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Environmental hostility, strategic orientation and the importance of management accounting—an empirical analysis of new technology-based firms

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Abstract

This paper reports empirical analysis of two research propositions which arise from different variables from the contingency theory of management accounting. The approach uses data from a sample of 183 new technology-based firms (NTBFs) in Sweden. The contingency variables were considered under the headings of *environmental hostility* and *strategic orientation*. While we might have expected to see here some evidence of correlations between variables of environmental hostility–management accounting and between strategic orientation–management accounting, only a few variables are apparent for the sample available. We note that the importance of standard methods in management accounting (general, costing, budgeting, investment calculation) does not seem to be precipitated by the contingencies such as environmental hostility and strategic orientation. Previous research has identified technology as one of the most important contingency factors. However, our technology variables will not seem to have an impact on the importance of management accounting practices in the NTBFs. We also conclude that the correlation analysis indicates that earlier work experience and different types of management problems in small high-tech firms is of importance for development of the cost management approach.

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Keywords: New technology-based firms; Management accounting; Environmental hostility; Strategic orientation

1. Introduction

In the conditions of intensified competition, the management accounting practices of a small firm, particularly a new technology-based firm (NTBF) needs to have objective information about the formation of the firm's performance. The focus of this paper is *on the importance of management accounting in small high-tech firms*. The theoretical framework adopted is that of the *contingency theory*. The approach uses data from a sample of 183 small NTBFs in Sweden, gathered from a postal questionnaire. The contingency theory suggests that there is no ideal form for management accounting systems. These contingencies (contextual variables) are usually classified as the *environment*, *organizational structure* and *technology* (Emmanuel et al., 1990). The concept technology is valuable because it is a simple yet rich way of absorbing the uncertainty stemming from a myriad of

contextual factors (Macintosh, 1987). In this paper, we focus on the *Environment* (hostility: risk, change, competition behaviour, new products), *Strategic orientation* (innovative or conservative, price, follower-market leader, competitors) and the importance of management accounting practices. Also work experience and management problems related to management accounting (importance) is going to be analyzed.

A growing body of research has established levels between accounting and information systems and several contextual or contingency variables, such as environmental uncertainty, product competition, rate of technological change, managerial climate, differentiation and integration. The valuable point in these contingency variables have a great deal more influence on the design and use of accounting data information systems than previously thought (Macintosh, 1987). However, what is needed is a framework that is capable of both absorbing these factors and capturing them in a simple way.

In this study, the empirical part consists of small NTBFs, i.e. 'entrepreneurial' firms. According to

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Borch et al. (1999a,b), entrepreneurial firms will have strategies related to innovation and growth characterized by risk-taking. Innovation may be defined as the willingness to place strong emphasis on technological development (Slevin and Covin, 1994). The advantages of studying small business management from a *firm behaviour* perspective are that (Slevin and Covin, 1994): (i) firm behaviour, as strategy, structure and performance, are more clearly understood than when only studying characteristics of individual entrepreneurs (ii) firm behaviour is more easily measured than at the individual level and (iii) firm behaviour is more manageable. A firm-level behaviour can be managed by the creation of particular resources and strategies and may thus allow considerable managerial intervention.

This study makes a contribution to the existing management accounting practices and their importance for the NTBFs regarding environmental hostility and strategic orientation. There are a couple of environmental variables that have influenced high-technology firms. Together with the cost structure in the firm, we argue that they mainly determine the importance of management accounting practices in the firm. One limitation is that we are not going to analyze how (changes) the contextual variables have influenced management accounting practices in the NTBFs. We will only measure the relationship between the contextual variables and the importance of management accounting practices.

The aim of this study is to *find empirical patterns of management accounting practices (importance) according to hostile environments and strategic orientation in small NTBFs*. The analysis is based on a set of variables which are used in the correlation analysis to identify management accounting importance for the small high-tech firms. The paper is organized as follows: Section 2 draws on previous research to identify the variables used in the study and to create a theoretical framework. The method and sample is presented in Section 3. The data are based on 183 small NTBFs in Sweden in 1999. The correlation matrixes are presented in Section 4 and finally, Section 5 presents a discussion and further research.

2. Previous research and theoretical framework

2.1. Entrepreneurial firms, management and environment

Entrepreneurial orientation is often conceptualized as a latent construct comprising three dimensions: innovativeness, risk-taking and proactiveness. These three components of entrepreneurship are argued by Miller (1983) to comprise a basic, undimensional *strategic orientation*. Innovativeness involves seeking creative or unusual solutions to problems and needs. In entrepreneurship research and economic studies, innovativeness is often viewed as a surrogate measurement for entrepreneurship

(Miller and Friesen, 1982). The risk-taking dimension refers to the willingness of management to commit significant resources to opportunities in the face of uncertainty. Proactiveness is defined in terms of the firm's propensity, aggressively and proactively to compete with its rivals.

On the basis of this three-dimensional construct of entrepreneurial orientation, a firm's strategic posture can be established along a ranging from *conservative* to *entrepreneurial* (Covin and Slevin, 1989; Miller and Friesen, 1983). Conservative firms tend to be risk-averse, non-innovative and reactive. Entrepreneurial firms tend to be risk-takers, innovative and proactive. The conservative–entrepreneurial dichotomy also shares similarities with some of the dichotomies developed in the NTBF literature. Findings demonstrate that small firms are in general expected to favor *differentiation strategies*, since they only rarely will be able to utilize economies of scale. Small firms may possess various bundles of resources that serve as the foundations for development. According to the resource-based view (Penrose, 1959), differences in resources should be utilized and lead to differences in sustainable competitive advantage.

Ackroyd (1995) identified 11 distinguishing characteristics of small high-technology firms, for example, lack of hierarchy and boundaries, high mobility including growth and replication and an impressive ability to respond quickly to technological and market developments. These firms are also very customer-oriented, and innovative: their growth is often constrained by skills shortage. Van der Auwera and Eysenbrandts (1989) compiled a set of specific advantages of small versus medium/large NTBF's in Belgium. Small NTBF's have a greater job flexibility and less hierarchy. The flow of information between management and production is faster and they have a better view over the innovation process. Small firms also have a direct relationship with suppliers and customers and they respond more rapidly to direct demand from abroad. Segers (1993) underlines that there is an increased emphasis on NTBFs (Rothwell, 1983, 1984; Oakey et al., 1988) and on strategic partnerships or alliances (Doz, 1988).

According to Borch et al. (1999a,b), entrepreneurial firms will have strategies related to innovation and growth characterized by risk-taking. Innovation may be defined as the willingness to place strong emphasis on technological development (Slevin and Covin, 1994). The advantages of studying entrepreneurship and small business management from a *firm behaviour* perspective are that (Slevin and Covin, 1994): (i) firm behaviour, as strategy, structure and performance, are more clearly understood than when only studying characteristics of individual entrepreneurs (ii) firm behaviour is more easily measured than at the individual level and (iii) firm behaviour is more manageable. A firm-level behaviour can be managed by the creation of particular resources and strategies and may thus allow considerable managerial intervention.

According to Löfsten and Lindelöf (2002), the markets in which small high-tech firms operate, are competitive. Marketing is often especially difficult for technologically innovative firms, particularly when they are addressing new needs and markets. Independent technology firms have a much wider market distribution throughout the UK and abroad than is typical of other small firms (Monck et al., 1988). The ‘typical’ pattern of heavy dependence on a limited number of customers or geographical markets was not demonstrated in Löfsten and Lindelöf (2002). Almost 65% of the NTBFs customers were ‘other markets’ (Region: 35% and other markets: 65%).

The literature on the entrepreneurship-environment fit suggests that conservative and entrepreneurial firms manifest quite different characteristics in coping with their environments. Dynamic environments which often typify high-technology industries were found to encourage entrepreneurial firm-level behaviour (Miller et al., 1988; Khandwalla, 1987). Higher levels of innovative, risk-taking behaviour are also associated with uncertain environments (Pierce and Delbecq, 1977). When firms are faced with hostile environments, as in the high-technology sector, an entrepreneurial strategic orientation contributes to greater performance. According to Yeoh and Jeong (1995), in benign environments, a more conservative strategic orientation appears to promote performance among small firms (Covin and Slevin, 1989).

The variables used in our study relate to several basic dimensions of a firm’s external environment. These dimensions include environmental hostility: customer preferences, competitors, marketing activities and long-term forecasting of markets and technology forecasting activities. We extend the literature by exploring how NTBFs can link these elements in an entrepreneurial environment.

2.2. Contingency theory and management accounting

The idea that markets and competition might have an important influence on management accounting and control systems was the focus of a study by Khandwalla (1972), who found that the intensity and type of competition accentuates the need to determine whether or not organizational sub-units are operating as expected. The study included 97 large firms distributed over a wide range of industries and manufacturing technologies. The president of each firm rated three types of competition—price, marketing, and product—for intensity and for its importance of profitability. A number of interesting specific relationships emerged. Product competition, for instance, had the greatest impact on the usage of controls. Perhaps competition stimulates a great deal of new-product activity which, in turn, leads to more complex organizations. Different markets are sought out, R&D is required and advanced production processes are adopted.

According to Reid and Smith (2000), the contemporary contingency theory of management accounting has the limited aim of explaining how particular circumstances (contingencies) shape the form of management accounting systems. The earliest work on the subject by Burns and Stalker (1961) emphasized the influence of environmental conditions (technological uncertainty, organizational form). Woodward (1958, 1965) emphasized the technology employed by the firm as a key contingent variable. According to Reid and Smith (2000), the list of contingencies was extended to corporate strategy (Chandler, 1962) and to market environment by Lawrence and Lorch (1967).

Hayes (1977) concluded that three contingent variables were the main determinants of management accounting systems, namely (i) sub-unit interdependence (e.g. R&D intensity), (ii) dynamism of environment (e.g. marketing intensity) and (iii) work method specification (e.g. production intensity). According to Laitinen (2001) and Libby and Waterhouse (1996) present a review of organizational literature that is relevant to management accounting change. They identified four organizational and economic factors associated with the adaption of changes in management accounting: intensity of competition, degree of decentralization, size and organizational capacity to learn. Yakou and Dorweiler (1995) argue that management accounting change is frequent for firms operating in competitive markets where understanding costs and measuring performance are keys to survival. Strong market competition creates turbulence, stress, risk and uncertainty for firms so that they continuously revise their management accounting in response to threats and opportunities in the competitive environment.

A number of environmental variables seem to be closely associated with importance and use of management accounting practices. Gosselin (1997) argues that these variables are *not effective in small firms*. Gosselin proposed a negative relationship between formalization and innovation and Gosselin sent a questionnaire to 415 strategic business units (162 replied). His sample consisted of manufacturing industries in which product diversity and production process complexity are important. He discarded responses from small firms for which structural and business strategy would have little relevance.

Miller (1983) classified firms into three types of with respect to their planning philosophy (i) simple firms are small firms which operate in relatively homogenous environments where formal planning is minimal and emphasizes operational issues and expediency (ii) planning firms are larger and their goal is to achieve efficient operations by using formal planning methods. These firms operate in stable and predictable environments and to function in a mechanistic manner and (iii) organic firms are typically larger and usually operate in a dynamic environment.

Emmanuel et al. (1990) argue that the contingency approach to management accounting is based on the premise

that there is no universally appropriate accounting system applying equally to the organizations in all circumstances. According to Haldma and Lääts (2002), the major external factors that have been examined at the firm level in management accounting and control research are external environment (Chapmann, 1977; Khandwalla, 1977; Merchant, 1990; Hartmann, 2000). The most widely emphasized research aspects are environmental uncertainty and hostility (Haldma and Lääts, 2002).

The hardly predictable environmental elements have their own impact on organizational structure, performance evaluation, budgeting and budgetary control. Environmental hostility from intense competition stresses the importance of formal control and sophisticated accounting (Khandwalla, 1972; Otley, 1978). Haldma and Lääts (2002) argue that the most common internal factors that have been examined in relation to management accounting are organizational size, technology and firm's strategies.

2.3. Theoretical framework

2.3.1. Environmental hostility

The environment is a term used to explain a number of factors and relevant factors of a firm's environment which affect the design of the management accounting system and include the importance of R&D, technology and innovation, environment change, competition behaviour, price competition and the number of different product-/service-markets faced by the degree of hostility (price, product/service, technology competition).

Yeoh and Jeong (1995) say that, conceptualizing the external environment in terms of *environmental hostility* (Covin and Slevin, 1989), an entrepreneurial orientation may be of particular interest to small exporting firms in hostile environments. Miller (1987) means that there should be some common relationships between environmental dimensions and those of strategy. The dimensions of dynamism, hostility and heterogeneity have often been used to characterize the environment. These are representative of key challenges facing firms, and are summarized in Table 1. The marketing differentiation strategy will typically be used in response to intense hostility.

Certain environmental characteristics may elicit entrepreneurial behaviour on the part of organizations (Covin and Slevin, 1991). Dynamic environments have been found to encourage entrepreneurial firm-level behaviour (Miller et al., 1988). Organizations often respond to challenging environmental conditions, such as those in high-technology environments. Several studies indicate the relationship between entrepreneurial posture and firm performance is moderated by environmental conditions. The literature on the entrepreneurship-environment fit suggests that conservative and entrepreneurial firms manifest quite different characteristics in coping with their environments.

Table 1

Environmental classes and variables

Change variables (questionnaire data)	Static variables (published data)
<i>Dynamism</i> Growth opportunities Change in production/service technology Rate of innovation in industry products, services and processes R&D in industry	Dynamism
<i>Heterogeneity</i> Needed diversity in production and marketing methods to cater to different customers	Heterogeneity
<i>Hostility</i> Hostility of key competitor's market activities Number of areas in which there is a competition Unpredictability of competitor market activities Legal, political or economic constraints	Hostility

Source. Miller (1987, p. 62).

Dynamic environments which often typify high-technology industries were found to encourage entrepreneurial firm-level behaviour (Miller et al., 1988; Khandwalla, 1987). Higher levels of innovative, risk-taking behaviour are also associated with uncertain environments (Pierce and Delbecq, 1977). When firms are faced with hostile environments, as in the high-technology sector, *an entrepreneurial strategic orientation contributes to greater performance* (see Section 2.3.2). According to Yeoh and Jeong (1995), in benign environments, a more conservative *strategic orientation* appears to promote performance among small firms (Covin and Slevin, 1989).

2.3.2. Strategic orientation

According to many, the strategy concept has one of its main values, for both profit-seeking and non-profit-seeking organisations, in determining how an organisation defines its *relationship to its environment* in the pursuit of its objectives (Bourgeois, 1980). Organisational environment includes such dimensions as uncertainty, directness, change, dynamism, homogeneity and complexity. Danila (1989) claims that managers have discovered that technology and strategy are inseparable. The most important reason is that management of technology seems to be closer and closer to strategy and to the firm's *competitive success*. For a long time the study of strategy and more specifically the study of corporate strategy have been distinct from the study of technology. Miller (1987) claims that organizational structures and strategy-making processes are highly interdependent and must be complementary in many ways to ensure good performance under challenging conditions.

Miller (1987) claims that the organizational structures and strategy-making processes are highly interdependent, and must be complementary in many ways, in order to

ensure good performance under challenging conditions. An empirical analysis of 97 small and medium-sized firms showed that a structural formalization and integration were related to the levels of interaction and proactiveness among decision makers and to four aspects of rationality in decision-making: analysis of decisions, planning, systematic scanning of environments and explicitness of strategies. Structure alone is insufficient in firms that must often perform complex innovations; interactive and rational decision-making must complement it in order to facilitate both identification of emerging market threats and opportunities, and collaboration, among diverse specialists who must simultaneously consider the repercussions of innovation for marketing, R&D, and production (Galbraith, 1973; Khandwalla, 1977).

It may be hypothesized that a successful strategic (technology) partnership constitutes an optimization of the potential synergies and the dynamic complementarities between large, established firms and small-NTBFs (Segers, 1993). With respect to technology, Hagedoorn and Schakenraad (1990) limit strategic partnering to inter-firm technology co-operation, i.e. those firms of inter-firm collaboration for which joint development of new technologies and or agreements aimed at improved innovative performance are at least a part of the agreement. In that context, strategic partnering is defined as those agreements that focus on a long-lasting effect on the product–market positioning of the participating companies (Segers, 1993). According to Doz (1988), partnerships usually offer large firms a channel to tap into the innovative and entrepreneurial potential of smaller companies. Rothwell (1983) states that the main advantage of small firms are ‘people embodied’, while those of large firms are ‘resource embodied’. Segers (1993) claims that NTBFs often enjoy the advantage of dynamic, entrepreneurial management embodied in the system that is flexible and highly responsive to change, and who are willing to accept financial, technological and marketing risk.

2.3.3. Management accounting

The planning philosophy of NTBFs has obvious implications for management accounting procedures regarding environmental changes. Innes and Mitchell (1990) found that in technology firms product cost structure is usually weighted towards overheads and direct materials. The problems identified encompass the core areas of management accounting and include the timelessness and accuracy of costing information, the adequacy of financial performance measures and the practicality of operating a conventional control system. They found that the change in management accounting practice is associated with a specific set of circumstances (for example: competitive market, organizational structure and product technology). Laitinen (2001) says that there are a number of organizational and strategy factors that may affect management accounting change in small technology firms. However,

in our study, we will only measure the *importance* of management accounting practices in NTBFs.

The main variables that may affect the importance of management accounting practices in NTBFs in Sweden can be classified in the two groups *environmental hostility* and *strategic orientation*. In our study, we use a set of variables to search for patterns that can explain the importance of management accounting practices in NTBFs. The management accounting practices in this study are: (i) importance of management accounting (general) (ii) cost management (importance of standards, budgeting) and (iii) importance of investments methods (calculation). Also, more detailed analysis of management accounting practices is of interest: different costing methods, earlier work experience of business development, earlier work experience of management accounting, management problems and costing/budgeting versus total work time.

The variables used in our study relate to several basic dimensions of a firm’s external environment. These dimensions include environmental hostility and strategic orientation. The research propositions are:

- P1. The importance of management accounting depends on environmental hostility.
- P2. The importance of management accounting depends on strategic orientation.

3. Method

3.1. Characteristics of surveyed firms

In this section, we review the methods used to construct the data set for our work. First, the characteristics of surveyed firms is described and second, a statistical profile is presented of the sampled firms. Studies of new technology-based industry also include a section intended to define high technology (Markusen et al., 1986; Hall et al., 1987). These indicators fall into two groups (Monck et al., 1988): measures of resource inputs to high-technology activity, i.e. R&D effort, R&D expenditure and the employment of qualified personnel; and secondly, measures of output or performance of high-tech firms, such as growth rates, patent records and technological innovations. A range of questions in our survey were intended to provide an indication of the technological capability of the NTBF’s. These include information on the inputs to R&D, percentage of staff employed (and founders) by firms that have qualified scientists and research links with universities.

Löfsten and Lindelöf (2001, 2002) refer to the NTBF’s number of patents, licenses and education level. Patents are often used as an indicator of technological development, although the propensity to patent varies between sectors, firms and countries (Taylor and Silberston, 1973). Over the years there have been a number of surveys of entrepreneurs

that have investigated the question of whether higher levels of education are associated with smaller firms that have a better performance than otherwise comparable firms which are owned by less educated individuals. However, the results have been somewhat inconsistent. We checked their business descriptions in the database, in order to ensure that sample firms were involved in technology creation. Firms operating in sales and distribution with no R&D were excluded.

Little (1979) settled on the following characteristics of an NTBF: (1) it must not have been established for more than 25 years (2) it must be a business based on potential invention or one having substantial technological risks over and above those of normal business (3) it must have been established by a group of individuals—not as a subsidiary of an established company (4) it must have been established for the purpose of exploiting an invention or technological innovation. Bollinger et al. (1983) describes a number of factors, and policies, that are most critical for countries that wish to encourage the growth of NTBF's: (1) regional policy (2) sector differences and product versus process innovation (3) technology-oriented complexes and (4) other factors such as information flow, existence of financial markets and capital constraints, and government or large firm procurement procedures.

3.2. Sample and postal questionnaire

This section is devoted to a description of the sample and the broad characteristics of the firms involved. A total of 183 NTBFs were responded, of 572 sampled firms. The total number of surveyed firms were 572 with a technological base. However, defining what is and what is not high technology is problematic. Much emphasis is placed on high-technology industries, and so a workable definition would seem to be essential. These include (Monck et al., 1988): new knowledge-based, leading edge, and R&D intensive industry. In order to make valid comparisons both between this study and other studies, only single-plant independent firms are included (joint-stock firms, trading companies, limited partnership companies). As expected, the new and emerging technologies such as information and software technology dominated the population.

A postal questionnaire was sent to the managing directors of these firms in January 1999 (response rate: ca. 32%). The questionnaire had been thoroughly pretested and modified as a result of discussions with six firms. Questionnaire responses were collected from independent organisations (respondent: manager/director) during early 1999 and in the middle of 1999. After two reminders (and one reminder by telephone) in springtime, 183 firms had responded to the survey. The response rate of 32% compares reasonable with similar mail surveys of small firms (Yli-Renko et al., 2001: 24%, McDougall et al., 1994: 11% and Chandler and Hanks, 1995: 19%). Of the firms that

had not responded to the survey, some firms could not be localized or had no activity and some firms said they did not have time to answer the questionnaire.

The postal questionnaire on importance of management accounting practices in NTBFs elicited information relating to management accounting practices related to environmental hostility and strategic orientation. First, a couple of organizational characteristics and type of branch, describing the background of the firms and the technological base were mapped. The first three variables map importance of management accounting, the next 10 variables measure environmental hostility and the last six variables measure strategic orientation.

It will be recalled that the objective of the sample was to identify primarily high-tech independent firms. The branches are software/information technology, technology consultants, electronics/electrical, pharmacology and pharmaceutical preparation, mechanics and industrial chemistry/plastics industry. The sample ($N = 572$ NTBFs) is a random sample of 1 240 independent NTBFs in Sweden, and were drawn on a stratified basis according to branches. To identify the firms, CD-Rom business databases were used as well as a database of new, Swedish technology-based firms that has been developed within the CREATE group at the Department of Industrial Dynamics at Chalmers University of Technology. The database includes all Swedish firms that fulfil certain criteria of size, year of foundation, independence at start and industry.

Table 2 presents selected information on the firms that replied to the questionnaire. The average size of the firms is 10 employees. All firms of less than 50 employees with a solid technological base in 1999 were included in the sample (of 1 240 independent NTBFs in Sweden).

Performance is examined under three headings: *employment growth*, *sales growth* and *profitability* (1996–1998). Growth in this study is not analyzed as a separate employment element. Expanding sales are a central element in a successful innovation process, but it is also important to measure profitability (profit margin), a sort of relative performance (the 'business' perspective) (See Appendix B). Monck et al. (1988) say that it is curious that data on profitability performance of high-tech firms is very different from that on the other measures of performance and the low proportion of firms making profits in their early years of life are also attributable to the fact that many actually start without any formal product to sell. For the NTBFs, however, profitability fairly consistently increases with age so that the best-established firms appear to be making the highest rates of profit.

Davidsson et al. (1996) say, that in Sweden, the growth of established small firms are more important for employment growth than the establishment of new firms. Only a small numbers of owners/managers in small firms are innovative, change oriented and seeking new business opportunities (Davidsson, 1989). The fact that areas in

Table 2
Response rate and branch frequencies

<i>Response rate</i>				
<i>N</i>	572			
<i>n</i>	183			
Response rate (%)	32			
The sample: firms between 1 and 50 employees				
Firm size (mean): 10 employees				
<i>Performance—means and frequencies^a</i>				
	Response		No response	
	Mean	Std	Mean	Std
Growth (%)				
Sales	23.34	50.28	23.28	46.91
Employment	12.01	39.78	15.87	49.88
Profitability (profit margin)	5.89	14.84	4.89	19.17
<i>Branch—frequencies (%)</i>				
	Response	No response		
Software/information technology	34.3	30.0		
Technology consultants	25.4	23.6		
Electronics/electrical	11.9	16.4		
Pharmacology and pharmaceutical preparation	14.2	15.5		
Mechanics	9.7	10.9		
Industrial chemistry/plastics industry	4.5	3.6		
Sum	100.0	100.0		

^a See Appendix B for measurement procedures.

which NTBFs are concentrated experience an ‘above-average’ performance in their conventional sectors can be explained in two ways (Monck et al., 1988). The first is that the high-tech sector ‘leads’ economic development and that the conventional sectors benefit from the additional purchasing power generated. The second explanation is that the type of ‘environment’ which includes the establishment and growth of NTBFs is also one likely to lead to growth amongst conventional business. To fulfil the development ambitions, NTBFs will be faced with normal management problems associated with rapid growth.

Section 4 reports correlation analyses. The relationships of the importance of management accounting, as measured by Likert scales 1–5, binary scales (Yes = 1, No = 0) and percent to the variables of environmental hostility and strategic orientation, were analyzed with Pearson correlation coefficients. Tables 3 and 4 report correlations between variables used in the study (for an overview of all variables, see Appendices A and B). All statistical estimations were carried out with the SPSS (Statistical Programs for Social Sciences).

4. Analysis

In this section, the empirical analysis is going to be presented. The analysis examines the association between

specific contingencies (first section: environmental hostility and strategic orientation) and the importance of management accounting practices in the NTBFs. There is also a sub-section that identifies correlations between branch, work experience, management problems and the importance of a couple of different management accounting practices. In Section 2.3.3, we have stated two research propositions:

- P1.* The importance of management accounting depends on environmental hostility.
P2. The importance of management accounting depends on strategic orientation.

In the discussion below, we concentrate on the correlations between environmental hostility–management accounting and strategic orientation–management accounting. The *environment* is a term used to explain a number of relevant variables of a firm’s environment which affect the design of the management accounting system (including R&D, technology and innovation, environment change).

Libby and Waterhouse (1996) classified management accounting in five broad classes: (i) planning (ii) controlling (iii) costing (iv) directing and (v) decision-making systems. The first class consists of two managerial calculations that broadly cover the areas which such qualitative calculations

Table 3
Correlation matrix—environmental hostility, strategic orientation and the importance of management accounting

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
<i>Management accounting</i>																			
1. Importance of management accounting (general)																			
2. Cost management (importance of standards in costing, budgeting)	0.109																		
3. Importance of investment methods (calculation)	0.300**	0.311**																	
<i>Environmental hostility</i>																			
4. Importance of R&D, technology and innovation	0.103	0.059	0.022																
5. Industry–technology level	0.136	0.015	0.049	0.094															
6. Environment (risk)	0.256**	−.007	0.014	0.287**	0.470**														
7. Environment change	0.128	0.071	0.054	0.069	0.655**	0.533**													
8. Competition behaviour	0.112	0.119	0.062	0.010	0.396**	0.349**		.327**											
9. Industry competition – products/services	0.147*	0.024	0.064	0.319**	0.330**	0.339**	0.282**	0.367**											
10. General milieu	0.054	0.140	0.018	0.045	0.141	0.223**	0.193**	0.125	0.115										
11. Price competition	0.003	0.017	0.046	0.044	0.203**	0.175*	0.123	0.181*	0.307**	0.305*									
12. New products–competitors	0.122	−0.017	0.058	0.222**	0.189*	0.286**	0.197**	0.309**	0.407**	0.207**	0.326**								
13. Decreasing demand	0.070	0.023	0.074	0.020	0.096	0.073	0.104	0.084	0.234**	0.136	0.372**	0.271**							
<i>Strategic orientation</i>																			
14. Conservative–innovative and action-oriented	0.130	−0.067	0.074	0.346**	0.298**	0.319*	0.296**	0.139	0.346**	0.096	0.148*	0.224**	0.055						
15. Follower or market-leader	0.154*	0.073	0.003	0.432**	0.052	0.262**	0.103	0.065	0.209**	.062	0.069	0.73	−0.001	0.434**					
16. Competitors–co-operation–elimination	0.195**	0.039	0.002	0.193**	0.206**	0.247**	0.197**	0.081	0.157*	0.032	0.168*	0.158*	0.014	0.261**	0.242**				
17. Price–competitors (low–high)	0.193*	0.057	0.013	0.151*	0.036	0.171*	0.149*	0.078	0.327**	0.034	0.276**	0.102	0.074	0.188*	0.329**	0.298**			
18. Price–cost-based	0.000	0.077	0.024	0.065	−0.006	0.052	0.105	0.092	0.038	0.161*	0.199**	0.027	0.115	0.081	0.034	0.004	0.109		
19. Price–market-based	0.163*	−0.053	0.056	0.180	0.145	0.233**	0.089	0.131	0.293**	0.084	0.254**	0.329**	0.188*	0.299**	0.004	0.120	0.168*	−0.063	

Notes. **Correlation is significant (0.01-level), 2-tailed; *Correlation is significant (0.05-level), 2-tailed.

Table 4
Correlation matrix—branch, work experience, management problems, etc. and the importance of different management accounting practices

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Branch															
2. Type of firm (manufacturing or service firms)	−0.05														
3. Firm start—importance of R&D	0.023	0.002													
4. Refinement level	0.028	−0.031	0.208**												
5. Importance of management accounting (general)	0.048	−0.041	−0.066	0.026											
6. Costing method (1–4: absorption costing, activity-based costing, direct costing, other)	0.071	0.081	−0.026	0.039	0.171*										
7. Cost management (importance of standards in costing, budgeting)	−0.007	−0.149*	0.001	0.103	0.109	0.060									
8. Importance of investment methods (calculation)	0.013	−0.131	−0.044	−0.026	0.300**	0.112	0.311**								
9. Earlier work experience of business development (Yes, No)	0.025	−0.088	−0.094	0.037	0.242**	0.196*	0.173**	0.191**							
10. Earlier work experience of management accounting (Yes, No)	0.119	0.072	0.011	0.061	0.135	0.081	0.013	0.075	0.236**						
11. Management problems—manage R&D	−0.087	−0.101	0.081	0.013	0.087	−0.086	0.387**	0.240**	0.123	−0.114					
12. Management problems—business ratios	−0.067	0.028	0.047	0.052	−0.039	−0.097	0.249**	0.015	−0.053	−0.078	0.399**				
13. Management problems—bureaucracy	−0.007	−0.081	0.094	−0.002	0.080	−0.069	0.221**	0.121	−0.030	−0.070	0.222**	0.311**			
14. Costing/budgeting versus total work time	0.016	−0.121	0.022	0.027	0.224**	0.021	0.271**	0.221**	−0.009	−0.087	0.119	0.075	0.142		
15. Accounting/cash flow analysis versus total work time	0.048	0.005	0.040	0.017	0.097	0.097	0.054	0.090	−0.023	0.103	0.023	0.045	0.062	0.178*	

Notes. **Correlation is significant (0.01-level), 2-tailed; *Correlation is significant (0.05-level), 2-tailed.

typically are used: cost management (costing, budgeting) and investment planning (methods, calculation). Also, cost accounting systems are important because of the many recent innovations in costing methods. The aim of the first empirical section is to better understand the association of two contingencies and the importance of management accounting (see Table 3).

In Table 3 the correlations and the variables to which they relate are identified under the headings of management accounting, environmental hostility and strategic orientation. The table shows the Pearson correlations (r). The third variable is characterized by high occurrence on the first and second variables, which is natural. The variables in the matrix (environmental hostility) measures the complexity of the environment. Of the variables (environmental hostility), not one of importance of R&D, technology and innovation, industry–technology level, environment change, competition behaviour, general milieu, price competition, new products–competitors, decreasing demand showed any significant correlation with management accounting variables (general, cost management and investment methods–importance). This is perhaps not to be expected, as we would normally assume environment hostility to have an impact on the importance of accounting data. However, it was argued that the environment will affect the importance of management accounting practices.

The characteristics of ‘conservative’ firms are that they grow slowly and have a low percent of R&D expenditure (variable: conservative–innovative and action-oriented). However, these NTBFs are growth-oriented firms (see also Löfsten and Lindelöf, 2001, 2002) and have a high level of R&D expenditure. The NTBFs are also faced by a high level of competition. The firm’s need of management accounting increase when technology and environments have changed and may also have external demands for change. This is characterized by high occurrence on environment (risk) and importance of management accounting (general) ($r = 0.256^{**}$).

Table 3 indicates that there is a direct relationship between environment (risk) ($r = 0.256^{**}$), industry competition–products/services ($r = 0.147^*$), follower or market leader ($r = 0.154^*$), competitors–co-operation–elimination ($r = 0.195^{**}$), price–competitors (low–high) ($r = 0.193^{**}$) and price–market-based ($r = 0.163^*$) with the importance of management accounting (general). We have also strong significant correlations between new products–competitors and variable 4 ($r = 0.222^{**}$), variable 5 ($r = 0.189^{**}$), variable 6 ($r = 0.286^{**}$), variable 7 ($r = 0.197^{**}$), variable 8 ($r = 0.309^{**}$), variable 9 ($r = 0.407^{**}$), variable 10 ($r = 0.207^{**}$) and variable 11 ($r = 0.326^{**}$): all these variables are under the heading *environmental hostility*. Bringing new products on the market requires a great deal of planning and co-ordination, an important function of management accounting systems (relationship: industry competition–products/services

and management accounting (general), $r = 0.147^*$). New-product development entails problem-solving, a function that is well served by accounting systems since they provide information for rate of return analysis and new-product pricing decisions.

We have also strong correlations between competitors–co-operation–elimination (variable 16) and variables 4–7 and between variable 19 (price–market-based) and variables 6, 9, 11–14. Also, while we might have expected to see here some evidence of a correlation between variables of environmental hostility–management accounting (variables 1–3) and between strategic orientation–management accounting (variables 1–3), only a few is apparent for the sample available. The research propositions 1 and 2 *cannot be supported* (only partly supported). We note that the importance of standard methods in management accounting (general, costing, budgeting, investment calculation) *does not seem to be precipitated by the contingencies such as environmental hostility and strategic orientation*. Gordon and Miller (1976) found that the firm’s management accounting systems are regarded as being determined by its environment, its organizational form and its decision-making style. Gordon and Miller’s firms have the following characteristics: high sales growth, high market share and high discretion and moderate informality. However, our correlations indicate significant associations between environmental hostility variables and strategic orientation variables.

This second empirical section (a sub-section) concerns questions about work experience, management problems and importance of management accounting practices. According to Ritchie and Richardson (2000) smaller business and accounting are often considered to be separable fields of study which exert different perspectives upon each other. These small firms do not plan as formally as a typical ‘planning firm’, but the NTBF does not plan as intuitively as the simple firm either. The NTBF context is normally characterized by a complex and dynamic or hostile environment, including high-technology, product/service change due to intense competition.

We now refer to the correlation results in Table 4. There is a clear empirical relation of the firms that have management problems (manage R&D, $r = 0.387^{**}$, business ratios, $r = 0.249^{**}$ and bureaucracy, $r = 0.221^{**}$) and cost management (importance of standards in costing, budgeting). These relations indicate that the NTBFs which already have problems in the management of the firm tend to structure the governance of the firms by cost management (a sort of *reactive* approach to management). Earlier work experience of business development (Yes or No) is significantly correlated with importance of management accounting ($r = 0.242^{**}$) and cost management (importance of standards in costing, budgeting) ($r = 0.173^{**}$). We conclude that this sub-section on correlation indicates that

earlier work experience and different types of management problems in small high-tech firms is of importance for development of the cost management approach. The table also shows that there is a correlation between different types of costing methods and the importance of management accounting ($r = 0.171^*$).

This study recognizes the challenges faced by small accounting practitioners in developing their management accounting systems as well as their costing methods. The relationship between small firm owner-managers and their accountants is mainly an economic one. The differentiation of management accounting systems often occurs in firms that are pursuing policies of strategic focus (Seal, 2001). Management accounting can be seen as one of the mechanisms for the adaptation and survival of the small firm. According to Perren and Grant (2000) and Perren et al. (1998) identified that research into management information, control and decision-making in small firms appears on the surface to be contradictory. Some research suggests that small firms have little management information, poor control and that the decision-making is ad hoc (Nayak and Greenfield, 1994).

5. Discussion and further research

To fulfil the development ambitions the NTBFs will be faced with normal management problems associated with rapid growth. The problem of management development associated with entrepreneurial growth is a well-known phenomenon. Small firms are usually associated with simple processes and organizational arrangements. Our point here, is that small NTBFs are *not typically small firms*. They have a *strong scientific technology base* and has *been established for the purpose of exploiting an innovation*. As the firms become larger, the need for managers to handle greater quantities of information increases to a point where they have to institute controls.

This paper reports correlation analysis of two research propositions which arise from different variables from the contingency theory of management accounting. The contingency variables were considered under the headings of *environmental hostility* and *strategic orientation*. The first proposition was that the importance of management accounting depends on environmental hostility and the second proposition was that the importance of management accounting depends on strategic orientation. The research propositions cannot be supported from the empirical data (only partly supported). Environmental hostility were measured by 10 variables and 6 variables measure strategic orientation.

The firm's need of management accounting increase when technology and environments have changed and may also have external demands for change. This is characterized by high occurrence on environment (risk)

and importance of management accounting (general). We note that the importance of standard methods in management accounting (general, costing, budgeting, investment calculation) does not seem to be precipitated by the contingencies (headings or general groups) such as environmental hostility and strategic orientation. Previous research has identified technology as one of the most important contingency factors. However, our *technology variables* (importance of R&D, technology and innovation, industry–technology level under the heading of environmental hostility) do not seem to have an impact on the importance of management accounting practices in the NTBFs. It is difficult from the analysis above, to reach conclusions about cause and effect, as correlation analysis is silent on such important issues.

To summarize, there are a number of environmental (environment—risk, industry competition) and strategy variables (follower or market leader, competitors and price) and other variables (in the empirical sub-section) that may affect management accounting practices (importance) in NTBFs. In previous research, the major external factors that have been examined at the firm level in management accounting are external environment (environmental uncertainty and hostility) and national culture. In the future, it is reasonable to search for factor patterns that can begin to explain and predict the direction of management accounting change in small NTBFs.

Fig. 1 shows the environmental hostility-based theoretical model for further studies. The described model influences the three investigated management accounting practices (management accounting—general, cost management—importance of standards in costing, budgeting) and importance of investment methods (calculation). The contingency factors are divided into two groups (headings): *Environmental hostility* and *Strategic orientation*. Environmental hostility is divided into 10 different variables and strategic orientation is divided into six different variables. Contingency-based studies assume the existing link between nature, the use of management accounting systems and subsequently enhanced performance.

Fig. 1 shows only a few examples of environmental hostility and strategic orientation (For all variables—see Appendix A, Tables A1 and A2). These variables indicate examples of environmental hostility and influence the firm's actions and strategy (strategic orientation). Environmental hostility impact both on strategic orientation and management accounting. Firms growth and profitability depends on strategic orientation and on management accounting. Firm growth can be defined by various measures and should not be analyzed as a separate employment element. Growth must be seen as employment growth and sales, which leads to increasing resources within the firm. Expanding sales are a central element in

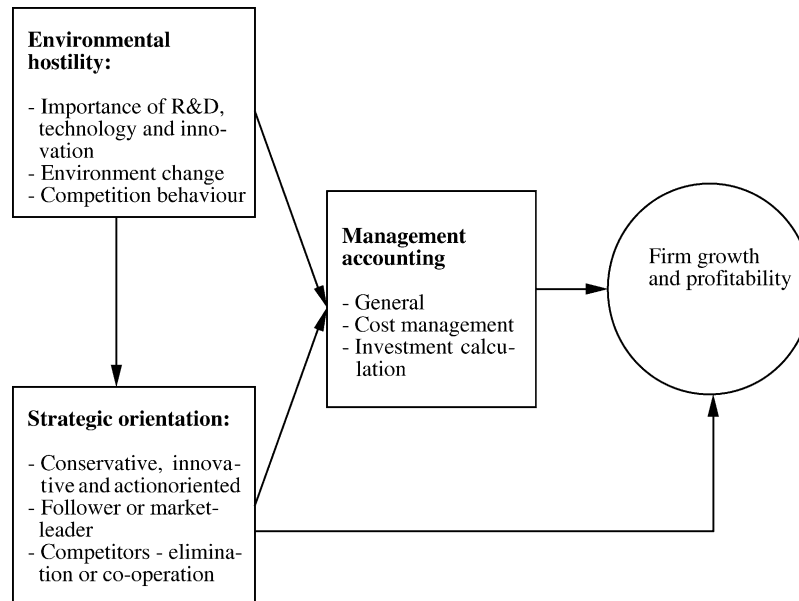


Fig. 1. Theoretical model for further studies.

a business process, but it is also important to measure profitability (profit margin, see Appendix B).

Further research methods is going to include statistical analysis undertaken using structural equation modeling (SEM). Our approach to estimating the structural equation model will follow the *two-stage procedure* recommended by Anderson and Gerbing (1988). The first stage involves estimation of the measurement model using confirmatory factor analysis. This stage tests whether or not the variables selected to measure each construct exhibit sufficient convergent and discriminant validity. A potential problem when structural equation analysis is used in empirical studies of management is mechanical relationships. Bentler and Chou (1987) argue that one of the most important questions in SEM is whether the sample comes from a population that is relevant to the theoretical ideas that are being evaluated. The crucial element in analyzing the results of SEM models is to make sure that the latent variables, the questions asked (this paper is based on a questionnaire), correspond with the theoretical claims that are made, and with the conclusions generated through the use of the model.

This study's findings should be interpreted in the light of several limitations. In addition to generally acknowledged limitations of survey research, is the incompleteness of the set of management accounting practices considered (only three variables). Small firms are usually associated with simple processes and management accounting systems. However, these practices may be associated more with the planning philosophy than with firm size and small NTBFs are not typically simple. This study identifies some core areas of management accounting importance

and the impact of the environment and strategic orientation and the accuracy and experience of costing information.

Appendix A

Table A1

Variables used in the study—environmental hostility, strategic orientation and the importance of management accounting

Variables	Mean	Std	Scale ^a
<i>Management accounting</i>			
Importance of management accounting (general)	3.33	1.40	1–5
Cost management (importance of standards in costing, budgeting)	1.72	1.10	1–5
Importance of investment methods (calculation)	2.09	1.40	1–5
<i>Environmental hostility</i>			
Importance of R&D, technology and innovation	2.84	1.86	1–5
Industry–technology level	3.52	3.54	1–5
Environment (risk)	2.92	1.32	1–5
Environment change	3.20	2.91	1–5
Competition behaviour	3.33	3.14	1–5
Industry competition-products/services	2.95	2.75	1–5
General milieu	1.70	1.85	1–5
Price competition	2.72	2.91	1–5
New products–competitors	3.17	3.00	1–5
Decreasing demand	2.83	3.01	1–5
<i>Strategic orientation</i>			
Conservative–innovative and action-oriented	4.17	1.41	1–5
Follower or market-leader	4.00	3.45	1–5
Competitors–co-operation–elimination	2.74	2.42	1–5
Price–competitors (low–high)	2.93	2.87	1–5
Price–cost-based	2.56	2.60	1–5
Price–market-based	2.76	2.79	1–5

^a 1, very poor; 5, very high.

Table A2

Variables used in the study—branch, work experience, management problems, etc. and the importance of different management accounting practices

Variables	Mean	Std	Scale ^a
Branch	3.11	2.09	1–6 ^b
Type of firm (manufacturing or service firms)	1.90	0.96	1–3
Firm start—importance of R&D	2.14	1.61	1–5
Refinement level	2.46	1.23	1–5
Importance of management accounting (general)	3.33	1.40	1–5
Costing method (1–4: absorption costing, activity-based costing, direct costing, other)	1.64	1.36	1–4
Cost management (importance of standards in costing, budgeting)	1.72	1.10	1–5
Importance of investment methods (calculation)	2.09	1.40	1–5
Earlier work experience of business development	0.63	0.48	Y/N ^c
Earlier work experience of management	0.11	0.32	Y/N
Management problems—manage R&D	1.65	1.29	1–5
Management problems—business ratios	1.81	1.30	1–5
Management problems—bureaucracy	2.37	1.41	1–5
Costing/budgeting versus total work time	4.00	5.02	Percent
Accounting/cash flow analysis versus total work time	5.88	5.86	Percent

^a 1, very poor; 5, very high.

^b The branches are software/information technology, technology consultants, electronics/electrical, pharmacology and pharmaceutical preparation, mechanics and industrial chemistry/plastics industry.

^c Yes, 1; No, 0.

Appendix B

Growth dimensions are expressed as sales growth (turnovers) and employment growth (number of employees):

$$\bar{g}_{\text{Growth\%/year}} = \frac{\left(\frac{x_{n+1}}{x_n}\right) - 1 + \left(\frac{x_{n+2}}{x_{n+1}}\right) - 1}{2} \quad (\text{B1})$$

where

x_n = value year n

n = year (base)

The profitability (profit margin) is calculated as:

$$\text{Profitability} = \frac{\text{net income} + \text{financial costs}}{\text{sales}} \quad (\text{B2})$$

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