocation method, these cost pools are functionally (e.g., based on departments) or process (e.g., based on activities) oriented. In the second stage the costs from the cost pools are assigned to the cost objects, using cost allocation bases. Dependent on the type of allocation method, volume-based or hierarchical (e.g., batch-level, product-sustaining and facility-related) cost allocation bases are used.

Abernethy et al. (2001) view cost system design choices as varying along three dimensions: number of cost pools (single versus multiple cost pools), nature of cost pools (responsibility-based versus activity-based cost pools), and nature of cost allocation bases (volume-based versus hierarchical cost allocation bases). Together these dimensions form a continuum of 'cost system sophistication', with one end of the continuum representing a simple traditional cost system (with a single responsibility-based cost pool and a volume-based cost allocation base) and the other end representing a sophisticated cost system (with multiple activity-based

cost pools and hierarchical cost allocation bases). Similarly, Drury and Tayles (2005) view cost system design choices as varying along a continuum of 'cost system complexity'. They suggest that three factors[10] determine the level of complexity of a cost system: the number of cost pools, the number of different types of cost allocation bases, and the nature of these bases (transaction, duration, or intensity).[11] Combining both views, it can be observed that what distinguishes a traditional cost system from an ABC system is not so much the number, but the nature of cost pools and/or cost allocation bases used. Both a traditional and an activity-based cost system may have a small to a large number of cost pools and cost allocation bases, but only an activity-based cost system may have activity-based cost pools (as opposed to responsibility-based only) and/or hierarchical cost allocation bases (as opposed to volume-based only). This also indicates that the distinction between adopters (or users) and non-adopters (or non-users) of ABC, which is used in many studies to operationalize the sophistication of cost systems, is insufficiently capable of describing the variety of cost systems used in practice. Figure 2.3 summarizes the above discussion on the dimensions that determine the level of sophistication, in terms of cost pools and cost allocation bases, of (absorption) cost systems.

Figure 2.3: Dimensions that determine the level of sophistication of (absorption) cost systems



[10] Actually, Drury and Tayles (2005) also discuss a fourth distinguishing characteristic of cost systems: the extent to which costs of resources are assigned to cost pools based on using either direct charging or cause-and-effect resource cost drivers. They consider this characteristic less important, however, than the other three characteristics they discuss.

[11] Transaction drivers are based on the number of times activities are performed; duration drivers are based on the amount of time required to perform an activity; and intensity drivers are based on directly charging for the resources used each time an activity is performed (Kaplan and Cooper, 1998).

2.4.2 Determinants of cost system sophistication

To date, a number of studies have been conducted on the determinants of cost system sophistication. In a qualitative field study, conducted among five divisions of two Australian firms, Abernethy et al. (2001) examined the relation between the level of product diversity, the cost structure, the usage of advanced manufacturing technologies, and the sophistication of the cost systems used by the divisions. Four of the divisions had a relatively simple cost system, with three or less cost pools and only one, volume-based cost allocation base. Nevertheless, the management in three of these divisions was reasonably to very satisfied with the information generated by the system. The researchers attribute this to the 'fit' between the level of sophistication of the cost systems used and the contextual characteristics product diversity and cost structure. In all three divisions both the level of product diversity and the indirect costs as percentage of the total manufacturing costs were low. In the fourth division on the other hand, both were high. The management of this division was dissatisfied with its cost system, which the researchers attribute to the lack of 'fit' between both contextual characteristics and the cost system in use. The fifth division, finally, used a rather complex traditional cost system, with many cost pools and two, volume-based cost allocation bases. The users were very satisfied with this system. The level of product diversity was high in this division, but this was facilitated by investments in advanced manufacturing technologies. As a result, the indirect costs that were present were mostly associated with these investments, and therefore were facility-related costs. According to the researchers these circumstances gave little reason to adopt a (complex) ABC system, as the batch- and product-related costs that in general are associated with product diversity were low. As a consequence, the need to include a variety of non-volume-related cost allocation bases strongly decreased.

In a survey-study, conducted among 187 British firms, Drury and Tayles (2005) examined the relation between seven contextual characteristics of the firms and the sophistication of their cost system. They measured the sophistication of the firms' cost systems using a composite scale, based on both the number of cost pools and the number of different types of cost allocation bases used. These two characteristics were chosen because the other distinguishing characteristics are discrete (see earlier), making it difficult to combine them with these two continuous characteristics into one measure of cost system sophistication.
The study shows, among other findings, that 35% of the studied firms used a cost system with ten or fewer cost pools and 59% with fewer than three different types of cost allocation bases. Only 12% of them used a cost system with more than twenty cost pools and more than six different types of cost allocation bases. Consistent with the researchers' expectations, the sophistication of the cost systems was positively associated with the level of product diversity and the size (net sales) of the firms, and negatively with their degree of customization. Also, service and financial firms were found to use more sophisticated cost systems than a group of other firms (which for 95% consisted of manufacturing firms). No significant association was found for the other studied contextual characteristics: the percentage of indirect costs in the cost structure, the intensity of competition, and the importance of cost information for decision making. In an additional analysis, the researchers also examined the same relations for the two cost system design characteristics separately. The results of the analysis for the number of cost pools were reasonably similar to those of the main analysis, whereas those for the number of different types of cost allocation bases were almost identical.

In another, somewhat similar survey-study, conducted among 176 British firms, Al-Omiri and Drury (2007) examined the relationship between nine contextual characteristics and cost system sophistication. However, in this study four different measures were used to measure the sophistication of cost systems, two continuous (the number of cost pools and the number of different types of cost allocation bases) and two dichotomous (use versus non-use of ABC, and use of variable versus absorption costing). Testing shows, though, that (as may be expected) the various measures are strongly associated. For example, both the number of cost pools and the number of different types of cost allocation bases are significantly higher among users of ABC than among non-users.
The results of the study indicate that the sophistication of cost systems is positively associated with the intensity of competition, the importance of cost information for decision making, the extent to which other innovative management accounting techniques are used, the size (net sales), and (for manufacturing firms) the extent to which JIT/lean production techniques are used. Also, financial and (for users versus non-users of ABC) service firms were found to use more sophisticated cost systems than a group of other firms (which for 87% consisted of manufacturing firms). No significant association was found for any of the other studied contextual characteristics: the level of product diversity, the quality of information technology, and the percentage of indirect costs in the cost structure. The results differ somewhat for the various measures of sophistication, however. Also, 13% of the studied firms indicated they do not use a formal cost system. These firms were found to have a lower level of product diversity, a smaller size, and a lower percentage of indirect costs in the cost structure than firms that do use a formal cost system, as well as to attach less importance to cost information for decision making. Finally, the sophistication of the used cost systems, measured in terms of use versus non-use of an ABC system and in terms of the number of different types of cost allocation bases, was found to be positively associated with the level of satisfaction of the respondents with the accuracy of the assignment of the indirect costs to products/services by their cost system.

2.4.3 Some methodological aspects

The studies discussed in this section focus on the determinants of (what they refer to as) the level of cost system sophistication. As argued earlier, researchers started to focus on this construct because operationalizing ABC usage proved to be difficult, and they hoped to be able to distinguish between simple and complex ABC systems. Studies on the determinants of the adoption and use of ABC have used many inconsistent definitions of and measurement instruments for ABC adoption (or use). Partly, this reflects the fact that there still is some disagreement among researchers on what *exactly* defines an ABC system (see, e.g., the debate on this issue between Dugdale and Jones (1997) and Innes and Mitchell (1997)). In addition, it also reflects the multiple criteria that researchers have used for considering a firm to be an ABC adopter or not (see Section 2.2). A major underlying cause of these inconsistencies is that ABC (and ABC usage) is a typical example of a practice-defined (as opposed to a theory-defined) variable (Luft and Shields, 2003). Such variables are given meaning by elaborating their theoretical properties and identifying what managers do with them (Bisbe et al., 2007). As argued by Bisbe et al. (2007), the more general the nature of a practice-defined variable, the more difficult it is to find agreement from practice on the set of theoretical properties (and therefore on the domain) of the variable. Also, assessing the cumulative findings of a stream

of research on a practice-defined variable is hindered when the definition of the practice is unclear, fails to take the multiple properties of the practice into account or when definitions differ between studies (Bisbe et al., 2007). These issues are thus likely to be at least partially responsible for the inconclusive results of research to date on the determinants of the adoption and use of ABC. Unfortunately, the alternative construct (cost system sophistication) suffers from many of these same problems. For example, researchers have compromised on the distinguishing characteristics of cost systems they have taken into account when measuring cost system sophistication (e.g., Drury and Tayles, 2005), and others have used a number of different proxies for measuring the construct (e.g., Al-Omiri and Drury, 2007). Furthermore, especially if we look at the results of the two surveys on the determinants of the level of cost system sophistication, these results do not appear to be more consistent than those of the earlier research on the determinants of ABC adoption and use.

2.5 Summary and conclusions

This chapter has presented an overview of the research conducted to date on the antecedents and consequences of cost system design choices. For the most part, it has focused on studies of the factors that determine the adoption of and/or success with ABC. These studies provide a number of major conclusions. First, these studies show that there are many factors that influence the stages that organizations have to go through before being a successful user of ABC. Moreover, the influence of many of these factors appears to vary by stage of the implementation process. A major distinction in this respect is between contextual and process attributes (or factors). Contextual attributes influence both pre- and post-adoption stages, whereas process attributes may, together with the contextual attributes, affect post-adoption stages only. Another conclusion that may be drawn is that the studies on the influence of contextual factors on the adoption of ABC to date have shown unstable results, both among and within studies. This applies to both studies on contextual factors that are logically associated with the ABC theory (such as cost structure, competition and product diversity), and studies on contextual factors that influence organizational innovativeness (such as size, strategy and structure).

The studies on the influence of process factors on the extent to which firms have success with ABC, on the other hand, have consistently found a number of factors to be determinants of whether or not ABC implementations are successful, especially factors such as: top management support, linkage of ABC to quality initiatives, training in implementing ABC, linkage of ABC to performance evaluation and compensation, and adequate resources. These factors have in common that they are all non-technical, which implies that the extent to which an ABC implementation is successful is mainly determined by behavioral and organizational factors. Overall, the discussed studies on the level of success with ABC in practice show fairly consistent results: when ABC is implemented effectively and in an appropriate environment, its use is found to have clearly demonstrable positive effects on firms' financial performance, both in terms of stock return and operational return.

From a methodological point of view, however, comments can be made on each of the discussed studies. For studies on ABC adoption and adoption determining factors especially statistical power and the time variance of these factors are major methodological issues. For

studies on ABC success and success determining factors the possible distortion of the found effects of the use of ABC on the performance of firms as a result of selection bias is the main issue. Another possible cause of the rather unstable results of studies on adoption determining factors may be the rather limited operationalization of cost system design choices as use versus non-use of ABC. Therefore, several recent studies have operationalized the design of cost systems more broadly. However, especially if we look at the results of the two discussed survey studies, these results do not appear to be much more consistent than those of the earlier research. Both among and within the two studies the results strongly differ.

Chapter 3

Theory and hypotheses development

3.1 Introduction

This chapter first briefly discusses contingency theory and forms of fit, as the theoretical foundation of this dissertation is contingency theory. Next, it develops the hypotheses that will be tested in the empirical part of the dissertation. In order to examine the first research question, on the relationship between environmental, organizational and technological factors, and ABC adoption and use, eleven hypotheses are formulated. Similarly, in order to examine the second, on the relationship between cost system sophistication, purposes of use, and cost system effectiveness, four hypotheses are formulated.
The remainder of this chapter is structured as follows. Section 3.2 discusses some important aspects of contingency theory and forms of fit. Section 3.3 develops the hypotheses on the relationship between environmental, organizational and technological factors, and ABC adoption and use. Next, Section 3.4 develops the hypotheses on the relationship between cost system sophistication, purposes of use, and cost system effectiveness. Finally, Section 3.5 summarizes and concludes.

3.2 Contingency theory and forms of fit

Consistent with most previous research on the antecedents and consequences of cost system design choices (Luft and Shields, 2003), the theoretical foundation of this dissertation is contingency theory. This theory contends that there is no universally applicable system of management accounting and control. Instead the most appropriate system depends on the specific circumstances confronting an organization. The alignment (or 'fit') between the design of management accounting and control systems and contextual (or 'contingency') factors is therefore what contingency theory focuses attention on. There are various forms of theoretical fit that have been used to classify contingency-based management accounting and control research: selection, interaction (matching and multiplicative interaction) and systems (e.g., Chenhall, 2003; Gerdin and Greve, 2008; Luft and Shields, 2003).[12] Selection fit studies examine the way in which contextual factors are related to aspects of management accounting and control in organizations, with no attempt to assess whether this association is linked to their performance. The two types of interaction fit studies, i.e., matching and multiplicative interaction fit studies[13], that are generally distinguished, examine the way in which contextual

[12] There is considerable and confusing variation in the use of terminology to describe the various forms of fit. In this section, I follow the terminology used by Chenhall and Chapman (2006).
[13] As emphasized by Chenhall and Chapman (2006), multiplicative interaction fit models are less theoretically precise than matching interaction fit models. Matching models are based on the idea that for each level of a contextual factor there is a unique value for the management accounting and control aspect that will maximize

factors influence the relationship between aspects of management accounting and control in organizations and their performance. Finally, systems fit studies examine the way in which multiple aspects of management accounting and control in organizations and dimensions of context interact in a variety of ways to enhance their performance (Chenhall and Chapman, 2006). The forms of theoretical fit that underlie the *main* empirical analyses presented in this dissertation are selection fit (Section 5.3) and (multiplicative) interaction fit (Section 6.3).[14]

Prior contingency-based research has examined the effects of many contextual factors, such as the external environment, strategy, technology, organizational structure and size, on different, often generic, conceptualizations of aspects of management accounting and control (see, e.g., Chenhall, 2003, for an excellent, recent overview). This dissertation distinguishes between three types of contextual factors: environmental factors, which are related to the external environment of an organization; organizational factors, which are related to the strategy and structure of an organization; and technological factors, which are related to the fundamental work processes in an organization.

3.3 Hypotheses on the relationship between environmental, organizational and technological factors, and ABC adoption and use

Consistent with the general distinction made in this dissertation between environmental, organizational and technological factors, this section presents hypotheses on the antecedents of ABC adoption and use for these three categories of contextual factors, respectively. The antecedents of *both* ABC adoption and ABC use are examined since research by Gosselin (1997) indicates that firms frequently remain in a certain stage of the ABC implementation model (see Section 2.2), for instance by taking the decision to invest resources for the implementation of ABC, but never actually implementing it, which suggests that (to the extent that such decisions are systematically related to these contextual factors) the strength of the relationship between the antecedents and ABC adoption and ABC use *may* differ in practice.

3.3.1 Environmental factors and ABC adoption and use

The first category of factors hypothesized to affect ABC adoption choices consists of environmental factors. These factors are related to the external environment of an organization and generate a certain (external) pressure to adopt ABC. Two environmental factors are examined in this study: competition and perceived environmental uncertainty.

Competition. Competition refers to the intensity of the competition in the market(s) of the firm. This factor seems to be important because a higher level of intensity of market competition increases the importance of accurate cost information, as in highly competitive

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performance, with all other values resulting in lower performance. Multiplicative models on the other hand, are based on the more general idea that higher (lower) values of the contextual factor require higher (lower) values of the management accounting and control aspect to achieve higher (lower) performance.

[14] As emphasized by Chenhall and Chapman (2006), the different forms of fit entail detailed and specific sets of expectations and assumptions, concerning significant issues such as the nature of organizational equilibrium, the gradual or quantum nature of organizational change, and the linearity or non-linearity of relationships (see also Luft and Shields, 2003).

markets competitors are likely to take advantage of any costing errors (Cooper, 1988b). The influence of competition on the adoption and use of ABC has earlier been studied by Bjørnenak (1997) and Malmi (1999). The results of Bjørnenak are contrary to expectations. The adopters of ABC were found to have a lower percentage of sales from exports (used as a proxy for competition) and a lower number of competitors than the non-adopters, although either effect is not statistically significant. The results of Malmi are consistent with expectations: both the percentage of turnover from exports (again, used as a proxy for competition) and the perceived change in competition were found to be significantly higher for the adopters of ABC than for the non-adopters. The proxies of percentage of sales and turnover from exports used in these studies are based on the assumption that competition is more intensive in foreign markets than in the home market, which may be a rather strong assumption. Based on the former arguments, the following hypothesis is formulated:

H1: *The higher the level of intensity of market competition, the more likely it is that firms will (a) adopt and (b) use ABC.*

Perceived environmental uncertainty. Perceived environmental uncertainty (PEU) refers to top managers' perceived inability to predict an organization's external environment accurately (Milliken, 1987). The critical aspects of the PEU construct are: (1) it refers to the external environment of an organization, (2) it refers to perceptions of that environment, (3) a degree of uncertainty results from the perceptions, and (4) the relevant perceptions are those of top managers (Tymon et al., 1998). Milliken (1987) differentiates three types of environmental uncertainty: state uncertainty, effect uncertainty, and response uncertainty, but argues that strictly speaking only state uncertainty is PEU. This factor seems to be important because a higher level of perceived environmental uncertainty increases firms' need for information, including cost information. It is important to emphasize that it is the perceived uncertainty, rather than the actual uncertainty that is present in the environment, that influences the decisions that managers make in response to their firms' external environment (Govindarajan, 1984). To my knowledge, the influence of perceived environmental uncertainty on the adoption and use of ABC has not been studied before. Based on the former arguments, the following hypothesis is formulated:

H2: *The higher the level of perceived environmental uncertainty, the more likely it is that firms will (a) adopt and (b) use ABC.*

3.3.2 Organizational factors and ABC adoption and use

The second category of factors hypothesized to affect ABC adoption choices consists of organizational factors. These factors influence the innovativeness of an organization and may facilitate or hinder the adoption of ABC. Five organizational factors are examined in this study: competitive strategy, vertical differentiation, formalization, centralization, and organizational size.

Competitive strategy. Competitive strategy refers to the strategic choices that an organization makes concerning the products and/or services that it offers, and the market(s) in which it operates. A widely used typology with regard to competitive strategies is the Miles and Snow (1978) typology. Based on their level of product/market innovation, this typology categorizes organizations into three basic types: prospectors, analyzers and defenders, with prospectors being the most, and defenders being the least innovative. Snow and Hrebiniak (1980) show that in practice all three strategies require strength in financial management. The differences in organizational innovativeness between these types of organizations suggest that firms' competitive strategy may affect their ABC adoption choices, however. Gosselin (1997) has earlier found a significant association between competitive strategy and the adoption of an activity management (AM) approach. Gosselin distinguishes three levels of AM (activity analysis, cost driver-analysis and activity-based costing), and found prospectors to be the most likely to adopt one of these approaches, followed by analyzers and defenders. Based on the former arguments, the following hypothesis is formulated:

H3: *The higher the level of product/market innovation, the more likely it is that firms will (a) adopt and (b) use ABC.*

Organizational structure. The organizational innovation literature argues that the adoption and implementation of innovations can be facilitated or hindered by the organization's structural design. Organizational structure has multiple dimensions. The three most widely studied dimensions are vertical differentiation, formalization and centralization. Vertical differentiation refers to the depth of the organizational structure. It reflects the number of hierarchical levels below the chief executive officer. Formalization refers to the degree to which jobs within an organization are standardized. Centralization refers to the degree to which power and control in an organization are in the hands of relatively few individuals. Gosselin (1997) has studied the influence of these three dimensions on the adoption and implementation of AM. His results provide some support for the so-called ambidextrous model from the organizational innovation literature. This model states that the initiation of innovations is easier in organic organizations (i.e., organizations that score low on all three dimensions), whereas implementation is facilitated in mechanistic organizations (i.e., organizations that score high on all three dimensions). More specifically, among firms that adopted an AM approach, Gosselin found a significant positive association between vertical differentiation and the adoption of ABC. Among firms that adopted ABC, a significant positive association was found between formalization and centralization and the implementation of ABC. Therefore, a positive relationship is expected between the three structural dimensions and the adoption and use of ABC, which leads to the following hypotheses:

H4: *The higher the level of vertical differentiation, the more likely it is that firms will (a) adopt and (b) use ABC.*

H5: *The higher the level of formalization, the more likely it is that firms will (a) adopt and (b) use ABC.*

H6: *The higher the level of centralization, the more likely it is that firms will (a) adopt and (b) use ABC.*

Organizational size. Organizational size refers to the size of the firm, usually measured in terms of number of employees. In the organizational innovation literature usually a positive association is found between size and organizational innovativeness. Larger firms are argued to have more complex and diverse facilities and greater resources available, and to employ more professional and skilled workers, that facilitate the adoption and implementation of innovations (Damanpour, 1992). The results of prior studies in the area of ABC are somewhat mixed, however. For example, Innes et al. (2000), Krumwiede (1998) and Malmi (1999) have found a significant positive association, whereas, for example, Bjørnenak (1997) and Gosselin (1997) have found no association between the size of firms and the adoption of ABC. Based on the former arguments, the following hypothesis is formulated:

H7: *The larger the organizational size, the more likely it is that firms will (a) adopt and (b) use ABC.*

3.3.3 Technological factors and ABC adoption and use

The third category of factors hypothesized to affect ABC adoption choices consists of technological factors. These factors are related to the fundamental work processes in an organization and generate a certain (internal) pressure to adopt ABC. Three technological factors are examined in this study: product diversity, number of production lines, and structure of the production process. Moreover, a potential moderating effect of usage of advanced manufacturing technology (AMT) on the relationship between product diversity and ABC adoption choices is also examined.

Product diversity. Product diversity refers to "conditions in which [products] place different demands on activities or activities place different demands on resources. This situation arises, for example, when there is a difference in mix or volume of products that causes an uneven assignment of costs" (CAM-I, 1992). Different types of diversity include: physical size, complexity, and batch size (Cooper, 1988b; Miller, 1996). Proponents of ABC claim that product diversity is a major factor that results in the reporting of distorted product costs by traditional cost systems (e.g., Kaplan and Cooper, 1998). A number of studies have therefore previously studied the relationship between product diversity and ABC adoption and use, and found inconclusive results. The results of Bjørnenak (1997) are contrary to expectations. The adopters of ABC are found to have a significantly lower degree of customized production (used as a proxy for product diversity) than the non-adopters, whereas both groups do not significantly differ with respect to the number of product variants.[15] Similarly, Clarke et al. (1999) found no significant association with the number of product lines produced by firms, and, in their multivariate analysis of adopters versus non-adopters of ABC, Al-Omiri and

[15] One explanation for these findings of Bjørnenak (1997) is that the degree of customized production may be more related to task uncertainty as a result of made-to-order production than to product diversity. This would also make this finding consistent with those of Krumwiede (1998) and Ittner et al. (2002) on the influence of the structure of the production process on ABC adoption choices.

Drury (2007) found no significant association with two dimensions (volume and support diversity[16]) of product diversity. The results of Malmi (1999), on the other hand, conform to expectations, as the adopters of ABC are found to produce a larger number of different products than the non-adopters. In his multivariate analysis of adopters versus non-adopters, Krumwiede (1998) also found a positive association between product diversity and ABC adoption. Therefore, the following hypothesis is formulated:

H8: *The higher the level of product diversity, the more likely it is that firms will (a) adopt and (b) use ABC.*

Interaction of product diversity and usage of AMT. AMT is an umbrella term used to describe a variety of computer-controlled automated process technologies, which can provide cost-efficient flexibility and flow in manufacturing (e.g., Jonsson, 2000). Following Adler (1988), three broad types (categories) of AMTs are generally distinguished in the literature: design, manufacturing and administrative AMTs. Design AMTs focus on the design of products and processes, manufacturing AMTs on the actual manufacturing and physical transformation of the products, and administrative AMTs on tracking operations (Jonsson, 2000). In this study, I will focus on manufacturing AMTs. Typical examples of such technologies are computer-aided manufacturing (CAM), flexible manufacturing systems (FMS), and automated material handling systems. In their qualitative field study of the relationship between product diversity and cost system sophistication in five divisions of two firms, Abernethy et al. (2001) found this relationship to be influenced by the extent to which the divisions used AMTs to manage the diversity. It appears that to some extent firms have an option on whether to manage their diversity by investing in AMTs, which in general will decrease their batch- and product-related costs and thus their need to adopt and use an ABC system, or by investing in such a sophisticated cost system. Therefore, these two options are partially considered to be an "either-or" choice, suggesting a negative interaction effect between product diversity and usage of AMT. Based on these arguments, the following hypothesis is formulated:

H9: *The influence of product diversity on a firm's likelihood of (a) adopting and (b) using ABC is negatively moderated by the extent to which these firms use advanced manufacturing technologies.*

Production process. In addition to product diversity and its interaction with usage of AMT, other aspects of the production process of firms are also likely to have an influence on their ABC adoption choices. Two such aspects are the number of production lines in the firm, and the structure of its production process. The number of production lines seems to be important because with increases in the number of production lines, also the number of cost pools needed may increase, and thereby the need for a more sophisticated cost system. Groot (1999), who found users of ABC to operate significantly more production lines than non-users, has earlier studied the influence of the number of production lines on ABC adoption choices. With respect to the structure of firms' production processes, Reeve (1993) argued

[16] Volume diversity occurs when products are produced in different batch sizes, whereas support diversity occurs when varying support is given to each product by various support departments (Al-Omiri and Drury, 2007; see also Cooper, 1988b and Estrin et al., 1994).

that firms with a continuous production process are less likely to adopt and use ABC than firms with a discrete production process, as many ABC cost drivers are less important in such firms. On the other hand, Krumwiede (1998) argued that firms with a non-job shop (i.e., continuous) production process are more likely to adopt ABC than firms with a job-shop (i.e., discrete) production process, as the level of task uncertainty as a result of made-to-order production is lower in firms with a non-job shop production process. His empirical results confirmed this hypothesis. Similarly, the empirical results of Ittner et al. (2002) showed that firms with a continuous production process were more likely to use ABC than firms with a hybrid or a discrete production process (in that order, with only the difference between firms with a continuous production process and firms with a discrete production process being statistically significant). Therefore, it seems that in earlier studies expectations with respect to the influence of the structure of firms' production processes on ABC adoption choices were based on two underlying factors: importance of ABC cost drivers, and task uncertainty as a result of made-to-order production. It seems reasonable to assume that ABC cost drivers are most important in firms with a hybrid production process, and that, on average, the degree of made-to-order production increases as one moves from firms with a continuous production process to firms with a discrete production process. Combining the two factors and using a somewhat more detailed classification with respect to the structure of the production process, I hypothesize that firms with a production process classified as either homogeneous mass production or unit production are less likely to adopt and use ABC than firms with a production process classified as either heterogeneous mass production or serial unit production. Accordingly, the following hypotheses are formulated:

H10: *The larger the number of production lines, the more likely it is that firms will (a) adopt and (b) use ABC.*

H11: *Firms with a production process classified as either heterogeneous mass production or serial unit production are more likely to (a) adopt and (b) use ABC than firms with a production process classified as either homogeneous mass production or unit production.*

3.4 Hypotheses on the relationship between cost system sophistication, purposes of use, and cost system effectiveness

This section presents hypotheses on the relationship between cost system sophistication, purposes of use, and cost system effectiveness.

3.4.1 Cost system sophistication and purposes of use

Cost systems can be used for many different purposes. Major purposes include stock valuation, product pricing, customer profitability analysis, new product design, performance measurement and budgeting (e.g., Kaplan and Cooper, 1998). Kaplan and Cooper (1998) argue that firms essentially need multiple cost systems, to perform three primary functions: (1) valuation of inventory and measurement of the cost of goods sold for financial reporting, (2) estimation of the costs of activities, products, services, and customers, and (3) providing

economic feedback to managers and operators about process efficiency. Previous research indicates, however, that in practice the large majority of firms has only a single cost system, from which different information is extracted for different purposes (e.g., Drury and Tayles, 2005). Concerning the usage of such a system for internal managerial accounting purposes, the normative literature generally distinguishes between cost system usage for strategic purposes, such as product pricing, customer profitability analysis and new product design, and for operational purposes, such as cost modeling, performance measurement and cost reduction (e.g., Cokins, 2001; Player and Keys, 1995). Consistent with this literature, using exploratory factor analysis (see Section 4.5.1), I identify two underlying dimensions of cost system purposes of use among nine widely used purposes in this study: cost system usage (and importance) for strategic purposes and cost system usage (and importance) for operational purposes.[17]

This distinction is important because the normative literature strongly argues that the design (i.e., the level of sophistication) of a cost system should differ, depending on its intended purposes, in order to be optimal (e.g., Cokins, 2001; Player and Keys, 1995). In particular, usage for operational purposes is argued to generally require a more sophisticated cost system design than usage for strategic purposes.[18] For example, on the design of ABC systems, Kaplan and Cooper (1998, p. 138) argue that "Strategic systems may require relatively few activities (typically 20 – 60) while operational […] systems often require several hundred activities to provide a finer view of the processes that underlie production and customer service." Similarly, Player and Keys (1995, p. 31) argue that "As a rule of thumb, a strategic costing system with 15 to 50 [cost] drivers [i.e., cost allocation bases] is generally adequate […] For operational purposes, drill down into the detail activities and drivers until an understanding of what causes cost to occur is established." This understanding then also enables better, and likely more detailed, cause-and-effect drivers to be established that more accurately measure the resources consumed by cost objects. These arguments not only apply to activity-based, but also to traditional cost systems, although in practice their number of cost pools and cost allocation bases will usually be lower (e.g., Al-Omiri and Drury, 2007).

[17] As discussed in Section 4.5.1, the first dimension loads heavily on such items as stock valuation, product pricing and customer profitability analysis, whereas the second dimension loads heavily on such items as cost modeling, performance measurement and cost reduction. Note that it is debatable whether these last purposes should (always) be considered *operational*. For example, Chenhall (2004) recently used exploratory factor analysis on a slightly different list of nine cost system purposes of use to identify underlying dimensions of usefulness of ABCM. This list (similar to mine) included many major purposes for which firms use their cost system, some of which the normative literature generally qualifies as strategic purposes, and others which this literature generally qualifies as operational purposes. Chenhall also found two dimensions, which *in terms of clustering of the items* are almost identical to the two dimensions of 'cost system purposes of use' identified in this study, and which he *both* considered to be *strategic* purposes of ABCM information. What does not seem debatable, however, and what is more important than the exact labeling of the dimensions (which is always somewhat subjective when using exploratory factor analysis), is that the normative literature argues that cost system usage for operational purposes (or 'cost management purposes', as Chenhall refers to these) generally requires a more sophisticated (i.e., a more detailed) cost system design than cost system usage for strategic purposes (or 'product planning purposes', as Chenhall refers to these).

[18] Note that usage for operational purposes especially may benefit from improved visibility into the economics of production processes, whereas usage for strategic purposes especially may benefit from increased accuracy of the reported costs of cost objects.

3.4.2 Cost system sophistication, purposes of use and cost system effectiveness

Pizzini (2006) recently examined the effects of four critical attributes of cost system design on the relevance and usefulness of cost data, and on the financial performance of hospitals. These four attributes relate to the level of detail provided, the ability to disaggregate costs according to behavior, the frequency with which information is reported, and the extent to which variances are calculated. One of Pizzini's main findings was that the level of detail provided was significantly and positively associated with both the relevance and usefulness of cost data. More detailed cost information was also significantly and positively associated with three of her four measures of financial performance. These results indicate that more detailed cost systems provide more relevant and useful cost data, which in turn lead to better financial performance, which (in terms of this study) implies a positive relationship between the level of cost system sophistication and cost system effectiveness.[19] Pizzini's study does not take the purposes for which the cost system is used into account, however.

Concerning the influence of these purposes of use, I first posit that, although it is also possible that cost system usage for multiple purposes has a negative effect on the level of effectiveness of a firm's cost system, as the system may have to compromise on the optimal level of sophistication in order to comply with these multiple purposes, it seems more likely that this effect is mostly positive. That is, I expect that as a firm's cost system is used for a broader range of purposes, the system will be used more intensively for decision making and its users will be more satisfied (i.e., the level of effectiveness will be higher). I expect this relationship to apply to both cost system usage for strategic and for operational purposes. Accordingly, I hypothesize that:

H12: *When cost system usage for strategic purposes is higher, (a) the intensity of use of and (b) the level of satisfaction with the cost system are higher.*

H13: *When cost system usage for operational purposes is higher, (a) the intensity of use of and (b) the level of satisfaction with the cost system are higher.*

In addition, I also posit that the nature of the relationship between the level of cost system sophistication and cost system effectiveness varies, depending on the extent to which the system is used for strategic and for operational purposes. More specifically, I expect these interaction effects to be non-monotonic.[20] Usage for operational purposes is argued to generally require a more sophisticated cost system design than usage for strategic purposes (e.g., Cokins, 2001; Player and Keys, 1995). The normative literature also argues, however,

[19] The attribute 'level of detail provided' in Pizzini's (2006) study is closely related to the construct 'cost system sophistication' as operationalized in this study, and is found to be significantly positively correlated with the number of allocation bases, which is part of this construct, in Pizzini's study. In addition, her measurement of 'usefulness', using a single question that asks respondents to rate the extent to which users rely on cost system data to make decisions, is almost identical to the measurement of 'intensity of use' in this study.

[20] In other words, I expect the effect of cost system sophistication on cost system effectiveness to be negative over a portion of the observed range of the interacting variables, and positive over the remainder of their range (cf. Schoonhoven, 1981). Overall, my analysis is based on a multiplicative interaction (= contingency) model of fit (see Gerdin and Greve, 2008, for an excellent overview of the assumptions underlying this model of fit), which I test using regression analysis including interaction terms, combined with a graphical analysis in order to interpret the form of the interaction effects (see Chapter 6).

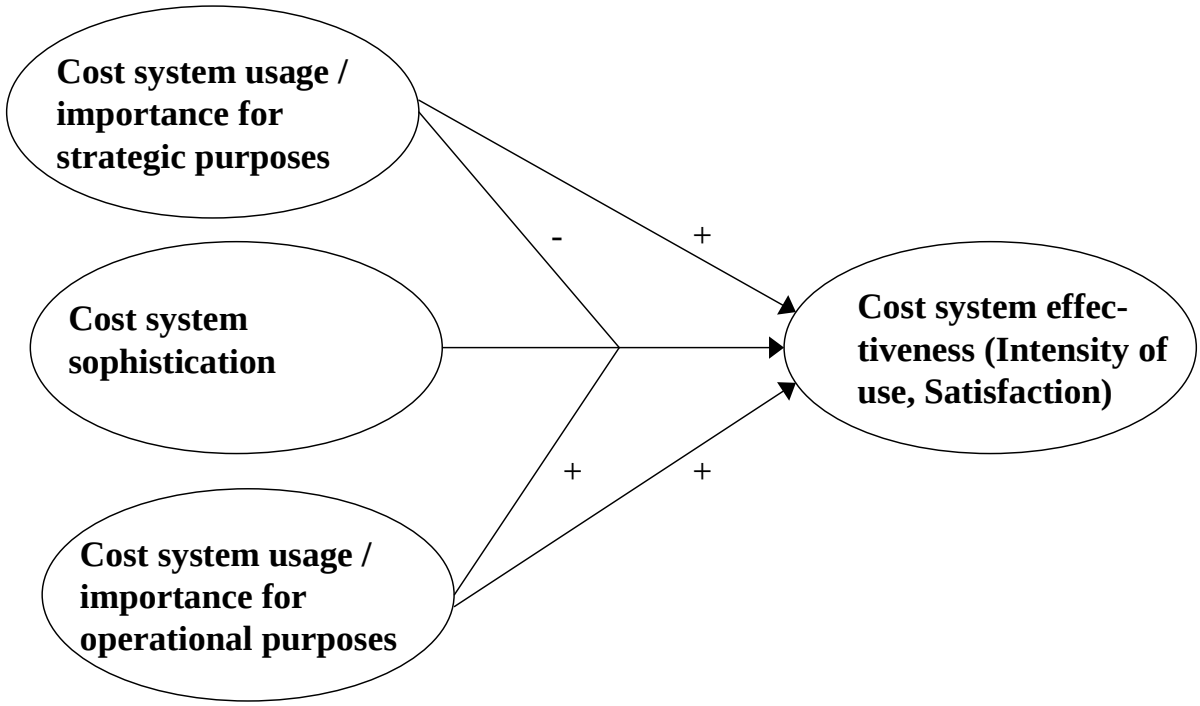
that cost system usage for strategic and for operational purposes may, at least to some extent, be complementary (e.g., Kaplan and Cooper, 1998). Since the large majority of firms is found to have only a single cost system (e.g., Drury and Tayles, 2005), this implies that many firms' cost system compromises on the optimal level of sophistication in order to comply with both strategic and operational purposes. Despite their suggested complementarities, overall I expect that when a firm's cost system is used much for strategic purposes (and thus *relatively* less for operational purposes), a less sophisticated cost system will be most effective, whereas when a firm's cost system is used little for strategic purposes (and thus *relatively* more for operational purposes), a more sophisticated cost system will be most effective. I have similar expectations for usage for operational purposes, but in the opposite directions. These expectations are based on the fact that an overly sophisticated cost system (in relation to its primary purposes) will be unnecessary costly and complex, which for instance is considered to be a major cause of many ABC implementation failures (e.g., Cokins, 2001; Player and Keys, 1995), whereas a cost system that is too unsophisticated necessitates doing more special studies (which are also costly), as the information provided by the system will be too aggregated for decision making. Therefore, I hypothesize that:

H14: *At higher (lower) levels of cost system usage for strategic purposes, cost system sophistication will negatively (positively) affect (a) the intensity of use of and (b) the level of satisfaction with the cost system.*

H15: *At higher (lower) levels of cost system usage for operational purposes, cost system sophistication will positively (negatively) affect (a) the intensity of use of and (b) the level of satisfaction with the cost system.*

Hence, I examine both direct and interactive effects of cost system sophistication and purposes of use on cost system effectiveness. Figure 3.1 shows my conceptual research model describing these relationships. In the empirical tests of this model, I control for the influence of a number of environmental, organizational and technological factors, since these factors not only may influence cost system sophistication and purposes of use, but also cost system intensity of use and satisfaction. The specific control variables used are derived from the literature on the determinants and effectiveness of cost system design.

Figure 3.1: Conceptual research model of the relationship between cost system sophistication, purposes of use, and cost system effectiveness



3.5 Summary and conclusions

This chapter has briefly discussed contingency theory and forms of fit, and also developed the hypotheses that will be tested in the empirical part of the dissertation. Contingency theory, which is the theoretical foundation of this dissertation, contends that there is no universally applicable system of management accounting and control. Instead the most appropriate system depends on the specific circumstances confronting an organization. The alignment (or 'fit') between the design of management accounting and control systems and contextual (or 'contingency') factors is therefore what contingency theory focuses attention on. This dissertation distinguishes between three types of contextual factors: environmental factors, which are related to the external environment of an organization; organizational factors, which are related to the strategy and structure of an organization; and technological factors, which are related to the fundamental work processes in an organization. Eleven hypotheses on the relationship between environmental, organizational and technological factors, and ABC adoption and use have been developed. In addition, four hypotheses on the relationship between cost system sophistication, purposes of use, and cost system effectiveness have been developed.

Chapter 4

Data and measure description

4.1 Introduction

This chapter describes the data and measurement instruments used in the empirical part of this dissertation (i.e., the following two chapters). The data are (almost exclusively) taken from a large-scale survey-study that I conducted in spring 2002, on the use of cost systems in medium-sized, Dutch manufacturing firms. Medium-sized firms were targeted for this study because larger firms commonly consist of a number of organizational units, which may not all use the same (or even a similar) cost system, whereas smaller firms may not use sophisticated cost allocation systems at all. The sample was confined to manufacturing firms, as these are assumed to be a relatively homogeneous group, distinct from non-manufacturing firms.
The remainder of this chapter is structured as follows. Section 4.2 describes the sample and data collection methods used. Section 4.3 discusses the representativeness of the sample. Section 4.4 describes the procedures that were used for dealing with missing values. Next, Section 4.5 discusses the measurement instruments used in this study. Section 4.6 discusses some statistical considerations. Section 4.7 presents and discusses the interrelationships among the contextual factors. Finally, Section 4.8 summarizes and concludes.

4.2 Sample and data collection

I selected the sample for this study from the database REACH[21]. This database contained comprehensive financial and economic information on the largest 5000 Dutch firms for the most recent ten-year period. As the study focused on medium-sized manufacturing firms, firms were included in the sample if (a) they had between 50 and 500 employees, and (b) their main activity was in a manufacturing industry. These criteria yielded 2108 (independent) firms representing all major manufacturing industries. Next, these firms were categorized into two groups, based on the amount of information available in the database. This division was made because resources were limited, and I wanted to spend most resources on those firms for which the database contained the fullest information. The first group contained all firms providing full information for at least three years (672 firms). The second group contained all other firms (1436 firms). Since larger firms have an obligation to disclose this information, the firms in the first group are larger than those in the second group.
Firm-level data on cost systems and characteristics of the firm unavailable in the database were collected with a 14-page questionnaire mailed to either the general manager or the

[21] REACH ('Review and analysis of companies in Holland') is a database from Bureau Van Dijk Electronic Publishing. Nowadays it is part of the pan-European database AMADEUS.

financial manager in each firm.[22] These managers were chosen as respondents as they should be able to provide the necessary information required for this study. Many recommendations from Dillman's (2000) Tailored Design Method were followed in this part of the study. The questionnaire was pretested with six financial managers[23], which led to some (small) changes in the questionnaire. The procedure for firms in the first group consisted of, at the most, four moments of contact: contact by phone, and sending a questionnaire, reminder postcard and replacement questionnaire. More specifically, the procedure for firms in this group (track) consisted of the following steps. First, the respondent in each firm thought to be the most appropriate was contacted by phone and requested to answer the questionnaire. The person thought to be most appropriate was either the person mentioned as contact person in REACH (in almost all cases either the general or financial manager of the firm), or the financial manager of the firm. Second, if the person agreed to participate, the questionnaire was send to him/her. Third, if the respondent had not yet responded within 3 weeks, he/she was sent a reminder postcard. Finally, if the respondent had not yet responded within another 3 weeks, he/she was sent a replacement questionnaire. The procedure for firms in the second group consisted of, at the most, two moments of contact: sending a questionnaire and replacement questionnaire. More specifically, the procedure for firms in this group (track) consisted of the following steps. First, the questionnaire was sent to the respondent in each firm thought to be the most appropriate. Second, if the respondent had not yet responded within 3 weeks, he/she was sent a replacement questionnaire. In all cases, together with the questionnaire and the replacement questionnaire, I sent the respondent an accompanying letter explaining the purpose of the study and guaranteeing confidentiality, as well as a postage-paid return envelope. Also, at the final moment of contact in each procedure, I sent the respondent a postage-paid return card asking the reason(s) for leaving the questionnaire unanswered. The reasons for leaving the questionnaire unanswered (269 firms) were (more than one answer possible): "Questionnaire would take too long to fill out" (52%), "General policy against filling out questionnaires" (30%), "Some of the questions not appropriate for business" (13%), and "Other" (19%).

Eventually, 137 firms from the first group and 81 from the second returned a questionnaire. In addition, 14 questionnaires were returned anonymously. Seven questionnaires were unusable, and are not taken into account in the analyses reported in this dissertation.[24] The overall

[22] In the overall sample (N=225; see Section 4.3), 175 (77.8%) respondents are working as financial managers, 34 (15.1%) as general managers, and 16 (7.1%) did not disclose whether they are working as a financial or a general manager. In order to assess whether the 'type of respondent' has an influence on my results, I first (similar to the wave analysis that I will discuss in Section 4.3) assessed (using regression analysis) the difference in means between financial and general managers in terms of the study variables, controlling for the influence of 'track'. For three of the seventeen variables a statistically significant *conditional* difference in means was found between the two groups: 'cost system sophistication' (*CS_SOPH*)($F(2, 171) = 3.943$, $p = .021$; $b = -1.029$, $p = .042$), 'competition' (*COM*)($F(2, 206) = 4.352$, $p = .014$; $b = -2.412$, $p = .017$), and 'product diversity' (*PD*)($F(2, 206) = 6.548$, $p = .002$; $b = -9.292$, $p < .01$). This indicates that, controlling for the influence of 'track', the level of sophistication of their cost system, the level of intensity of their market's competition, and the number of and the differences between their products (stock keeping units), on average, are significantly lower in the firms of the financial managers than in those of the general managers, which *may* be due to a 'type of respondent' effect. To test for the robustness of my results, I therefore re-estimated all regression models with 'type of respondent' included as an additional control variable. The effect of this variable is not significant in any of the models, and all conclusions concerning the hypotheses are the same as those reported in this dissertation.

[23] More specifically, the questionnaire was pretested with six second-year postgraduate students (attaining education for the title of Register Controller), all working as financial managers in daily life.

[24] Several respondents had skipped (or missed) multiple pages of the questionnaire containing the survey's most important questions, while others overall had too many missing values (> 40%).

usable response rate is therefore 10.7% (= 225 / 2108). For the analyses reported in this dissertation all returned questionnaires are pooled. Except for the difference by design in organizational size, there are no a priori reasons to assume that the responses from firms in the first group will differ from responses from firms in the second.[25] Consistent with this presumption, Chow (and Chow-type) tests[26] (e.g., Greene 2000) for all models show no significant differences between the two groups (at a significance level of .10). The average respondent is 41 years of age (median = 40.5 years), is working at his/her employer for almost 9 years (median = 5 years), and holds his/her position for a little more than 5 years (median = 3 years).

4.3 Sample representativeness

The overall usable response rate in this study is relatively low. Especially in such situations it is important to investigate the representativeness of a sample, i.e., the possibility of non-response bias. Non-response bias refers to the extent to which the respondents to a survey are systematically different from the non-respondents (Van der Stede et al., 2006). I used two widely used methods to assess the extent of non-response bias in my sample: (1) archival analysis (in which I compare the respondents to the non-respondents in terms of industry representation), and (2) wave analysis (in which I compare early to late respondents in terms of relevant study variables).

4.3.1 Archival analysis (industry representation)

Table 4.1 shows the distribution of respondents across industries for the sample yielded from the database, the sample before listwise deletion (N=225), and the sample after listwise deletion (n=193). In order to assess the composition of these two samples, both before and after listwise deletion, in terms of industry representation, I used two procedures. First, I used the one-sample Chi-square test to examine whether the distribution of the two samples is consistent with the sample yielded from the database. For the sample before listwise deletion the result is $\chi^2(13, 225) = 18.09$, $p = .154$; for the sample after listwise deletion the result is $\chi^2(13, 193) = 17.13$, $p = .193$. These results must be treated with care, however, as one of the underlying assumptions of the test statistic is not met in either case. More specifically, this concerns the assumption that none of the expected frequencies should be less than 1, as the sampling distribution of χ^2 is only asymptotically chi-square, i.e., the sampling distribution of χ^2 is the same as the chi-square distribution as the expected frequencies become large (infinite). As explained by Siegel and Castellan (1988), when the expected frequencies are small, the probabilities associated with the chi-square distribution may not be sufficiently close to the probabilities in the sampling distribution of χ^2 for appropriate inferences to be made. In the case of the sample before listwise deletion, the manufacture of coke, refined petroleum products and nuclear fuel industry (DF) has an expected frequency of less than 1, whereas in the case of the sample after listwise deletion, the manufacture of tanning and

[25] A t-test for two independent samples indeed shows a significant difference between the two groups for organizational size in the sample after listwise deletion ($t(191) = 8.335$, $p < .001$). None of the other variables shows a significant difference at a significance level of .10.

[26] The Chow test is an econometric test of whether the coefficients in two *linear* regressions on different datasets are equal (Chow, 1960). Similarly, the Chow-type test is an econometric test of whether the coefficients in two *logistic* regressions on different datasets are equal.

Table 4.1: Distribution of respondents across industries

Industry		Database		Sample before listwise deletion (N = 225)						Sample after listwise deletion (n = 193)					
Code	Title	f	%	f	%	f_e	$f - f_e$	Ratio	χ^2	f	%	f_e	$f - f_e$	Ratio	χ^2
DA	Manufacture of food, beverage and tobacco products	272	12.9%	15	7.1%	27	-12	-45.2%	5.58	13	6.7%	25	-12	-47.8%	5.69
DB	Manufacture of textiles and textile products	80	3.8%	5	2.4%	8	-3	-37.9%	1.15	5	2.6%	7	-2	-31.7%	0.74
DC	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	11	0.5%	3	1.4%	1	2	171.2%	3.24	3	1.6%	1	2	197.9%	3.94
DD	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	53	2.5%	8	3.8%	5	3	50.1%	1.34	5	2.6%	5	0	3.0%	0.00
DE	Manufacture of pulp, paper and paper products; publishers and printers	220	10.4%	24	11.3%	22	2	8.5%	0.16	23	11.9%	20	3	14.2%	0.41
DF	Manufacture of coke, refined petroleum products and nuclear fuel	5	0.2%	0	0.0%	1	-1	-100.0%	0.50	0	0.0%	0	0	-100.0%	0.46
DG	Manufacture of chemicals and chemical products	158	7.5%	17	8.0%	16	1	7.0%	0.08	15	7.8%	14	1	3.7%	0.02
DH	Manufacture of rubber and plastic products	127	6.0%	14	6.6%	13	1	9.6%	0.12	12	6.2%	12	0	3.2%	0.01
DI	Manufacture of other non-metallic mineral products	74	3.5%	11	5.2%	7	4	47.8%	1.70	11	5.7%	7	4	62.4%	2.63
DJ	Manufacture of basic metals and of fabricated metal products	345	16.4%	38	17.9%	35	3	9.5%	0.31	34	17.6%	32	2	7.6%	0.18
DK	Manufacture of machinery and equipment	380	18.0%	47	22.2%	38	9	23.0%	2.02	43	22.3%	35	8	23.6%	1.94
DL	Manufacture of electrical and optical equipment and instruments	154	7.3%	12	5.7%	15	-3	-22.5%	0.79	11	5.7%	14	-3	-22.0%	0.68
DM	Manufacture of transport equipment	126	6.0%	10	4.7%	13	-3	-21.1%	0.56	10	5.2%	12	-2	-13.3%	0.20
DN	Manufacture of furniture, manufacturing n.e.c.	103	4.9%	8	3.8%	10	-2	-22.8%	0.54	8	4.1%	9	-1	-15.2%	0.22
	Total	2108		212					18.09	193					17.13

Notes: Industry classification based on Dutch Central Bureau of Statistics. Ratio is calculated as $(f - f_e) / f_e$; χ^2 is calculated as $(f - f_e)^2 / f_e$ (i.e., the elements sum up to the Chi-square test). The anonymously returned questionnaires are excluded in the samples before and after listwise deletion.

dressing of leather, and of luggage, handbags, saddlery, harness and footwear industry (DC) and (again) the manufacture of coke, refined petroleum products and nuclear fuel industry industry (DF) suffer from this problem. Therefore, it seems inappropriate to use these results as the sole source of evidence for judging industry representation. I therefore also use a second indicator, namely the ratio of the difference between the actual and the expected number of cases in an industry divided by the expected number of observations (see Table 4.1). This ratio has a mean of 0, with deviations from 0 representing percentage differences between the actual and the expected numbers of cases (the ratio being negative if the number of actual cases in an industry is lower than expected, and positive if that number is higher than expected). Even though this procedure adds some substance to the assessment of industry representation, a major weakness is that this ratio is very sensitive to the number of cases in an industry, i.e., in industries with a relatively small number of firms a one-unit change will have a much larger impact on its ratio than a one-unit change will have in industries with a relatively large number of firms. Therefore, this indicator must also be treated with care. Overall, concentrating on the industries with a relatively large number of firms (i.e., an expected number of cases larger than 10), I conclude that the composition of the two samples is sufficiently comparable to the composition of the sample yielded from the database, with some overrepresentation of the manufacture of machinery and equipment industry (DK), and some underrepresentation of the manufacture of food, beverages and tobacco products industry (DA).

4.3.2 Wave analysis (early versus late respondents)

The most widely used method in management accounting research to assess the extent of non-response bias is comparing early to late respondents in terms of relevant study variables (Van der Stede et al., 2006). The idea behind this method is that late respondents are more likely to resemble non-respondents than do early respondents. The usual procedure to conduct this assessment is by comparing the means between the two groups using difference tests (i.e, t-tests for two independent samples). A complicating matter in my situation, however, is that two tracks (with different procedures) have been used to collect the data, after which the data has been pooled (see Section 4.2). Probably partly as a result of the differences in procedures, the proportion of early versus late respondents differs somewhat between the two groups.[27] As a consequence, a straightforward comparison between early and late respondents may provide a biased assessment of any differences between them. Therefore, I decided to use a slightly different approach, in which (using regression analysis) the difference in means between early and late respondents in terms of the study variables is assessed, controlling for the influence of 'track'.[28] Table 4.2 shows the main results of this analysis.

[27] Comparatively, the proportion of early respondents is somewhat larger among firms in the group (track) with the less intensive procedure, whereas the proportion of late respondents is somewhat larger among firms in the group (track) with the more intensive procedure. Even though this association is not statistically significant ($\chi^2(1) = 1.697$, $p = .193$), controlling for these differences provides a more accurate assessment of potential differences between the early and late respondents, since the firms in the two groups (tracks) differ, on average, in terms of organizational size (see Section 4.2).

[28] The regression model is thus (for each study variable): D.V. = $f(D_{tr}, D_{e\text{-}l})$, where D_{tr} is a dummy variable representing the two tracks and $D_{e\text{-}l}$ is a dummy variable representing the conditional difference in means between early and late respondents. This last coefficient is presented in the third column of Table 4.2.

Table 4.2: Conditional differences in means for study variables between early and late respondents

Variables	G_M-tests / F-tests	Conditional differences in means
ABC adoption (*ABC_ADOP*)	$G_M(2) = .464$, $p = .793$	$b = .242$, p = n.r.
ABC use (*ABC_USE*)	$G_M(2) = 5.132$, $p = .077$	$b = .653$, $p = .145$
Cost system sophistication (*CS_SOPH*)	$F(2, 173) = 2.963$, $p = .054$	$b = .629$, $p = .104$
Cost system purposes of use (*CS_PURP*)		
- Cost system usage for … purposes	$F(2, 158) = 3.942$, $p = .021$	$b = .068$, $p = .109$
- Cost system importance for … purposes	$F(2, 167) = 2.377$, $p = .096$	$b = .095$, $p = .513$
Cost system intensity of use (*CS_INTENS*)	$F(2, 207) = 1.341$, $p = .264$	$b = .155$, p = n.r.
Cost system satisfaction (*CS_SATISF*)	$F(2, 208) = .542$, $p = .582$	$b = .102$, p = n.r.
Competition (*COM*)	$F(2, 209) = 1.487$, $p = .228$	$b = .042$, p = n.r.
Perceived environmental uncertainty (*PEU*)	$F(2, 209) = 2.354$, $p = .097$	$b = .055$, $p = .236$
Competitive strategy (*COMS*)	$F(2, 209) = .573$, $p = .565$	$b = .096$, p = n.r.
Vertical differentiation (*VERT*)	$F(2, 209) = .973$, $p = .380$	$b = .170$ p = n.r.
Formalization (*FORM*)	$F(2, 209) = 1.585$, $p = .207$	$b = .143$, p = n.r.
Centralization (*CENT*)	$F(2, 209) = .672$, $p = .512$	$b = .100$, p = n.r.
Size (*SIZE*)	$F(2, 200) = 38.104$, $p = .000$	$b = .101$, $p = .186$
Product diversity (*PD*)	$F(2, 209) = .594$, $p = .553$	$b = 2.043$, p = n.r.
Usage of AMT (*AMT*)	$F(2, 205) = .626$, $p = .536$	$b = .121$, p = n.r.
Production lines (*PRLIN*)	$F(2, 209) = 2.871$, $p = .059$	$b = .484$, $p = .018$

Notes: See Section 4.5 for a description of the study variables. For these analyses, *CS_PURP* is calculated as the (unweighted) average, on both the usage scale and the importance scale, of the nine cost system purposes of use items. "n.r." refers to "not relevant" (given that a Model Chi-square (G_M)-test or F-test is insignificant).

As shown in the table, for *only one of the seventeen* variables ('production lines', *PRLIN*) a statistically significant *conditional* difference in means is found between early and late respondents, with early and late defined as having sent back the initial or the replacement questionnaire, respectively. This indicates that, controlling for the influence of 'track', the number of production lines that a firm operates, on average, is higher among the late respondents than among the early respondents. Therefore, depending on whether the late respondents indeed resemble the non-respondents, this indicates that non-response bias is not a substantial concern in my sample.

4.4 Missing value analysis

As in most survey studies, I experienced some item non-response, i.e., missing values. Item non-response occurs if respondents are unable or reluctant to provide answers to one or more items or if they accidentally skip items, but at the same time produce answers to other items (Bernaards and Sijtsma, 2000). The overall percentage of missing values was less than 3%. Listwise deletion would leave me with less than half of my sample, however, as most returned questionnaires contained at least one missing value. Therefore, missing data were first coded according to their underlying reason: (1) not applicable and/or unknown to respondent, (2) (real) missing value, and (3) impossible value. Next, to test whether the missing values were missing completely at random (MCAR), I performed Little's MCAR test, which was not

significant (χ^2 = 6939.939, *df* = 6910, *p* = .397). This implies that the imputation method has no impact on the results, and therefore any imputation method can be used (Hair et al., 1998). Therefore, where appropriate[29], missing data were handled using the maximum likelihood (ML) method. More specifically, the expectation-maximization (EM) algorithm was used. This algorithm consists of two steps – an expectation and a maximization step – that are repeated multiple times in an iterative process. Eventually this process converges to maximum likelihood estimates of the means, standard deviations and correlations (or, equivalently, the means and the covariance matrix) for all variables. These summary statistics can then be used to get consistent estimates of the parameters of interest (Allison, 2001). The questions concerning the 'usage of AMT' (*AMT*) construct were treated differently. Here all responses scoring –1 (not applicable and/or unknown to respondent) or –2 ((real)missing value) were replaced with the value 1 (not at all). It seems reasonable to assume that firms of which the respondent answered that a certain advanced manufacturing technology was unknown to him/her, or left the item concerning this technology unanswered, are not using the technology. The reason for not handling these items with the ML method is that the univariate distributions for the items of this measure were highly skewed (i.e., nonnormal). In principle this could of course be dealt with by transforming the variables before handling them with the ML method, but this was deemed inappropriate as the nonnormality was caused by the mixed-type nature of the items (i.e., each observed variable is a discrete-continuous mixture). All remaining missing values for the contextual factors, including those for the question concerning the 'production process' (*PRPRO*) construct as this is a categorical variable, were handled using listwise deletion. This procedure led to the sample after listwise deletion (*n*=193).

For the analyses reported in the empirical part of this dissertation, the available number of observations is less than the overall sample, however. For the main analyses reported in Chapter 5, the effective sample size is 191, as I removed two observations from the dataset after an extensive examination of logistic regression diagnostics (see Section 5.3). For the main analyses reported in Chapter 6, the effective sample size is 133. This decrease in the number of observations is caused by three major reasons. First, I concentrate on firms using absorption costing in Chapter 6. Moreover, in the questionnaire respondents were asked to answer all questions concerning cost system sophistication, purposes of use, intensity of use and satisfaction, for their firm's cost system that (at least) is used for the calculation and processing of its manufacturing costs. Respondents from firms that only used variable costing (15 firms) were asked to skip the questions concerning cost system sophistication and purposes of use, as the cost system sophistication questions are irrelevant for these firms. Second, there were quite a few missing values for the questions concerning cost system sophistication and (especially) purposes of use. As I considered it inappropriate to use the ML method for these questions, these were handled using listwise deletion. Finally, I removed four observations from the dataset after an extensive examination of regression diagnostics (see Section 6.3).

[29] More specifically, for questions v2_3, v3_3, v3_4, v3_5, v3_6, v3_7, v3_8, v3_9, v3_10, v3_11, v3_12, v3_13 and v3_14 (where, for example, v2_3 refers to Part Two, Question 3 of the questionnaire).

4.5 Measures

Table 4.3 describes all variables examined in this study, and the measurement instruments used to measure them (see also Appendix A). Except for the data on the firms' industry and size, which were collected from the database out of which the firms were selected, all data are from the survey. Most measurement instruments are multi-item, use five-point Likert-type scales, and are taken or adapted from earlier studies.[30] For all multi-item measurement instruments (except the 'cost system purposes of use' instrument) composite scales were constructed by averaging the scores on their indicators. I had two reasons for using average scores, as opposed to factor scores, for these measurement instruments. First, it is consistent with the way these earlier studies have used these instruments. Second, and more important, average scores were used because these instruments are considered to be formative-indicator constructs (linear combinations in which the construct depends upon the indicators) in this study, as opposed to reflective-indicator constructs (linear combinations in which the indicators are the results of the construct)[31], as the earlier studies have (implicitly) done (Bisbe et al., 2007; Bollen and Lennox, 1991). Each of their elements captures differing aspects of the constructs, that collectively define the constructs, that do not necessarily have to covary, and that each may have different antecedents and/or consequences (cf. Jarvis et al., 2003). This implies that most commonly used reliability and validity tests are meaningless with formative-indicator constructs (Bisbe et al., 2007; Jarvis et al., 2003).[32] Although not without problems (Bollen and Lennox, 1991), given current knowledge about how to handle formative-indicator constructs, computing composite (e.g., average) scores of their indicators seems to be an appropriate way to handle them (e.g., Wegener and Fabrigar, 2000). Finally, four measurement instruments are nonlinear. The 'cost system sophistication' (*CS_SOPH*), 'product diversity' (*PD*) and 'production lines' (*PRLIN*) constructs are measured using a $\log_2$ N scale, and are therefore inherently nonlinear; the 'organizational size' (*SIZE*) scale is transformed into a ln-scale because the distribution of the original values was highly skewed (i.e., nonnormal).

[30] A translation-backtranslation procedure was used for these instruments. The instruments were translated into Dutch by me, and back-translated by two colleagues. No meaningful differences between the original and the back-translated instruments appeared.

[31] In other words, with formative-indicator constructs the indicators determine the level of the construct, instead of the other way around. For example, when conceptualizing the 'perceived environmental uncertainty' (PEU) construct as a formative-indicator construct, the level of perceived environmental uncertainty can increase as a result of an increase in the uncertainty with respect to suppliers' actions *or* customer demands, tastes and preferences *or* deregulation and globalization, etc.; an increase in the level of perceived environmental uncertainty does not cause an increase in the uncertainty with respect to suppliers' actions *and* customer demands, tastes and preferences *and* deregulation and globalization, etc. (as conceptualizing PEU as a reflective-indicator construct would presume).

[32] For comparative reasons only, I calculated Cronbach's coefficient alphas for all multi-item measurement instruments used in this study, with the following results: COM: .30; PEU: .59; COMS: .70; FORM: .41; CENT: .84; PD (second dimension only): .63; AMT: .77. Overall, these alphas are similar to those reported in the earlier studies (e.g., Boyer et al., 1997; Govindarajan, 1984; Williams and Seaman, 2001), which in general would consider (most of) these constructs to be internally consistent. However, formative-indicator constructs do *not* have to be internally consistent, and these analyses thus are *un*informative. Also, note that Cronbach's coefficient alphas are a function of two parameters (e.g., Schmitt, 1996): (1) the inter-item correlations, and (2) the number of items in a scale. Even with low levels of inter-item correlations, a scale may still show an "acceptable level of alpha", namely when the number of items in the scale is large. This compensatory effect also seems to influence the Cronbach's coefficient alphas reported above.

The rest of this section describes all measurement instruments that will be used in the empirical part of this dissertation (i.e., in the following two chapters). In general, the order in which the measurement instruments are described is similar to the order in which they appeared in the questionnaire (see Appendix B for the complete questionnaire (in Dutch)).

Table 4.3: Description of variables and measurement instruments

Variables	Measurement instruments
- ABC adopter (*ABC_ADOP*)	- Firm that is either using or implementing ABC
- ABC user (*ABC_USE*)	- Firm that is using ABC
- ABC non-adopter/user	- Firm that is neither using nor implementing ABC
- Cost system sophistication (*CS_SOPH*)	- Number of cost pools used, measured on a $\log_2$ N scale, added to number of cost allocation bases used, also measured on a $\log_2$ N scale
- Cost system purposes of use (*CS_PURP*)	- A question with respect to whether a firm uses its cost system for each of nine widely used general purposes of cost systems, and if so, to what extent the cost system is of importance for that purpose
- Cost system intensity of use (*CS_INTENS*)	- Single question, measured on a five-point scale, with respect to the extent to which the cost system is used to make decisions
- Cost system satisfaction (*CS_SATISF*)	- Single question, measured on a five-point scale, with respect to the extent to which users of the information of the cost system are satisfied with the system
Environmental factors	
- Competition (*COM*)	- Average of three items, measured on a five-point scale, with respect to the level of intensity of the competition in the market(s) (instrument adapted from Khandwalla, 1972)
- Perceived environmental uncertainty (*PEU*)	- Average of eight items, measured on a five-point scale and weighted based on their level of importance, with respect to the level of predictability of the external environment during the last five years (instrument taken from Hoque, 2001)
Organizational factors	
- Competitive strategy (*COMS*)	- Average of six items, measured on a five-point scale, with respect to the level of product/market innovation (instrument taken from Delery and Doty, 1996)
- Vertical differentiation (*VERT*)	- Number of hierarchical levels between senior management and team leaders (instrument taken from Gosselin, 1997)
- Formalization (*FORM*)	- Average of four items, measured on a five-point scale, with respect to the degree to which tasks are standardized (instrument taken from Gosselin, 1997)
- Centralization (*CENT*)	- Average of twelve items, measured on a five-point scale, with respect to the degree to which power and control in the firm are concentrated in the hands of relatively few individuals (instrument taken from Gosselin, 1997)
- Size (*SIZE*)	- Ln-transformation of average number of employees in the three years preceding the data collection (Source data: REACH)

Technological factors	
- Product diversity (*PD*)	- Number of different products (stock keeping units) produced, measured on a $\log_2$ N scale, multiplied by the average of three items, measured on a five-point scale, with respect to the extent to which these products (stock keeping units) differ on average
- Usage of AMT (*AMT*)	- Average of nine items, measured on a five-point scale, with respect to the extent to which advanced manufacturing technologies are used in the production process in the firm (instrument taken from Boyer et al., 1996)
- Production lines (*PRLIN*)	- Number of production lines, measured on a $\log_2$ N scale
- Production process (*PRPRO*)	- Dummy variable classifying the structure of the production process in the firm, where 1 = homogeneous mass production (the reference group), 2 = heterogeneous mass production, 3 = serial unit production, and 4 = unit production

4.5.1 Cost system characteristics

ABC Adoption (ABC_ADOP) and *ABC use (ABC_USE)*. In most prior surveys firms using ABC have either been identified with a question directly asking respondents to indicate whether their firm uses ABC or not (e.g., Kallunki and Silvola, 2008), or with a question asking respondents to indicate which of several stages towards ABC implementation best describes their firm's current situation (e.g., Al-Omiri and Drury, 2007). Following this last procedure, in this study respondents were asked to indicate which of five stages best described their firm's current situation with respect to ABC. Firms of which the respondents indicated that they were using ABC are considered ABC users (*ABC_USE* = 1), whereas firms of which the respondents indicated that they were either implementing or using ABC are considered ABC adopters (*ABC_ADOP* = 1).

To obtain a better understanding of their actual ABC practices, the questionnaire contained several additional questions aimed only at the ABC adopters, about aspects of their level of implementation and way(s) of using ABC (see Section 5.4). As expected, Mann-Whitney tests show that the sample firms that indicated to be using ABC had finished significantly more of their planned implementation process than the firms that indicated to be implementing ABC (z = -2.674, p = .007), and also that their implementation process (so far) had gone according to plan to a larger extent (z = -2.160, p = .031).

Cost system sophistication (CS_SOPH) was measured using two questions (cf. Drury and Tayles, 2005). In these questions respondents were asked to indicate the number of cost pools and cost allocation bases used in their firm's cost system. Both were measured using a $\log_2$ N scale, where N is the number of cost pools and cost allocation bases; i.e., it is assumed that their nature is best reflected by a base 2 logarithmic function (see Table 4.4). I used this logarithmic function because I posit the influence of both the number of cost pools and the number of cost allocation bases on cost system sophistication to be nonlinear.[33] A composite scale was constructed by adding the two $\log_2$ N scores for each firm.[34]

[33] A one-unit in-/decrease in the number of cost pools is assumed to have a larger influence on the level of cost system sophistication when the system has only one or a few cost pools, than when the system already has many cost pools. A similar argument can be made for the number of cost allocation bases. The number of cost pools

Table 4.4: Log_2 N scale

Response Categories	1- 2 ❑	3- 4 ❑	5- 8 ❑	9- 16 ❑	17- 32 ❑	33- 64 ❑	65-128 ❑	…
N	2	4	8	16	32	64	128	…
Log_2 N	1	2	3	4	5	6	7	…

Cost system purposes of use (CS_PURP). Respondents were asked to indicate whether their firm uses its cost system for each of nine widely used purposes of cost systems (see Table 4.5), and if so, to what extent the cost system is of importance for that purpose. Appendix 4.A shows the usage rates and levels of importance for the nine cost system purposes of use, as well as their intercorrelations. The nine purposes were taken from Innes and Mitchell (1995b), and have also been used by Innes et al. (2000) and Cotton et al. (2003). In order to identify underlying dimensions of cost system purposes of use, which refers to the range (scope) of purposes for which the cost system is used, among the nine purposes (items), exploratory factor analysis was used, on both the dichotomous usage scale and the five-point importance scale.[35] Table 4.5 presents the results of using principle axis factoring and an oblique rotation (Direct Oblimin) to extract two factors with (initial) eigenvalues greater than one for each scale. For the usage scale the two factors explain 36.8 percent of the total variance of the nine items[36], and for the importance scale 33.9 percent. The factor analyses yield well-behaved solutions, with items typically loading on a single factor with a loading greater than .300 and few significant cross-loadings[37], that are very similar for the usage and importance scales (see

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and cost allocation bases indicated by the respondents were transformed into log_2 scores by taking the log base 2 of the highest number in each response category. On average, the sample firms' cost systems had 9-16 cost pools (*M*=4.113, *SD*=1.363) and 5-8 cost allocation bases (*M*=3.023, *SD*=1.593).

[34] As an additional robustness check, all analyses have also been conducted using a second, more comprehensive measure for 'cost system sophistication', which was not only based on the two questions (about the *number* of cost pools and cost allocation bases) that I used to construct *CS_SOPH*, but also on two additional ones, in which respondents were asked to indicate the *nature* of cost pools and cost allocation bases used in their firm's cost system. Specifically, the respondents were first asked which type of cost pools are used in their firm's cost system: functionally oriented (e.g., departmental) cost pools, functionally and process oriented cost pools, or process oriented (e.g., activity) cost pools. Next, they were asked which type of cost allocation bases are used in their firm's cost system: only unit-level allocation bases, both unit-level and batch-level allocation bases, or both unit-level, batch-level and product-sustaining allocation bases. For both characteristics, the three options were coded as 1, 2 and 3. A composite scale was constructed for this measure by standardizing the scores for each of the four cost system design characteristics and then taking the average of the resulting Z-scores. The correlation between the two 'cost system sophistication' measures is quite high (r = .762). As a consequence, the regression analysis results are comparable to the results as reported in this dissertation (see Chapter 6).

[35] This was done because this is a typical example of mixed-type data, i.e., data in which each observed variable is a discrete-continuous mixture, as the extent to which the cost system is of importance for a particular purpose is conditional on whether the firm uses its cost system for this purpose. For the factor analysis on the importance scale, all (missing) values for the firms that do not use their cost system for a particular purpose have been coded 1 ('not at all').

[36] The application of classical linear factor analysis has been argued to potentially distort the underlying structure of dichotomous data (e.g., Woods, 2002). One solution for handling this potential distortion is to use tetrachoric correlations rather than phi coefficients (Woods, 2002). Although using tetrachoric correlations provided some estimation problems (i.e., a nonpositive definite matrix that remained after smoothing the correlation matrix using MicroFACT 2.0; Waller, 2000), the resulting factor structure was very similar to the factor structure as reported in this dissertation, although the factor loadings were somewhat stronger in magnitude.

[37] Note that two items in the analysis for the usage scale and one item in the analysis for the importance scale have cross-loadings greater than .300. This is probably caused by the ambiguous nature of these items (purposes) as far as their strategic or operational nature is concerned.

Panel A and B, respectively). The reliability of all dimensions (α ranges between .61 and .72) is adequate.

Table 4.5: Exploratory factor analysis results for the cost system purposes of use items

	Panel A: Cost system usage		**Panel B: Cost system importance**	
Items	Factor 1: Cost system usage for operational purposes	Factor 2: Cost system usage for strategic purposes	Factor 1: Cost system importance for operational purposes	Factor 2: Cost system importance for strategic purposes
Cost reduction	**.553**	-.040	**.547**	-.057
Product pricing	-.143	**.580**	-.054	**.538**
Performance measurement	**.616**	.070	**.596**	.041
Cost modeling	**.795**	-.134	**.708**	-.094
Budgeting	**.396**	.015	**.448**	.059
Customer profitability analysis	**.313**	**.513**	.205	**.467**
Product output decisions	**.482**	**.370**	**.426**	**.362**
New product design	.147	**.487**	.093	**.592**
Stock valuation	-.046	**.586**	-.114	**.586**
Variance explained by each factor	26.3%	10.5%	23.9%	10.0%
Cronbach's coefficient alpha	.72	.61	.69	.63

Notes: *n*=133; Oblique-rotated loadings above .300 in bold.

Inspection of the primary loadings (values greater than .300) is used to interpret each of the two dimensions of cost system purposes of use.[38] The first factor, which loads heavily on such items as cost modeling, performance measurement and cost reduction, is interpreted as 'cost system usage / importance for operational purposes' (*OPER_USE* and *OPER_IMP*). The second factor, which loads heavily on such items as stock valuation[39], product pricing and customer profitability analysis, is interpreted as 'cost system usage / importance for strategic purposes' (*STRAT_USE* and *STRAT_IMP*).[40] The correlations between the two factors are .390 and .422, respectively (see Table 6.2), indicating that usage, and importance, of cost systems for strategic and operational purposes is, at least to some extent, complementary.

[38] Note that Chenhall (2004) has identified two dimensions of usefulness of ABCM, which *in terms of clustering of the items* are almost identical to the two dimensions of cost system purposes of use identified in this study.

[39] Given the debatable nature of stock valuation as being a strategic purpose of cost system usage (as in general it mainly serves an external financial reporting purpose), as an additional robustness check, all analyses have also been conducted with this item excluded. The results of these analyses are comparable to the results of the analyses with stock valuation included. The factor structures resulting from the exploratory factor analyses are very similar to the factor structures as reported in this dissertation. Also, the correlations between the factor scores calculated for both situations are very high ($r(131)$ ranges between .930 and .998, all $p < .001$). As a consequence, the regression analysis results are also comparable to the results as reported in this dissertation (see Chapter 6).

[40] In order to validate the two dimensions of cost system purposes of use, I extensively compared the factor structures resulting from the exploratory factor analyses to classifications of strategic versus operational purposes of cost systems in the literature (e.g., Cokins, 2001; Kaplan and Cooper, 1998; Player and Keys, 1995), and overall found them to be consistent.

Factor scores (calculated using Thurstone's least squares regression approach) are used to measure the two dimensions of cost system purposes of use.

Cost system effectiveness. I used two proxies to measure the effectiveness of firms' cost systems.[41] The first proxy, *cost system intensity of use (CS_INTENS)*, was measured with a single question asking respondents, on a five-point scale ranging from 1 (not at all) to 5 (to a very great extent), to rate the extent to which the cost system is used to make decisions in their firm.[42] The second proxy, *cost system satisfaction (CS_SATISF)*, was measured with a single question asking respondents, on a five-point scale ranging from 1 (not at all) to 5 (to a very great extent), to rate the extent to which users of the information of the cost system are satisfied with the system in their firm.[43]

4.5.2 Contextual characteristics

4.5.2.1 Environmental factors

Competition (COM) was measured using an (adapted) instrument developed by Khandwalla (1972). Respondents were asked, on a five-point scale ranging from 1 (not at all) to 5 (to a very great extent), to indicate the intensity of their firm's market competition with respect to three elements: price competition, product competition and marketing competition. A composite scale was constructed by averaging the scores on these three items.

Perceived environmental uncertainty (PEU) was measured using an instrument developed by Govindarajan (1984) and Gordon and Narayanan (1984), and adapted by Hoque (2001). Respondents were asked, on a five-point scale ranging from 1 (very unpredictable) to 5 (very predictable), to indicate their perceptions of the predictability of eight elements of the firm's external environment during the last five years. Next, respondents were asked, also on a five-point scale ranging from 1 (not at all) to 5 (to a very great extent), to indicate the extent to which these elements are important for the success or failure of their firm. The answers given

[41] As an additional robustness check, all analyses have also been conducted using a third, more comprehensive measure for cost system effectiveness. This measure was constructed by standardizing the scores for the cost system intensity of use and the cost system satisfaction proxies and then taking the average of the resulting Z-scores. Regression analysis shows that, when using this third, more comprehensive cost system effectiveness measure, *all* hypothesized simple and interaction effects as tested in Chapter 6 are significant.

[42] Note that this proxy is similar to, but conceptually different from, the two dimensions of cost system purposes of use. It is very well conceivable that there are firms that use their cost system with high (low) intensity, but for a limited (broad) range (scope) of purposes, although in general these two aspects will probably be (positively) related (see also H12 and H13). In order to explore the discriminant validity of these constructs, I performed an exploratory factor analysis on the nine items of cost system purposes of use and on the two proxies for cost system effectiveness simultaneously. I obtained a very clear three-factor structure, with all items loading on their respective construct and without significant cross-loadings (other than those already shown in Table 4.5), which provides empirical evidence on their discriminant validity.

[43] Note that both proxies for 'cost system effectiveness' have been measured using single-item measures, which option was chosen given the (already 14-pages) length of the questionnaire. Such measures are generally argued to be less reliable than multi-item measures. Note also that the respondents had to rate the intensity of use of and level of satisfaction with their firm's cost system for all users together, which (even though the respondents are general and financial managers, which were chosen as they likely are most knowledgeable about such issues in their firm), may also have led to some unreliability. As a consequence, given that these two proxies have been used as the dependent variables in the regression analysis, their use may have negatively influenced the power of the analysis.

to the first question were for each item weighted (multiplied) with the answers given to the second, square roots were taken, and the average of respondents' scores were taken to derive a composite scale.

4.5.2.2 Organizational factors

Competitive strategy (COMS) was measured using an instrument developed by Segev (1989), and adapted by Delery and Doty (1996). This instrument considers the strategic contingency variable best representing the Miles and Snow (1978) typology to be rate of product/market innovation. Respondents were asked, on a five-point scale ranging from 1 (not at all) to 5 (to a very great extent), to indicate the extent to which six product/market innovation characteristics apply to their firm. A composite scale was constructed by averaging the scores on these six items.

Table 4.6: Pearson correlations of *COMS* and the level of importance of twelve performance dimensions

Items	*r*	*p*	*Items*	*r*	*p*
Operating profit	-.062	.393	Market development	**.190**	**.008**
Return on investment	.011	.879	Research and development	**.281**	**.000**
Sales growth	.111	.126	Cost reduction programs	-.050	.494
Market share	**.159**	**.027**	Personnel development	.053	.467
Cash flow from operation	-.064	.375	Workplace relations	-.022	.764
New product development	**.298**	**.000**	Employee health and safety	.043	.552

Notes: n=193; all associations that are significant at the .10 level (two-tailed) are in bold.

To assess the validity of the *COMS* measure in a broader network of relationships (i.e., its nomological validity[44]), correlations were estimated with twelve items measuring the importance of performance dimensions for the total performance evaluation of the firm. In the questionnaire these questions were somewhat separated, which provides some protection against 'memory effects'. As the scores on the *COMS* measure represent the level of product/market innovation of the firms, with high- and low-scoring firms considered to be prospectors and defenders respectively, the measure was expected to correlate strongly with performance dimensions related to innovativeness. As shown in Table 4.6, *COMS* is significantly positively correlated with four performance dimensions: market share, new product development, market development, and research and development. As these four dimensions are clearly related to innovativeness, these results provide some evidence of the measure's nomological validity.

Vertical differentiation (VD) was measured as the total number of hierarchical levels between senior management and teamleaders in the respondents' firm (cf. Gosselin, 1997).

[44] Nomological validity refers to whether the measure of a construct relates to measures of other constructs with which it is theoretically expected to be correlated; that is, considering a nomological or theoretical network of constructs, does the measure behave in theoretically expected ways? (Viswanathan, 2005).

Formalization (FORM) was measured using four statements about the extent to which rules, procedures and policies are standardized in the respondents' firm. This instrument was taken from Gosselin (1997), who adapted it from Robbins (1983). A composite scale was constructed by averaging the scores on these four statements pertaining to formalization.

Centralization (CENT) was measured using a series of twelve standard decisions and identifying on a five-point scale, ranging from teamleader to head office manager, the level at which decisions are made. This instrument was taken from Gosselin (1997), who adapted it from Pugh et al. (1968). A composite score was constructed by averaging the scores on these twelve decision items.

Organizational size (SIZE) was measured as the number of employees. For this measure the data were obtained from the REACH database. Unfortunately, the database contained quite some missing data for this measure. In order to overcome this problem, for this measure the average was taken of all reported figures for the period 1999 up to and including 2001; i.e., for some firms the measure is based on one figure only (e.g., as reported ultimo 1999), whereas for others the measure is based on three figures (e.g., as reported ultimo 1999, 2000 and 2001). Even though the values do not relate to one and the same point in time for all firms, this solution was considered the best possible. Moreover, the values do provide good insight in the *relative* size differences between the firms over the three-year period. The scale is transformed into a ln-scale because the distribution of the original values was highly skewed (i.e., nonnormal).

4.5.2.3 Technological factors

Product diversity (PD). In most prior surveys on ABC adoption, product diversity has either been measured as the number of products (or product variants) produced in a firm (e.g., Malmi, 1999), or by using a composite scale of multiple items with respect to the complexity (diversity) of manufacturing and costing in a firm (e.g., Krumwiede, 1998). Both types of measures seem to insufficiently capture the exact nature of product diversity. As emphasized by Abernethy et al. (2001), producing multiple products does not in itself generate a demand for an ABC system. It is only when these products differ in terms of, for example, the batch sizes in which they are produced, that individual products will consume disproportionate levels of overhead resources relative to their production volumes and the potential for the reporting of distorted product costs by traditional cost systems becomes significant. On the other hand, when a firm produces only a small number of products, the demand for an ABC system will in general be low, even when these products differ substantially. Hence, the nature of product diversity is not so much reflected in either (a) the number of products produced or (b) the extent to which the products differ from each other on several, relevant dimensions, but in their *combined* effect. In line with this reasoning, in this study *PD* was measured by two questions. First, respondents were asked to indicate the number of different products (stockkeeping units) produced in their firm. This was measured using a $\log_2 N$ scale, where N is the number of products produced; i.e., it is assumed that the nature of product diversity is best reflected by a base 2 logarithmic function. Note that this function is nonlinear (concave): a one-unit in-/decrease in the number of products produced is assumed to have a larger influence on the level of product diversity when the firm produces only one or a few

products, than when the firm already produces many products.[45] Second, respondents were asked to indicate to what extent the products (stockkeeping units) produced in their firm differ on average on three dimensions: physical size, complexity and batch size. The $\log_2$ N scores were multiplied by the average of the scores on the three dimensions to obtain the measure of product diversity.

Usage of AMT (AMT) was measured using the part of an (adapted) instrument developed by Boyer et al. (1996) concentrating on manufacturing AMTs.[46] Respondents were asked, on a five-point scale ranging from 1 (not at all) to 5 (to a very great extent), to indicate the extent to which nine advanced manufacturing technologies are used in their firm's production process. A composite scale was constructed by averaging the scores on these nine items.

Production lines (PRLIN). In order to measure *PRLIN*, respondents were asked to indicate the number of production lines in their firm. Similar to product diversity (*PD*), this was measured using a $\log_2$ N scale.

Production process (PRPRO). In order to measure *PRPRO*, respondents were asked to indicate which of the following four classifications best describes the structure of their firm's production process: homogeneous mass production (*HomMass*), heterogeneous mass production (*HetMass*), serial unit production (*SerUnit*), or unit production (*Unit*).

4.6 Some statistical considerations

For the analyses that will be presented in Chapter 5, t-tests for two independent samples and logistic regression analysis including interaction terms are used to examine the hypotheses on the relationship between environmental, organizational and technological factors, and ABC adoption and use. For each category of factors, separate models are estimated for ABC adoption and for ABC use. In all cases, however, ABC adopters and ABC users are compared with the same group, ABC non-adopters/users. This means that in the analyses of ABC users, firms of which the respondents indicated that they are currently implementing ABC are left out of the estimation samples. Such firms probably have more in common with users of ABC, than with non-users. Therefore, considering them to be ABC non-users would possibly distort any potential differences between the groups. Also, all test results are interpreted using two-tailed values, and at a significance level of .10. This seems a reasonable strategy given the

[45] The number of products produced in the firms indicated by the respondents were transformed into $\log_2$ scores by taking the log base 2 of the highest number in each response category. I used response categories instead of asking respondents to provide specific numbers, as the latter option would likely have led to more missing values and/or a higher level of unreliability.

[46] Compared to the original instrument two adaptations were made. First, in order to be consistent throughout the questionnaire, a five-point scale was used instead of the seven-point scale used by Boyer et al. (1996). Second, instead of asking respondents to indicate the amount of investment made in the AMTs on a scale ranging from "no investment" to "heavy investment" as Boyer et al. (1996) did, respondents were asked to indicate the extent to which the AMTs are used in their firm's production process. This last adaptation was made in order to address two shortcomings identified by Boyer and Pagell (2000): (1) that the original instrument does not discriminate between technological leaders and firms that invest a lot of money in technologies that end up not (or hardly) being actually used, and (2) that the original instrument implicitly assumes that a heavy investment is an important investment, which is not necessarily always the case.

inconclusive results of prior research in this area.[47] Furthermore, all continuous independent variables have been mean centered before entering them in the logistic regression models. This procedure is widely recommended when estimating models containing interactions (e.g., Cohen et al., 2003), as in such models centering has both interpretational advantages (as it yields meaningful interpretations of each first-order regression coefficient of independent variables entered into the regression model), and eliminates nonessential multicollinearity. In regression models containing interactions centering changes the value of all coefficients except the one for the highest order term; in regression models containing no interactions centering only changes the value of the intercept.

For the analyses that will be presented in Chapter 6, correlation coefficients and regression analysis including interaction terms are used to examine the hypotheses on the relationship between cost system sophistication, purposes of use, and cost system effectiveness. Given the complexity of the main estimated models, all test results are again interpreted using two-tailed values, and at a significance level of .10. Also, again all continuous independent variables were mean centered before entering them in the models.[48]

4.7 Interrelationships among the contextual characteristics

In order to provide insight into the interrelationships among the contextual characteristics, Table 4.7 shows the Pearson correlations for the contextual (environmental, organizational and technological) factors examined in this study. Many of these correlations are statistically significant. As shown in the table, *COM* is positively correlated with *PEU*, *COMS* and *PD*, whereas *PEU* is also positively correlated with *VERT* and *AMT*. This indicates that as firms face a higher level of intensity of market competition, they perceive their environment as more uncertain, have a higher level of product/market innovation and produce a larger number of and more different products (stock keeping units). As firms perceive their environment as more uncertain, they have more hierarchical levels and use more advanced manufacturing technologies. Of the organizational factors, *COMS* is also positively correlated with *PD* and *AMT*, *VERT* is also positively correlated with *PD*, *AMT* and *PRLIN*, *FORM* is also positively correlated with *CENT* and *AMT*, whereas *SIZE* is also positively correlated with *PRLIN*. This indicates that as firms have a higher level of product/market innovation, they produce a larger number of and more different products (stock keeping units), use more advanced manufacturing technologies, and operate a larger number of production lines. As firms have more hierarchical levels, they produce a larger number of and more different products (stock keeping units), use more advanced manufacturing technologies and operate a larger number of production lines. As firms are more standardized, they are more centralized

[47] To date, hardly any research has been conducted on sample size requirements for logistic regression analysis. Peduzzi et al. (1996) examined the issue of how many events (the less common of the two possible outcomes) per independent variable are needed to obtain reliable estimates of regression coefficients when fitting a logistic regression model. Their results suggest that the number of events divided by the number of independent variables should be at least 10, and preferably more. Peduzzi et al. only considered main effects models containing discrete independent variables, however. Moreover, they provide no information about the bivariate distributions of outcome by independent variables. Therefore, the applicability of their results in other settings is still uncertain (Hosmer and Lemeshow, 2000).

[48] Variance inflation factors (VIFs) indicate that, after mean centering, multicollinearity is not a problem in any of the regression analyses (below 1.5 for the continuous independent variables, and below 4.0 for the dummy independent variables).

Table 4.7: Pearson correlations for the contextual factors

Variables	COM	PEU	COMS	VERT	FORM	CENT	SIZE	PD	AMT	PRLIN	HomMass	HetMass	SerUnit	Unit
COM	-													
PEU	.257***	-												
COMS	.313***	.099	-											
VERT	-.040	.138*	.028	-										
FORM	-.104	-.030	-.090	.051	-									
CENT	.019	.062	-.086	.111	.162**	-								
SIZE	.015	.011	.102	.058	-.059	.026	-							
PD	.219***	.055	.357***	.152**	-.045	-.033	.043	-						
AMT	.061	.130*	.226**	.180**	.191***	-.077	.020	.172**	-					
PRLIN	-.019	.071	.081	.186***	-.005	.061	.147**	.225***	.257***	-				
HomMass	.009	.007	-.090	-.076	.085	.103	-.076	-.119*	.085	-.002	-			
HetMass	.004	-.018	.018	.263***	.052	.147**	.154**	.019	.069	.277***	-.169**	-		
SerUnit	.053	-.052	.021	-.116	-.027	.042	-.136*	.119*	.058	-.021	-.260***	-.523***	-	
Unit	-.073	.076	.015	-.087	-.077	-.270***	.050	-.086	-.196***	-.264***	-.155**	-.312***	-.480***	-

Notes: *n*=193; ***, **, * indicates significance at the .01, .05 and .10 level (two-tailed), respectively.

and use more advanced manufacturing technologies. Finally, larger firms operate more production lines. Of the technological factors, *PD* is also positively correlated with *AMT* and *PRLIN*, whereas *AMT* is also positively correlated with *PRLIN*. This indicates that as firms produce a larger number of and more different products (stock keeping units), they use more advanced manufacturing technologies and operate a larger number of production lines. As firms use more advanced manufacturing technologies, they operate a larger number of production lines.

The Pearson (point-biserial) correlations with the dichotomous variables show that *HomMass* is negatively associated with *PD*, *HetMass* is positively associated with *VERT*, *CENT*, *SIZE* and *PRLIN*, *SerUnit* is positively associated with *PD* and negatively with *SIZE*, and *Unit* is negatively associated with *CENT*, *AMT* and *PRLIN*. This implies that, on average, firms with a homogeneous mass production process produce a smaller number of and less different products (stock keeping units) than firms with one of the other three types of production processes. Similarly, firms with a heterogeneous production process have more hierarchical levels, are more centralized, are larger and operate a larger number of production lines than firms with one of the other three types of production processes. Firms with a serial unit production process produce a larger number of and more different products (stock keeping units) and are smaller than firms with one of the other three types of production processes. Finally, firms with an unit production process are less centralized, use less advanced manufacturing technologies and operate a smaller number of production lines than firms with one of the other three types of production processes.

4.8 Summary and conclusions

This chapter has given a description of the data and measurement instruments used in the empirical part of this dissertation. The data are (almost exclusively) taken from a large-scale survey-study that I conducted in 2002, on the use of cost systems in medium-sized, Dutch manufacturing firms. Medium-sized firms were targeted for this study because larger firms commonly consist of a number of organizational units, which may not all use the same (or even a similar) cost system, whereas smaller firms may not use sophisticated cost allocation systems at all. Manufacturing firms were targeted because these are assumed to be a relatively homogeneous group, distinct from non-manufacturing firms. As part of a quite extensive procedure, a questionnaire was sent to either the general manager or the financial manager of 2108 firms. This questionnaire was used to gather firm-level data on their cost systems and on a number of contextual characteristics of the firms. Eventually, 225 usable and representative questionnaires (10.7%) were returned. I experienced some item non-response, however. Most measurement instruments used are multi-item, and taken or adapted from earlier studies. In accordance with the distinction between usage for strategic and operational purposes made in the literature, factor analysis identifies two dimensions of cost system purposes of use among nine widely used purposes: cost system usage (and importance) for strategic purposes and cost system usage (and importance) for operational purposes. Finally, the data show many significant interrelationships among the contextual characteristics of the firms.

Appendix 4.A: Usage rates, levels of importance and Pearson correlations for the cost system purposes of use items

	Usage rates		Levels of importance										
Items	*n*	*%*	*Mean*	*SD*	1	2	3	4	5	6	7	8	9
1. Cost reduction	92	69.2	2.662	1.392	-	.008	.351***	.310***	.254***	.264***	.241***	.102	-.042
2. Product pricing	127	95.5	3.947	1.103	.012	-	.112	.055	.007	.250***	.248***	.369***	.255***
3. Performance measurement	86	64.7	2.549	1.406	.392***	.067	-	.411***	.258***	.265***	.339***	.111	.096
4. Cost modeling	88	66.2	2.579	1.372	.383***	-.079	.469***	-	.365***	.072	.386***	.204**	-.043
5. Budgeting	120	90.2	3.767	1.255	.274***	.050	.233***	.300***	-	.262***	.194**	.132	.155*
6. Customer profitability analysis	82	61.7	2.466	1.464	.277***	.276***	.355***	.220**	.209**	-	.323***	.264***	.358***
7. Product output decisions	74	55.6	2.301	1.414	.223***	.171**	.385***	.449***	.216**	.447***	-	.425***	.158*
8. New product design	86	64.7	2.529	1.465	.120	.294***	.112	.236***	.074	.323***	.416***	-	.318***
9. Stock valuation	103	77.4	3.271	1.533	.029	.316***	.166*	-.006	.065	.351***	.242***	.278***	-

Notes: *n*=133; ***, **, * indicates significance at the .01, .05 and .10 level (two-tailed), respectively. The Pearson correlations for the usage scale are presented below the diagonal; the Pearson correlations for the importance scale are presented above the diagonal.

Chapter 5

The relationship between environmental, organizational and technological factors, and ABC adoption and use

5.1 Introduction

This chapter consists of two major parts. The first part presents and discusses the results of the analyses for the research question on the relationship between major environmental, organizational and technological factors, and ABC adoption and use. The second part of the chapter presents and discusses the results of exploratory analyses on the association between characteristics of ABC adopters and organizational structure factors. More specifically, the association between six aspects concerning the level of implementation and way(s) of using ABC among its adopters and three organizational structure factors is examined.
The remainder of this chapter is structured as follows. Section 5.2 presents some descriptive statistics. Section 5.3 presents the results of multivariate analyses on the relationship between environmental, organizational and technological factors, and ABC adoption and use. Section 5.4 further explores ABC usage, by presenting the results of exploratory analyses on whether the structure of firms is associated with the extent to and way(s) in which firms use ABC, given that they have adopted it. Finally, Section 5.5 summarizes and concludes.

5.2 Descriptive statistics

Table 5.1 shows the distribution of ABC usage across industries for the subsample used for the analyses presented in this chapter. The ABC *adoption* rate in this subsample is 17.3% (17.8% in the overall sample). Several industries show above-average adoption rates: manufacture of food, beverage and tobacco products, manufacture of other non-metallic mineral products, manufacture of basic metals and of fabricated metal products, and manufacture of machinery and equipment. The ABC *use* rate in the subsample is 10.5% (11.6% in the overall sample). Industries with above-average use rates are: manufacture of food, beverage and tobacco products, manufacture of chemicals and chemical products, manufacture of other non-metallic mineral products, and manufacture of basic metals and of fabricated metal products. Although comparable to earlier studies (e.g., Groot, 1999; Innes et al., 2000), the ABC adoption and use rates are rather low. This may partly be explained by the widespread use of the (somewhat similar) "cost pool method" (or "cost center method") in the Netherlands (Groot, 1999).[49] Overall, the figures shown in Table 5.1 suggest that ABC usage differs significantly across industries. Furthermore, these figures also suggest that there seem to be differences across industries over time, as at the moment at which the research was

[49] See Boons et al. (1992) for an analysis of the similarities and differences between ABC and the German/Dutch cost pool method, which is grounded in German cost theory.

conducted, implementation of ABC seemed to be concentrated in certain industries. Especially striking in this respect is the manufacture of machinery and equipment industry, where the number of firms "currently" implementing ABC was higher than the number of firms "currently" using ABC.

Table 5.1: Distribution of respondents and ABC usage across industries

Industry			ABC usage status			
			ABC adopters		ABC users	
Code	Title	*n*	*n*	*%*	*n*	*%*
DA	Manufacture of food, beverage and tobacco products	13	5	38.5	3	23.1
DB	Manufacture of textiles and textile products	5	0	-	0	-
DC	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	3	0	-	0	-
DD	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	5	0	-	0	-
DE	Manufacture of pulp, paper and paper products; publishers and printers	23	0	-	0	-
DF	Manufacture of coke, refined petroleum products and nuclear fuel	0	0	-	0	-
DG	Manufacture of chemicals and chemical products	15	2	13.3	2	13.3
DH	Manufacture of rubber and plastic products	11	1	9.1	1	9.1
DI	Manufacture of other non-metallic mineral products	11	3	27.3	2	18.2
DJ	Manufacture of basic metals and of fabricated metal products	34	10	29.4	7	20.6
DK	Manufacture of machinery and equipment	42	10	23.8	4	9.5
DL	Manufacture of electrical and optical equipment and instruments	11	1	9.1	1	9.1
DM	Manufacture of transport equipment	10	1	10.0	0	-
DN	Manufacture of furniture, manufacturing n.e.c.	8	0	-	0	-
	Total	191	33	17.3	20	10.5

Notes: Industry classification based on Dutch Central Bureau of Statistics.

Table 5.2 presents the descriptive statistics for the independent variables used in this chapter's analyses. As shown in the table, a number of statistically significant differences in means are observed between the groups.[50] Both the ABC adopters and the ABC users differ significantly from the ABC non-adopters/users on the following continuous independent variables: *COM*, *VERT*, *PD* and *PRLIN*. This indicates that, on average, the adopters and users of ABC face a higher level of intensity of market competition, have a larger number of hierarchical levels, produce a larger number of and more different products (stock keeping units), and operate a larger number of production lines than the non-adopters/users. In addition, the ABC users also differ significantly from the ABC non-adopters/users on the variables *CENT* and *AMT*, which indicates that, on average, the users of ABC are less centralized and use more advanced manufacturing technologies than the non-adopters/users. For the dichotomous independent variables, two significant associations are found with ABC adoption, and one with ABC use. Comparatively, firms with a homogeneous mass production process have adopted ABC more than expected ($\chi^2(1) = 2.936$, $p = .087$), whereas firms with a serial unit production process have adopted it less than expected ($\chi^2(1) = 3.257$, $p = .071$). Similarly, firms with a serial unit production process also use ABC relatively less than expected ($\chi^2(1) = 5.426$, $p = .020$).

[50] In addition, I have also tested on differences between the three groups of ABC non-adopters/users (n=158): (1) "currently considering ABC adoption" (n=36), (2) "no consideration of ABC to date" (n=87), and (3) "rejected ABC after assessment" (n=35). For the continuous independent variables significant differences in means were found between the three groups for *FORM* and *CENT*. The average *FORM* scores are 3.25 (*SD*=.69) in group 1, 3.13 (*SD*=.62) in group 2 and 3.41 (*SD*= .56) in group 3 ($F(2, 155) = 2.695$, $p = .071$), whereas the average *CENT* scores are 3.83 (*SD*=.49) in group 1, 3.62 (*SD*=.66) in group 2 and 3.52 (*SD*=.61) in group 3 ($F(2, 155) = 2.417$, $p = .093$). For the dichotomous independent variables significant associations were found with *Unit*. The sample firms with a unit production process have not considered ABC to date relatively more than expected, whereas such firms either have rejected ABC after assessment or are currently considering ABC adoption relatively less than expected ($\chi^2(2) = 4.602$, $p = .100$).

Table 5.2: Descriptive statistics on ABC adopters and users versus ABC non-adopters/users

	Total sample (*n* = 191)		**ABC adopters (*n* = 33)**		**ABC users (*n* = 20)**		**ABC non-adopters/users (*n* = 158)**	
Variables	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
COM	3.43	.62	3.64**	.63	3.63*	.65	3.38	.61
PEU	3.03	.33	3.08	.38	3.09	.33	3.02	.32
COMS	3.02	.70	3.18	.61	3.16	.44	2.99	.72
VERT	2.16	1.11	2.46*	1.00	2.55*	1.05	2.10	1.13
FORM	3.22	.60	3.23	.43	3.22	.42	3.22	.63
CENT	3.62	.60	3.49	.48	3.40*	.52	3.64	.62
SIZE	4.96	.61	5.01	.51	5.08	.45	4.94	.63
PD	23.73	12.78	28.23**	10.59	28.51**	9.74	22.79	13.03
AMT	2.15	.73	2.31	.78	2.42*	.83	2.12	.72
PRLIN	2.73	1.42	3.13*	1.39	3.32**	1.35	2.65	1.41
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
HomMass	15	7.9	5	15.2	3	15.0	10	6.3
HetMass	49	25.7	10	30.3	8	40.0	39	24.7
SerUnit	85	44.5	10	30.3	4	20.0	75	47.5
Unit	42	22.0	8	24.2	5	25.0	34	21.5

Note: *n*=191; ***, **, * indicates significance (of differences in means relative to the ABC non-adopters/users) at the .01, .05 and .10 level (two-tailed), respectively.

5.3 Multivariate analyses

This section presents the results of multivariate analyses of the relationship between the environmental, organizational and technological factors, and ABC adoption and use, respectively.[51]

5.3.1 Logistic regression analysis results for the ABC adoption models

Table 5.3 summarizes the logistic regression analysis results for the relationship between the environmental, organizational and technological factors, and ABC adoption.

Table 5.3: Logistic regression analysis results for the ABC adoption models

Independent variables	**Model 1** (environmental factors only)	**Model 2** (organizational factors only)	**Model 3** (technological factors only)	**Model 4** (full model)
COM	.656**			. 677*
	(.337)			(.387)
	.153			.149
PEU	.251			.088
	(.601)			(.629)
	.031			.010
COMS		.362		.051
		(.288)		(.344)
		.082		.013
VERT		.311*		.298#
		(.171)		(.195)
		.112		.118

[51] As argued in Section 4.4, two cases were removed from the dataset before estimating these logistic regression models after carefully examining the leverage, discrepancy and influence of all cases, using the measures and cutoffs suggested by Cohen et al. (2003), Menard (2001) and Pregibon (1981). With the two cases included, logistic regression analysis shows that, compared to the results for the full ABC adoption model presented in this chapter, *VERT*, *CENT* and *PD* are no longer significant in this model, whereas *PRLIN* becomes significant. Similarly, in the full ABC use model, *VERT*, *PD* and *PD*AMT* are no longer significant.

FORM		.181		.249
		(.345)		(.382)
		.035		.053
CENT		-.497#		-.647*
		(.327)		(.394)
		-.097		-.139
SIZE		.146		.049
		(.326)		(.358)
		.029		.011
PD			.037**	.026#
			(.016)	(.018)
			.159	.118
AMT			.291	.101
			(.293)	(.319)
			.072	.026
PD * AMT			-.017	-.021
			(.020)	(.022)
			-.056	-.073
PRLIN			.194	.223
			(.150)	(.160)
			.092	.113
PRPRO			- (**)	- (**)
HetMass			-.996	-1.275*
			(.703)	(.763)
			-.146	-.199
SerUnit			-1.554**	-1.646**
			(.692)	(.735)
			-.260	-.292
Unit			-.683	-1.054
			(.732)	(.836)
			-.095	-.156
Intercept	-1.625***	-1.655***	-.629	-.528
	(.201)	(.206)	(.590)	(.642)
	-	-	-	-
R_L^2	.028	.042	.082	.125
G_M	4.872*	7.307	14.339**	22.000*

Notes: *n*=191; Cell statistics are unstandardized coefficients, standard errors and standardized coefficients. ***, **, *, # indicates significance at the .01, .05, .10 and .15 level (two-tailed), respectively. Chow-type test results for Model 1: $\chi^2(3) = .385$, $p = .943$, for Model 2: $\chi^2(6) = 8.422$, $p = .209$, for Model 3: $\chi^2(8) = 9.229$, $p = .323$, and for Model 4: $\chi^2(15) = 16.299$, $p = .362$. All continuous independent variables were mean centered before entering to avoid nonessential multicollinearity. Statistical significance of *b* is determined using the likelihood ratio test. Standardized logistic regression coefficients are estimated using the procedure suggested by Menard (2001; see also 2004).

Briefly, the results for the three partial models are as follows. In Model 1, ABC adoption is regressed on the environmental factors: *COM* and *PEU*. Although the model is significant ($G_M(2) = 4.872$, $p = .088$), its strength of association is relatively weak ($R_L^2 = .028$). Consistent with the results of the t-tests, only *COM* is significantly associated with ABC adoption. Next, in model 2, ABC adoption is regressed on the organizational factors: *COMS*, *VERT*, *FORM*, *CENT* and *SIZE*. This model is not significant ($G_M(5) = 7.307$, $p = .199$), and its strength of association is relatively weak ($R_L^2 = .042$). Therefore, despite the significant t-test result for *VERT*, I conclude that there is insufficient evidence to be sure that the deviance accounted for by this model is not attributable to random sampling variation. Finally, in Model 3, ABC adoption is regressed on the technological factors: *PD*, *AMT*, their interaction

effect (*PD*AMT*), *PRLIN*, and the three dummy variables representing *PRPRO* (*HetMass*, *SerUnit* and *Unit*). This model is significant: $G_M(7) = 14.339$, $p = .046$, $R_L^2 = .082$. The effects of two independent variables, *PD* and *SerUnit*, are statistically significant (plus the effect of *PRPRO* as a whole, which serves as a protection test for its constituent parts). The significant effect of *PD* is consistent with the results of the t-tests, but the insignificant effect of *PRLIN* is not.

In Model 4, the full model, ABC adoption is simultaneously regressed on the environmental, organizational and technological factors. This model is significant: $G_M(14) = 22.000$, $p = .079$, $R_L^2 = .125$. The effects of six independent variables are statistically significant (plus the effect of *PRPRO* as a whole, which serves as a protection test for its constituent parts). The standardized coefficients, which indicate the relative strength of effects of independent variables, suggest that *SerUnit* and *HetMass* have the strongest effect, followed by *COM*, *CENT*, *PD* and *VERT*. Note that, except for the effect of *HetMass*, all these effects are also significant in the three partial models. The results indicate that the log odds are 1.646 lower for firms with a serial unit production process than for firms with a homogeneous mass production process, whereas the odds are 80.7% lower. Similarly, the log odds are 1.275 lower for firms with a heterogeneous mass production process than for firms with a homogeneous mass production process, whereas the odds are 72.1% lower. Each one-unit increase in *COM* increases the log odds of ABC adoption by .677 and the odds by a multiple of 1.968, or by 96.8%. Each one-unit increase in *CENT* lowers the log odds of ABC adoption by .647 and reduces the odds by a multiple of .524, or by 47.6%. Each one-unit increase in *PD* increases the log odds of ABC adoption by .026 and the odds by a multiple of 1.026, or by 2.6%, when *AMT* equals its sample mean. Finally, each one-unit increase in *VERT* increases the log odds of ABC adoption by .298 and the odds by a multiple of 1.347, or by 34.7%.

For the environmental factors, the results provide support for H1a, but not for H2a: the level of intensity of market competition is significantly associated with ABC adoption, while the level of perceived environmental uncertainty is not. Both the full and the partial model show these effects. The finding for competition confirms previous results of Malmi (1999); the influence of perceived environmental uncertainty has, to my knowledge, not been studied before.

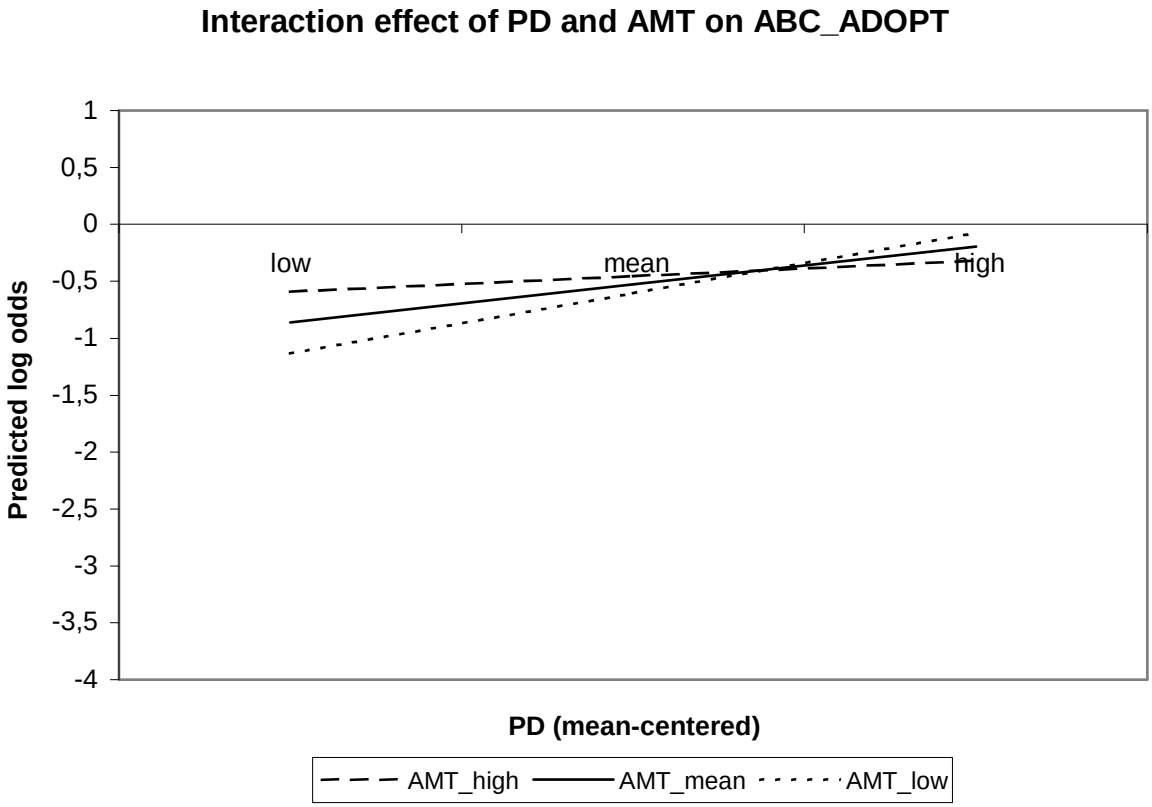
For the organizational factors, the results provide support for H4a, but not for H3a, H5a and H7a: the level of vertical differentiation is significantly associated with ABC adoption, while the level of product/market innovation and formalization, and the size of the firms, are not. The level of centralization is also significantly associated with ABC adoption, but its direction is negative and therefore contrary to expectations (providing no support for H6a). Note that these effects are only shown in the full model, as the partial model is not significant. The finding for competitive strategy is consistent with previous results of Malmi (1999), who also found no significant association between firms' competitive strategy and ABC adoption, but inconsistent with those of Gosselin (1997). Overall, the findings for vertical differentiation, formalization and centralization are ambiguous and suggest that these three factors are not unequivocal in their influence on ABC adoption. The effects for vertical differentiation and centralization indicate that, on average, ABC adopters have a higher number of hierarchical levels and are less centralized than non-adopters/users. One explanation for these findings is

that such organizations may have a stronger tendency to invest in ABC systems (or, more generally, in management accounting and control systems) in order to ensure that decisions taken at lower levels of the organization are taken in its best interest (i.e., are based on accurate information). The finding for organizational size (of no effect) may be caused by the fact that this study focuses on medium-sized firms only, causing the range of the 'size' variable to be restricted.

For the technological factors, the results provide support for H8a, but not for H9a and H10a: the level of product diversity is significantly associated with ABC adoption, while the number of production lines is not, which is also the case for the interaction of product diversity and usage of AMT. The results for H11a (on the influence of the structure of firms' production process on ABC adoption choices) are contrary to expectations, and therefore do not support this hypothesis. Both the full and the partial model show these effects. The finding for product diversity is consistent with the results of many previous studies, which emphasizes that this factor clearly plays a major role in ABC adoption choices. The findings for the interaction of product diversity and usage of AMT do not statistically support the qualitative findings of Abernethy et al. (2001). Although its sign is in the hypothesized (negative) direction, the interaction effect is not significant. One explanation for the insignificant effect of the number of production lines is that this variable may have (at least) two effects on ABC adoption choices. On the one hand, as was hypothesized, increases in the number of production lines may increase the number of cost pools needed, and thereby the need for a sophisticated cost system such as ABC. On the other hand, it may also partly be used by firms as a mechanism to manage their diversity. Firms with a heterogeneous range of products (i.e., a high level of product diversity) may divide it into more homogeneous parts and produce each part on a separate production line in order to minimize (especially) batch-related costs. Note that, consistent with this last argument, *PRLIN* and *PD* are significantly positively correlated ($r(193) = .225$, $p < .01$; see Table 4.7). This issue clearly needs further research. Finally, as noted above, the results for H11a are contrary to expectations. Firms with a homogeneous mass production process are found to be the most likely to adopt ABC, followed by firms with a unit production process, firms with a heterogeneous mass production process, and firms with a serial unit production process, whereas expectations were (almost) exactly the opposite. Only the differences between firms with either a heterogeneous mass production process or a serial unit production process, and firms with a homogeneous mass production process (the reference group) are statistically significant, however. Except for the finding that firms with a homogeneous mass production process are the most likely to adopt ABC, these results are also inconsistent with previous studies. This suggests that other factors besides importance of ABC cost drivers and made-to-order production may also be underlying the influence of the structure of the production process on ABC adoption choices.

In order to explore the form of the interaction of product diversity and usage of AMT, Figure 5.1 provides a graphical presentation of their joint (or interactive) effect on firms' likelihood of adopting ABC. The figure plots the regression of *ABC_ADOP* on *PD* at three values of *AMT*: the mean (AMT_mean), one standard deviation below the mean (AMT_low), and one standard deviation above the mean (AMT_high). Consistent with the insignificant interaction effect reported in Table 5.3, this graph shows little pattern: the three regression lines are quite similar, suggesting the nonexistence of an interaction effect.

Figure 5.1: Graphical presentation of the interaction effect on ABC adoption



5.3.2 Logistic regression analysis results for the ABC use models

Table 5.4 summarizes the logistic regression analysis results for the relationship between the environmental, organizational and technological factors, and ABC use.

Table 5.4: Logistic regression analysis results for the ABC use models

Independent variables	**Model 1** (environmental factors only)	**Model 2** (organizational factors only)	**Model 3** (technological factors only)	**Model 4** (full model)
COM	.629#			.841#
	(.416)			(.535)
	.123			.130
PEU	.396			.028
	(.762)			(.802)
	.041			.002
COMS		.274		-.211
		(.359)		(.471)
		.051		-.037
VERT		.388*		.395#
		(.204)		(.242)
		.117		.112
FORM		.215		.364
		(.432)		(.520)
		.035		.056

CENT		-.745*		-1.112**
		(.397)		(.519)
		-.123		-.173
SIZE		.396		.309
		(.412)		(.469)
		.065		.048
PD			.046**	.038#
			(.022)	(.026)
			.137	.123
AMT			.732*	.579
			(.391)	(.426)
			.125	.107
PD * AMT			-.048*	-.062**
			(.027)	(.032)
			-.111	-.155
PRLIN			.293#	.352*
			(.185)	(.205)
			.096	.126
PRPRO			- (**)	- (**)
HetMass			-.456	-.629
			(.829)	(.958)
			-.047	-.070
SerUnit			-1.725*	-1.758*
			(.896)	(1.023)
			-.200	-.221
Unit			-.328	-.926
			(.907)	(1.121)
			-.032	-.097
Intercept	-2.139***	-2.242***	-1.578**	-1.622*
	(.252)	(.273)	(.764)	(.920)
	-	-	-	-
R_L^2	.026	.064	.147	.216
G_M	3.265	7.961	18.370**	26.981**

Notes: *n*=178; Cell statistics are unstandardized coefficients, standard errors and standardized coefficients. ***, **, *, # indicates significance at the .01, .05, .10 and .15 level (two-tailed), respectively. Chow-type test results for Model 1: $\chi^2(3) = 2.251$, $p = .522$, for Model 2: $\chi^2(6) = 10.303$, $p = .113$, for Model 3: $\chi^2(8) = 9.842$, $p = .276$, and for Model 4: $\chi^2(15)$ = error (no unique solution could be found for the group (track) with the less intensive data collection procedure). All continuous independent variables were mean centered before entering to avoid nonessential multicollinearity. Statistical significance of *b* is determined using the likelihood ratio test. Standardized logistic regression coefficients are estimated using the procedure suggested by Menard (2001; see also 2004).

Briefly, the results for the three partial models are as follows. In Model 1, ABC use is regressed on the environmental factors: *COM* and *PEU*. This model is not significant ($G_M(2) = 3.265$, $p = .195$), and its strength of association is relatively weak ($R_L^2 = .026$). Therefore, despite the significant t-test result for *COM*, I conclude that there is insufficient evidence to be sure that the deviance accounted for by this model is not attributable to random sampling variation. Next, in Model 2, ABC use is regressed on the organizational factors: *COMS*, *VERT*, *FORM*, *CENT* and *SIZE*. This model is also not significant ($G_M(5) = 7.961$, $p = .158$), and its strength of association is also relatively weak ($R_L^2 = .064$). Therefore, despite the significant t-test results for *VERT* and *CENT*, I conclude that there is insufficient evidence to be sure that the deviance accounted for by this model is not attributable to random sampling variation. Finally, in Model 3, ABC use is regressed on the technological factors: *PD*, *AMT*,

their interaction effect (*PD*AMT*), *PRLIN*, and the three dummy variables representing *PRPRO* (*HetMass*, *SerUnit* and *Unit*). This model is significant: $G_M(7) = 18.370$, $p = .010$, $R_L^2 = .147$. The effects of five independent variables, *PD*, *AMT*, *PD*AMT*, *PRLIN* and *SerUnit*, are statistically significant (plus the effect of PRPRO as a whole, which serves as a protection test for its constituent parts). The significant effects of *PD*, *AMT* and *PRLIN* are consistent with the results of the t-tests.

In Model 4, the full model, ABC use is simultaneously regressed on the environmental, organizational and technological factors. This model is significant: $G_M(14) = 26.981$, $p = .019$, $R_L^2 = .216$. The effects of seven independent variables are statistically significant (plus the effect of *PRPRO* as a whole, which serves as a protection test for its constituent parts). The standardized coefficients, which indicate the relative strength of effects of independent variables, suggest that *SerUnit* has the strongest effect, followed by *CENT*, *PD*AMT*, *COM*, *PRLIN*, *PD* and *VERT*. Note that all these effects are also significant in the three partial models. The results indicate that the log odds are 1.758 lower for firms with a serial unit production process than for firms with a homogeneous mass production process, whereas the odds are 82.8% lower. Also, each one-unit increase in *CENT* lowers the log odds of ABC use by 1.112 and reduces the odds by a multiple of .329, or by 67.1%. Each one-unit increase in *COM* increases the log odds of ABC use by .841 and the odds by a multiple of 2.319, or by 131.9%. Each one-unit increase in *PRLIN* increases the log odds of ABC use by .352 and the odds by a multiple of 1.422, or by 42.2%. Each one-unit increase in *PD* increases the log odds of ABC use by .038 and the odds by a multiple of 1.039, or by 3.9%, when *AMT* equals its sample mean. Each one-unit increase in *VERT* increases the log odds of ABC use by .395 and the odds by a multiple of 1.484, or by 48.4%. Finally, since the effect of *PD*AMT* is significant, each one-unit increase in *AMT* decreases the *change in log odds* of ABC use *as a result of a one-unit increase in PD* by .062 and the *change in odds* by a multiple of .940, or by 6.0%.

For the environmental factors, the results provide support for H1b, but not for H2b: the level of intensity of market competition is significantly associated with ABC use, while the level of perceived environmental uncertainty is not. Note that these effects are only shown in the full model, as the partial model is not significant. Overall, these findings are very similar to those for the ABC adoption models.

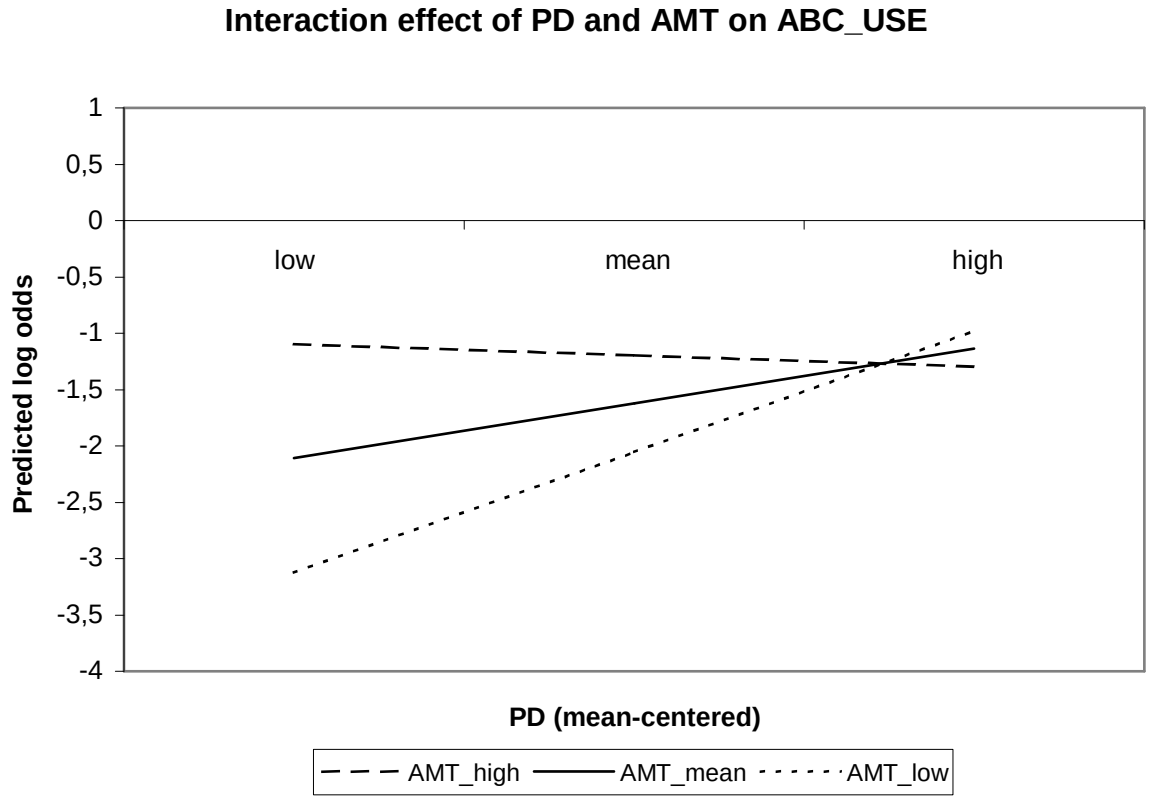
For the organizational factors, the results provide support for H4b, but not for H3b, H5b and H7b: the level of vertical differentiation is significantly associated with ABC use, while the level of product/market innovation and formalization, and the size of the firms, are not. The level of centralization is also significantly associated with ABC use, but its direction is negative and therefore contrary to expectations (providing no support for H6b). Note that these effects are only shown in the full model, as the partial model is not significant. Overall, these findings are again very similar to those for the ABC adoption models.

For the technological factors, the results provide support for H8b, H9b and H10b: the level of product diversity and the number of production lines are significantly associated with ABC use, which is also the case for the interaction of product diversity and usage of AMT. The results for H11b (on the influence of the structure of firms' production process on ABC use

choices) are contrary to expectations, and therefore do not support this hypothesis. Both the full and the partial model show these effects. Compared to the full ABC adoption model, the effects of *PRLIN* and *PD*AMT* are now significant, while the effect of *HetMass* no longer is significant. The finding for the number of production lines is consistent with the argument that increases in the number of production lines will likely increase the number of cost pools needed, and thereby the need for a sophisticated cost system such as ABC, and inconsistent with the alternative argument (given in Section 5.3.1) that it may also partly be used by firms as a mechanism to manage their diversity, thereby reducing their need for such a system. The findings for the interaction of product diversity and usage of AMT support the qualitative findings of Abernethy et al. (2001). At least to some extent firms appear to have an option on whether to manage their product diversity by investing in AMTs, which in general will decrease their batch- and product-related costs and thus their need to use an ABC system, or by investing in such a sophisticated cost system.

In order to explore the form of the interaction of product diversity and usage of AMT, Figure 5.2 provides a graphical presentation of the interaction effect. The figure plots the regression of *ABC_USE* on *PD* at three values of *AMT*: the mean (AMT_mean), one standard deviation below the mean (AMT_low), and one standard deviation above the mean (AMT_high). This graph clearly shows that at one *SD* below the mean of *AMT*, *PD* has a positive effect on *ABC_USE*, while at one *SD* above the mean, the effect of *PD* on *ABC_USE* is negative. This indicates that this interaction effect is non-monotonic: at higher (lower) levels of usage of AMT, product diversity negatively (positively) affects firm's likelihood of using ABC.

Figure 5.2: Graphical presentation of the interaction effect on ABC use



5.3.3 Discussion

This section examined the associations between major environmental, organizational and technological factors, and ABC adoption and use. Overall, the results indicate that firms with a higher level of competition, vertical differentiation and product diversity, and a lower level of centralization are more likely to adopt ABC, whereas firms with either a heterogeneous mass production process or a serial unit production process are less likely to adopt ABC than firms with a homogeneous mass production process. Similarly, firms with a higher level of competition, vertical differentiation and product diversity, more production lines, and a lower level of centralization are more likely to use ABC, whereas firms with a serial unit production process are less likely to use ABC than firms with a homogeneous mass production process. Also, the influence of product diversity on a firm's likelihood of using ABC is found to be negatively moderated by the extent to which the firm uses advanced manufacturing technologies.

It is important to emphasize that research on the determinants of the adoption and use of management accounting innovations is not only interesting on its own, but also a requirement for adjusting for selection bias when examining the performance consequences of such innovations (see also Section 2.3.4). If studies such as this one do not find any systematic differences between adopters (or users) and non-adopters (or non-users) of management accounting innovations, there probably is no need to adjust for selection bias when studying their performance consequences. If, however, such studies do find systematic differences on certain factors, and if these factors are also related to organizational performance, not adjusting for it will cause estimates of the performance effects of implementing management accounting innovations to be biased and inconsistent. Overall, the results of this chapter's analyses clearly indicate the existence of systematic differences between adopters and users of ABC, and ABC non-adopters/users.

5.4 Further exploration of ABC usage[52]

This section presents the results of exploratory analyses on whether the structure of firms is associated with the extent to and way(s) in which firms use ABC, given that they have adopted it. More specifically, the association between three organizational structure factors and six aspects of the level of implementation and way(s) of using ABC among its adopters is examined. These aspects concern the level and (perceived) quality of the implementation of ABC, the width and integration of the ABC systems, and the update frequency of the structure and contents of these systems. Little empirical evidence exists to date on these aspects. Also, as argued by Chenhall (2003, p. 132): "Much can be learned about the success or otherwise of MCS by examining how the control culture, organic or mechanistic [organizational structure], influences the process of implementation. This becomes particularly important when studying the adoption of innovative MCS such as activity-based [costing] … which are closely linked to the organization's control culture."

[52] The content of this section was earlier (with some adaptations) published as Schoute (2004). Given the already small sample size, all available observations are used for the analyses reported in this section, independent of the treatment of missing values in the rest of this chapter.

5.4.1 Level of implementation and way(s) of using ABC

In the overall sample (*N*=225), 40 (17.8%) of the surveyed firms have adopted ABC. At the moment of research these firms were either using ABC or implementing it (26 (11.6%) versus 14 (6.2%), respectively). In the questionnaire respondents of firms that had adopted ABC were asked two questions about the level of implementation and four about the way(s) of using ABC in their firm. The former were used to measure the level and (perceived) quality of the implementation of ABC. The latter were used to measure the width and integration of the ABC systems (partial versus company wide, and stand-alone versus integrated, respectively), as well as the frequency of updating the structure (e.g., the activities) and contents (e.g., the costs) of these systems. These six variables are tested on associations among themselves, as well as on associations with several organizational structure factors. Non-parametric tests are used for this purpose.[53] This is done for two reasons. First, the number of observations is rather limited (about 75-80% of the 40 adopters have answered the questions). Second, the frequency distribution of the observations for many variables is nonnormal. While testing on associations among the six variables, a statistically significant association is found for three combinations of variables. The level of implementation of ABC is positively associated with the (perceived) quality of the implementation. Also, the frequency of updating the structure of the ABC systems is positively associated with the frequency of updating their contents. More surprisingly, the width of the ABC systems is negatively associated with their integration: company wide ABC systems are found to be implemented as stand-alone systems to a larger extent, whereas partial ABC systems are found to be implemented as integrated systems to a larger extent. Because of these interrelationships among the six variables, their data are presented in three cross-tables (see Tables 5.5 to 5.7).

Table 5.5: Level versus quality of implementation

	Quality of implementation[a]					
Level of implementation[a]	*Not at all*	*To a little extent*	*To some extent*	*To a considerable extent*	*To a very great extent*	*Total*
10%			1			1
30%		1				1
50%		1	3			4
60%			2	1		3
70%				2		2
80%			1	3		4
85%				2		2
90%				2		2
95%				1		1
100%			2	7	2	11
Total		2	9	18	2	31

[a] level of association: r_s = .624, p = .000

The first measured variable (*ABC_LEV*) concerns the level of implementation of ABC. Respondents were asked which part of the planned implementation process of ABC approximately was finished in their firm at the moment of research. As shown in Table 5.5,

[53] More specifically, dependent on the measurement scales of the variables, the following statistical tests are used: Spearman's rho (r_s), phi coefficient (r_ϕ) and the Mann-Whitney test.

the answers clearly show that in most firms the implementation process was not entirely finished yet.
The second measured variable concerns the (perceived) quality of the implementation of ABC (*ABC_QUAL*), where quality of implementation was defined as implementing according to plan. Respondents were asked to what extent in their assessment the implementation process of ABC (so far) had gone according to plan. Table 5.5 also shows the answers given to this question, which reveal that for most of the studied firms the implementation process had gone according to plan to a considerable or to a very great extent.

Table 5.6: Width versus integration of ABC systems

	Integration[a]		
Width[a]	*Stand-alone system*	*Integrated system*	*Total*
Partial system		5	5
Company wide system	14	13	27
Total	14	18	32

[a] level of association: r_ϕ = -.380, p = .032

The third variable concerns the width of the ABC systems (*ABC_WID*). Respondents were asked whether the ABC system in their firm encompasses all production units or not. As shown in Table 5.6, as much as 27 of the 32 respondents (84.4%) indicated that the ABC system in their firm encompasses all units. This high percentage is probably partly caused by the fact that this study focuses on medium-sized firms. Among larger firms this percentage will probably be considerably lower.
The fourth variable concerns the integration of the ABC systems (*ABC_INT*). Respondents were asked whether the ABC system in their firm is integrated with other information systems or not. For 18 of the 32 respondents (56.3%) this turned out to be the case.

Table 5.7: Update frequency of structure versus contents of ABC systems

	Update frequency of contents[a]							
Update frequency of structure[a]	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*Total*
(1) Less than two-yearly	1		1					2
(2) Two-yearly		3						3
(3) Yearly			11	1	2	3	2	19
(4) Half-yearly							2	2
(5) Quarterly			1		1		1	3
(6) Monthly								
(7) More than monthly			1					1
Total	1	3	14	1	3	3	5	30

[a] level of association: r_s = .572, p = .001

The last two variables concern the frequency of updating the ABC systems (*ABC_UFS* and *ABC_UFC*). Respondents were asked how frequently the structure (e.g., the activities) and contents (e.g., the costs) of the ABC system in their firm are updated.
As shown in Table 5.7, in many firms both turn out to be updated on a yearly basis (19 of the 30 firms (63.3%) for structure and 14 of the 30 firms (46.7%) for contents). Note also that two respondents indicated that their firm updates the structure of its ABC system more frequently than its contents. Apparently these firms operate in a highly changeable environment and/or were still busy developing their ABC system.

5.4.2 Association with organizational structure factors

To date, next to Gosselin (1997), this study is the second that examines the association between the structure of firms and their (non-)adoption of ABC. Both studies measure structure based on three dimensions: vertical differentiation, formalization and centralization. Vertical differentiation concerns the depth of the organizational structure. Formalization concerns the extent to which tasks within an organization are standardized. Centralization concerns the extent to which power and authority are in the hands of relatively few individuals. Gosselin found, among others, that a higher level of vertical differentiation is associated with adoption of ABC, and that a higher level of formalization and centralization are associated with ABC implementation (see Section 2.2.2). As presented earlier in this chapter, I also have found that a higher level of vertical differentiation is associated with adoption (and use) of ABC. Furthermore, adoption and use of ABC were also found to be associated with a lower level of centralization, which is opposite to the findings of Gosselin. As a consequence of different categorizations of the studied firms, the results of the two studies are hard to compare. Together, however, they clearly suggest that organizational structure factors are associated with ABC adoption choices. An aspect that so far has not been studied, however, is whether such factors also influence the way(s) in which firms use ABC, given that they have adopted it. In order to examine this issue, the six aspects of the level of implementation and way(s) of using ABC among its adopters have been tested for association with the three organizational structure factors.

These analyses, as well as those of Gosselin (1997), are as far as the association between the three organizational structure factors and ABC adoption choices concerns mainly based on the so-called ambidextrous model from the organizational innovation diffusion-adoption literature. This model states that the initiation of innovations is easier in organistic organizations, whereas mechanistic characteristics of organizations make implementation of these innovations easier. Organistic (mechanistic) organizations are characterized by a low (high) level of vertical differentiation, formalization and centralization. The results of both studies only partly confirm this model. The results presented in this section may provide new light on this matter, however. For example, formalization has not been found to have an influence on ABC adoption decisions. However, given that firms have decided to adopt ABC, formalization does seem to have an influence on the quality of the implementation, as well as on the way(s) in which firms use ABC. Therefore, a high level of formalization does indeed, conform the model, seem to ease the implementation of ABC.

5.4.2.1 Analyses for the complete group of ABC adopters

None of the three factors is significantly associated with the level of implementation of ABC: r_s = -.105, p = .573 (for vertical differentiation), r_s = .233, p = .207 (for formalization) and r_s = -.133, p = .477 (for centralization), respectively. The (perceived) quality of the implementation of ABC is significantly and positively associated with the factor ‘formalization’, but not with the other two factors: r_s = -.134, p = .464 (for vertical differentiation), r_s = .301, p = .094 (for formalization) and r_s = .110, p = .550 (for centralization), respectively. This suggests that more formalized firms achieve a higher level

of implementation quality, i.e., that the implementation process of ABC in such firms goes according to plan to a larger extent.

Table 5.8 presents the results of tests on association between the three organizational structure factors and the width of the ABC systems. For this variable a significant and positive association is found with the factor 'formalization'. This implies that in more formalized firms ABC is implemented company wide to a larger extent than in less formalized firms. Note also that the effect for the factor 'centralization', although not statistically significant, is substantial and also positive (statistical power may play an important role here).

Table 5.8: Organizational structure factors and width of ABC systems

	n	*Mdn*[a]	*Min*[a]	*Max*[a]
Vertical differentiation				
Company wide system	27	11.5	1.0	31.5
Partial system	5	11.5	11.5	31.5
Mann-Whitney test: $p = .631$				
Formalization				
Company wide system	27	15.5	1.5	32.0
Partial system	5	8.5	1.5	15.5
Mann-Whitney test: $p = .048$				
Centralization				
Company wide system	27	19.0	1.0	32.0
Partial system	5	13.0	3.0	16.0
Mann-Whitney test: $p = .125$				

[a] based on ranks

Table 5.9 presents the results of tests on association between the three organizational structure factors and the integration of the ABC systems. As shown in Table 5.9, for this variable no significant associations are found with the three organizational structure factors. Note, however, that although the effects for the factors 'formalization' and 'centralization' are not statistically significant, they are substantial (and both negative). Similar to the effect of the factor 'centralization' on the width of the ABC systems (see Table 5.8), statistical power may play a role here.

Table 5.9: Organizational structure factors and integration of ABC systems

	n	*Mdn*[a]	*Min*[a]	*Max*[a]
Vertical differentiation				
Integrated system	18	11.5	1.0	31.5
Stand-alone system	14	11.5	11.5	31.5
Mann-Whitney test: $p = .292$				
Formalization				
Integrated system	18	15.5	1.5	29.0
Stand-alone system	14	23.0	1.5	32.0
Mann-Whitney test: $p = .127$				
Centralization				
Integrated system	18	13.0	1.0	29.5
Stand-alone system	14	20.0	4.0	32.0
Mann-Whitney test: $p = .123$				

[a] based on ranks

The update frequency of the structure of ABC systems is found to be significantly and positively associated with the factor 'centralization', but not with the other two factors: r_s = .134, p = .472 (for vertical differentiation), r_s = .090, p = .629 (for formalization) and r_s = .304, p = .096 (for centralization), respectively. This suggests that more centralized firms update the structure of their ABC system more frequently than less centralized firms. The update frequency of the contents of ABC systems is also found to be significantly and positively associated with the factor 'centralization', but not with the other two factors: r_s = .117, p = .529 (for vertical differentiation), r_s = .050, p = .788 (for formalization) and r_s = .383, p = .033 (for centralization), respectively. This implies that more centralized firms also update the contents of their ABC system more frequently than less centralized firms.

5.4.2.2 Analyses for the group of ABC users

In order to examine whether, and if so to what extent, the ABC usage status (ABC adopters versus ABC users) has an influence on the results that are presented in this section, the analyses are also conducted for (only) the group of ABC users. These subgroup analyses are partly motivated by a remark made by Krumwiede (1998) in which he states the suspicion that among users of ABC, less mechanistic organizations may possibly implement ABC systems as stand-alone systems to a larger extent, whereas more mechanistic organizations may possibly implement ABC systems as integrated systems to a larger extent.[54] The results of the subgroup analyses are comparable to those of the analyses for the complete group of ABC adopters. For all effects the sign remains the same; some effects loose their significance, however, probably as a result of the loss of statistical power due to the smaller sample size. The only variable for which the results do change considerably, is for the integration of ABC systems. Table 5.10 presents the results of these subgroup analyses.

Table 5.10: Organizational structure factors and integration of ABC systems (users of ABC)

	n	*Mdn*[a]	*Min*[a]	*Max*[a]
Vertical differentiation				
Integrated system	12	8.5	1.0	22.5
Stand-alone system	11	17.5	8.5	22.5
Mann-Whitney test: p = .063				
Formalization				
Integrated system	12	12.0	1.5	17.0
Stand-alone system	11	17.0	1.5	23.0
Mann-Whitney test: p = .272				
Centralization				
Integrated system	12	9.0	1.0	21.5
Stand-alone system	11	15.0	4.0	23.0
Mann-Whitney test: p = .074				

[a] based on ranks

[54] This based on the distinction Krumwiede (1998) makes between routine ABC-users and ABC-users with a fully integrated system, of which he considers the latter to be the most advanced ABC users.

In comparison to the results of the analyses for the complete group of ABC adopters (see Table 5.9), the effects of two variables have become significant: both vertical differentiation and centralization are now significantly and negatively associated with the integration of ABC systems with other information systems. This implies that among users of ABC, firms with a lower level of vertical differentiation and centralization seem to implement their ABC system to a larger extent as an integrated system, whereas firms with a higher level of vertical differentiation and centralization seem to implement their ABC system to a larger extent as a stand-alone system. These results are contrary to the suspicion of Krumwiede (1998).

5.4.3 Discussion

Future research will have to show to what extent the results that have been presented in this section are specific for these firms, or more generally applicable. The results with regard to the integration of the ABC systems appear to be strange at a first glance. However, combined with the results for the width of the ABC systems, four combinations/categories arise, namely firms with: (1) a partial, stand-alone system, (2) a partial, integrated system, (3) a company wide, stand-alone system, and (4) a company wide, integrated system. Of these, the firms with a company wide, stand-alone system are characterized by the highest (average) level of formalization and centralization. Next come the firms with a company wide, integrated system, while the firms with a partial, integrated system are characterized by the lowest (average) level of formalization and centralization (the sample does not contain firms with a partial, stand-alone system).[55] Seen as such there appear to be at least two possible explanations for these results. First, there may be differences with respect to the purposes for which firms use their ABC system. More formalized and centralized firms probably have less need for a new control system and will possibly use their ABC system mostly to support decision making (for which an implementation as stand-alone system in many cases suffices). Less formalized and centralized firms probably have more need for a new control system and will possibly use their ABC system (at least to some extent) for control purposes (for which an implementation as integrated system is more suitable). A second possible explanation has to do with cost-benefit considerations. The benefits of integration may not offset its (extra) costs in firms with a company wide system. Due to the fact that these costs will probably be substantially lower with a partial system, this consideration may be different for firms with such a system.

5.5 Summary and conclusions

The first part of this chapter presented the results of the analyses for the research question on the relationship between major environmental, organizational and technological factors, and ABC adoption and use. The results of these analyses indicate that firms with a higher level of competition, vertical differentiation and product diversity, and a lower level of centralization are more likely to adopt ABC, whereas firms with either a heterogeneous mass production

[55] These results for the factors ‘formalization’ and ‘centralization’ apply to both the complete group of ABC-adopters, and to the group of ABC-users. For the factor ‘vertical differentiation’ the results are somewhat different. The firms with a company wide, stand-alone system are characterized by the highest (average) level of vertical differentiation, followed by the firms with a partial, integrated system, while the firms with a company wide, integrated system are characterized by the lowest (average) level of vertical differentiation.

process or a serial unit production process are less likely to adopt ABC than firms with a homogeneous mass production process. Similarly, firms with a higher level of competition, vertical differentiation and product diversity, more production lines, and a lower level of centralization are more likely to use ABC, whereas firms with a serial unit production process are less likely to use ABC than firms with a homogeneous mass production process. Also, the influence of product diversity on a firm's likelihood of using ABC is found to be negatively moderated by the extent to which the firm uses advanced manufacturing technologies.

The second part of this chapter discussed the results of exploratory analyses of the association between characteristics of ABC adopters and organizational structure factors. More specifically, the association between six aspects concerning the level of implementation and way(s) of using ABC among its adopters and three organizational structure factors was examined. The six aspects concern the level and (perceived) quality of the implementation of ABC, the width and integration of the ABC systems, and the update frequency of the structure and contents of these systems. The analyses show that the three organizational structure factors (vertical differentiation, formalization and centralization) not only influence ABC adoption decisions, but also the way(s) firms deal with ABC, given that they have adopted it. Among others, more formalized firms achieve a higher level of implementation quality and their ABC implementations are company wide more often than in less formalized firms. Also, more centralized firms update both the structure and the contents of their ABC system more frequently than less centralized firms.

Chapter 6

The relationship between cost system sophistication, purposes of use, and cost system effectiveness

6.1 Introduction

This chapter consists of two major parts. The first part discusses the results of the analyses for the research question on the relationship between cost system sophistication, purposes of use, and cost system effectiveness. In these analyses, which concentrate on firms using absorption costing (see Section 4.4), I will build on the two dimensions of cost system purposes of use identified in Chapter 4, cost system usage (and importance) for strategic purposes and cost system usage (and importance) for operational purposes. The second part of the chapter discusses the results of exploratory analyses of the association between both the usage and importance of cost systems for each of nine purposes and ten environmental, organizational and technological factors.
The remainder of this chapter is structured as follows. Section 6.2 presents some descriptive statistics. Section 6.3 presents the results of multivariate analyses on the relationship between cost system sophistication, purposes of use, and cost system effectiveness. Section 6.4 further explores the level of cost system usage and importance, and their association with the ten contextual factors. Finally, Section 6.5 summarizes and concludes.

6.2 Descriptive statistics

Cost systems can be used for many different purposes. As discussed in Section 4.5.1, in the questionnaire respondents were asked to indicate whether their firm uses its cost system for each of nine widely used purposes of cost systems. On average, the sample firms use their cost system for almost 6.5 of the nine purposes (median = 6), with a range from 1 to 9. Tests on associations between the number of purposes for which the firms use their cost system and the ten contextual factors (only) show a significant correlation for the variable ‘competition’: the higher the level of intensity of market competition, the larger the number of different purposes for which the cost system is used. For each of the nine purposes, Table 6.1 shows the number (and percentage) of firms that use their cost system for this purpose.

As shown in Table 6.1, the purposes with the highest usage rates are product pricing (95.5%), budgeting (90.2%) and stock valuation (77.4%). The purposes with the lowest usage rates are performance measurement and new product design (both 64.7%), customer profitability analysis (61.7%) and product output decisions (55.6%). Note that there is no discernible pattern contrasting strategic and operational purposes in these usage rates. More than half of the firms use their cost system for each of the nine purposes. In general, these firms thus use their cost system for both strategic and operational purposes.

Table 6.2: Descriptive statistics and Pearson correlations

Variables	*Mean*	*SD*	CS_INTENS	CS_SATISF	STRAT_USE	OPER_USE	STRAT_IMP	OPER_IMP	CS_SOPH
CS_INTENS	3.711	.849	-						
CS_SATISF	3.372	.802	.432***	-					
STRAT_USE	.000	.830	.260***	.238***	-				
OPER_USE	.000	.884	.240***	.238***	.390***	-			
STRAT_IMP	.000	.826	.480***	.339***	.758***	.300***	-		
OPER_IMP	.000	.854	.406***	.303***	.280***	.842***	.422***	-	
CS_SOPH	7.135	2.325	.181**	.141	.012	.282***	.054	.319***	-
COM	3.401	.601	.103	.034	.189**	.173**	.122	.253***	.129
PEU	3.021	.342	.162*	.130	.115	.061	.155*	.152*	.009
COMS	2.988	.696	.145*	.128	.016	.160*	.060	.104	.121
VERT	2.193	1.086	.101	.126	.003	.077	.065	.119	.280***
FORM	3.214	.586	.242***	.052	-.083	-.026	.051	.091	.050
CENT	3.630	.557	.156*	.004	.003	.007	.061	.118	.129
SIZE	4.945	.618	.055	.106	-.012	.002	.081	.079	.151*
PD	24.788	13.506	.286***	.012	.084	.092	.164*	.137	.191**
AMT	2.174	.713	.175**	.201**	-.055	.174**	.043	.279***	.219**
PRLIN	2.770	1.377	.127	.142	.109	-.005	.209**	.080	.181**
HomMass	.083	-	.135	.065	.014	.049	-.012	.086	.041
HetMass	.263	-	.174**	-.043	.128	.070	.069	.088	.039
SerUnit	.451	-	-.172**	.003	-.085	-.041	-.009	-.035	-.053
Unit	.203	-	-.070	-.001	-.045	-.060	-.057	-.111	-.005

Notes: *n*=133; ***, **, * indicates significance at the .01, .05 and .10 level (two-tailed), respectively.

Table 6.1: Descriptive statistics on cost system purposes of use

	Question A		Question B				
Purposes	*n*	*%*	*Mean*	*SD*	*Mdn*	*Min*	*Max*
Cost reduction	92	69,2	3,40	1,01	4	1	5
Product pricing	127	95,5	4,09	0,92	4	2	5
Performance measurement	86	64,7	3,40	1,01	3	1	5
Cost modeling	88	66,2	3,39	0,95	3,5	1	5
Budgeting	120	90,2	4,07	0,91	4	1	5
Customer profitability analysis	82	61,7	3,38	1,14	3	1	5
Product output decisions	74	55,6	3,34	1,08	3	1	5
New product design	86	64,7	3,35	1,17	3,5	1	5
Stock valuation	103	77,4	3,93	1,04	4	1	5

Notes: *n*=133; Question A was "For each of the following purposes, please indicate if your firm uses its (absorption) cost system for this purpose (Scale: No or Yes)". Question B was "If Yes, then please indicate to what extent the cost system is of importance for the purpose concerned (Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)". The descriptive statistics reported for Question B in this table are therefore conditional on Question A being answered affirmatively.

The fact that a firm uses its cost system for particular purposes does of course not mean that its use is equally important for each of these purposes. Therefore, for each purpose for which their firm uses its cost system, respondents were also asked to what extent the cost system is of importance for that purpose. As also shown in Table 6.1, the three purposes for which the cost systems are considered to be the most important, are the same as the three purposes for which the cost systems are most widely used in these firms. The (average) importance of cost systems for the other purposes is almost equal.

Table 6.2 presents the descriptive statistics and Pearson correlations for the main variables used in this chapter's analyses. As observed in the table, cost system sophistication, purposes of use, intensity of use and satisfaction are all significantly positively interrelated, except for three pairs (*CS_SOPH* and *CS_SATISF*, *CS_SOPH* and *STRAT_USE*, and *CS_SOPH* and *STRAT_IMP*). On average, the firms' cost systems are used to make decisions "to a considerable extent" (*M*=3.711, *SD*=.849), and their users are satisfied "to some extent" (*M*=3.372, *SD*=.802). These two proxies for cost system effectiveness are significantly positively correlated. Although not reported in the table, on average, the firms' cost systems are used significantly more, and are considered to be significantly more important, for strategic than for operational purposes.[56] With regard to the two cost system effectiveness

[56] A t-test for two paired samples shows a significant difference between the (unweighted) average score for the items reflecting cost system usage for strategic purposes (*M*=.748, *SD*=.281) and the (unweighted) average score for the items reflecting cost system usage for operational purposes (*M*=.692, *SD*=.307), $t(132) = 1.995$, $p = .048$. This indicates that, on average, the firms' cost systems are used for a significantly broader range of strategic than operational purposes. Similarly, a t-test for two paired samples also shows a significant difference between the (unweighted) average for the items reflecting cost system importance for strategic purposes (*M*=3.051, *SD*=.965) and the (unweighted) average score for the items reflecting cost system importance for operational purposes (*M*=2.771, *SD*=.918), $t(132) = 2.935$, $p = .004$. As is the case for the regression analysis results (see fn. 39), these differences in means are also significant when the 'stock valuation' item is excluded from the analysis, although at slightly lower significance levels ($p = .091$ and $p = .027$, respectively).

proxies, *CS_SOPH* is significantly correlated with *CS_INTENS*, but not with *CS_SATISF*. Also, interestingly, *CS_SOPH* is significantly positively correlated with *OPER_USE* and *OPER_IMP*, but not with *STRAT_USE* and *STRAT_IMP*. This indicates that when the firms' cost systems are used more (and are considered to be more important) for operational purposes, their design is more sophisticated, whereas this is not the case for strategic purposes. The significant positive correlations between the two dimensions of cost system purposes of use, in terms of both usage and importance, and the two cost system effectiveness proxies provide some initial support for hypotheses 12 and 13: when cost system usage (and importance) for strategic and operational purposes is higher, cost system effectiveness is higher, in terms of both the intensity of use of and level of satisfaction with the cost systems.
The correlations with the contextual factors show that *STRAT_USE* is significantly correlated with *COM*, while *STRAT_IMP* is significantly correlated with *PEU*, *PD* and *PRLIN*. Further, *OPER_USE* is significantly correlated with *COM*, *COMS* and *AMT*, while *OPER_IMP* is significantly correlated with *COM*, *PEU* and *AMT*. This indicates that cost system usage and importance for strategic purposes differ somewhat in their associations with the contextual factors, and similarly do cost system usage and importance for operational purposes. Finally, *CS_SOPH* is significantly positively correlated with *VERT*, *SIZE*, *PD*, *AMT* and *PRLIN*. This indicates that the sample firms' cost systems are more sophisticated when their number of hierarchical levels is larger, they employ more employees, the number of and the differences between the products (stock keeping units) they produce are larger, they use more advanced manufacturing technologies, and the number of production lines that they operate is larger. These last findings confirm some results of Drury and Tayles (2005), who also found cost system sophistication to be positively associated with firms' size and level of product diversity.

6.3 Multivariate analyses

This section presents the results of multivariate analyses of the relationship between cost system sophistication, purposes of use, and cost system effectiveness, operationalized as intensity of use and satisfaction, respectively.[57]

6.3.1 The relationship between cost system sophistication, purposes of use, and cost system intensity of use

Table 6.3, Panel A, presents the results of a series of regression models testing the influence of cost system sophistication and purposes of use on cost system intensity of use, controlling for the influence of a number of environmental, organizational and technological factors.[58] As the results for the two models testing the interaction effects with cost system usage (Model 1) and cost system importance (Model 2) for strategic and operational purposes are very similar,

[57] As argued in Section 4.4, four cases were removed from the dataset before estimating these regression models after carefully examining the leverage, discrepancy and influence of all cases, using the measures and cutoffs suggested by Cohen et al. (2003). With the four cases included, regression analysis shows that, compared to the results presented in this chapter, four of the simple and interaction effects are no longer significant: *OPER_USE* in Model 1, *CS_SOPH*OPER_IMP* in Model 2, *OPER_USE* in Model 3, and *OPER_IMP* in Model 4.
[58] As an additional robustness check of the results, all regression models were also estimated without the control variables. All conclusions concerning the hypotheses remain the same as those reported in this chapter.

this section will first discuss the results of Model 1, and then only briefly any differences with Model 2.

In Model 1, cost system intensity of use is regressed on cost system sophistication, cost system *usage* for strategic purposes, cost system *usage* for operational purposes, their interaction effects, and the control variables. This model is significant ($F(18, 114) = 3.685$, $p < .01$, adjusted $R^2 = .268$). As expected, the simple effects of *STRAT_USE* and *OPER_USE* are both positive and significant, although the effect of *OPER_USE* is only marginally significant. As all continuous independent variables are mean centered, this indicates that at the average level of cost system sophistication, the more strategic and/or operational purposes a firm's cost system is used for, the more intensively its system is used for decision making.[59] This provides support for hypotheses 12 and 13. Note that the simple effect of *STRAT_USE* is stronger than the simple effect of *OPER_USE* in this model, which, as will be shown later, is also the case in the other three models.

Table 6.3: Regression analysis results for the associations between cost system sophistication, purposes of use, and cost system effectiveness

Independent variables	**Panel A: Intensity of use**		**Panel B: Satisfaction**	
	Model 1 (containing interactions with Cost system usage)	**Model 2** (containing interactions with Cost system importance)	**Model 3** (containing interactions with Cost system usage)	**Model 4** (containing interactions with Cost system importance)
CS_SOPH	.026	.035	.014	.021
	(.032)	(.029)	(.033)	(.034)
	.071	.095	.040	.061
STRAT_USE / STRAT_IMP	.211**	.405***	.189**	.275***
	(.090)	(.083)	(.094)	(.095)
	.249	.477	.235	.343
OPER_USE / OPER_IMP	.137#	.150*	.161*	.144#
	(.087)	(.084)	(.091)	(.096)
	.161	.177	.201	.180
CS_SOPH * STRAT_USE /	-.084**	-.102***	-.027	-.054
STRAT_IMP	(.041)	(.037)	(.043)	(.043)
	-.230	-.280	-.079	-.156
CS_SOPH * OPER_USE /	.078**	.063*	.087**	.062#
OPER_IMP	(.036)	(.036)	(.038)	(.041)
	.214	.173	.251	.180
COM	-.174	-.185#	-.115	-.106
	(.123)	(.113)	(.129)	(.129)
	-.123	-.131	-.087	-.079
PEU	.343*	.203	.184	.077
	(.204)	(.186)	(.215)	(.213)
	.138	.082	.078	.033

[59] Similarly, the insignificant simple effect of *CS_SOPH* indicates that at the average level of cost system usage for *both* strategic and operational purposes, the level of cost system sophistication is not associated with the intensity of use of the cost systems.

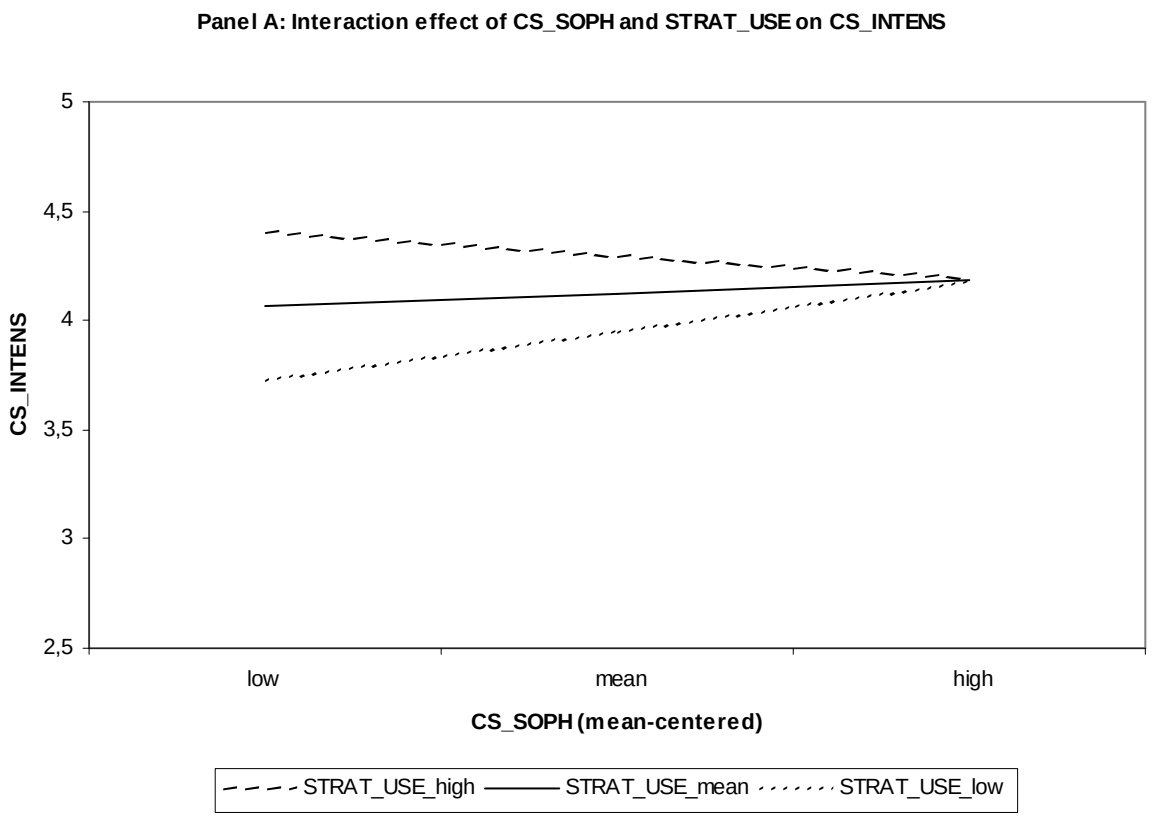
COMS	.070	.084	.097	.111
	(.104)	(.094)	(.109)	(.108)
	.057	.069	.084	.096
VERT	-.053	-.049	.052	.060
	(.066)	(.059)	(.069)	(.068)
	-.068	-.062	.071	.081
FORM	.365***	.286***	.064	.002
	(.114)	(.104)	(.120)	(.119)
	.252	.197	.046	.001
CENT	.147	.109	.046	-.014
	(.131)	(.118)	(.138)	(.135)
	.096	.071	.032	-.010
SIZE	.060	-.060	.164	.071
	(.108)	(.101)	(.114)	(.115)
	.044	-.044	.127	.055
PD	.019***	.014***	-.004	-.008
	(.005)	(.005)	(.006)	(.006)
	.296	.218	-.063	-.132
AMT	.066	.077	.132	.132
	(.103)	(.096)	(.109)	(.110)
	.055	.065	.117	.117
PRLIN	.009	-.034	.072	.042
	(.052)	(.048)	(.055)	(.055)
	.015	-.055	.124	.073
HetMass	-.324	-.236	-.416#	-.342
	(.267)	(.243)	(.281)	(.278)
	-.169	-.123	-.229	-.188
SerUnit	-.633**	-.640***	-.133	-.146
	(.247)	(.226)	(.260)	(.259)
	-.373	-.377	-.083	-.091
Unit	-.420#	-.386#	-.082	-.060
	(.287)	(.262)	(.302)	(.300)
	-.200	-.184	-.041	-.030
Intercept	4.124***	4.111***	3.509***	3.507***
	(.230)	(.212)	(.242)	(.242)
	-.050	-.034	-.061	-.042
R^2_{adj}	.268	.396	.093	.112
F	3.685***	5.799***	1.752**	1.929**

Notes: *n*=133; Cell statistics are unstandardized coefficients, standard errors and standardized coefficients. ***, **, *, # indicates significance at the .01, .05, .10 and .15 level (two-tailed), respectively. Chow test results for Model 1: $F(19, 95) = .528$, $p = .943$, for Model 2: $F(19, 95) = .716$, $p = .794$, for Model 3: $F(19, 95) = .982$, $p = .489$, and for Model 4: $F(19, 95) = .904$, $p = .579$. All continuous independent variables were mean centered before entering to avoid nonessential multicollinearity. Standardized regression coefficients are estimated using the procedure suggested by Jaccard et al. (1990).

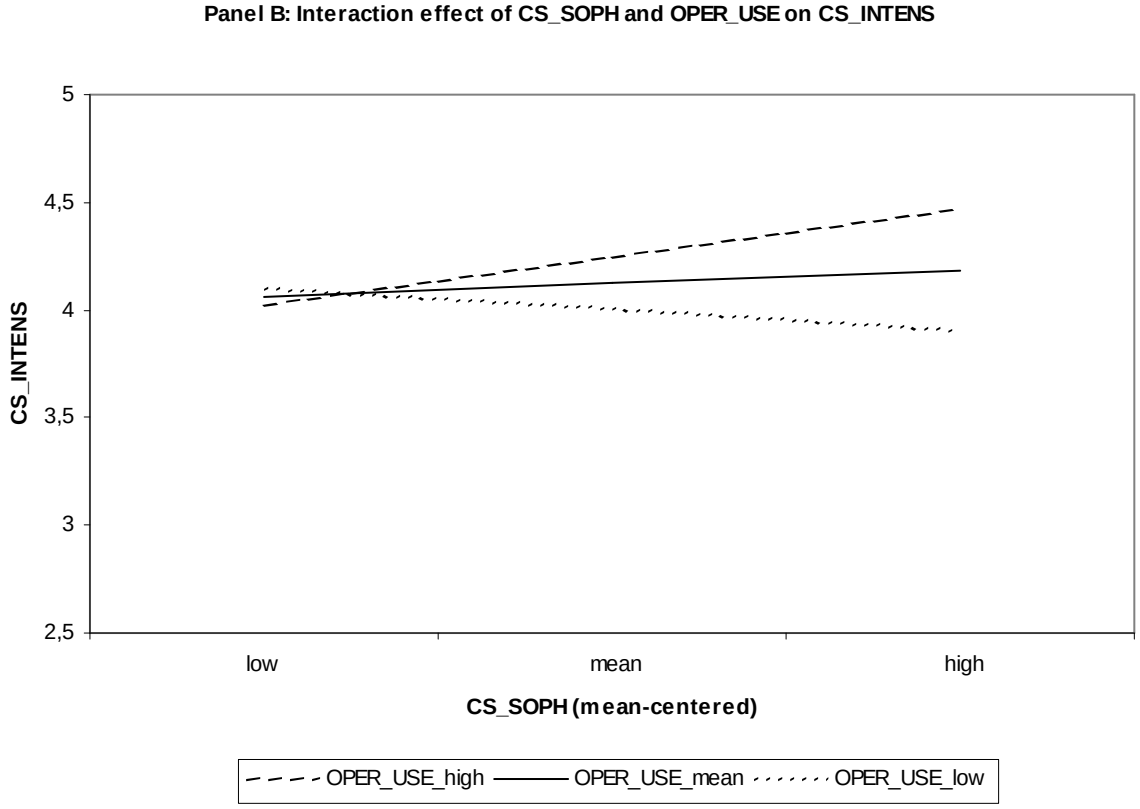
Both interaction effects have the expected sign, and are significant. Cost system sophistication and cost system usage for strategic purposes interact *negatively* to affect the intensity of use of a firm's cost system. On the other hand, cost system sophistication and cost system usage for operational purposes interact *positively* to affect the intensity of use of a firm's cost system. In order to interpret whether these interaction effects are monotonic or (as expected) non-monotonic, Figure 6.1 shows the interaction effects graphically.[60]

First, Panel A of Figure 6.1 plots the regression of *CS_INTENS* on *CS_SOPH* at three values of *STRAT_USE*: the mean (STRAT_USE_mean), one standard deviation below the mean (STRAT_USE_low), and one standard deviation above the mean (STRAT_USE_high). This graph clearly shows that at one *SD* below the mean of *STRAT_USE*, *CS_SOPH* has a positive effect on *CS_INTENS*, while at one *SD* above the mean of *STRAT_USE*, the effect of *CS_SOPH* on *CS_INTENS* is negative. This indicates that this interaction effect is indeed non-monotonic, and provides support for H14a: at higher (lower) levels of cost system usage for

Figure 6.1: Graphical presentations of the interaction effects on cost system intensity of use



[60] Each graph shows one interaction effect, at the average level of the other interacting variable. The graphical presentations of Models 2 and 4 are very similar to those of Models 1 and 3, respectively, and are therefore not reported. See Schoonhoven (1981) for an alternative approach to interpret the form of interaction effects.



strategic purposes, cost system sophistication negatively (positively) affects the intensity of use of cost systems. Similarly, Panel B of Figure 6.1 plots the regression of *CS_INTENS* on *CS_SOPH* at three values of *OPER_USE*: the mean (OPER_USE_mean), one standard deviation below the mean (OPER_USE_low), and one standard deviation above the mean (OPER_USE_high). In contrast to the graph for *STRAT_USE*, this graph shows that at one *SD* below the mean of *OPER_USE*, *CS_SOPH* has a negative effect on *CS_INTENS*, while at one *SD* above the mean of *OPER_USE*, the effect of *CS_SOPH* on *CS_INTENS* is positive. Therefore, this interaction effect is also non-monotonic, and provides support for H15a: at higher (lower) levels of cost system usage for operational purposes, cost system sophistication positively (negatively) affects the intensity of use of cost systems.[61]

Four of the contextual factors are significantly associated with cost system intensity of use. The standardized regression coefficients suggest that *SerUnit* has the strongest effect, followed by *PD*, *FORM* and *PEU*. The association between cost system intensity of use and *SerUnit* is negative, indicating that the firms' cost systems are used less intensively for

[61] As argued by Hartmann & Moers (2003), especially as *CS_SOPH* is significantly correlated with *OPER_USE* (but the same reasoning also applies to cost system usage for strategic purposes), this effect may also potentially be due to an endogeneity problem. That is, if firms, on average, adjust the level of sophistication of their cost system to their level of cost system usage for operational purposes (i.e., when *CS_SOPH* is endogeneous), *CS_INTENS* becomes a quadratic, curvilinear function of *CS_SOPH* and I may mistakenly interpret this alternative (path) model as an interaction effect. In order to assess the plausibility of this alternative explanation, I estimated a series of models regressing *CS_INTENS* (and also *CS_SATISF*) on *CS_SOPH* and the square of *CS_SOPH* (after mean centering), and the control variables. As none of these analyses provides any support for the presence of a quadratic, curvilinear relationship between *CS_SOPH* and *CS_INTENS* (or *CS_SATISF*), this alternative (endogeneity) explanation for the interaction effect does not seem very plausible.

decision making by firms with a serial unit production process than by firms with a homogeneous mass production process. The associations between cost system intensity of use and product diversity, formalization and perceived environmental uncertainty are all positive. This indicates that the larger the number of and the differences between the products (stock keeping units) a firm produces, the more tasks within the firm are standardized and the more uncertain its environment is perceived to be, the more intensively the firm's cost system is used to make decisions.

As shown in Table 6.3, Panel A, the results of Model 2 are very similar to those of Model 1. In Model 2, cost system intensity of use is regressed on cost system sophistication, cost system *importance* for strategic purposes, cost system *importance* for operational purposes, their interaction effects, and the control variables. Again the model is significant ($F(18, 114) = 5.799$, $p < .01$, adjusted $R^2 = .396$), and all conclusions concerning the simple and interaction effects are the same as for Model 1, although some of these effects are now significant at somewhat higher significance levels. Compared to Model 1, the effect of *PEU* on cost system intensity of use no longer is significant, but the negative effect of *COM* marginally is. Overall, the results of Model 2 thus show that the results of Model 1 are quite robust with respect to this alternative model specification.

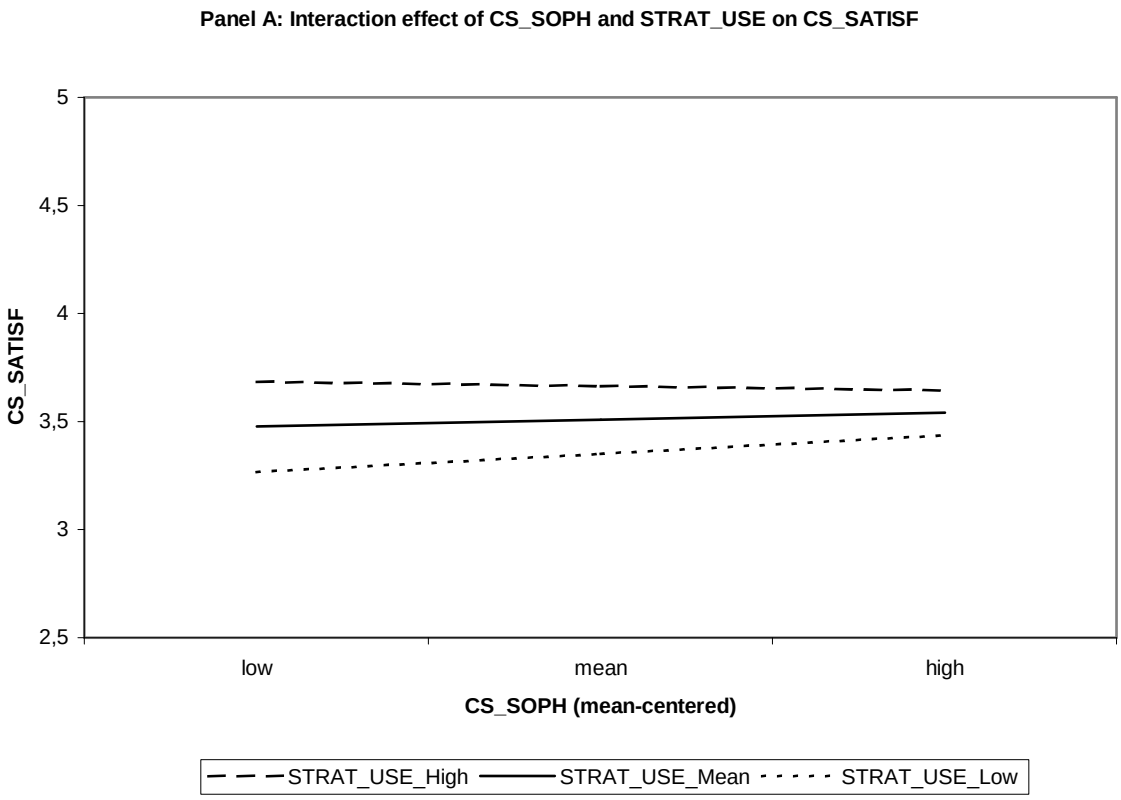
6.3.2 The relationship between cost system sophistication, purposes of use, and cost system satisfaction

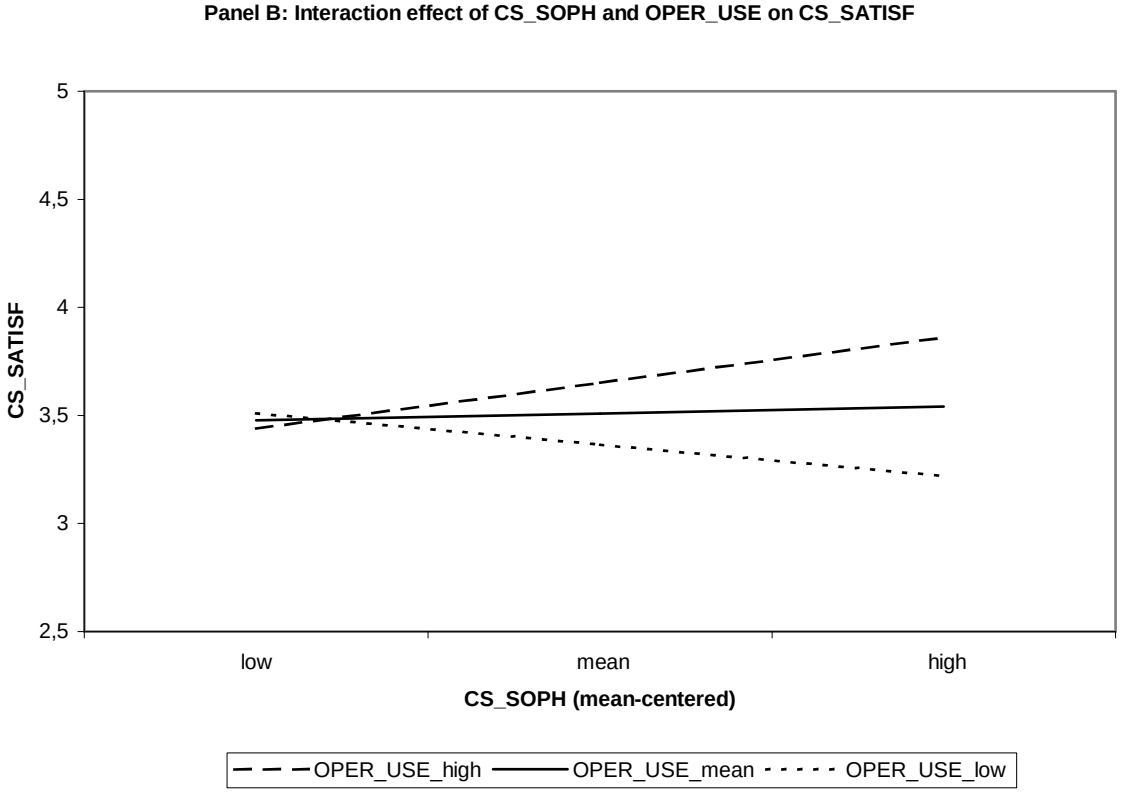
All regression analyses were re-conducted with an alternative proxy for cost system effectiveness, viz. cost system satisfaction, as presented in Table 6.3, Panel B. Since the results for the two models testing the interaction effects with cost system usage (Model 3) and cost system importance (Model 4) for strategic and operational purposes again are very similar, this section will first discuss the results of Model 3, and then only briefly any differences with Model 4.

In Model 3, cost system satisfaction is regressed on cost system sophistication, cost system *usage* for strategic purposes, cost system *usage* for operational purposes, their interaction effects, and the control variables. Although this model is significant, the variance in the level of cost system satisfaction that it explains is relatively low ($F(18, 114) = 1.752$, $p < .05$, adjusted $R^2 = .093$). Similar to Models 1 and 2, the simple effects of *STRAT_USE* and *OPER_USE* are both positive and significant. This indicates that at the average level of cost system sophistication, the more strategic and/or operational purposes a firm's cost system is used for, the higher the level of satisfaction with the cost system. Note that the simple effect of *STRAT_USE* on cost system satisfaction is again stronger than the simple effect of *OPER_USE*.

Also similar to Models 1 and 2, both interaction effects have the expected sign. Only the effect of *CS_SOPH*OPER_USE* is significant, however, which indicates that cost system sophistication and cost system usage for operational purposes interact *positively* to affect the level of satisfaction with a firm's cost system. In order to interpret whether these interaction effects are monotonic or (as expected) non-monotonic, Figure 6.2 provides a graphical presentation of the interaction effects.

Figure 6.2: Graphical presentations of the interaction effects on cost system satisfaction





Panel A of Figure 6.2 plots the regression of *CS_SATISF* on *CS_SOPH* at three values of *STRAT_USE*: the mean (STRAT_USE_mean), one standard deviation below the mean (STRAT_USE_low), and one standard deviation above the mean (STRAT_USE_high). Consistent with the insignificant interaction effect for *STRAT_USE*, this graph hardly shows any pattern: the three regression lines are almost the same, suggesting the nonexistence of an interaction effect. Therefore, the results do not provide support for H14b. Panel B of Figure 6.2 plots the regression of *CS_SATISF* on *CS_SOPH* at three values of *OPER_USE*: the mean (OPER_USE_mean), one standard deviation below the mean (OPER_USE_low), and one standard deviation above the mean (OPER_USE_high). Similar to the results for *CS_INTENS*, this graph shows that at one *SD* below the mean of *OPER_USE*, *CS_SOPH* has a negative effect on *CS_SATISF*, while at one *SD* above the mean of *OPER_USE*, the effect of *CS_SOPH* on *CS_SATISF* is positive. Therefore, this interaction effect is non-monotonic, and provides support for H15b: at higher (lower) levels of cost system usage for operational purposes, cost system sophistication positively (negatively) affects the level of satisfaction with cost systems.

In contrast with Models 1 and 2, except for a marginal effect of *HetMass*, none of the contextual factors is significantly associated with cost system satisfaction. In other words, while some of these factors are associated with the extent to which cost systems are used for decision making, they are not significantly related to the extent to which users are satisfied with the system.

As shown in Table 6.3, Panel B, the results of Model 4 are very similar to those of Model 3. In Model 4, cost system satisfaction is regressed on cost system sophistication, cost system *importance* for strategic purposes, cost system *importance* for operational purposes, their interaction effects, and the control variables. Again the model is significant ($F(18, 114) = 1.929$, $p < .05$, adjusted $R^2 = .112$), and all conclusions concerning the simple and interaction effects are the same as for Model 3, although some of these effects are now significant at somewhat higher, and others at somewhat lower significance levels. Compared to Model 3, the effect of *HetMass* on cost system satisfaction no longer is significant. Overall, the results of Model 4 thus show that the results of Model 3 are quite robust with respect to this alternative model specification.

6.3.3 Discussion

Building on the two dimensions of cost system purposes of use, which refers to the range (scope) of purposes for which the cost system is used, identified in Section 4.5.1, i.e., cost system usage (and importance) for strategic purposes and cost system usage (and importance) for operational purposes, this section examined the associations between cost system sophistication, purposes of use, and cost system effectiveness. On average, the firms' cost systems are used significantly more, and are considered to be significantly more important, for strategic than for operational purposes. Concerning the optimal design of cost systems, the literature argues that usage for operational purposes requires a more sophisticated design than usage for strategic purposes. Consistent with this assertion, the results show that when the firms' cost systems are used more (and are considered to be more important) for operational

purposes, their design is more sophisticated, whereas this is not the case for strategic purposes.

To more fully investigate the assertion, the joint (or interactive) effect of cost system sophistication and cost system usage (and importance) for strategic and operational purposes on cost system effectiveness was examined, controlling for the influence of environmental, organizational and technological factors. In this analysis, cost system effectiveness was proxied by the intensity of use of and level of satisfaction with the cost systems. The results show that when cost system usage (and importance) for strategic and operational purposes is higher, cost system effectiveness is higher. More specifically, at the average level of cost system sophistication, the more strategic and/or operational purposes a firm's cost system is used for, the more intensively the system is used for decision making and the more satisfied are its users. Also, and more important, the results show that cost system sophistication and cost system usage (and importance) for strategic purposes interact negatively to affect the intensity of use of the system, while cost system sophistication and cost system usage (and importance) for operational purposes interact positively. Similarly, cost system sophistication and cost system usage (and importance) for operational purposes also interact positively to affect the level of satisfaction with the system. Additional analysis shows that these interaction effects are non-monotonic. Accordingly, overall the results imply that at higher (lower) levels of cost system usage and importance for strategic purposes, cost system sophistication negatively (positively) affects cost system intensity of use, while at higher (lower) levels of cost system usage and importance for operational purposes, cost system sophistication positively (negatively) affects cost system intensity of use and satisfaction.

6.4 Further exploration of cost system usage and importance[62]

Given the sample firms' wide diversity in terms of usage and importance of cost systems for the nine different purposes (see Section 6.2), it seems interesting to examine whether this may be associated with the internal and external environment in which these firms operate. For this purpose, I examine the association between both the usage and level of importance of cost systems for each of the nine purposes and ten environmental, organizational and technological factors.

Table 6.4 first presents the results of testing on associations between the usage of cost systems for particular purposes and the contextual factors (see the upper row for each purpose). Sixteen associations are found to be statistically significant. Fourteen of these are positive and two are negative (the usage for product output decisions and for new product design are negatively associated with the level of formalization and the level of usage of advanced manufacturing technologies, respectively).

Table 6.4 also presents the results of testing on associations between the level of importance of cost systems for particular purposes, conditional on whether they use their cost system for (among others) this purpose, and the contextual factors (see the second row for each purpose). As shown in Table 6.4, twenty-four associations are found to be statistically significant. All of these associations are positive.

[62] The content of this section was earlier (with some adaptations) published as Schoute (2007).

6.4.1 Association with environmental factors

Prior to the analyses, I expected that competition would be strongly associated with the usage and importance of cost systems for cost reduction, product pricing and customer profitability analysis. When a firm is confronted with more fierce competition, the importance of producing for relatively low costs, of determining accurate cost prices for pricing, and of identifying its most profitable (and certainly also its loss-making) customers, is higher. A cost level that is too high can lead to loss of (potential) sales volume, cost and selling prices that are too low can lead to loss of margins and those that are too high can (also) lead to loss of (potential) sales volume, and as a result of insufficient understanding of the profitability of customers a firm may aim too little of its efforts on the most profitable. I also expected that more perceived environmental uncertainty would be associated with more usage and greater importance of such systems for what-if analyses (cost modeling) and product output decisions, as these are typical purposes with which a firm can anticipate and/or react on the level of uncertainty it is confronted with.

The results of the analyses only partially support these expectations. The level of intensity of market competition is positively associated with the usage of cost systems for cost reduction, performance measurement, customer profitability analysis, and stock valuation. The level of perceived environmental uncertainty is positively associated with the usage for product output decisions. This means that users are significantly different from non-users of cost systems for these purposes. A higher level of competition apparently increases the need for reducing cost, measuring performance on financial indicators (cost), and extensively analyzing (potential) customers to select the (most) profitable. The effect for stock valuation is less obvious, but is possibly also related to an increased need for cost reduction (in this case of stock keeping costs). A higher level of perceived environmental uncertainty apparently increases the need to support decisions regarding the product mix, both for the short and long term (e.g., decisions with regard to the assortment for the next year, but also decisions on whether to accept or reject a particular order).

The level of intensity of market competition is positively associated with the importance of cost system use for both cost reduction, cost modeling and budgeting. Also, the level of perceived environmental uncertainty is positively associated with the importance of cost system use for product output decisions. When firms are confronted with a higher level of competition, they attach more importance to the use of their cost system for cost reduction, what-if analyses and budgeting. Strikingly, these are all operational purposes, which have in common that they are all aimed at controlling or reducing costs. Thus, once again the relationship between the level of competition and the need for cost reduction emerges. This also applies to the relationship between the level of uncertainty with respect to the external environment in which firms operate and the need to support product mix decisions. When firms face more uncertainty, they attach more importance to the use of their cost system for such decisions.

Table 6.4: Pearson correlations between the contextual factors and the usage and level of importance of the cost system for different purposes

	Environmental		Organizational					Technological		
Purposes	COM	PEU	COMS	VERT	FORM	CENT	SIZE	PD	AMT	PRLIN
Cost reduction	.220**	.041	.104	.088	.069	.089	.042	.150*	.153*	-.076
	*.222***	*.112*	*-.006*	*.050*	*.267***	*.053*	*.054*	*.076*	*.321****	*.169*
Product pricing	.085	.030	-.091	.005	.002	.051	-.061	.000	-.122	-.010
	-.139	*.019*	*.097*	*.074*	*.049*	*-.075*	*.085*	*.163**	*.063*	*.061*
Performance measurement	.162*	.045	.152*	.087	-.014	.064	-.017	.146*	.115	-.032
	.017	*.178*	*-.136*	*.196**	*.166*	*.214***	*-.006*	*.187**	*.249***	*.182**
Cost modeling	.063	-.027	.150*	-.019	.003	-.084	-.021	.036	.185**	-.027
	*.215***	*.114*	*-.074*	*-.098*	*.002*	*.140*	*.196**	*.053*	*.108*	*.033*
Budgeting	.136	.044	.043	.223**	-.042	.242***	.100	.051	.041	-.074
	*.159**	*.113*	*.037*	*.008*	*.168**	*.152**	*.190***	*-.034*	*.148*	*.023*
Customer profitability analysis	.184**	.103	.079	.131	.006	.022	-.001	.110	.065	.116
	-.096	*.133*	*-.045*	*.180*	*.369****	*.054*	*.179*	*.057*	*.209**	*.211**
Product output decisions	.084	.164*	.023	.005	-.167*	-.084	-.042	-.064	.039	.103
	.099	*.202**	*.064*	*.177*	*.195**	*.087*	*-.039*	*.166*	*.212**	*.301****
New product design	.057	.035	.055	-.067	-.047	.043	.076	.029	-.166*	.060
	.082	*.096*	*.067*	*.063*	*.092*	*.112*	*.108*	*.167*	*.081*	*.061*
Stock valuation	.211**	.041	.043	-.097	-.081	-.069	-.009	.178**	.054	.080
	.005	*.074*	*-.031*	*-.027*	*.091*	*.193**	*.104*	*.040*	*.043*	*.234***

Notes: *n*=133; ***, **, * indicates significance at the .01, .05 and .10 level (two-tailed), respectively. The upper row for each purpose shows the association of the contextual factors with Question A: “For each of the following purposes, please indicate if your firm uses its (absorption) cost system for this purpose (Scale: No or Yes)”. The bottom row for each purpose (italized) shows the association of the contextual factors with Question B: “If Yes, then please indicate to what extent the cost system is of importance for the purpose concerned (Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)”.

6.4.2 Association with organizational factors

For the organizational factors my ex ante expectation was that having a more innovative strategy would especially be associated with the usage and importance of cost systems for what-if analyses (cost modeling) and new product design. Even when a firm is relatively strongly focused on product/market innovation, it still has to keep an eye on the consequences of its innovative behavior on its cost level. These two purposes of cost systems are especially suitable for anticipating on such consequences. I also expected that having an organizational structure with more hierarchical layers and/or a more centralized management would be associated with the usage and importance of such systems for performance measurement and budgeting, and that being larger would also be associated with the usage and importance of cost systems for budgeting. In general, a deeper organizational structure and a larger number of employees increase the need for control in a firm, for which budgeting especially (but also performance measurement) is a highly suitable means. Also, Merchant and Van der Stede (2003) argue that these purposes tend to centralize the power in an organization.

The analyses show that usage of a more innovative strategy is positively associated with the usage of cost systems for performance measurement and cost modeling. Also, both the level of vertical differentiation and the level of centralization are positively associated with their usage for budgeting. Finally, a higher level of formalization is negatively associated with the usage of cost systems for product output decisions. For none of the nine purposes, cost system usage is found to be associated with the size of the firms. In other words, firms with a higher level of product/market innovation use their cost system relatively more for measuring performance and for what-if analyses. A higher level of vertical differentiation (more hierarchical layers) apparently increases the need for control in a firm (for which budgeting is a very suitable means), whereas a higher level of centralization is associated with the use of budgeting, as has generally been found in prior research (Merchant and Van der Stede, 2003). The results for formalization imply that cost systems in more standardized firms are used less for product mix decisions. A possible explanation for this relation is that relatively standardized firms may be confronted with relatively little (in- and external) uncertainty (see also the results for perceived environmental uncertainty), where ad hoc orders are relatively scarce and assortment decisions are relatively infrequent and/or radical.

The level of vertical differentiation is positively associated with the importance of cost system use for performance measurement. Also, the level of formalization is positively associated with the importance of such systems for cost reduction, budgeting, customer profitability analysis and product output decisions. The level of centralization is positively associated with the importance of cost system use for performance measurement, budgeting and stock valuation. Finally, the size of the firms is positively associated with the importance of cost system use for cost modeling and budgeting. Again these results suggest that a higher level of vertical differentiation (more hierarchical layers) increases the need for control in a firm, this time in the form of more importance of cost system use for measuring performance. The relationships found for the level of formalization (the extent to which tasks within a firm are standardized) can be explained by the fact that standardization is a very suitable means to reduce costs, budgeting is a suitable means to accomplish more standardization, and analyses of and decisions about certain customers and (parts of) the assortment possibly are

standardized (where possible) because of their great importance. A higher level of centralization is clearly related to more importance of cost system use for control purposes: performance measurement, budgeting and stock valuation. The association with budgeting is consistent with an association found with usage. As firms are larger they attach more importance to the use of their cost system for what-if analysis and budgeting. The latter probably again as a result of a (larger) need for control in such firms.

6.4.3 Association with technological factors

For the technological factors my expectation prior to the analyses was that more product diversity would especially be associated with the usage and importance of cost systems for product pricing and stock valuation. More product diversity involves a disproportionate use of indirect and support activities by products, which increases the chances of inaccurate cost and (as a consequence) product prices. As mentioned earlier, in turn these may lead to loss of margins and/or loss of (potential) sales volume. Also, usage of more advanced manufacturing technologies was expected to be associated with the usage and importance of such systems for cost reduction and product output decisions, whereas operating more production lines was expected to be associated with the usage and importance of cost systems for product output decisions and stock valuation. In its pursuit of cost reduction a firm generally will not only use cost systems, but (pre-eminently) also technological means. Also, as a firm uses more advanced manufacturing technologies and has more production lines at its disposal, product mix decisions, i.e., decisions about whether, how and where certain products (and/or orders) will be produced, will be more difficult. The usage of cost systems can support such decisions. Finally, a firm that has more production lines at its disposal will in general probably have more work in process and (as a result) stock, which increases the importance of its cost system for stock valuation.

Again the results of the analyses are only partially consistent with these expectations. The level of product diversity is positively associated with the usage of cost systems for cost reduction, performance measurement and stock valuation. Also, the extent to which firms use advanced manufacturing technologies is positively associated with the usage of such systems for cost reduction and cost modeling, and negatively with the usage for new product design. None of the purposes is associated with the firms' number of production lines. On the one hand, product diversity relates to the number of different products (or variants) that a firm produces, and on the other hand to the extent to which the products (or variants) that it produces differ from each other with respect to issues such as physical size, complexity and/or batch level. A high level of product diversity is relatively costly, which increases the need for reducing costs, measuring performance on financial indicators (costs), and valuing stock. For, especially when a firm produces relatively many (and differing) products, the need for insights into the stock position is relatively large. The positive association of usage of advanced manufacturing technologies with both cost reduction and cost modeling (what-if analyses) may be a result of the fact that implementing advanced manufacturing technologies may also be a method to reduce costs. The negative association with new product design suggests that technologically advanced firms may use other (not cost-related) systems and methods in their design processes.

The level of product diversity is positively associated with the importance of cost system use for product pricing and performance measurement. Also, the extent to which firms use advanced manufacturing technologies is positively associated with the importance of such systems for both cost reduction, performance measurement, customer profitability analysis and product output decisions. Finally, the number of production lines is positively associated with the importance of cost system use for performance measurement, customer profitability analysis, product output decisions and stock valuation. As firms produce more (and differing) products, they attach more importance to the use of their cost system for pricing products and measuring performance on financial indicators (costs). The latter effect again is consistent with an effect found earlier, which also applies to the association between usage of advanced manufacturing technologies and cost reduction. The other purposes that are related to usage of advanced manufacturing technologies are also found to be related to the number of production lines. Both contextual factors apparently increase the importance of measuring performance on financial indicators (costs), analyzing the profitability of customers, and supporting product mix decisions. A higher number of production lines apparently results in more importance being attached to the use of the cost system for providing insights into such issues as the performance per line/process, the profitability of particular customers and (parts of) the assortment (for which certain production lines are being used), and/or whether a certain order has to be accepted or not, and if so, on which line it has to be produced. Finally, a possible explanation of the positive association between the number of production lines and the importance of the cost system for stock valuation is the fact that a higher number of production lines generally will involve more stock (especially work in process), into which the cost system may be able to provide insights.

6.4.4 Discussion

In general, the results presented in this section show that the different purposes for which cost systems are used, as well as (when they are being used) their importance, are clearly associated with the specific environmental, organizational and technological circumstances with which the firm is confronted. For example, the results for budgeting suggest that, on average, users of cost systems for this purpose have more hierarchical layers and are more centralized than non-users. At the same time the results indicate that within the group of firms that use their cost system for this purpose, a higher level of intensity of market competition, formalization and centralization, and a larger size are associated with the extent to which they find the use of the cost system for this purpose to be of importance.

Another interesting finding is that six associations that are found to be significant in the analysis of the usage of cost systems for the different purposes and the contextual factors, are also found to be significant in the analysis of the associations between the importance of them (conditional on that they are being used for (among others) this purpose) and the contextual factors. Both the usage and importance of cost systems for cost reduction are positively associated with the level of intensity of market competition and the extent of usage of advanced manufacturing technologies. Likewise, both the usage and importance for performance measurement are positively associated with the level of product diversity. In addition, both the usage and importance for budgeting are positively associated with the level of centralization. Finally, both the usage and importance for product output decisions are

associated with the level of perceived environmental uncertainty and the level of formalization (although the associations for formalization have opposite directions). This implies that these circumstances are not only reasons for firms to use their cost system for these purposes, but also that among the firms that actually use them for these purposes, the same circumstances also appear to influence the importance of this usage.

6.5 Summary and conclusions

Building on the two dimensions of cost system purposes of use identified in Chapter 4, cost system usage (and importance) for strategic purposes and cost system usage (and importance) for operational purposes, the first part of this chapter discussed the results of the analyses for the research question on the relationship between cost system sophistication, purposes of use, and cost system effectiveness. Specifically, the joint effect of cost system sophistication and cost system usage (and importance) for strategic and operational purposes on cost system effectiveness, as proxied by the intensity of use of and level of satisfaction with the cost systems, was examined, controlling for the influence of environmental, organizational and technological factors. The results indicate that at higher (lower) levels of cost system usage and importance for strategic purposes, cost system sophistication negatively (positively) affects cost system intensity of use, while at higher (lower) levels of cost system usage and importance for operational purposes, cost system sophistication positively (negatively) affects cost system intensity of use and satisfaction.

The second part of this chapter discussed the results of exploratory analyses of the association between both the usage and importance of cost systems for each of the nine purposes and ten environmental, organizational and technological factors. The analyses show that, on average, the studied firms use their cost system for a little more than six (of the nine) purposes. The most widely used and most important purposes are those for product pricing, budgeting and stock valuation. However, there is a large variation in both the number and types of purposes. In general, the results show that the different purposes for which cost systems are used, as well as (when they are being used) their importance, are clearly associated with the specific circumstances the firm is confronted with.

Chapter 7

Conclusions, limitations, and suggestions for future research

7.1 Introduction

The central topic of this dissertation is the antecedents and consequences of cost system design choices. This topic already has a long history in the field of management accounting. In the second half of the 1980s, the design of cost systems regained much interest from both academics and practitioners. The internal and external environment in which many firms operated, and thus the environment in which costing was undertaken, had undergone substantial change. Traditional cost systems were heavily criticized for not being sufficient anymore in this new environment, and an alternative cost system, activity-based costing (ABC), emerged. The fundamental characteristic of this alternative cost system is its focus on activities performed by supporting units as the basis for assigning these units' costs to cost objects. ABC systems try to identify the causal relations between cost objects and the indirect costs they generate by measuring cost objects' demand for supporting activities.

Since its introduction in the literature, an overwhelming stream of publications on ABC has developed, in which its benefits are strongly emphasized. Furthermore, ABC has become a central topic in the management accounting textbooks, and consultants have heavily promoted its use. One would therefore be inclined to believe that many firms by now would be using ABC. International surveys, however, repeatedly show that the percentage of firms that actually uses ABC is usually less than 20 percent. This has given rise to the so-called ABC paradox: the phenomenon that ABC, despite its clear theoretical benefits, is actually used by only a relatively small number of firms.

For researchers, ABC and its (relatively infrequent) use in practice offer a fruitful research subject. Since its introduction in the management accounting literature, several streams of research on ABC have developed, of which research on the determinants of the adoption and use of ABC is a major one. The results of this stream of research, in which the influence of many potential determinants has been studied, are generally inconclusive. On the one hand, this has led researchers into arguing that more research in this area is necessary, as the source of the inconclusive results may, according to these researchers, not only be substantial, but may also be methodological. On the other hand, it also has led researchers into broadening the scope of their research by, instead of focusing on adoption (or use) versus non-adoption (or non-use) of ABC, focusing their studies on either the stages towards ABC implementation, or on the determinants of the level of sophistication or complexity of cost systems. Building on these two developments within this stream of research, the overall objective of this dissertation is to provide empirical evidence on the antecedents and consequences of cost

system design choices. This objective translates into the following two research questions, which are each dealt with in a separate chapter in the empirical part of the dissertation:

1. **What is the relationship between environmental, organizational and technological factors, and ABC adoption and use?**

2. **What is the relationship between cost system sophistication, purposes of use, and cost system effectiveness?**

The data used to empirically examine these research questions are taken from a large-scale survey-study that I conducted in 2002, on the use of cost systems in medium-sized, Dutch manufacturing firms. Medium-sized firms were targeted for this study because larger firms commonly consist of a number of organizational units, which may not all use the same (or even a similar) cost system, whereas smaller firms may not use sophisticated cost allocation systems at all. Manufacturing firms were targeted because these are assumed to be a relatively homogeneous group, distinct from non-manufacturing firms. As part of a quite extensive procedure, a questionnaire was sent to either the general manager or the financial manager of 2108 firms. This questionnaire was used to gather firm-level data on their cost systems and on a number of contextual characteristics of the firms. Eventually, 225 usable and representative questionnaires (10.7%) were returned. I experienced some item non-response, however, as a result of which the effective sample size used in the analyses is lower.

7.2 Conclusions on the relationship between environmental, organizational and technological factors, and ABC adoption and use

Based on eleven hypotheses on the relationship between environmental, organizational and technological factors, and ABC adoption and use, developed in Chapter 3, the first research question was empirically examined in Chapter 5. Comprehensive models, simultaneously examining the influence of major environmental, organizational and technological factors, of ABC adoption and use were tested. These models build on and extend relations examined earlier by, among others, Bjørnenak (1997), Gosselin (1997) and Malmi (1999). The results showed that firms with a higher level of competition, vertical differentiation and product diversity, and a lower level of centralization are more likely to adopt ABC, whereas firms with either a heterogeneous mass production process or a serial unit production process are less likely to adopt ABC than firms with a homogeneous mass production process. Similarly, firms with a higher level of competition, vertical differentiation and product diversity, more production lines, and a lower level of centralization are more likely to use ABC, whereas firms with a serial unit production process are less likely to use ABC than firms with a homogeneous mass production process. Also, the influence of product diversity on a firm's likelihood of using ABC was found to be negatively moderated by the extent to which the firm uses advanced manufacturing technologies, supporting qualitative findings of Abernethy et al. (2001).

In addition, in Chapter 5 also the association between six aspects concerning the level of implementation and way(s) of using ABC among its adopters and three organizational structure factors was examined. The six aspects concern the level and (perceived) quality of

the implementation of ABC, the width and integration of the ABC systems, and the update frequency of the structure and contents of these systems. Overall, these exploratory analyses showed that the three organizational structure factors (vertical differentiation, formalization and centralization) not only influence ABC adoption decisions, but also the way(s) firms deal with ABC, given that they have adopted it. Among others, more formalized firms achieve a higher level of implementation quality and their ABC implementations are company wide more often than in less formalized firms. Also, more centralized firms update both the structure and the contents of their ABC system more frequently than less centralized firms.

7.3 Conclusions on the relationship between cost system sophistication, purposes of use, and cost system effectiveness

Based on four hypotheses on the relationship between cost system sophistication, purposes of use, and cost system effectiveness, developed in Chapter 3, the second research question was empirically examined in Chapter 6. Building on two dimensions of cost system purposes of use identified in Chapter 4, cost system usage (and importance) for strategic purposes and cost system usage (and importance) for operational purposes, the joint (or interactive) effect of cost system sophistication and cost system usage (and importance) for strategic and operational purposes on cost system effectiveness was examined, controlling for the influence of environmental, organizational and technological factors. The results showed that when cost system usage (and importance) for strategic and operational purposes is higher, cost system effectiveness is higher. More specifically, at the average level of cost system sophistication, the more strategic and/or operational purposes a firm's cost system is used for, the more intensively the system is used for decision making and the more satisfied are its users. Also, and more important, the results showed that cost system sophistication and cost system usage (and importance) for strategic purposes interact negatively to affect the intensity of use of the system, while cost system sophistication and cost system usage (and importance) for operational purposes interact positively. Similarly, cost system sophistication and cost system usage (and importance) for operational purposes also interact positively to affect the level of satisfaction with the system. Additional analysis showed that these interaction effects are non-monotonic. Accordingly, overall the results imply that at higher (lower) levels of cost system usage and importance for strategic purposes, cost system sophistication negatively (positively) affects cost system intensity of use, while at higher (lower) levels of cost system usage and importance for operational purposes, cost system sophistication positively (negatively) affects cost system intensity of use and satisfaction.

In addition, in Chapter 6 also the association between both the usage and importance of cost systems for each of nine purposes and ten environmental, organizational and technological factors was examined. These exploratory analyses showed that, on average, the studied firms use their cost system for a little more than six (of the nine) purposes. The most widely used and most important purposes are those for product pricing, budgeting and stock valuation. However, there is a large variation in both the number and types of purposes. In general, the results showed that the different purposes for which cost systems are used, as well as (when they are being used) their importance, are clearly associated with the specific circumstances the firm is confronted with.

7.4 Limitations of the study

As with any study, the findings of this study are subject to a number of potential limitations. Because cross-sectional research can establish associations, but not causality, the direction of effects cannot be established with certainty. Also, there may be omitted variables which may bias the results. Another issue that may potentially influence the findings is measurement error. As argued in Chapter 2, the two constructs this dissertation mainly focuses on, ABC usage and cost system sophistication, are typical examples of practice-defined variables. Such variables are more likely to suffer from measurement error than theory-defined variables. It also applies to the measurement of the two proxies for cost system effectiveness, intensity of use and satisfaction, as these have, given the length of the questionnaire, both been measured using single-item measures. Such measures are generally argued to be less reliable than multi-item measures, and given that they have been used as the dependent variables in some of the regression analyses, their use may thus have negatively influenced the power of the analysis. Another issue is that the list of nine purposes used to identify the underlying dimensions of cost system purposes of use is not comprehensive, which may have influenced the dimensions found. Finally, there is the issue of generalizability. The response rate in this study is rather low and, consequently, the sample size rather small. Although comparisons with the sampling database showed that the sample is representative in terms of industry, it may be biased with respect to other (unknown) variables. Also, it has to be emphasized that part of the results presented in this dissertation are the result of exploratory analyses, and need to be confirmed by future research. Despite these potential limitations, this study has important implications for both practice in and research on the design of cost systems.

7.5 Suggestions for future research

Several major areas for future research on the antecedents and consequences of cost system design choices can be identified. First, research developing better measurement instruments for the cost system design variables could significantly contribute to the literature. Several authors make promising suggestions on this issue. For example, Bisbe et al. (2007) suggest specifying activity-based cost management (ABCM) as a higher-order construct which has dimensions of cost drivers and value drivers which, in turn, both have indicators that elaborate specifically on what cost and value drivers mean. Second, research could also significantly contribute by developing better instruments for measuring the antecedent and consequence variables. Additional research is, for example, necessary to further develop the instrument used in this dissertation to measure the ‘product diversity’ construct. Finally, research that develops and tests alternative conceptual research models of the relationships between the antecedents and consequences of cost system design choices could significantly contribute to the literature. For example, Abernethy et al. (2001) argue that usage of AMT moderates the relationship between product diversity and ABC usage *via its influence on the cost structure of firms*. Future research is necessary to examine this mediated moderating effect. It also may fruitfully examine other joint (or interaction) effects of antecedents on the design of cost systems.

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Appendix A

Measurement instruments used

COST SYSTEM CHARACTERISTICS

ABC_ADOP/ ABC_USE. **Please indicate which of the following five stages best describes your firm's situation with respect to activity-based costing (ABC).** *(Please check one possibility.)*

a) currently using ABC
b) currently implementing ABC
c) currently considering ABC adoption
d) no consideration of ABC to date
e) rejected ABC after assessment

ABC_LEV. **Which part of the planned implementation process of ABC is approximately finished in your firm at this point in time?** *(Scale: ____%)*

ABC_QUAL. **To what extent has the implementation process of ABC (so far) gone according to plan in your firm?** *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

ABC_WID. **Does the ABC system in your firm encompass all production units or not?** *(Scale: "No" or "Yes")*

ABC_INT. **Is the ABC system in your firm integrated with other information systems or not?** *(Scale: "No" or "Yes")*

ABC_UFS/ ABC_UFC. **How frequently are the structure (e.g., the activities) and the contents (e.g., the costs) of the ABC system in your firm updated?** *(Please check one possibility for each.)*

a) More than monthly
b) Monthly
c) Quarterly
d) Half-yearly
e) Yearly
f) Two-yearly
g) Less than two-yearly

CS_SOPH. Regarding your firm's cost system, please indicate

a. How many cost pools are used *(log_2 N scale: "0", "1-2", "3-4", "5-8", "9-16", "17-32", "33-64", "65-128" and ">128".)*

b. How many cost allocation bases are used *(log_2 N scale: "0", "1-2", "3-4", "5-8", "9-16", "17-32", "33-64", "65-128" and ">128".)*

CS_PURP. For each of the following purposes, please indicate

a. if your firm uses the cost system referred to in the former question for this purpose *(Scale: "No" or "Yes")*

b. (If Yes) Further indicate, by circling the appropriate number below, to what extent the cost system is of importance for the purpose concerned *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

Cost reduction
Product pricing
Performance measurement
Cost modeling
Budgeting
Customer profitability analysis
Product output decisions
New product design
Stock valuation

CS_INTENS. Overall, how would you rate the extent to which the cost system referred to in the former questions is used to make decisions in your firm? *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

CS_SATISF. Overall, how would you rate the extent to which users of the cost system referred to in the former questions are satisfied with the system in your firm? *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

CONTEXTUAL CHARACTERISTICS

COM. **Please indicate, by circling the appropriate number below, the intensity of your firm's market competition with respect to the following elements** *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

Price competition
Product competition
Marketing competition

PEU. **For each of the following elements of your firm's external environment, please**

a. **Assess, by circling the appropriate number below, the degree of predictability during the past five years** *(Scale: 1 = very unpredictable, 2 = fairly unpredictable, 3 = neutral, 4 = fairly predictable and 5 = very predictable)* – **REVERSE CODED**

b. **Further indicate, by circling the appropriate number below, to what extent the elements are of importance to the success or failure of your firm** *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

Suppliers' actions
Customer demands, tastes and preferences
Deregulation and globalization
Market activities of competitors
Production technologies
Government regulations and policies
Economic environment
Industrial (workplace) relations

COMS. **Please indicate, by circling the appropriate number below, to what extent the following characteristics apply to your firm** *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

<u>"My firm…"</u>
… produces products in innovative ways
… offers a wide variety of products
… has a very diverse customer group
… offers many new products
… offers innovative new products
… allots many resources to marketing

VERT. **How many hierarchical levels exist between senior management and teamleaders in your firm?** *(Please provide a specific number.)*

FORM. **The following questions relate to the degree to which jobs are standardized within your firm.**

a. **Written job descriptions exist for:**

a) operation level employees only
b) operation level employees and teamleaders only
c) operation level employees, teamleaders and production line managers
d) operation level employees, teamleaders, production line and production managers
e) all employees, including senior management

b. **Where written descriptions exist, at what level are employees monitored to ensure compliance with standards set in the job description?** *(Scale: 1 = low, 2 = somewhat low, 3 = moderate, 4 = somewhat high and 5 = high)*

c. **What is the degree of flexibility given to employees to deviate from the standards?** *(Scale: 1 = low, 2 = somewhat low, 3 = moderate, 4 = somewhat high and 5 = high)* – **REVERSE CODED**

d. **To what degree are teamleaders and production line managers free to exercise their judgment when they make decisions?** *(Scale: 1 = low, 2 = somewhat low, 3 = moderate, 4 = somewhat high and 5 = high)* – **REVERSE CODED**

CENT. **What is the lowest level of management in the group below that has the authority to make the following decisions in your firm?** *(Scale: Teamleader, Production line manager, Production manager, Plant manager, and Head office manager.)*

Decide to design a new product
Establish the budget level
Choose the methods of work to be used
Select machinery or equipment to be used for a job
Select suppliers
Determine labor force requirements
Select type or brand for new equipment
Decide what type of costing system will apply
Dismiss direct workers
Determine sale prices
Alter responsibilities or areas of work of a line department
Determine personnel rewards

PD. **How many different products (stock keeping units) are being produced in your firm?** *(log_2 N scale: "1-2", "3-4", "5-8", "9-16", "17-32", "33-64", "65-128", "129-256", "257-512" and ">512".)*

Please indicate, by circling the appropriate number below, to what extent the products (stock keeping units) produced in your firm differ on average on the following dimensions *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

Physical size
Complexity
Batch size

AMT. **Please indicate, by circling the appropriate number below, to what extent the following advanced manufacturing technologies are used in your firm's production process** *(Scale: 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a considerable extent and 5 = to a very great extent)*

Computer-aided manufacturing (CAM)
Robotics
Real-time process control systems
Group technology (GT)
Flexible manufacturing systems (FMS)
Computerized numerical control machines (CNC)
Automated material handling systems
Environmental control systems
Bar coding/automatic identification

PRLIN. **How many production lines does your firm have?** *(log_2 N scale: "1-2", "3-4", "5-8", "9-16", "17-32", "33-64", "65-128" and ">128".)*

PRPRO. **Which classification best describes the structure of the production process in your firm?**

a) homogeneous mass production
b) heterogeneous mass production
c) serial unit production
d) unit production

Appendix B

Nederlandstalige vragenlijst (Questionnaire in Dutch)

De doelstelling van deze vragenlijst is gegevens te verzamelen over het gebruik van kostensystemen in middelgrote, Nederlandse productiebedrijven. De vragenlijst bestaat uit drie delen:

Deel 1.	*Respondent:*	*de vragen in dit deel hebben betrekking op uw achtergrond.*
Deel 2.	*Kostensysteem:*	*de vragen in dit deel hebben betrekking op het kostensysteem dat in uw bedrijf (tenminste) wordt gebruikt voor de berekening en verwerking van de* ***fabricagekosten****.*
Deel 3.	*Uw bedrijf:*	*de vragen in dit deel hebben betrekking op kenmerken van uw bedrijf.*

Het beantwoorden van de vragen zal ongeveer 20 minuten duren.

BELANGRIJK

Het is de bedoeling dat de vragenlijst wordt ingevuld voor het geheel aan economische activiteiten (dus inclusief eventuele deelnemingen en dochter- en groepsmaatschappijen) dat onderdeel vormt van de in de adressering van de brief genoemde rechtspersoon.

Retourneer de ingevulde vragenlijst a.u.b.

- **bij voorkeur door gebruik te maken van de bijgevoegde, reeds gefrankeerde envelop,**
- **of anders door deze te faxen naar:** **VRIJE UNIVERSITEIT AMSTERDAM**
  ARCA
  t.a.v. MARTIJN SCHOUTE
  fax: ----------

DEEL 1. RESPONDENT

De vragen in dit deel hebben betrekking op uw achtergrond.

1. Wat is uw leeftijd?

____ Jaar

2. Hoeveel jaar werkt u reeds bij uw huidige werkgever?

____ Jaar

3. Hoeveel jaar bekleedt u reeds uw huidige functie?

____ Jaar

4. Heeft u hoger onderwijs genoten?

Nee 0 → Ga direct naar Vraag 5
Ja 0

(Zo Ja) **Welke vorm van hoger onderwijs heeft u genoten?** *(Meerdere antwoorden mogelijk.)*

0 Een HBO opleiding
0 Een universitaire opleiding
0 Een post-HBO opleiding
0 Een post-doctorale opleiding
0 Anders, namelijk _____

5. Bent u in uw huidige functie de persoon die in uw bedrijf de eindbeslissing neemt over belangrijke wijzigingen in het kostensysteem (bijvoorbeeld wijzigingen ten aanzien van de gebruikte kostenallocatiemethode)?

Ja 0 → Ga direct naar Deel 2
Nee 0

(**Zo Nee)** **Wie dan wel?** *(Meerdere antwoorden mogelijk.)*

0 Algemeen directeur van uw bedrijf
0 Financieel directeur van uw bedrijf
0 Gehele directieteam van uw bedrijf
0 Hoger management (indien van toepassing)
0 Anders, namelijk _____

DEEL 2. KOSTENSYSTEEM

*De vragen in dit deel hebben betrekking op het kostensysteem dat in uw bedrijf (tenminste) wordt gebruikt voor de berekening en verwerking van de **fabricagekosten**.*

1. Geef voor ieder van de volgende toepassingen aan of uw bedrijf variabele en/of integrale kostprijsberekening gebruikt. *(Geen of meerdere antwoorden mogelijk.)*

Toepassingen	Variabele kostprijsberekening	Integrale kostprijsberekening
Kostenreductie	0	0
Prijsbepaling van producten	0	0
Prestatiemeting	0	0
Kostenmodellering	0	0
Budgettering	0	0
Klantwinstgevendheidsanalyse	0	0
Productoutputbeslissingen	0	0
Ontwerp van nieuwe producten	0	0
Voorraadwaardering	0	0
Anders, namelijk _____	0	0

2. Bent U bekend met "activity-based costing" (ABC)?

Nee 0 → Ga direct naar Vraag 3
Ja 0

(Zo Ja) **Wat is/zijn de bron(nen) van uw kennis over ABC?** *(Meerdere antwoorden mogelijk.)*

0 Opleiding(en)
0 Cursus(sen)
0 Vakliteratuur
0 Ervaring opgedaan bij eerdere werkgever(s)
0 Ervaring opgedaan bij huidige werkgever
0 Anders, namelijk _____

3. Wat is in uw bedrijf de verdeling van de totale fabricagekosten over de volgende kostencategorieën?

Directe materiaalkosten	____	%
Directe fabricage arbeidskosten	____	%
Indirecte fabricagekosten	____	% +
	======	
	100	%
	======	

*Indien uw bedrijf **ALLEEN** variabele kostprijsberekening gebruikt → Ga naar Vraag 7*

Ga anders a.u.b. verder met de volgende vraag

4. Welke van de volgende kostenallocatiemethoden wordt in uw bedrijf gebruikt? *(Kruis één mogelijkheid aan.)*

0 Delingscalculatiemethode
0 Toeslagcalculatiemethode
0 Kostenplaatsenmethode
0 Activity-based costing

5. Geef voor het kostensysteem van uw bedrijf aan

a. Hoeveel kostenpools (kostenverzamelplaatsen) er worden gebruikt *(Kruis één mogelijkheid aan.)*

0	1- 2	3- 4	5- 8	9- 16	17- 32	33- 64	65-128	>128
0	0	0	0	0	0	0	0	0

b. Welk type kostenpools (kostenverzamelplaatsen) er worden gebruikt *(Kruis één mogelijkheid aan.)*

0 Functioneel georiënteerde (bijvoorbeeld afdelings-) kostenpools
0 Procesgeoriënteerde (bijvoorbeeld activiteiten-) kostenpools
0 Functioneel en procesgeoriënteerde kostenpools
0 Anders, namelijk _____

c. Hoeveel kostenallocatiebases er worden gebruikt *(Kruis één mogelijkheid aan.)*

0	1- 2	3- 4	5- 8	9- 16	17- 32	33- 64	65-128	>128
0	0	0	0	0	0	0	0	0

d. Welk type kostenallocatiebases er worden gebruikt *(Kruis één mogelijkheid aan.)*

0 Slechts volume-gerelateerde allocatiebases
0 Zowel volume- als serie-gerelateerde allocatiebases
0 Zowel volume- en serie-gerelateerde als productondersteunende allocatiebases
0 Anders, namelijk _____

e. In welk jaar het in gebruik is genomen *(Geef een specifiek jaartal, tenzij het systeem vóór 1990 in gebruik is genomen: kruis in dat geval de betreffende mogelijkheid aan.)*

Jaar: ____ 0 vóór 1990

6. Geef voor ieder van de volgende toepassingen aan

a. Of uw bedrijf hiervoor het in Vraag 5 bedoelde kostensysteem gebruikt

(Zo Ja) b. Geef verder aan, door hieronder het juiste nummer te omcirkelen, in welke mate het kostensysteem van belang is voor de betreffende toepassing *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

	Nee	Ja		*Helemaal niet*				*In zeer grote mate*
Kostenreductie	0	0	→	1	2	3	4	5
Prijsbepaling van producten	0	0	→	1	2	3	4	5
Prestatiemeting	0	0	→	1	2	3	4	5
Kostenmodellering	0	0	→	1	2	3	4	5
Budgettering	0	0	→	1	2	3	4	5
Klantwinstgevendheidsanalyse	0	0	→	1	2	3	4	5
Productoutputbeslissingen	0	0	→	1	2	3	4	5
Ontwerp van nieuwe producten	0	0	→	1	2	3	4	5
Voorraadwaardering	0	0	→	1	2	3	4	5
Anders, namelijk _____	0	0	→	1	2	3	4	5

7. In welke mate wordt naar uw inschatting het kostensysteem in uw bedrijf gebruikt om beslissingen te nemen? *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate, 5 = in zeer grote mate)*

Helemaal niet				*In zeer grote mate*
1	2	3	4	5

8. In welke mate zijn naar uw inschatting gebruikers van de informatie van het kostensysteem tevreden met het systeem in uw bedrijf? *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

Helemaal niet				*In zeer grote mate*
1	2	3	4	5

9. Geef voor ieder van de volgende drie benaderingen aan welke van de volgende vijf fasen het beste de huidige situatie van uw bedrijf typeert *(Kruis per regel één mogelijkheid aan.)*

"Mijn bedrijf…"	**A** Gebruikt de benadering momenteel	**B** Is de benadering momenteel aan het implementeren	**C** Overweegt momenteel om de benadering te gaan implementeren	**D** Heeft nog niet serieus overwogen om de benadering te gaan implementeren	**E** Heeft besloten om de benadering niet te gaan implementeren
Activiteitenanalyse *(het identificeren en beschrijven van activiteiten)*	0	0	0	0	0
Cost driver-analyse *(het onderzoeken, kwantificeren en verklaren van de effecten van kostenveroorzakers)*	0	0	0	0	0
Activity-based costing *(kostprijsberekening op basis van activiteiten)*	0	0	0	0	0

*Indien activity-based costing in uw bedrijf momenteel **NIET** wordt gebruikt*
***OF** wordt geïmplementeerd* → *Ga naar Deel 3*

Ga anders a.u.b. verder met de volgende vraag

10. Welk gedeelte van het geplande implementatieproces van ABC is op dit moment bij benadering afgerond in uw bedrijf?

____ %

11. In welke mate is naar uw inschatting het implementatieproces van ABC (tot op heden) in uw bedrijf volgens plan verlopen *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

Helemaal niet				*In zeer grote mate*
1	2	3	4	5

12. Omvat het ABC systeem in uw bedrijf alle productie-eenheden?

0 Ja
0 Nee

13. Is het ABC systeem in uw bedrijf geïntegreerd met andere informatiesystemen?

0 Ja
0 Nee

14. Hoe frequent worden de structuur (bijvoorbeeld de activiteiten) en inhoud (bijvoorbeeld de kosten) van het ABC systeem in uw bedrijf geüpdate? *(Kruis per kolom één mogelijkheid aan.)*

	Structuur	Inhoud
Vaker dan maandelijks	0	0
Maandelijks	0	0
Per kwartaal	0	0
Per halfjaar	0	0
Jaarlijks	0	0
Twee-jaarlijks	0	0
Minder dan twee-jaarlijks	0	0

DEEL 3. UW BEDRIJF

De vragen in dit deel hebben betrekking op kenmerken van uw bedrijf.

1. Welke classificatie typeert de structuur van het productieproces in uw bedrijf het beste? *(Kruis één mogelijkheid aan.)*

0 Homogene massaproductie
0 Heterogene massaproductie
0 Seriestukproductie
0 Stukproductie

2. Geef aan, door hieronder het juiste nummer te omcirkelen, in welke mate de volgende geavanceerde fabricagetechnologieën worden gebruikt in het productieproces in uw bedrijf *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

	Helemaal niet				*In zeer grote mate*	*Dit is mij onbekend*
Computergestuurde fabricage	1	2	3	4	5	0
Robottechnologie	1	2	3	4	5	0
Real-time procesbeheersingssystemen	1	2	3	4	5	0
Groepstechnologie	1	2	3	4	5	0
Flexibele fabricagesystemen	1	2	3	4	5	0
Computergestuurde numerieke besturingsmachines	1	2	3	4	5	0
Geautomatiseerde material handling-systemen	1	2	3	4	5	0
Omgevingsbeheersingssystemen	1	2	3	4	5	0
Streepjescodering/automatische identificatie	1	2	3	4	5	0

3. Hoeveel verschillende producten (artikelsoorten) worden in uw bedrijf geproduceerd? *(Kruis één mogelijkheid aan.)*

1- 2	3- 4	5- 8	9- 16	17- 32	33- 64	65-128	129-256	257-512	>512
0	0	0	0	0	0	0	0	0	0

4. Geef aan, door hieronder het juiste nummer te omcirkelen, in welke mate de in uw bedrijf geproduceerde producten (artikelsoorten) gemiddeld van elkaar verschillen op de volgende dimensies *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

	Helemaal niet				*In zeer grote mate*
Formaat	1	2	3	4	5
Complexiteit	1	2	3	4	5
Seriegrootte	1	2	3	4	5

5. Welk percentage van de productie in uw bedrijf is gericht op de specifieke wensen van individuele afnemers?

____ %

6. Hoeveel productielijnen heeft uw bedrijf? *(Kruis één mogelijkheid aan.)*

1- 2	3- 4	5- 8	9- 16	17- 32	33- 64	65-128	>128
0	0	0	0	0	0	0	0

7. Geef aan, door hieronder het juiste nummer te omcirkelen, in welke mate de volgende praktijken van belang zijn in de bedrijfsvoering van uw bedrijf? *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

	Helemaal niet				*In zeer grote mate*
Verminderen van seriegrootte	1	2	3	4	5
Verminderen van insteltijd	1	2	3	4	5
Verminderen van het aantal leveranciers	1	2	3	4	5
Preventief onderhoud	1	2	3	4	5
Inkopen doen bij just in time (JIT) leveranciers	1	2	3	4	5
Verhogen van bezorgingsfrequenties	1	2	3	4	5
Verminderen van voorraad om kapitaalinvesteringen vrij te maken	1	2	3	4	5
Verminderen van voorraad om fabricage- en planningsproblemen aan het licht te brengen	1	2	3	4	5
Inspectie	1	2	3	4	5
Gebruik maken van benchmark-gegevens	1	2	3	4	5
Vereenvoudigen van het product	1	2	3	4	5
Statistische procesbeheersing	1	2	3	4	5
Gebruik maken van standaardonderdelen	1	2	3	4	5
Ontwerpen van kwaliteit in het product	1	2	3	4	5
Modulair ontwerp van onderdelen	1	2	3	4	5
Procesverbetering (wijziging van proces)	1	2	3	4	5
Trainen van werknemers in kwaliteitsmanagement en –beheersing	1	2	3	4	5
Empowerment van machine/procesoperators om kwaliteitsproblemen te verhelpen	1	2	3	4	5
Communicatie door het topmanagement van kwaliteitsdoelen naar de organisatie toe	1	2	3	4	5
Nadruk op kwaliteit in plaats van prijs bij het selecteren van leveranciers	1	2	3	4	5
Rekening houden met produceerbaarheid en assemblage in de product ontwerpfase	1	2	3	4	5

8. De volgende vragen hebben betrekking op de mate waarin taken binnen uw bedrijf zijn gestandaardiseerd

a. Beschreven taakomschrijvingen bestaan voor:

0 Uitsluitend uitvoerende medewerkers
0 Uitsluitend uitvoerende medewerkers en teamleiders
0 Uitvoerende medewerkers, teamleiders en productielijnmanagers
0 Uitvoerende medewerkers, teamleiders, en productielijn- en productiemanagers
0 Alle medewerkers, inclusief het hoogste management

b. Daar waar opgestelde taakomschrijvingen bestaan, in welke mate wordt er toezicht gehouden op medewerkers om naleving van in de taakomschrijving voorgeschreven richtlijnen te garanderen? *(Schaal: 1 = laag, 2 = enigszins laag, 3 = middelmatig, 4 = enigszins hoog en 5 = hoog)*

Laag				*Hoog*
1	2	3	4	5

c. Wat is de mate van flexibiliteit die gegeven is aan medewerkers om van de richtlijnen af te wijken? *(Schaal: 1 = laag, 2 = enigszins laag, 3 = middelmatig, 4 = enigszins hoog en 5 = hoog)*

Laag				*Hoog*
1	2	3	4	5

d. In welke mate zijn teamleiders en productielijnmanagers vrij om naar eigen inzicht te handelen als zij beslissingen nemen? *(Schaal: 1 = laag, 2 = enigszins laag, 3 = middelmatig, 4 = enigszins hoog en 5 = hoog)*

Laag				*Hoog*
1	2	3	4	5

9. Hoeveel hiërarchische niveaus bestaan er tussen topmanagers en teamleiders in uw bedrijf? *(Geef een specifiek getal.)*

____ Aantal hiërarchische niveaus

10. Wat is het laagste - hieronder genoemde - managementniveau dat de autoriteit heeft om de volgende beslissingen te nemen in uw bedrijf? *(Kruis per regel één mogelijkheid aan.)*

	Teamleider	Productie-lijnmanager	Productie-manager	Fabrieks-manager	Hoofdkantoor-manager
Geef aan indien het managementniveau waar in deze kolom naar wordt verwezen NIET bestaat in uw bedrijf	0	0	0	0	0
Beslissen om een nieuw product te ontwerpen	0	0	0	0	0
Vaststellen van het budgetniveau	0	0	0	0	0
Kiezen van de te gebruiken werkmethoden	0	0	0	0	0
Selecteren van machines of apparatuur om te gebruiken voor een taak	0	0	0	0	0
Selecteren van leveranciers	0	0	0	0	0
Bepalen van benodigde arbeidskrachten	0	0	0	0	0
Selecteren van type of merk voor nieuw aan te schaffen apparatuur	0	0	0	0	0
Beslissen welk type kostensysteem zal worden toegepast	0	0	0	0	0
Ontslaan van directe werknemers	0	0	0	0	0
Vaststellen van verkoopprijzen	0	0	0	0	0
Wijzigen van verantwoordelijkheden of werkterreinen van een lijnafdeling	0	0	0	0	0
Vaststellen van personeelsbeloningen	0	0	0	0	0

11. Geef aan, door hieronder het juiste nummer te omcirkelen, in welke mate de volgende kenmerken van toepassing zijn op uw bedrijf *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

"Mijn bedrijf…"	*Helemaal niet*				*In zeer grote mate*
… produceert producten op vernieuwende wijzen	1	2	3	4	5
… biedt een ruime verscheidenheid aan producten	1	2	3	4	5
… heeft een zeer uiteenlopende klantengroep	1	2	3	4	5
… biedt veel nieuwe producten aan	1	2	3	4	5
… biedt vernieuwende nieuwe producten aan	1	2	3	4	5
… wijst veel middelen toe aan marketing	1	2	3	4	5

12. Geef, door hieronder het juiste nummer te omcirkelen, de intensiteit aan van de concurrentie op de markt van uw bedrijf ten aanzien van tot de volgende factoren *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

	Helemaal niet				*In zeer grote mate*
Prijsconcurrentie	1	2	3	4	5
Productconcurrentie	1	2	3	4	5
Marketing concurrentie	1	2	3	4	5

13. Voor ieder van de volgende factoren die betrekking hebben op de externe omgeving van uw bedrijf,

a. Beoordeel, door hieronder het juiste nummer te omcirkelen, de mate van voorspelbaarheid gedurende de afgelopen vijf jaar *(Schaal: 1 = zeer onvoorspelbaar, 2 = redelijk onvoorspelbaar, 3 = neutraal, 4 = redelijk voorspelbaar en 5 = zeer voorspelbaar)*

	Zeer onvoorspelbaar				*Zeer voorspelbaar*
Acties van leveranciers	1	2	3	4	5
Behoeften, smaken en voorkeuren van klanten	1	2	3	4	5
Deregulering en globalisering	1	2	3	4	5
Marktactiviteiten van concurrenten	1	2	3	4	5
Productietechnologieën	1	2	3	4	5
Regelingen en beleid van de overheid	1	2	3	4	5
Economische omgeving	1	2	3	4	5
Arbeidsverhoudingen	1	2	3	4	5

b. Geef verder aan, door hieronder het juiste nummer te omcirkelen, in welke mate de factoren van belang zijn voor het succes of falen van uw bedrijf *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

	Helemaal niet				*In zeer grote mate*
Acties van leveranciers	1	2	3	4	5
Behoeften, smaken en voorkeuren van klanten	1	2	3	4	5
Deregulering en globalisering	1	2	3	4	5
Marktactiviteiten van concurrenten	1	2	3	4	5
Productietechnologieën	1	2	3	4	5
Regelingen en beleid van de overheid	1	2	3	4	5
Economische omgeving	1	2	3	4	5
Arbeidsverhoudingen	1	2	3	4	5

14. Voor ieder van de volgende dimensies,

a. Beoordeel, door hieronder het juiste nummer te omcirkelen, de totale prestatie van uw bedrijf ten opzichte van haar concurrenten over de afgelopen drie jaar *(Schaal: 1 = ruim onder het gemiddelde, 2 = net onder het gemiddelde, 3 = gemiddeld, 4 = net boven het gemiddelde en 5 = ruim boven het gemiddelde)*

	Ruim onder het gemiddelde				*Ruim boven het gemiddelde*
Operationele winst	1	2	3	4	5
Rentabiliteit van het geïnvesteerd vermogen	1	2	3	4	5
Omzetgroei	1	2	3	4	5
Marktaandeel	1	2	3	4	5
Kasstroom uit bedrijfsvoering	1	2	3	4	5
Ontwikkeling van nieuwe producten	1	2	3	4	5
Marktontwikkeling	1	2	3	4	5
Onderzoek en ontwikkeling	1	2	3	4	5
Kostenreductieprogramma's	1	2	3	4	5
Ontwikkeling van het personeel	1	2	3	4	5
Arbeidsverhoudingen	1	2	3	4	5
Gezondheid en veiligheid van medewerkers	1	2	3	4	5

b. Geef verder aan, door hieronder het juiste nummer te omcirkelen, in welke mate de dimensies van belang zijn voor de totale prestatiebeoordeling van uw bedrijf *(Schaal: 1 = helemaal niet, 2 = in geringe mate, 3 = in zekere mate, 4 = in behoorlijke mate en 5 = in zeer grote mate)*

	Helemaal niet				*In zeer grote mate*
Operationele winst	1	2	3	4	5
Rentabiliteit van het geïnvesteerd vermogen	1	2	3	4	5
Omzetgroei	1	2	3	4	5
Marktaandeel	1	2	3	4	5
Kasstroom uit bedrijfsvoering	1	2	3	4	5
Ontwikkeling van nieuwe producten	1	2	3	4	5
Marktontwikkeling	1	2	3	4	5
Onderzoek en ontwikkeling	1	2	3	4	5
Kostenreductieprogramma's	1	2	3	4	5
Ontwikkeling van het personeel	1	2	3	4	5
Arbeidsverhoudingen	1	2	3	4	5
Gezondheid en veiligheid van medewerkers	1	2	3	4	5

15. Geef voor ieder van de volgende besturingsconcepten en –technieken aan

a. Of uw bedrijf het momenteel gebruikt

(Zo Ja) b. Geef verder aan, door hieronder het juiste nummer te omcirkelen, hoe succesvol de implementatie van dit besturingsconcept of deze –techniek is geweest in uw bedrijf *(Schaal: 1 = zeer onsuccesvol, 2 = redelijk onsuccesvol, 3 = neutraal, 4 = redelijk succesvol en 5 = zeer succesvol)*

	Nee	Ja		*Zeer onsuccesvol*				*Zeer succesvol*
Total Quality Management (TQM)	0	0	→	1	2	3	4	5
Just In Time (JIT)	0	0	→	1	2	3	4	5
Balanced Scorecard (BSC)	0	0	→	1	2	3	4	5
Value-Based Management (VBM)								
→ op Return On Investment-gebaseerde systemen, zoals Cash Flow Return On Investment (CFROI)	0	0	→	1	2	3	4	5
→ op Residual Income-gebaseerde systemen, zoals Economic Value Added (EVA)	0	0	→	1	2	3	4	5

Hartelijk dank voor het invullen van deze vragenlijst. Retourneer deze a.u.b. bij voorkeur door gebruik te maken van de bijgevoegde, reeds gefrankeerde envelop, of anders per fax.

Appendix C

Nederlandstalige samenvatting (Summary in Dutch)

Titel: Antecedenten en gevolgen van ontwerpkeuzes van kostensystemen

In dit proefschrift staat het onderwerp kostensystemen, en dan vooral de antecedenten en gevolgen van ontwerpkeuzes ervan, centraal. Dit onderwerp kent reeds een lange historie binnen het vakgebied Management Accounting. Halverwege de jaren tachtig van de vorige eeuw ontstond, zowel in de theorie als praktijk, een hernieuwde aandacht voor het ontwerp van kostensystemen. De in- en externe omgeving waarin veel organisaties opereerden en dus waarbinnen kostprijsberekening plaatsvond, was substantieel veranderd. Van de traditionele kostprijsberekeningsmethoden werd gesteld dat zij niet langer voldeden in deze veranderde omgeving en er werd een alternatieve methode, activity-based costing (ABC), ontwikkeld. De gedachte die achter deze methode schuil gaat, is dat niet de producten de kosten veroorzaken, maar de activiteiten die nodig zijn om de producten voort te brengen. Sinds haar introductie in de literatuur vormt ABC onderwerp van een overweldigende publicatiestroom. Hierin worden de voordelen van deze methode breedvoerig geroemd. Toepassing van ABC zou voor vrijwel iedere organisatie zeer profijtelijk (kunnen) zijn. Vandaar dat ABC inmiddels een prominente plaats inneemt in de management accounting tekstboeken. Indien men verder bedenkt met welk enthousiasme de organisatieadvieswereld ABC spoedig na de introductie als nieuw adviesproduct heeft omarmd, zou verwacht mogen worden dat ABC in de praktijk inmiddels op grote schaal wordt toegepast. Niets blijkt echter minder waar. Uit enquêteonderzoek blijkt telkenmale weer dat de ontwikkeling van ABC in de praktijk ver achterblijft bij hetgeen op basis van de ontwikkeling in de theorie zou mogen verwacht. In dit verband wordt inmiddels gesproken van ‘de ABC paradox’: het verschijnsel dat ABC, ondanks duidelijke theoretische voordelen, door slechts een relatief gering aantal bedrijven daadwerkelijk wordt toegepast.

Voor onderzoekers biedt ABC en het (relatief tegenvallende) gebruik ervan in de praktijk een dankbaar onderzoeksobject. Sinds haar introductie in de management accounting literatuur, is een aantal onderzoeksstromingen op het gebied van ABC ontstaan, waarvan onderzoek naar factoren die de adoptie en het gebruik van ABC bepalen, een belangrijke is. Deze stroming heeft tot op heden geen overtuigende resultaten opgeleverd. Aan de ene kant heeft dit er toe geleid dat onderzoekers pleiten voor meer onderzoek op dit gebied. Dit vanwege het feit dat het bestaande onderzoek op dit gebied enkele belangrijke methodologische tekortkomingen kent die de onstabiele resultaten ervan (mede) zouden hebben kunnen veroorzaakt. Aan de andere kant heeft het er toe geleid dat onderzoekers hun onderzoek zijn gaan verbreden door in plaats van hun aandacht te richten op vergelijkingen tussen gebruikers en niet-gebruikers van ABC, hun aandacht te richten op de onderscheidende kenmerken van kostensystemen (zoals de mate van verfijning) en hoe deze kenmerken samenhangen met de in- en externe omgeving van de bedrijven die de kostensystemen gebruiken. Voortbouwend op deze twee ontwikkelingen binnen deze stroming, richt dit proefschrift zich op de beantwoording van de volgende twee onderzoeksvragen:

1. **Wat is de relatie tussen omgevings-, organisatorische en technologische factoren, en de adoptie en het gebruik van ABC?**

2. **Wat is de relatie tussen de mate van verfijning van kostensystemen, hun toepassingen en hun effectiviteit?**

In hoofdstuk 2 wordt een overzicht gegeven van het tot op heden uitgevoerde onderzoek naar de antecedenten en gevolgen van ontwerpkeuzes van kostensystemen. Hierbij is met name aandacht besteed aan studies naar factoren die de adoptie van en/of het succes met ABC bepalen. Deze studies geven aanleiding tot een aantal belangrijke conclusies. Zo blijkt uit deze studies dat er nogal wat factoren van invloed zijn op de fasen die organisaties moeten doorlopen alvorens succesvol gebruiker van ABC te zijn. De invloed van deze factoren lijkt bovendien te variëren per fase van het implementatieproces. Een belangrijk onderscheid hierbij is dat tussen contextuele en proceskenmerken (of factoren). Contextuele kenmerken kunnen zowel de fasen vóór als ná het moment waarop een organisatie ABC als idee heeft aanvaard beïnvloeden. Proceskenmerken kunnen daarentegen slechts, tezamen met de contextuele kenmerken, de fasen ná het moment waarop een organisatie ABC als idee heeft aanvaard beïnvloeden. De studies naar de invloed van contextuele factoren op de adoptie van ABC hebben tot op heden vrij onstabiele resultaten opgeleverd, zowel over als binnen de studies. Dit geldt zowel voor studies naar logisch met de ABC-theorie samenhangende contextuele factoren (zoals kostenstructuur, concurrentie en productdiversiteit), als voor studies naar organisatorisch innovatievermogen beïnvloedende contextuele factoren (zoals omvang, strategie en structuur).

De studies naar de invloed van procesfactoren op de mate waarin bedrijven met ABC succes hebben, hebben daarentegen een aantal factoren onderkend waarvan consistent wordt aangetoond dat zij bepalend zijn voor het al dan niet succesvol zijn van implementaties van ABC. Het gaat hierbij met name om factoren als: steun van het topmanagement, koppeling van ABC aan het kwaliteitsbeleid, training in het implementeren van ABC, koppeling van ABC aan prestatiebeoordeling en –beloning en voldoende middelen. Deze factoren hebben met elkaar gemeen dat zij alle van niet-technische aard zijn, hetgeen impliceert dat met name gedragsmatige en organisatorische factoren bepalend zijn voor de mate waarin een ABC-implementatie succesvol is. De behandelde studies naar de mate van succes met ABC in de praktijk tonen als geheel een behoorlijk consistent beeld: zeker indien ABC op een effectieve wijze en in een geschikte omgeving wordt geïmplementeerd, lijkt het gebruik ervan duidelijk aantoonbare positieve effecten te hebben op de financiële prestaties van bedrijven, zowel in termen van aandelenrendement als bedrijfsrendement. Vanuit methodologisch oogpunt kunnen echter bij ieder van de behandelde studies de nodige kanttekeningen worden geplaatst. Belangrijke methodologische kwesties bij studies naar ABC-adoptie en adoptiebepalende factoren zijn met name onderscheidingsvermogen (statistische power) en tijdsveranderlijkheid van de adoptiebepalende factoren. Bij studies naar ABC-succes en succesbepalende factoren is de belangrijkste kwestie de mogelijke vertekening van gevonden effecten van het gebruik van ABC op de prestaties van bedrijven als gevolg van selection bias. Een andere mogelijke oorzaak van de vrij onstabiele resultaten van studies naar adoptiebepalende factoren zou de vrij beperkte operationalisering van ontwerpkeuzes van kostensystemen in termen van gebruik versus niet-gebruik van ABC kunnen zijn. Enkele recente studies hebben het ontwerp

van kostensystemen daarom breder geoperationaliseerd. Echter, zeker als we de resultaten van de inmiddels verrichte enquêtestudies in ogenschouw nemen, lijken deze vooralsnog niet veel consistenter dan die van het eerdere onderzoek. Zowel over als binnen de studies verschillen de resultaten sterk.

In hoofdstuk 3 wordt eerst kort aandacht besteed aan contingentietheorie en vormen van 'fit'. Vervolgens worden hier de hypothesen ontwikkeld die in het empirische gedeelte van dit proefschrift worden getoetst. Contingentietheorie, hetgeen de theoretische basis van het proefschrift vormt, stelt dat er geen universeel toepasbaar systeem van management accounting en control bestaat. In plaats daarvan is het meest geschikte systeem afhankelijk van de specifieke omstandigheden waarmee een organisatie wordt geconfronteerd. De afstemming (of 'fit') tussen het ontwerp van management accounting en control systemen en contextuele (of 'contingentie') factoren is dan ook datgene waar contingentietheorie zich op richt. In dit proefschrift wordt onderscheid gemaakt tussen drie typen contextuele factoren: omgevingsfactoren, organisatorische factoren en technologische factoren. Omgevingsfactoren houden verband met de externe omgeving van een organisatie. Organisatorische factoren houden verband met de strategie en structuur van een organisatie. Technologische factoren houden verband met de fundamentele werkprocessen in een organisatie. Ten aanzien van de relatie tussen omgevings-, organisatorische en technologische factoren en ABC adoptie en gebruik, zijn elf hypothesen opgesteld. Daarnaast zijn er vier hypothesen opgesteld voor de relatie tussen de verfijning van kostensystemen, hun toepassingen en hun effectiviteit.

In hoofdstuk 4 worden de in dit proefschrift gebruikte empirische gegevens geïntroduceerd. Deze gegevens zijn (vrijwel uitsluitend) afkomstig van een grootschalig enquêteonderzoek naar het gebruik van kostensystemen in middelgrote, Nederlandse productiebedrijven, dat ik in 2002 heb verricht. Dit onderzoek richtte zich op middelgrote bedrijven omdat grotere bedrijven overwegend uit meerdere bedrijfsonderdelen bestaan, welke niet allemaal hetzelfde (of zelfs een vergelijkbaar) kostensysteem hoeven te gebruiken, terwijl kleinere bedrijven mogelijk helemaal geen verfijnd kostenallocatiesysteem gebruiken. Verder richtte het zich op productiebedrijven op basis van de veronderstelling dat zij een relatief homogene groep vormen, anders dan niet-productiebedrijven. Als onderdeel van een behoorlijk uitgebreide procedure, is aan ofwel de algemene directeur, ofwel de financiële directeur van 2108 bedrijven een vragenlijst toegestuurd. Deze vragenlijst is gebruikt om gegevens te verzamelen over de door hen gebruikte kostensystemen, alsmede over een aantal contextuele kenmerken van de bedrijven. Uiteindelijk zijn 225 bruikbare en representatieve vragenlijsten (10,7%) retour ontvangen. Er was echter sprake van enige mate van partiële non-repons. De meeste gebruikte meetinstrumenten zijn multi-item en afkomstig van eerder onderzoek. Conform het in de literatuur gemaakte onderscheid tussen gebruik voor strategische en operationele doelen, wijzen de resultaten van een factoranalyse uit dat er twee dimensies aan het gebruik van kostensystemen ten behoeve van negen veelgebruikte doelen ten grondslag liggen: gebruik (en belang) van een kostensysteem voor strategische doelen en gebruik (en belang) van een kostensysteem voor operationele doelen. Ten slotte blijken er vele significante relaties tussen de contextuele kenmerken van de bedrijven te zijn.

In het eerste deel van hoofdstuk 5 worden de resultaten behandeld van de analyses voor de eerste onderzoeksvraag, naar de relatie tussen belangrijke omgevings-, organisatorische en

technologische factoren, en de adoptie en het gebruik van ABC. De resultaten van deze analyses duiden erop dat bedrijven met een hogere mate van concurrentie, verticale differentiatie en productdiversiteit, en een lagere mate van centralisatie een grotere kans hebben om ABC te adopteren, terwijl bedrijven met een heterogene massa productieproces of een seriestuk productieproces een kleinere kans hebben om ABC te adopteren dan bedrijven met een homogene massa productieproces. Evenzo blijken bedrijven met een hogere mate van concurrentie, verticale differentiatie en productdiversiteit, meer productielijnen, en een lagere mate van centralisatie een grotere kans te hebben om ABC te gebruiken, terwijl bedrijven met een seriestuk productieproces een kleinere kans hebben om ABC te gebruiken dan bedrijven met een homogene massa productieproces. Verder blijkt de invloed van productdiversiteit op de kans dat een bedrijf ABC gebruikt negatief te worden gemodereerd door de mate waarin het bedrijf geavanceerde fabricagetechnologieën gebruikt.

In het tweede deel van dit hoofdstuk worden de resultaten behandeld van exploratieve analyses van de samenhang tussen kenmerken van ABC gebruikers en organisatiestructurele factoren. Hierbij is met name aandacht besteed aan de samenhang van een zestal aspecten met betrekking tot de mate van implementatie en wijze(n) van gebruik van ABC bij adopters ervan, en een drietal organisatiestructurele factoren. De zes onderzochte aspecten betreffen de mate en (gepercipieerde) kwaliteit van de implementatie van ABC, de breedte en integratie van de ABC-systemen, en de updatefrequentie van de structuur en inhoud van deze systemen. Uit de analyses blijkt onder meer dat de drie organisatiestructurele factoren (verticale differentiatie, formalisatie en centralisatie) niet alleen van invloed zijn op het al dan niet adopteren van ABC, maar tevens op de wijze waarop bedrijven ermee omgaan, gegeven dat zij het geadopteerd hebben.

Voortbouwend op de twee geïdentificeerde dimensies van toepassingen van kostensystemen, gebruik (en belang) van een kostensysteem voor strategische doelen en gebruik (en belang) van een kostensysteem voor operationele doelen, worden in het eerste deel van hoofdstuk 6 de resultaten behandeld van de analyses voor de tweede onderzoeksvraag, naar de relatie tussen de mate van verfijning van kostensystemen, hun toepassingen en hun effectiviteit. Hierbij wordt met name het interactieve effect van verfijning van kostensystemen en gebruik (en belang) voor strategische en operationele doelen op de effectiviteit van kostensystemen, gemeten als de intensiteit van gebruik van en mate van tevredenheid met de kostensystemen, onderzocht, controlerend voor de invloed van omgevings-, organisatorische en technologische factoren. De resultaten duiden erop dat op hogere (lagere) niveaus van gebruik en belang van kostensystemen voor strategische doelen, verfijning van kostensystemen negatief (positief) van invloed is op de intensiteit van gebruik, terwijl op hogere (lagere) niveaus van gebruik en belang van kostensystemen voor operationele doelen, verfijning van kostensystemen positief (negatief) van invloed is op de intensiteit van gebruik en mate van tevredenheid.

In het tweede deel van hoofdstuk 6 zijn de resultaten behandeld van exploratieve analyses van de mate van samenhang tussen het gebruik en belang van kostensystemen voor ieder van de negen toepassingen en de tien omgevings-, organisatorische en technologische factoren. Gemiddeld blijken de onderzochte bedrijven hun kostensysteem voor iets meer dan zes (van de negen onderscheiden) toepassingen te gebruiken. De meest gebruikte en belangrijkste toepassingen blijken die ten behoeve van prijsbepaling van producten, budgettering en

voorraadwaardering. Er is echter sprake van een grote variatie, zowel in aantal als in typen toepassingen. Over het algemeen tonen de resultaten dat de verschillende toepassingen waarvoor kostensystemen worden gebruikt, alsmede (gegeven dat zij er voor worden gebruikt) het belang ervan, duidelijk samenhangen met de specifieke omstandigheden waarmee het bedrijf wordt geconfronteerd.

In hoofdstuk 7 worden de belangrijkste conclusies van het onderzoek samengevat, worden de belangrijkste beperkingen van het onderzoek besproken en worden enkele suggesties voor toekomstig onderzoek gedaan.