

# Post-Completion Auditing of Capital Investments and Organizational Learning

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## **ABSTRACT**

This doctoral dissertation investigates post-completion auditing (PCA) of capital investments and organizational learning (OL). The empirical data in this cross-sectional field study is primarily based on interviews conducted in the 30 largest Finnish manufacturing companies. The dissertation consists of an introduction and three articles covering different aspects of PCA and OL. The first article examines reasons for the non-adoption of PCA. It specifically analyses and maps alternate capital investment controls (ACICs) that enable evaluation of the success of an investment and the enhancement of OL and draws upon the concept of equifinality to discuss the role of ACICs in discouraging PCA adoption. Drawing on the concepts of cybernetic control systems, the second article assesses the significance of PCA in measuring performance and controlling current investments (assisting correction and abandonment decisions), enhancing the integrity of investment appraisals, and in evaluating personnel. Additionally, the paper examines the beneficial effects of PCA related to organizational learning. The third article investigates whether or not the design of PCA systems provides a platform for organizational learning. First, with the aid of Huber's (1991) categorisation of OL constructs and the PCA literature, an OL-conducive PCA design was synthesised. It was then used as a benchmark for investigating PCA practices in the companies that were the focus of this study.

The results confirm prior literature that enhancing OL is the major reason for PCA and that the major perceived benefits of PCA are related to OL. The empirical evidence supports that the benefits that result from double-loop type learning which are related to future capital investments, are the major advantages of PCA, whereas PCA can be marginally beneficial in assisting problem detecting and solving (single-loop learning) for current investments. The findings of the study support the contention that PCA system sophistication can have an important role in facilitating (or hindering) OL. Specifically, organizational-memory-related aspects, such as adequate filing of PCA results and convenient access to them, can aid a company to effectively convey past investment experiences to new projects. Additionally, the results suggest that alternate capital investment controls (ACICs) can have a major role in explaining PCA practices in companies. The ACICs identified in this study include formal and informal systems and procedures specifically for performance measurement (e.g. following up production key figures, sales and profit centers) and OL (e.g. utilising central expertise and experienced internal resources). ACICs seem to diminish the relevance of PCA in companies and

consequently affect the perceived importance of PCA adoption and PCA system sophistication. It is particularly smaller companies, companies that do not have a critical mass of investments, who may perceive ACICs as sufficient and do not adopt PCA. In a similar vein among the PCA adopters, the larger companies having a critical mass of major capital investments tend to have more sophisticated PCA designs, whereas the smaller companies appear to rely on less sophisticated PCA combined with ACICs.

**Keywords:** post-completion auditing, organizational learning, capital investment, capital budgeting, non-adoption, managerial use, management control system design, management control package, equifinality, field study.

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### PART II: ORIGINAL ARTICLES

1. Huikku, Jari (2007) Explaining the non-adoption of post-completion auditing, *European Accounting Review*, 16(2), 363-398.
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## **PART I**

### **OVERVIEW OF THE DOCTORAL DISSERTATION**



## 1. Introduction

Success in capital investment greatly affects the extent to which a company can achieve its strategic objectives. Academic researchers suggest that post-completion auditing (PCA) of capital investments can provide valuable feedback for current and future investments, and consequently make capital investment more effective (Neale, 1991a; Pierce and Tsay, 1992). Researchers particularly emphasise that PCA information can facilitate organizational learning (OL) for planning future investment projects (ibid.). In other words, it has the potential to aid a company to avoid previous mistakes and to systematically identify successful processes that can be repeated (Northcott and Alkaraan, 2007). PCA is a formal process that checks the outcomes of individual investment projects after the initial investment is completed and when the project is operational (Chenhall and Morris, 1993). It can be regarded as one formal control system within a company's management control system (MCS)<sup>1</sup> package, which consists of various formal and informal controls (Otley, 1999; Malmi and Brown, 2008). The use of PCA is very common among large companies in Anglo-Saxon countries and many companies in other countries have also adopted PCA (Neale, 1994; Arnold and Hatzopoulos, 2000).

In spite of PCA's widespread diffusion and suggested usefulness for enhancing OL, empirical research focusing on PCA is not voluminous. We still have major research gaps to be addressed. We do not have a thorough understanding of why many large companies do not adopt PCA in spite of the suggested organizational learning benefits. Additionally, we know little about the relevance of different managerial uses of PCA and its benefits related to OL. Furthermore, scholars suggest that adequate content and communication of PCA reports play a major role in enabling OL. Nevertheless, there is little empirical

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<sup>1</sup> See discussion about the MCS definition e.g. in Chenhall (2003), Merchant and Otley (2007), and Malmi and Brown (2008). In this dissertation a broad conception of MCS is adopted. Accordingly, I refer to MCS as a system that is "designed to help an organization adapt to the environment in which it is set and to deliver the key results desired by stakeholder groups" (Merchant and Otley, 2007, p. 785).

research on the design of PCA systems in general, and on their communication aspects in particular. Accordingly, the objective of this doctoral dissertation is to contribute to the PCA literature by shedding light on the relationship between PCA and organizational learning. More specifically, the dissertation first investigates whether and how companies use alternate control mechanisms to evaluate the success of their investments and to enhance organizational learning. It continues by discussing the circumstances under which these alternate mechanisms can discourage adoption of PCA. Second, the significance of different managerial uses of PCA and specifically OL will be addressed. Third, the interplay between PCA design and OL will be examined. The empirical evidence in this cross-sectional field study is primarily based on interviews conducted in the 30 largest Finnish manufacturing companies.

The dissertation consists of two parts. Part One is the introduction chapter of the dissertation and it is followed by Part Two presenting the three published articles. Following this introductory section Part One is further structured as follows. First, Section 2 provides a review of the post-completion auditing literature on the adoption, objectives and benefits, and design of PCA systems, and identifies the research gaps to be addressed in the dissertation. Section 3 presents the objective of the dissertation and is followed by Section 4 which presents the theoretical underpinnings of the dissertation. Thereafter, Section 5 introduces the study's method and describes the companies from where the data was gathered. Section 6 summarises the objectives, results, and contributions of the original articles. Finally, Section 7 discusses the empirical results and presents the conclusions of the study.

## 2. Review of the post-completion auditing literature

Capital investment<sup>2</sup> practices within firms have motivated significant empirical research since 1950s. These studies have adopted a common view of capital investment as a process, albeit there are many different capital investment process models.<sup>3</sup> The studies address practices at one or several phases in the capital investment process. These have predominantly been surveys, and many of them specifically address the use of theoretically recommended investment appraisal methods<sup>4</sup> in practice (e.g. Alkaraan and Northcott, 2006; Arnold and Hatzopoulos, 2000; Farragher et al., 1999; Gitman and Forrester, 1977; Graham and Harvey, 2001; Honko and Virtanen, 1975; Istvan, 1961; Keloharju and Puttonen, 1995; Liljeblom and Vaihekoski, 2004; Pike, 1983, 1996; Sandahl and Sjögren, 2003; Verbeeten, 2006).<sup>5</sup> Additionally, but to a lesser extent, scholars have addressed capital investment practices by using case studies in order to obtain a more profound understanding about the complex investment processes in their organizational contexts (e.g. Bower, 1970; Carr and Tomkins, 1996; Guilding, 2003; Kasanen et al., 1993; King, 1975; Lumijärvi, 1990, 1991; Ross, 1986; Wikman, 1992). Nevertheless, despite its suggested usefulness, post-completion auditing has received only minor attention in empirical capital investment research (Haka, 2007).

In this dissertation, PCA is defined as follows. PCA is a formal review of a completed investment project fulfilling the following criteria: (1) it takes place after an

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<sup>2</sup> In this study I use the term “capital investment”, however “capital budgeting” is also widely used in the literature.

<sup>3</sup> For different capital investment process models, see e.g. Northcott (1992), Mukherjee and Henderson (1987), and Pike and Neale (2003). The common feature in all of them is that the control phase is always presented as the final and concluding phase. Northcott suggests that the capital investment process has the following stages: (1) project identification, (2) project definition and screening, (3) analysis and acceptance, (4) implementation, and (5) monitoring and post-audit. Hence, she divides the concluding phase into two stages. Monitoring refers to the control taking place during the implementation of a capital investment project. In this phase it is typical to follow up on the cost budget, scheduling and technical specifications, to see that they are progressing according to plan.

<sup>4</sup> For normative investment theory see e.g. the following text books: Honko (1979), Levy and Sarnat (1990), Aho (1992), Northcott (1992), Brealey and Myers (1997), Pike and Neale (2003), Götze et al. (2007).

<sup>5</sup> See Haka (2007) and Northcott (1991, 1992) for comprehensive reviews of survey and case-based capital investment research addressing investment appraisal methods and other aspects in investment processes.

investment has been completed (commissioned) and has begun to generate cash flows (or savings); (2) PCA reporting is at least partly focused on a comparison between the pre-investment estimates of an investment project and the actual figures and achievements after completion; and (3) PCA is systematic and regular, and there are instructions related to it. This definition is congruent with that suggested by Gadella (1986), Pierce and Tsay (1992), Chenhall and Morris (1993), and CIMA (2005), but is more explicit with regard to criterion (3). Nevertheless, I recognise the difficulty of providing a catch-all definition of PCA including more detailed requirements such as the type of projects selected, the format, who does it, who is responsible for it, when and how frequently it is conducted, and how the results are communicated. In addition to informal ways of controlling capital investments, the PCA definition adopted here rules out monitoring and routine reporting.<sup>6</sup>

Contributions to the PCA literature suggest that PCA can be beneficial to providing feedback for both current and future capital investments (Neale, 1989, 1994; Pierce and Tsay, 1992; Mills and Kennedy, 1993). Nevertheless, enhancing organizational learning (OL) for future investment projects has been considered by companies to be the major objective of PCA (Neale and Holmes, 1991; Mills and Kennedy, 1993), and also the major perceived benefit of PCA<sup>7</sup> (Corr, 1983; Pierce and Tsay, 1992; Neale and Holmes, 1991). Additionally, researchers have reported that PCA would provide feedback for correction/abandonment decision-making regarding underperforming investment projects (Neale, 1989; Pierce and Tsay, 1992) and enhance the integrity of investment project appraisals (Lumijärvi, 1990; Pierce and Tsay, 1992). Furthermore, some companies appear

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<sup>6</sup> In practice, monitoring of the implementation phase and PCA are overlapping concepts, because monitoring is, to some extent, a prerequisite for PCA. Nevertheless, monitoring alone cannot be considered as fulfilling the criteria for PCA. In a monitoring phase, it is typically too early to estimate whether or not an investment project will achieve its targets. Internal and external routine reporting (monthly, trimestral, annually, etc.) do not usually fulfil all the criteria required for PCA. For example, routine reporting is typically: (1) profit-center or cost-center focused, not investment project focused and, (2) does not compare the pre-investment objectives of an investment project with the actual achievements.

<sup>7</sup> Prior literature uses the term "PCA benefits" broadly in this connection simultaneously covering the uses of PCA potentially leading to achievement of PCA benefits. Accordingly, in this dissertation the words "benefits" and "use" are used synonymously.

to use PCA for evaluating/rewarding their personnel involved in the capital investment process (Smith, 1994; Neale, 1994). We have still, however, little empirical research about the relevance of PCA for these different managerial uses and its concrete effects related to OL.

The adoption rates of PCA have been much studied in the UK and in the USA.<sup>8</sup> It appears that in these countries most of the large companies use PCA.<sup>9</sup> In other countries, adoption rate studies have been rare. Neale (1994) carried out a survey in Norway, and Azzone and Maccarone (2001) in Italy. Neale found that 41% of the large Norwegian companies use PCA and the corresponding figure in large Italian companies was 71%. Nevertheless, these surveys indicate that there are still large companies in which PCA adoption is not considered to be appropriate to their organization. There is little empirical research on PCA non-adoption, and none that focuses on the non-adoption phenomenon *per se*. In a few comprehensive surveys of PCA (Ghobadian and Smyth, 1989; Neale and Holmes, 1991; Pierce and Tsay, 1992; Azzone and Maccarrone, 2001) non-adoption has been discussed, but it has not been the primary interest of the studies.

The reasons reported for non-adoption can be delineated into three main overlapping groups: (1) scarcity of capital investments; (2) difficulties of PCA; and (3) alternative ways to achieve the benefits suggested for PCA. Although alternative capital investment controls (ACICs) such as good relationships between corporate and divisional managers (or between managers and controllers) have been recognised as a reason for non-adoption of PCA (Neale and Holmes, 1991; Azzone and Maccarrone, 2001), there are still major gaps in research. We do not have a thorough understanding of existing ACICs, or whether and how companies can evaluate completed capital investments and thus enhance

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<sup>8</sup> See Neale (1994) for presentation of PCA adoption surveys in the UK and the USA.

<sup>9</sup> Adoption rates reported in different studies: (1) in the UK, 98% (Arnold and Hatzopoulos, 2000) and 79% (Neale, 1991b), and (2) in the USA, 88% (Farragher et al., 1999), 76% (Gordon and Myers, 1991), and 90% (Klammer and Walker, 1984).



OL by using them. Consequently, the role of ACICs as a reason for non-adoption is ambiguous.

Common aspects to be considered in the design of a PCA system include (1) selection of projects for PCA, (2) timing of PCA, (3) persons or teams conducting PCA, (4) location of responsibility for PCA, (5) format of a PCA report, and (6) communication of reports (e.g. Neale, 1991a, 1994; Neale and Holmes, 1990, 1991; Gordon and Myers, 1991; Kennedy and Mills, 1993; Pierce and Tsay, 1992; Smith, 1994; Azzone and Maccarrone, 2001; Huikku, 2001). PCA scholars emphasise that an appropriate design for a PCA system, specifically with regard to the PCA report and its communication, is a prerequisite for effective knowledge transfer and sharing, and consequently for OL (Neale, 1989, 1991a; Mills and Kennedy, 1993). Nevertheless, the communication aspects of PCA results have received little attention in previous studies. Ghobadian and Smyth (1989) report that it is common to distribute PCA reports to the persons responsible for initiating, planning, and implementing the project. Furthermore, according to Kennedy and Mills (1993), dissemination of reports to parties not directly involved in the project and particularly to other divisions tends to be quite limited.

Empirical research that addresses the relationships between OL and PCA design is scarce. Azzone and Maccarrone (2001) suggest that companies striving to achieve their main objectives (OL or decision-making support for current investments) have designed their PCA systems accordingly. For example, the location of responsibility for PCA appears to be more centralised in firms indicating OL as their most important objective. Neale (1991a) investigated whether objectives and design of PCA are associated with the perceived benefits of PCA. With regard to PCA objectives and the perceived benefits, he reports that the benefits are associated with the degree of emphasis placed on the objectives. Hence, companies stressing OL related objectives are more successful at reaping the OL

benefits. Additionally, with regard to PCA design and benefits, he suggests that companies selecting only the major investment projects for PCA are more likely to achieve OL benefits than companies that include all their projects. To sum up, in spite of the emphasised significance of PCA design for enhancement of OL, examination of the relationship between PCA design and OL is a much neglected area in prior research. Specifically, our knowledge about the role of PCA reports and aspects of their communication in enhancing OL is in its infancy.

### **3. Objective of the dissertation**

*The objective of this doctoral dissertation is to shed light on the relationship between PCA and organizational learning.* In order to fill the research gaps identified in the preceding section and hence to contribute to the PCA literature, the study approaches this relationship from different angles in three articles. *The first article* examines reasons for the non-adoption of PCA. Although alternate control mechanisms have been recognised as a reason for non-adoption, we lack a more thorough understanding of their role. Consequently, the purpose of this paper is to explore the existing types of alternate controls, and if and how companies can evaluate completed investments and facilitate organizational learning for capital investment by using them. Additionally, the paper aims to discuss the circumstances under which alternate controls are appropriate for controlling completed investments, and consequently potentially discourage the adoption of PCA.

In addressing PCA non-adoption, the paper draws on a combination of literatures in the area of management control package (Fisher, 1995; Otley, 1999), organizational learning (Huber, 1991), and contingency-based research (e.g. Chenhall, 2003). In particular, the discussion concerning substitution and complementarity of different control systems within the management control package literature, and hence the notion of equifinality

(Gresov and Drazin, 1997) plays a core role in explaining non-adoption. Based on the findings of contingency-based research<sup>10</sup>, suggesting that smaller companies use less formal and less sophisticated controls, size of the firm is explicitly addressed as a potential reason for non-adoption (Child and Mansfield, 1972; Khandwalla, 1972; Bruns and Waterhouse, 1975; Merchant, 1981; Chenhall, 2003; Al-Omiri and Drury, 2007).

Motivated by the contradictory results in prior research, the purpose of *the second article* is to assess the significance of PCA for various managerial uses. Drawing on the concepts of cybernetic control systems (Otley, 1980; Flamholz et al., 1985), it assesses the relevance of PCA in measuring performance and controlling current investments, enhancing the integrity of investment appraisals, and in evaluating personnel. Additionally, the study elaborates and maps the organizational learning benefits that result from PCA, and discusses the extent to which they are related to single and double-loop types of learning (Argyris, 1977).

Finally, the purpose of *the third article* is to investigate whether or not the designs of PCA systems provide a platform for organizational learning. Although PCA scholars suggest that an adequate content and communication of PCA reports have a major role in enabling OL, we have little empirical research on the designs of PCA systems in general, and their communication aspects in particular. First, with the aid of Huber's (1991) categorization of the constructs of organizational learning (OL) and the prior PCA literature, an OL-conducive PCA design was synthesised. Then, this proposed design was used as a benchmark for studying PCA practices in the companies that were the focus of this study. In addressing the relationship between PCA design and OL, the paper makes an

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<sup>10</sup> Contingency-based research attempts to explain the effectiveness of MCS by investigating designs that are ideal under certain circumstances. The contextual variables typically addressed within companies include size, organization structure, technology, nature of environment, strategy and national culture (see e.g. Chenhall, 2003).

explicit attempt to shed light on the reasons behind the claimed ineffectiveness of PCA (Haka, 2007).

#### **4. Theoretical underpinnings of the study**

##### **Organizational learning**

Organizational learning (OL) is a process that involves the sharing of knowledge, beliefs or assumptions among individuals within an organization, and is influenced by a broader set of social, political or structural elements (Marquardt and Reynolds, 1994). Consequently, OL is not only the sum of individual learning in an organization. According to Argyris (1977), in the OL process an organization responds to changes in its environment by detecting errors and correcting them to maintain the central features of the organization. He distinguishes two types of OL: single-loop and double-loop learning. In single-loop learning the main focus is on problem solving, whereas in double-loop learning the reasons why the problems arose are addressed. Accordingly, in double-loop learning errors are not only detected and corrected, but the underlying policies and goals are also questioned. In a similar vein, Senge (1990) presents that adaptive learning (Argyris' single-loop) must be joined by generative learning (Argyris' double-loop) to expand the organization's capacity to create its future.

Huber (1991) suggests that OL processes include four constructs: knowledge acquisition, information distribution, information interpretation, and organizational memory. Knowledge is first obtained in a knowledge acquisition process. Then, information from various sources is shared, and new information (or understanding) is created in an information distribution process. In the next step, the information interpretation phase, commonly understood interpretations are attached to information. Finally, in the organizational memory phase, knowledge is stored for later use.

Effective reusing of a firm's existing knowledge assets is essential for realising competitive advantage (Teece et al., 1997; Jensen and Szulanski, 2007). Similarly, Kolb (1984) has accentuated the importance of past experiences in the learning process. Communication aspects play a major role in knowledge reusing by enabling its transfer and sharing, and consequently OL (Ghoshal and Bartlett, 1988; Ghoshal et al., 1994, Tucker et al., 1996). Accordingly, Garvin (1993) emphasises the importance of quick and efficient transferring of learning experiences as a prerequisite to OL.

Management control systems have been found to enhance (or inhibit) organizational learning (Kloot, 1997; Carmona and Grönlund, 1998; Partanen, 2001). In congruence with this, it has been suggested that PCA information has the potential to aid a company in systematically identifying successful processes that can be repeated in future investment projects, and to help avoid previous mistakes (Neale, 1989; Northcott and Alkaraan, 2007). Chenhall and Morris (1993) found that PCA feedback can enhance managerial learning at the investment project definition stage particularly in more certain operating situations, whereas environmental uncertainty can moderate the learning. Additionally, Mills and Kennedy (1993) suggest that PCA information can be valuable for developing capital investment processes in general.

This dissertation utilises Huber's (1991) constructs of OL in order to examine reasons for the non-adoption of PCA (Article 1) and the interplay between PCA design and organizational learning (Article 3). These constructs have previously been used in the management control system literature to examine, for example, integrative strategic performance measurement systems (Chenhall, 2005), organizational memories in accounting consultation units (Salterio and Denham, 1997), and links between management control and OL (Kloot, 1997). Huber's comprehensive presentation of OL processes is specifically appropriate for structuring studies if they cover all OL phases and emphasise

the study of explicit knowledge. This is the case in this study. However, it is clear that in addition to explicit knowledge which can be explicated or formalised, tacit knowledge (skills and know-how) can play an essential role in the OL process (Nonaka and Takeuchi, 1995; Polanyi, 1966). Argyris' (1977, 1990) OL concepts (single/double-loop learning) are used in assessing PCA's OL related benefits (Article 2).

### **Management control package approach**

#### *Cybernetic control systems*

Traditional control systems (e.g. budgeting) – also called cybernetic control or feedback systems – typically build a core for management control within a company. Cybernetic systems rely on variance information to correct the progress of the process in question (Otley, 1980; Green and Welsh, 1988; Lockett and Eggleton, 1991; Simons, 1995; Merchant and Otley, 2007). They comprise four core control mechanisms: planning, measurement, feedback and evaluation-reward (Flamholtz et al., 1985). The basic requirements for a functioning cybernetic control system is the existence of ex-ante objectives, the ability to measure the actual outcomes against them, and ability to take corrective actions (e.g. Simons, 1995). The study draws on the concepts of cybernetic control systems in assessing the significance of PCA in measuring performance and controlling current investments (assisting correction/abandonment decisions), enhancing the integrity of investment appraisals, and in evaluating personnel.

#### *Controls as complements and substitutes*

Contributions to the management control package literature suggest that in addition to cybernetic controls, companies simultaneously use various other control mechanisms (e.g. Otley, 1999). Malmi and Brown (2008) categorise these as administrative and cultural

controls.<sup>11</sup> Administrative controls relate to arrangements regarding organizational structure/design (e.g. level of centralisation, standardisation, formalisation and configuration), governance structure (structure and composition of board and management/project teams), and the formal policies/procedures within a firm (e.g. standard operating procedures, human resources management) (Chenhall, 2003; Simons, 1995; Abernethy and Chua, 1996). Cultural controls relate to “efforts to persuade people to adapt to certain values, norms and ideas about what is good, important, praiseworthy, etc. in terms of work and organizational life” (Alvesson and Kärreman, 2004, p. 426).<sup>12</sup>

Management control systems (MCS) can be regarded to operate as a package of interrelated formal and informal control mechanisms<sup>13</sup>, and consequently in studying them a wide and holistic view is appropriate (Otley, 1980, 1999; Flamholtz et al., 1985; Macintosh and Daft, 1987; Alvesson and Kärreman, 2004; Malmi and Brown, 2008). Accordingly, where on the one hand, research in MCS contends that different types of controls can be used in a complementary, mutually reinforcing manner (Waterhouse and Tiessen, 1978; Merchant, 1985) on the other hand, several researchers (Galbraith, 1973; Mintzberg, 1983; Fisher, 1995; Gerdin, 2005; Sandelin, 2008) maintain that control systems may substitute rather than complement each other.

Despite calls from several researchers (Otley, 1980; Fisher, 1995; Chenhall, 2003; Gerdin, 2005; Malmi and Brown, 2008), we have still only limited knowledge about the substitution and complementarity of various controls within companies’ control packages. The researchers argue that the existing alternative mechanisms can discourage companies from adopting new ones (Activity-Based Costing: Innes et al., 2000; Balanced Scorecard:

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<sup>11</sup> See Simons (1995), Bruns and Waterhouse (1975), and Merchant and Van der Stede (2007) concerning other ways to enumerate and categorise the available controls.

<sup>12</sup> Alvesson and Kärreman call cultural controls socio-ideological controls. See also Simons (1995) concerning beliefs systems, Schein (1997) concerning symbol-based controls, and Ouchi (1979) concerning clan control.

<sup>13</sup> Informal control mechanisms may, for example, include ad hoc analysis, discussions, meetings and observations, (see e.g. Preston, 1986; Jönsson and Grönlund, 1988; Rockness and Shields, 1988; Abernethy and Brownell, 1997; Marginson, 1999; Spekle, 2001).

Speckbacher et al., 2003; PCA: Neale and Holmes, 1991, and Azzone and Maccarone, 2001).

### *Equifinality*

Motivated by the MCS and PCA literatures, which suggest that different controls can act as substitutes for each other, this dissertation investigates whether alternate capital investment controls affect the non-adoption of PCA. In doing this, I draw primarily on the notion of equifinality. In an equifinal situation, open systems have not only one, but multiple alternative choices for reaching the desired final state (von Bertalanffy, 1968). Equifinality occurs in an organizational setting when “a system can reach the same final state, from different initial conditions and by a variety of different paths” (Katz and Kahn, 1978, p. 30).

Gresov and Drazin (1997) maintain that equifinality in the organization design context means that the same final state (i.e. performance of an organization) can be achieved by multiple organizational structures. This is the case even if the contingencies faced by the organization are the same. Accordingly, they present a classification of four design conditions, that build on the degree of conflict in functional demands (low vs. high) and the latitude of structural options (constrained vs. unconstrained). Equifinality in its different forms occurs in three of these situations, whereas an optimal profile is assumed when there is low conflict in functional demands and constrained latitude of available structural options (see Gresov and Drazin, 1997). In the situation of trade-off equifinality a low conflict in functional demands occurs, and latitude of structural options is unconstrained. Furthermore, in a situation of suboptimal equifinality a company attempts to satisfy multiple and conflicting functional demands with constrained structural options. Finally, in a situation of configurational equifinality a company has unconstrained options to satisfy conflicting functional demands.



In this study, the notion of equifinality acts as a trigger and a lens for discovering and analysing potential alternative ways to enable companies to satisfy their functional demands set for PCA. Evaluation of the success of an investment (core function of PCA) and enhancement of OL (the major objective for PCA) were examined as the functional demands. Evaluation can be considered a pre-stage for learning, and hence evaluation and learning are relatively similar in their implications for organization design, i.e. a low degree of conflict in functional demands is expected. Additionally, the structural options are unconstrained because the companies can tentatively use alternate capital investment controls or PCA to evaluate/learn. This kind of situation corresponds most closely to trade-off equifinality, where a trade-off (i.e. substitution) of one structure for another still facilitates achievement of the same functional outcome (Gresov and Drazin, 1997).<sup>14</sup>

## **5. Research method and data**

Considering that the study's purpose is to obtain a wide and comprehensive picture of the research topics, a case analysis method<sup>15</sup> that investigates only one or a few companies would not suffice (Yin, 1994). Accordingly, my original intention was to conduct a survey of a large sample size of companies, but during the early phase of the study it became clear that respondents tend to incorrectly understand questions. Specifically, ambiguous distinctions between the basic concepts such as pre-audit, monitoring and PCA would have jeopardised the validity and reliability (McKinnon, 1988; Modell, 2005) of the study. It appeared that face-to-face interviews would have to be conducted in order to clarify such issues as they arose. Additionally, it had been very challenging to compress all of the explanations of definitions and relevant questions into a short enough questionnaire. For

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<sup>14</sup> The potentiality for a trade-off effect has previously been acknowledged in other organizational studies by Galbraith (1977), Kerr and Jermier (1978), and Eisenhardt (1988).

<sup>15</sup> See e.g. Lillis and Mundy's (2005) suggestion how to distinguish single case studies, multiple case studies, cross-sectional field studies, and surveys based on sample size, sampling logic, and preciseness/measurability of existing constructs, for example.

these reasons the study was converted into a cross-sectional field study addressing the PCA practices in the 30 largest Finnish manufacturing corporations.<sup>16</sup>

According to Lillis and Mundy (2005), a cross-sectional field study, which lies somewhere between an in-depth case study and a broad-based survey, can be particularly appropriate when there is doubt about the precise specification and measurement of variables, their empirical interpretation, or the relationships among them. This is the case in this study. Compared to a single case study, a field study enabled cross-case comparisons using replication logic (Eisenhardt, 1989). Furthermore, relative to surveys, the adopted method permitted me to depart from the demands of precise measurability and pose important “how” and “why” questions that could develop existing theory (Keating, 1995). Although the adopted method had the disadvantage of restricting the statistical power and hence generalization<sup>17</sup> of the results, it clearly improved the reliability and internal/construct validity of the study. Specifically, it facilitated explaining to the participants of the interviews the definitions in detail, posing further questions, returning to earlier questions, and going through real examples of PCA reports.

The empirical data for all three articles was gathered simultaneously using two mechanisms during the interviews: a theme interview (see Appendix A) and a structured questionnaire which was completed in the presence of the interviewer. The nine-page questionnaire included 44 factual and attitudinal questions about PCA. It included the instructions for completing the PCA, and the design of a PCA system (i.e. the type of projects selected, the format, who does it, who is responsible for it, when and how frequently it is conducted). Additionally, the questionnaire covered other aspects of PCA, such as the objectives for PCA, its uses/benefits, difficulties, communication, reasons for

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<sup>16</sup> The top 30 companies were those listed in the Finnish business magazine *Talouselämä* on 24 May 2002.

<sup>17</sup> See Lukka and Kasanen's (1995) about generalization rhetoric in accounting research (statistical, contextual, and constructive rhetoric).

non-adoption, alternative mechanisms to manage capital investment knowledge, and ideas for future development of PCA in a company.

The questionnaire was developed with the assistance of prior PCA studies (e.g. Neale, 1989, 1994; Pierce and Tsay, 1992; Azzone and Maccarrone, 2001; Huikku, 2001). Specifically, the experiences obtained during my in-depth case study (Huikku, 2001) relating to PCA processes in three major divisions of one large Finnish conglomerate (31 interviews) were found to be helpful. They helped me in designing a meaningful questionnaire and analysing the data, and in enhancing the construct validity of the study (see Vaivio, 2008). Likert-5 scaling was used for the attitudinal questions. Additionally, triangulation between different empirical materials played a major role in increasing the reliability of the evidence (Ferreira and Merchant, 1992; Vaivio, 2008). Accordingly, in addition to interviewing more than only one person in the many companies, written instructions, official newsletters, and above all, copies of PCA reports were used for triangulation purposes.

In total 49 interviews were conducted between December 2002 and January 2004. As far as I am aware, this is the most extensive PCA study using face-to-face interviews. Typically the interviewees were CFOs/controllers and persons in charge of technology, production, investments or business development in corporate management or major divisions of the organizations (see Appendix B). The principal interviewees per company (“the most knowledgeable persons about capital investment control”) were identified through press releases, phone calls, seminars, hints from colleagues, and newspapers. Additionally, in some companies other relevant persons were interviewed. All the contacted persons agreed to be interviewed. The duration of an interview was on average about two hours, and all interviews except one were tape-recorded. After each interview and without delay the material was transcribed. Thereafter the transcribed material, completed

questionnaires and other material (e.g. capital investment and PCA instructions and copies of conducted PCAs) were preliminary analysed to obtain useful feedback for the coming interviews and analysis. Accordingly, during the interviewing process the material was continuously read and re-read, numerous spreadsheet tables on the findings were compiled and updated, within and cross-case patterns analysed, and the findings contrasted to prior theory and the theories relevant to this study. Finally, after the whole interview process had been conducted, coding and analysing of data continued - mainly based on thematic approach<sup>18</sup> - and the first versions of the research papers were written (Eisenhardt, 1989; Yin, 1994).

From the research paradigm point of view, the study can be positioned in the functionalist (management) accounting research stream adopting objectivism as a philosophy of science position rather than in the interpretive paradigm where subjectivism would be anticipated (Burrell and Morgan, 1979; Chua, 1986).<sup>19</sup> Lillis and Mundy (2005) suggest that cross-sectional field studies are typically functionalistic, and similar to this study, the usual method of data analysis is both qualitative and quantitative. Ontologically, with regard to objectivism, empirical reality is assumed to be objective and external to the subject (i.e. the paradigm is based on realism as an ontological position), whereas with subjectivism, social reality is emergent, subjectively created, and objectified through human interaction (nominalism) (Chua, 1986).<sup>20</sup>

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<sup>18</sup> Thematically constructed data matrices in Excel played a major role in aiding the data analysis. The main principle was to display observations per theme/question under scrutiny in all the companies to detect and quantify the regularity of observations and incidence of patterns. In the initial stage, the matrices were constructed to present all the companies studied as rows and the themes/questions as columns. During the later analysis phases, the matrices facilitated easy regrouping of the companies and their answers (e.g. between PCA adopters/non-adopters, larger/smaller PCA adopters). The use of data matrices promoted completeness in assessing the presence/absence of constructs and relations in the companies. Additionally, specifically for within case analysis the company specific data were displayed in table formats (e.g. tables presenting all PCA design properties of each company studied).

<sup>19</sup> See Kakkuri et al. (2008a,b), Ahrens (2008), and Vaivio and Siren (2008) for a recent intensive academic exchange regarding the objective/subjective dichotomy in the management accounting literature.

<sup>20</sup> Additionally, objectivist studies are assumed to be positivist (regarding epistemology), determinist (human nature) and nomothetic (methodology) (Burrell and Morgan, 1979). Furthermore, both functionalist and interpretive paradigms assume regulation and stability in society.

In this study the interviews conducted in the multiple units were appropriate for the clarification and understanding of constructs and their interrelationships. Importantly, multiple units facilitated identifying and analysing cross-case patterns. Nevertheless, the chosen method would not have been sufficient to providing in-depth understanding about accounting in its varying complex organizational contexts, as is the typical aim in subjectivist, interpretive studies.<sup>21</sup> For interpretive purposes, more intensive and longer data collection per unit, and less constrained framing of the research questions would have been required (Lillis and Mundy, 2005). The theoretical contribution of the study relates to theory refinement; it elaborates further prior theories by clarifying them, adding more details to them and extending their scope (Keating, 1995; Ittner and Larcker, 2001).<sup>22</sup>

With regard to the companies studied in this research, the net sales of the largest company were €31.2 billion in 2001, the largest absolute amount of tangible assets was €12.3 billion, and the largest gross investments amounted to €3.9 billion annually (see Table 1). The number of personnel ranged from 780 to 57,700; 23 of the companies were listed on at least one stock exchange.

Table 1. Descriptive statistics of the 30 largest Finnish manufacturing companies (in € million)

	Mean	Median	St. dev.	Min	Max
Net Sales	3 789	1 651	6 115	531	31 191
Tangible assets	1 763	545	3 054	57	12 335
Gross investments	474	127	816	11	3 850

With respect to their PCA adoption the companies can be split into three main groups: PCA adopters, ad hoc adopters, and non-adopters. 16 companies of the 30 can be considered to

<sup>21</sup> See Ahrens et al's (2008) polyphonic debate about the interpretive accounting research.

<sup>22</sup> This is consistent with Lillis and Mundy's (2005) suggestion that cross-sectional field studies generally fall into the category of theory refinement.

conduct systematic PCA for their capital investments.<sup>23</sup> Four companies (ad hoc adopters) sometimes conduct some kind of PCA for various reasons, and 10 companies do not use PCA at all. The division of PCA adoption per industry sector is presented in Table 2.

Table 2. PCA adoption per industry sector

Industry sector	PCA adopters	Ad hoc adopters	Non-adopters	Total no.
Metal	4	0	4	8
Forest	4	0	1	5
Food processing	3	0	1	4
Chemical & Plastics	2	1	0	3
Energy	1	0	1	2
Building material	1	1	0	2
Telecom/Electronics	0	1	1	2
Diversified	0	0	2	2
Others	1	1	0	2
Total	16 (53%)	4 (13%)	10 (34%)	30

In line with the definition of PCA given in this paper, the common features for all the non-adopters here are that they do not formally compare pre-investment estimates of investment projects with actual figures after the investment projects have been completed and have started to generate cash flows. None of the non-adopters confessed to ever having done any PCA. Consequently, the borderline between PCA non-adopters and other companies is clear, whereas the borderline between PCA adopters and ad hoc adopters is not so clear. Nevertheless, the companies that only randomly conduct some kind of review of completed investment projects by comparing ex ante and ex post figures are grouped as ad hoc adopters. Additionally, the common features for all of the ad hoc adopters are the lack of systematic procedures for conducting PCA and reporting results, and the lack of written PCA instructions.

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<sup>23</sup> In two conglomerates consisting of largely independent businesses, different policies for PCA were found. In both companies, the larger divisions were PCA adopters, and they were chosen to represent the whole company. The other minor divisions were an ad hoc adopter and a non-adopter.

## **6. Summary of the original articles**

### **Article 1: Explaining the non-adoption of post-completion auditing**

The first article of the thesis investigates reasons for the non-adoption of PCA. The prior literature suggests that management controls can not only substitute, but also complement each other (Fisher, 1995; Gerdin, 2005). In a similar vein, prior PCA research maintains that the existence of alternate capital investment controls (ACICs) can discourage the adoption of PCA (Neale and Holmes, 1991; Azzone and Maccarrone, 2001). Nevertheless, we know little about the existing ACICs and their potential role in adoption. Consequently, in addressing the non-adoption of PCA, this study aims to explore the existing types of ACICs, and to study whether and how companies can evaluate their completed investments, and enhance organizational learning by using ACICs. Additionally, the study aims to examine the circumstances under which ACICs can be appropriate for controlling investments.

In investigating PCA non-adoption, the study draws on a combination of literatures in the areas of equifinality, organizational learning and contingency-based research. Substitution and complementarity between the ACICs and PCA are analysed by primarily drawing on the notion of equifinality (von Bertalanffy, 1968). Huber's (1991) constructs of OL are utilised to structure the potential ACICs to enable organizational learning. Furthermore, literature in contingency-based research is used to analyse the circumstances under which ACICs can be appropriate. The empirical data is primarily based on the interviews with the most knowledgeable person in the 11 organizational units chosen for their non-adoption out of the 30 largest Finnish manufacturing companies in which interviews were conducted.<sup>24</sup> Nevertheless, in examining substitution and complementarity

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<sup>24</sup> In addition to ten non-adopter companies, a non-adopter division in one conglomerate was included.

issues between ACICs and formal PCA, and to address the appropriateness of ACICs under different circumstances, the PCA adopters were used as a reference group.

This study resulted in the discovery and mapping of ACICs that discretely or as a package of controls enable companies to evaluate the success of investment projects and enhance OL related to capital investments. Consequently, the existence of ACICs implies that PCA non-adopters do not necessarily jeopardise successful capital investments. It was found that companies have various means available to help them understand whether or not the targets of an investment project are being met. The means include formal systems for routinely following up key production figures, sales and profit centers. Additionally, control mechanisms such as visiting investing sites, presentations and discussions can be formally arranged for investment control purposes, but typically they seem to be more informal. Furthermore, companies appear to acquire capital investment knowledge for OL purposes in many ways. Specifically, the use of central expertise and experienced internal resources appear to be important.

Can ACICs and PCA, then, act as substitutes for each other, and consequently constitute a reason for non-adoption? It appeared that ACICs and PCA are not substitutes because they cannot reciprocally carry out each other's tasks. Accordingly, it would be unlikely that the launching of PCA would replace any or all ACICs (Gresov and Drazin, 1997). Hence, ACICs and PCA seem to complement rather than substitute each other. Nevertheless, the empirical data of this study provide support for the argument that the management of smaller<sup>25</sup> companies that do not have major strategic, complex and repetitive capital investments can perceive that ACICs yield an equal or sufficiently equal performance to PCA. As a consequence, it appears that ACICs can discourage PCA

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<sup>25</sup> Although all the companies studied can be regarded large in terms of turnover and absolute amount of tangible assets, there are significant size differences between them.



adoption, because companies may base their non-adoption decision on cost-benefit thinking (cf. Granlund, 2001).

To the best of my knowledge, this study is the first explicit attempt to assess the role of alternative control mechanisms in discouraging the adoption of control systems, and the first study of PCA non-adoption to use empirical evidence from interviews. The study adds to the management control systems and equifinality literatures by extending the use of the concept of equifinality to cover management control system adoption analysis. It contributes to the PCA literature (Neale and Holmes, 1991; Azzone and Maccarone, 2001) by discovering and mapping ACICs that enable companies to evaluate the success of an investment and enhance OL. Furthermore, it discusses whether ACICs discourage PCA adoption. Specifically, the examination of alternative mechanisms to acquire capital investment knowledge and their relation to non-adoption decisions has previously been neglected. Additionally, the paper adds to the MCS literature by providing a discussion of the circumstances under which companies can perceive ACICs to be appropriate.

## **Article 2: Managerial uses of post-completion auditing of capital investments**

The second article of the dissertation investigates the different managerial uses of post-completion auditing (PCA) of capital investments. The enhancement of organizational learning has been accentuated as the major reason for PCA (Neale, 1989), but we have little and partly contradictory empirical results concerning the relevance of other suggested managerial uses of PCA. Consequently, drawing on the concepts of cybernetic control systems (Lockett and Eggleton, 1991), this study aims to assess the significance of PCA for measuring performance and controlling current investments (assisting correction and abandonment decisions), enhancing the integrity of investment appraisals, and in evaluating personnel. Although OL has been reported to be the major reason for conducting PCA, the

practical OL benefits of PCA within companies are still ambiguous. Hence, this paper also aims to elaborate and map these benefits and discuss the extent to which they are related to single/double-loop types of learning (Argyris, 1977). The empirical data come from the 16 PCA adopters that were identified in face-to-face interviews that were conducted in the 30 largest Finnish manufacturing companies.

This research adds to the extant PCA literature by providing empirically supported insights with regard to the significance of different managerial uses of PCA. The prerequisites for functioning cybernetic control systems are the existence of ex-ante targets, the ability to measure outcomes against them, and the ability to take necessary corrective actions (Flamholz et al., 1985). Nevertheless, PCA's appropriateness for measuring the ex-post performance of an investment project has been much neglected in research. Accordingly, this study assesses the performance measurement ability of PCA by specifically addressing the technical difficulties of PCA, such as separation of incremental cash flows, changes in business environment, and estimation of future cash flows, as potential reasons for inappropriateness. Based on the data, it appears that the companies do not perceive difficulties to be a reason to jeopardise the functionality of PCA as a performance measurement tool. Additionally, it appears that measuring the performance of an investment project is not beneficial per se, as reported by the companies in Pierce and Tsay's (1992) and Neale's (1994) studies, but it is PCA's core function that supports other PCA uses. With regard to PCA's ability to assist necessary corrective actions, the findings are consistent with the literature (Neale, 1989; Pierce and Tsay, 1992; Corr, 1983). This suggests that, due to inherently inappropriate timing, PCA's role in correction and abandonment decisions for current investments can be minor. Furthermore, although evaluation/rewarding of personnel has been shown to be a fundamental element of

functioning cybernetic control systems (Otley, 1999), it appears that coupling of PCA with formal evaluation/rewarding is rare due to timing-related difficulties.

As a contribution to the PCA literature, the study responded to the calls from Neale (1991b), Haka (2007), and Northcott and Alkaraan (2007) to address the impacts of PCA. Specifically, PCA's practical benefits for organizational learning were mapped and elaborated. It appears that the companies clearly perceive PCA's role to be relevant for double-loop type of learning and thus benefiting future investments, whereas PCA's role seems to be questionable for single-loop learning due to timing related issues. Hence, the data lends support for the prior research (Neale, 1989, 1994; Pierce and Tsay, 1992) that contends that the major benefits of PCA are related to obtaining feedback for improving the planning of future investments. By discovering and discussing alternate mechanisms to detect underperforming investment projects, to analyse correction/abandonment options, and enhance the integrity of investment appraisals, the paper also adds to the management control literature concerning substitution and complementarity of different control mechanisms (Gerdin, 2005). It appears that the "non-PCA" control mechanisms available to companies such as quality systems, routine reporting, visits, presentations, and discussions can diminish the significance of PCA in satisfying these functional demands.

### **Article 3: Design of a post-completion auditing system for organizational learning**

The third article of the dissertation examines the relationship between PCA design and organizational learning. Although the PCA literature has pinpointed that enhancing OL is the major reason for conducting PCA and that an adequate design of PCA system is of utmost importance in facilitating OL (Neale, 1989, 1994, Mills and Kennedy, 1993), we do not have a thorough understanding about their relationship (Neale, 1989; Azzone and Maccarrone, 2001). Consequently, the aim of this paper is to investigate whether or not the

designs of PCA systems provide a platform for OL. Specifically, in addressing the interplay between PCA design and OL, the paper responds to Haka's (2007) call to study why PCA systems seem to be ineffective. First, drawing on the Huber's (1991) constructs of OL and prior PCA literature, a tentative OL-conducive PCA design was synthesised. Next, this design was used as a benchmark for analysing the findings. The empirical data in this paper comes from the 14 PCA adopters, out of the 30 largest Finnish manufacturing companies that contributed to the whole study, that emphasise OL to be their dominant aim for PCA.

The paper contributes to the PCA literature by explicitly extending the discussion concerning the interplay between PCA design and OL to cover information interpretation and distribution and aspects of organizational memory. Responding to Haka's (2007) call, the findings provide support for the contention that ineffectiveness of PCA can be related to its design. Specifically, it appears that aspects of organizational memory, such as inappropriate filing and difficult access to PCA reports, inhibit the effective transferring of past investment experiences to new projects. In addition, other aspects related to the communication of PCA reports can inhibit effective OL, such as lack of improvement proposals and their systematic follow-up, lack of interactive forums for interpretation of results, and restricted dissemination. However, it appears that companies with more sophisticated PCA designs manage to transfer and share learning experiences more effectively.

The paper also adds to the literature by providing a discussion about the reasons behind the variation in PCA sophistication. It seems that a smaller size and the alternate existing means to manage capital investment knowledge (e.g. utilising central expertise and experienced internal resources) affect the degree of sophistication. In other words, from an OL point of view, it is particularly smaller companies that have less capital investments who do not pay so much attention to the sophistication of PCA design. This is because they

perceive that their brief PCA combined with the package of ACICs yields a sufficient performance.

## **7. Discussion and conclusions**

This study made an attempt to contribute to the PCA literature by shedding light on the relationship between PCA and organizational learning. It examined whether and how companies use alternate control mechanisms to evaluate the success of their investments and to enhance organizational learning. It continued by discussing the circumstances under which alternate capital investment controls (ACICs) potentially discourage the adoption of PCA. In addition, the significance of the different managerial uses of PCA and specifically OL was investigated. Furthermore, the interplay between PCA design and OL was addressed. The empirical data in this cross-sectional field study was mainly based on the interviews conducted in the 30 largest Finnish manufacturing companies.

In this limited sample, 20 out of the 30 companies (i.e. 67%) conduct PCA at least to some extent, whereas 10 companies do not formally compare pre-investment estimates of investment projects with actual outcome after the projects have been commissioned and started to generate cash flows. This separation appeared to be clear and accordingly these 10 companies would probably have also been classified as PCA non-adopters in other recent PCA studies (Neale, 1989, 1994; Farragher et al, 1999; Arnold and Hatzopoulos, 2000; Azzone and Maccarrone, 2001). Nevertheless, there appears to be “a grey area” within PCA adopters; namely companies who conduct formal PCA only irregularly and unsystematically. Following the PCA definition that was set out for this study, these four companies have been classified as ad hoc adopters and ruled out when studying managerial uses of PCA and PCA design. In general, the results indicate that the inclusion of ad hoc adopters to the list of PCA adopters tends to drive adoption rates upwards.

Subject to the limitations of the chosen method and the constraints of the applied theoretical lenses, the study suggests overarching contributions to the following two main areas. First, the study provides insights into the relationship of PCA and organizational learning. It confirms suggestions found in prior studies that enhancing OL is the major reason for conducting PCA (Azzone and Maccarrone, 2001; Neale, 1989) and also the major perceived benefits of PCA are related to OL (Neale, 1994; Pierce and Tsay, 1992). The results augment our understanding about PCA's organizational learning impacts in organizations. PCA appears to particularly aid companies in enhancing the accuracy of assumptions and goals in planning future capital investments, whereas it can be marginally beneficial in aiding problem detection/solving for current investments. In other words, PCA appears to have a relevant role for double-loop type of learning, but not for single-loop learning (Argyris, 1977). Additionally, I argue that the level of PCA system sophistication can have an important role in facilitating (or hindering) OL. Specifically, aspects related to organizational memory, such as adequate filing of PCA results and convenient access to them, can aid a company in the effective conveying of past investment experiences to new projects. In a similar vein, responding to Haka's (2007) call, the results support a contention that aspects of PCA design can explain PCA's ineffectiveness as an OL tool.

Second, drawing on the concept of equifinality (Gresov and Drazin, 1997) and the management control package literature on substitution/complementarity (e.g. Fisher, 1995), the other overarching contribution in the three papers relates to augmenting our understanding about "the black box" of alternate capital investment controls. The investigation resulted in the discovery and mapping of ACICs that discretely or as a package enable companies to achieve equal or sufficiently close to equal benefits compared to formal PCA. It appeared that the companies use ACICs for all major suggested managerial purposes of PCA: evaluating the success of an investment project,

organizational learning, assisting decision-making for current investments (modifications/abandonment), and enhancing the integrity of investment appraisals.

The findings lend support for my argument that ACICs can have a major role in explaining PCA practices in companies. ACICs seem to diminish the relevance of PCA in companies and consequently influence the perceived importance of PCA adoption and PCA system sophistication. Accordingly, smaller companies that do not have a critical mass of investments may perceive ACICs to be sufficient for their purposes and therefore do not adopt PCA at all. On the other hand, it seems that larger companies do not consider ACICs alone to yield a sufficient performance specifically regarding the major managerial uses of PCA, namely evaluating the success of an investment and enhancing OL, however, they do adopt PCA. It is particularly the larger companies with more major strategic, complex and repetitive investments that appear to perceive PCA as offering superior performance compared to ACICs and regard PCA as a complement to ACICs. Furthermore, and in a similar vein, among the PCA adopters, the larger companies tend to have more sophisticated PCA designs (e.g. Chenhall, 2003; Al-Omiri and Drury, 2007), whereas the smaller companies seem to rely on less sophisticated PCA designs combined with ACICs.

Malmi and Granlund (2009) suggest that management accounting research should focus more on providing valid assistance for practitioners in determining which practices are suitable for them and under which circumstances. Accordingly, in addition to providing theoretical insights, the results of this study related to PCA and ACICs can be of pragmatic value to organizations. Above all, they encourage organizations to adopt a wide view and systematically consider interrelationships between various available controls and not only focus on the control mechanism in question when designing management control systems. With specific reference to organizational learning, it appears to be of utmost importance to first identify and analyse all the relevant mechanisms available to transfer and share

investment knowledge. An organization is then in a better position to develop a comprehensive and effective tool box for these purposes. Furthermore, the synthesised PCA design conducive to OL may aid companies in designing their PCA systems more effectively. Moreover, the dissertation can be of practical relevance for organizations by providing guidance to assess the circumstances under which PCA adoption would be appropriate.

Studies covering reasons for PCA adoption could potentially shed more light on non-adoption as well. Hence, it would be fruitful to further study the circumstances (e.g. capital-intensity, characteristics of investments, size, technology, strategy, and organization structure) under which companies perceive ACICs to be insufficient and adoption of PCA appropriate. The results in this study indicate that the companies having a more sophisticated PCA design, specifically related to aspects of organizational memory, are more successful at achieving the OL benefits. Nevertheless, more research is needed to deepen our knowledge of the design-benefit relationship.

Inspired by the results of ACICs in the PCA context, future management control research could explicitly investigate the role of alternate controls in the (non)adoption of management accounting innovations (e.g. Activity-Based Costing, Balanced Scorecard and Value-Based Management). Although Speckbacher et al. (2003) (with regard to BSC) and Inness et al. (2000) (ABC) suggest that satisfaction with the existing systems can discourage the adoption of new technologies, we lack a thorough understanding of their role in (non)adoption processes. Additionally, by examining relationships between the formal control systems in question and alternate controls, our understanding about sophistication level of adopted formal controls could be augmented.



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## Appendices

### Appendix A: A theme interview structure

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#### General

- Description of the person to be interviewed (education, career, main tasks and responsibilities now)
- How is the person to be interviewed participating in the capital investment process?
  - What kinds of investment proposals and decisions do you make?
  - How often do you propose/reject investments?
- Do you have a written investment policy & instructions (please, copy if possible)?
  - Who is responsible for instructions?
- What kinds of investments do you make?

#### Capital investment process

- Describe your investment process.
- What kinds of investment calculations are prepared?
- Who makes the calculations?
- Are bonuses somehow related to the success of capital investments?
- How are internal auditors involved in your capital investment process?
- How realistic are investment proposals in your corporation?

#### Monitoring (= control of costs and timetable of investment before the start-up)

- How do you follow cost accumulation and timetable per project?
  - Who does it, when, tools used, forums for presentation of follow-up, dissemination of results, final report?
- Are there cost overruns?
  - What happens if costs are exceeded?

#### Post-audit of capital investments (= control or evaluation of the investment after the start-up)

- This issue will be covered mainly by an interview with a separate set of questions.
- Please give an example of your post-audit report
- How do you otherwise control your investments (other methods than formal monitoring and post-audit)?
- How do people motivate their statements about the success of the investment project if post-audits are not conducted?
- Do you feel that post-audit reports are sometimes manipulated?

#### Organizational learning and capital investments

- Question 44 in a separate set of questions. Please describe more in detail your practices to utilise existing knowledge related to capital investment.
- What kinds of issues can be learnt in capital investment process? (Please consider all the phases in investment process):
  - Examples of learning experiences?
  - How have learning experiences been utilised/could be utilised in your coming projects?
  - How have learning experiences affected your investment process?
  - Examples of potential learning cases in your business?
- What is the role of central investment expertise (e.g. engineering unit, investment unit, investment council, technical director etc.) in your capital investments?
- How do you ensure that you learn from your investment projects?
- Are you satisfied with the learning processes related to your capital investment activities?



## Appendix B: Interviews

Persons interviewed	Date	Duration (min)
1. Financial Manager (ex), division (Metal A)	9.12.2002	100
2. Manager of Corporate Planning, corporation (Chemical & Plastics A)	19.12.2002	135
3. Internal Auditor, corporation (Chemical & Plastics A)	19.12.2002	110
4. Managing Director, Engineering unit (Chemical & Plastics A)	30.12.2002	90
5. Chief Financial Officer, corporation (Chemical & Plastics B)	31.12.2002	170
6. Director (ex), division (Metal B)	5.1.2003	75
7. Chief Financial Officer, division (Forest A)	8.1.2003	75
8. Chief Financial Officer, corporation (Diversified A)	17.1.2003	105
9. Senior Vice President & COO, division (Diversified A)	17.1.2003	60
10. Accounting Manager, division (Diversified A)	17.1.2003	120
11. Chief Financial Officer, corporation (Energy A)	23.1.2003	120
12. Technical Director, division (Forest A)	24.1.2003	120
13. Chief Financial Officer, corporation (Metal B)	5.3.2003	130
14. Manager, Investment Coordination, corporation (Forest B)	6.3.2003	105
15. Director, Industrial Operations, division (Diversified A)	7.3.2003	70
16. Chief Financial Officer, corporation (Building material A)	11.3.2003	105
17. Director of Project Planning, corporation (Energy A)	13.3.2003	75
18. Vice President of Corporate Business Development, corporation (Metal B)	18.3.2003	120
19. Vice President of Technology, corporation (Building material A)	28.3.2003	130
20. Chief Financial Officer, division (Building material B)	25.4.2003	65
21. Controller, corporation (Food processing A)	12.5.2003	120
22. Operations Controller, corporation (Others A)	15.5.2003	200
23. Executive Vice President, Finance & Information Services, corp. (Metal C)	20.5.2003	75
24. Vice President, Operations & Sourcing, corporation (Forest C)	21.5.2003	140
25. Chief Financial Officer, corporation (Telecom & electronics A)	2.6.2003	105
26. Business Controller, division (Others B)	3.6.2003	150
27. Chief Financial Officer, corporation (Food processing B)	4.6.2003	170
28. Group Manager European Manufacturing, corporation (Others A)	6.6.2003	120
29. Chief Financial Officer, corporation (Metal D)	10.6.2003	120
30. Controller, factory (Forest C)	12.6.2003	135
31. Chief Financial Officer, corporation (Metal E)	26.6.2003	110
32. Chief Financial Officer, corporation (Food processing C)	1.8.2003	155
33. Vice President, Production, corporation (Metal A)	8.8.2003	135
34. Development Director, corporation (Food processing A)	15.8.2003	140
35. Business Controller, division (Telecom & Electronics B)	19.8.2003	75
36. Chief Financial Officer, division (Food processing D)	25.8.2003	125
37. Chief Financial Officer & Deputy CEO, corporation (Chemical & Plastics C)	25.8.2003	105
38. Vice President, Finance & Administration, division A (Energy B)	2.9.2003	130
39. Senior Vice President, Str., Investments & Bus. Planning, corp. (Forest D)	3.9.2003	130
40. Executive Vice President, Strategy & Bus. Development, corp. (Metal F)	4.9.2003	130
41. Vice President, Production, division (Metal G1)	5.9.2003	115
42. Director of Technical Development, corporation (Forest E)	10.9.2003	195
43. Senior Vice President, Investments, division (Metal G2)	11.9.2003	195
44. Manager, Process Development Group, factory (Metal A)	19.9.2003	105
45. Director, Real Estates & Energy Supplies, factory (Metal A)	19.9.2003	90
46. Vice President, Finance & Administration, division B (Energy B)	30.9.2003	135
47. Group Controller, corporation (Diversified B)	30.10.2003	80
48. Business Controller, division (Metal H)	14.11.2003	135
49. Senior Vice President, Investments and Manufacturing, corp. (Metal B)	27.1.2004	120

All interviews were tape-recorded (except Nr. 35, where notes were taken).

## **PART II**

### **ORIGINAL ARTICLES**



## **ARTICLE 1**

### **Explaining the Non-Adoption of Post-Completion Auditing**

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# Explaining the Non-Adoption of Post-Completion Auditing

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**ABSTRACT** This field study examines reasons for the non-adoption of post-completion auditing (PCA) of capital investments. The empirical evidence is based primarily on interviews conducted in the 30 largest Finnish manufacturing companies. PCA can be briefly described as a formal process that checks the outcomes of individual investment projects after the initial investment is completed and the project is operational. Management Control Systems and PCA literatures suggest that different control systems can act as alternatives for each other. This paper specifically analyzes and maps alternate capital investment controls (ACICs) that enable the achievement of benefits suggested for PCA and draws upon the equifinality concept to discuss the role of ACICs in discouraging PCA adoption. The findings suggest that ACICs do exist, and, therefore, PCA non-adopters do not necessarily jeopardize successful capital investments. The ACICs identified in this study included formal and informal systems and procedures for performance measurement (e.g. following up production key figures, sales and profit centers) and organizational learning (e.g. utilizing central expertise and experienced internal resources). Furthermore, the empirical evidence from this study suggests that smaller companies with fewer major strategic, complex and repetitive capital investments can perceive ACICs to be sufficient, and discourage the adoption of formal PCA.

## 1. Introduction

Success in capital investing greatly affects the extent to which a company can achieve its strategic goals. The academic literature suggests that post-completion auditing (PCA) of capital investments can be beneficial to capital investing by

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providing valuable feedback for ongoing investments and particularly for future investments (see, e.g. Neale, 1991a; Pierce and Tsay, 1992). PCA can be briefly described as a formal process that checks the outcomes of individual investment projects after the initial investment is completed and the project is operational (Chenhall and Morris, 1993). Nevertheless, in spite of the suggested benefits, surveys of PCA adoption rates indicate that there are many companies in which PCA adoption is not considered to be appropriate for their organization.<sup>1</sup> This paper examines reasons for the non-adoption of PCA of capital investments.

Management Control Systems (MCS) comprise various control systems such as budgeting, cost accounting and PCA. Contributions to the Management Control (MC) literature (e.g. Otley, 1980) suggest that MCS operates as a package of controls with interrelated mechanisms, and it is therefore appropriate to adopt a wide and holistic view of control when studying MCS. In addition, the researchers contend that different control systems within MCS can act as substitutes – not merely as complements – for each other (e.g. Fisher, 1995). In a similar vein, Speckbacher *et al.* (2003) (with regard to Balanced Scorecard – BSC) and Innes *et al.* (2000) (Activity-Based Costing – ABC) report that satisfaction with existing control systems can discourage the adoption of new techniques. Similarly, Neale and Holmes (1991) and Azzone and Maccarrone (2001) report in their PCA surveys that in addition to a scarcity of relevant investments and difficulties with PCA, informal control mechanisms such as good relationships between corporate and divisional managers (or between managers and controllers) can be a reason for non-adoption. Hence, the existence of alternate capital investment controls (ACICs) may discourage PCA adoption if companies achieve PCA benefits without launching a PCA system. The ACICs are broadly defined here as formal (except for formal PCA) or informal control mechanisms that enable companies to achieve PCA benefits for ongoing and future capital investments.

In examining PCA non-adoption, this paper focuses specifically on ACICs. Although ACICs have been recognized as a reason for PCA non-adoption, there are still major gaps in the research. We do not have a thorough understanding of existing ACICs, or if and how companies can evaluate completed capital investments and achieve PCA benefits by using them. Neither do we know if PCA non-adopters miss benefits suggested for PCA by relying on ACICs, thereby jeopardizing their success in capital investing. Furthermore, the way in which ACICs affect the adoption or non-adoption of PCAs is unclear. Motivated by the MCS and PCA literatures suggesting that different control systems can act as alternatives for each other, this paper helps fill the research gaps mentioned here by drawing primarily on the notion of equifinality (Gresov and Drazin, 1997). In an equifinal situation, open systems have not only one, but multiple choices for reaching the desired final state (von Bertalanffy, 1968). In analyzing potential interrelationships between PCA and ACICs, the study also responds to Gerdin's (2005) recent call to examine the existence of alternative and functionally equivalent MCS designs.

Additionally, in previous research on the adoption of PCA, there has been no explicit examination of the circumstances under which ACICs may be appropriate in controlling completed investments. This paper fills the research gap by examining a possible relationship between the appropriateness of ACICs on the one hand and organizational size and the characteristics of the capital investment on the other. This investigation focus on ACICs, in order to evaluate the success of an investment and to achieve benefits related to organizational learning (OL), because evaluation is a core function and a prerequisite for achieving any PCA benefits, and because, as suggested by Neale (1989, 1994), OL is the major benefit from PCA.

To sum up, the aim of this paper in addressing the non-adoption of PCA is twofold. First, to explore the existing types of ACICs, and to study if and how companies can evaluate completed investments and achieve the benefits suggested for PCA by using them. Second, to discuss the circumstances under which ACICs are appropriate for controlling completed investments.

In this study, (formal) PCA is defined as follows:<sup>2</sup> PCA is a formal review of a completed investment project fulfilling the following criteria: (1) it takes place after an investment has been completed (commissioned) and has begun to generate cash flows (or savings); (2) reporting is at least partly focused on a comparison between the pre-investment estimates of an investment project and the actual figures/achievements after completion; and (3) PCA is systematic and regular, and there are instructions for it. This definition of formal PCA rules out other capital investment controls such as the monitoring of capital investments<sup>3</sup> and routine reporting.<sup>4</sup>

The empirical evidence is primarily based on the interviews with the most knowledgeable person in each of 11 companies selected for their PCA non-adoption from the 30 largest Finnish manufacturing companies in which interviews were conducted. However, in order to shed more light on our analysis about substitution and complementarity issues between ACICs and formal PCA and to examine the appropriateness of ACICs under various circumstances, PCA adopters are used as a reference group in Sections 4.3–4.5. The study focuses on tangible capital investments such as factories, production lines, machines and equipment.

The findings of this study suggest that alternative ways of achieving benefits suggested for PCA do exist, and that non-adopters do not necessarily jeopardize successful capital investments. The ACICs identified in this study included formal and informal systems and procedures for evaluating the success of an investment (e.g. following up production key figures, sales and profit centers) and organizational learning (e.g. utilizing central expertise and experienced internal resources). The empirical evidence of this study suggests that smaller companies, having fewer major strategic, complex and repetitive investments, may perceive ACICs to be sufficient, and be discouraged from adopting PCA.

The remainder of this paper is structured as follows. Section 2 presents the literature that forms the basis for this study, and Section 3 describes the research



method. The empirical results are presented, analyzed and discussed in Section 4. The concluding remarks are presented in Section 5.

## 2. Literature

### *Benefits from PCA*

The PCA benefits can be related to current or future capital investments (Neale and Buckley, 1992). The benefits for current investments are project-control oriented, whereas future benefits are connected to better appraisal and planning of projects, and improvement of the capital investment system in general (Neale, 1991a; see also Mills and Kennedy, 1993). Evaluating the success of a completed investment (performance measurement) is a core function of PCA and a prerequisite for achieving benefits for controlling current and future projects.<sup>5</sup> In practice, evaluation of the success is conducted by comparing and analyzing *ex post* outcomes with *ex ante* targets (Neale and Holmes, 1991).

With regard to current projects, PCA may be beneficial in assessing whether or not the project is progressing according to the goals set, and whether it requires modifications or even abandonment (Mills and Kennedy, 1993). Nevertheless, empirical studies report that PCA's beneficial role in controlling current projects is perceived within companies to be of little importance (Neale, 1989; Pierce and Tsay, 1992). PCA's assisting role in modifications can be marginal for two reasons: (1) it can be too late to make changes after commissioning an investment project, and (2) triggers for change are likely to come from alternative control mechanisms (e.g. routine reporting). Furthermore, Corr (1983) and Neale (1991a) cite the relative insignificance of PCA in assisting abandonment decisions. Moreover, Neale (1994) suggests that benefits related to evaluations of personnel involved in the capital investment projects have been perceived as marginal.

The major perceived benefits from PCA are related to its enhancement of organizational learning, which is known to lead to an improvement in the future capital investing of a company (Neale, 1989; Pierce and Tsay, 1992).<sup>6</sup> Organizational learning is not merely the sum of individual learning within an organization; rather, it involves the sharing of knowledge, beliefs or assumptions among individuals, and it is influenced by a broader set of social, political or structural elements (Marquardt and Reynolds, 1994). It is a process whereby an organization responds to changes in its environment by detecting errors and correcting them in order to maintain the central features of the organization (Argyris, 1977).<sup>7</sup> MCS can play a major role in facilitating (or hindering) organizational learning (Kloot, 1997; Carmona and Grönlund, 1998). With regard to capital investments, it has been suggested that PCA information has the potential to aid a company in systematically identifying successful processes that can be repeated in future capital investment projects, and to help avoid previous mistakes (Neale and Holmes, 1991). Similarly, Chenhall and Morris (1993)

contend that PCA can enhance managerial learning at the project definition stage of the capital investment process. Furthermore, Mills and Kennedy (1993) report that PCA is conducive to learning for capital investment processes in general – not merely for project-specific investment activities. The feedback obtained in PCA, for example, may trigger improvements in capital investment procedures and instructions.

ACICs are investigated in this study with the aid of four organizational learning sub-processes distinguished by Huber (1991). According to Huber, knowledge is first obtained in a knowledge-acquisition process. Then, information from various sources is shared, and new information (or understanding) is created in an information-distribution process. As the next step in the information interpretation phase, commonly understood interpretations are attached to information. The final stage is the organizational memory phase, in which the knowledge is stored for later use.

With regard to the future investments, Pierce and Tsay (1992) suggest that companies consider PCA to be beneficial in enhancing the integrity of investment project appraisals.<sup>8</sup> The appraisals can include intentional biases upwards (or less often even downwards) when managers exaggerate project cash flows in order to gain approval for their investment proposals (see, e.g. Pruitt and Gitman, 1987; Pohlman *et al.*, 1988). In a similar vein, Lumijärvi (1990) contends that PCA is the only factor diminishing game-playing<sup>9</sup> behavior in the capital investment processes.

In summary, evaluation of the success of an investment (i.e. performance measurement) is the core function of PCA, facilitating and leading to the achievement of PCA benefits. Organizational learning aspects (learning for future capital investment projects and process development) are perceived within companies to be the major benefits of PCA adoption; whereas benefits related to the control of current projects are considered to be of little importance. Consequently, this study focuses on two issues: (1) if and how the success of a company's investments can be evaluated with the use of ACICs; and (2) an examination of the relationship between ACICs and organizational learning, using a construct articulated by Huber (1991), which specifically focuses on the first process, that of knowledge acquisition.

#### *PCA Non-adoption and Management Control Package View*

There has been little empirical research on PCA non-adoption, and none on the non-adoption phenomenon *per se*. There have been several comprehensive surveys of PCA (Ghobadian and Smyth, 1989; Neale and Holmes, 1991; Pierce and Tsay, 1992; Azzone and Maccarrone, 2001; see Appendix A), but non-adoption not been the primary focus of any of these studies.<sup>10</sup> To the best of my knowledge, this is, in fact, the first paper to analyze PCA non-adoption explicitly, using empirical data from interviews.<sup>11</sup>

Drawing on the reasons for PCA non-adoption reported in the literature, one could delineate three main overlapping groups: (1) scarcity of capital investments; (2) difficulties of PCA; and (3) alternative ways to achieve benefits suggested for PCA. Scarcity of investments can be considered an obvious reason for non-adoption because it is not appropriate from the cost–benefit point of view to implement and run a PCA program if a company makes few capital investments.

Changes in technologies/business environment and the uniqueness of projects (Pierce and Tsay, 1992; Azzone and Maccarrone, 2001) have been reported to be among the main difficulties behind PCA non-adoption. The usefulness of PCA can be diminished if feedback is irrelevant for future investments. Other main difficulties affecting non-adoption are separation of project-specific profit (Neale and Holmes, 1991; Pierce and Tsay, 1992) and the difficulty of using PCA for modifying ongoing projects (Neale and Holmes, 1991; Azzone and Maccarrone, 2001). Furthermore, a lack of resources for carrying out PCA was noted as a reason for non-adoption in all four studies mentioned above.

The third main group identified for PCA non-adoption consists of alternative ways to achieve benefits suggested for PCA. Research in MCS such as Otley (1980, 1999), Macintosh and Daft (1987), and Alvesson and Kärreman (2004) suggest that MCS operates as a package of controls with interrelated mechanisms; thus a wide and holistic view of control is pertinent when one is studying MCS. Different types of controls can be used in a complementary, mutually reinforcing manner (Waterhouse and Tiessen, 1978; Merchant, 1985). Furthermore, several researchers (Galbraith, 1973; Fisher, 1995; see also Gerdin, 2005) contend that control systems may also serve as substitutes for each other.

Complements and/or substitutes within a MC package also include informal control mechanisms (Otley, 1980; Spekle, 2001) such as discussions, meetings, observations and ad hoc analysis (see, e.g. Preston, 1986; Abernethy and Brownell, 1997). With regard to PCA, Neale and Holmes (1991) and Azzone and Maccarrone (2001) suggest that personal contacts between corporate and divisional managers (or operating managers and controllers) are one reason for non-adoption. Consistent with that contention, Marginson (1999) found that reliance on trust, cooperation and mutual/reciprocal accountability in interpersonal relationships supplanted most formal control mechanisms in the strategy formulation process of one company.

Furthermore, Speckbacher *et al.* (2003) report that many of the non-adopters of BSC are satisfied with their existing control systems. Innes and Mitchell (1995) and Innes *et al.* (2000) have reported similar findings with regard to the non-adoption of ABC. Also, although not explicitly associated with non-adoption of PCA, Scapens *et al.* (1982) suggest that profit center follow-up is used as a general control mechanism for evaluating capital investments. In line with this reasoning, Chenhall and Morris (1993) recognize in their PCA study that ‘managers who were not subject to formal PCAs still received information about the progress of [investment] projects as part of their own managerial function of

observing and evaluating their unit's activities'. These findings indicate that managers can perceive that the existing formal or informal control mechanisms, individually or as a package, can act as alternatives in achieving benefits suggested for the control systems in question.

In summary, the extant literature suggests that it is appropriate to adopt a wide view (i.e. the MC package view) when studying MCS, because control systems may complement and/or substitute for each other. Formal PCA can be considered one element in a company's total MC package. The literature reports that reliance on personal contacts discourages companies from PCA adoption, and that companies use profit center follow-up as a general control mechanism for capital investments. Nevertheless, we lack comprehensive knowledge about the alternative formal and informal control mechanisms that companies can use to achieve the benefits suggested for PCA. In this paper, alternatives to PCA are approached by drawing primarily on the notions of equifinality.

### *The Equifinality Approach and Research Questions*

Equifinality is a general property of open systems, meaning that systems may find many ways of being successful (von Bertalanffy, 1968). Katz and Kahn (1978, p. 30) state that equifinality occurs in an organizational setting when 'a system can reach the same final state, from different initial conditions and by a variety of different paths'. According to Gresov and Drazin (1997), equifinality in the organization design context means that the same final state (i.e. performance of an organization) can be achieved by multiple organizational structures, even if the contingencies faced by the organization are the same. They also suggest a classification of four design situations, building on degree of conflict in functional demands (low–high) and latitude of structural options (constrained–unconstrained). Equifinality occurs in three of these situations; in one situation (low conflict and constrained options), however, equifinality is not expected because an optimal profile of design is assumed.

In the context of this paper, the notion of equifinality acts as a trigger and a lens for discovering and discussing potential alternative ways to enable companies to achieve PCA benefits. In Gresov and Drazin's (1997) terms, the functional demands examined here are an evaluation of the success of an investment and learning for projects/process. These functional demands can be considered to be overlapping because, in addition to serving a function of its own, evaluation is an integral pre-stage in the learning processes. Consequently, they are relatively similar in their implications for organization design (i.e. a low degree of conflict in functional demands is expected). Furthermore, the latitude of structural options is considered to be unconstrained because ACICs and PCA (the structural alternatives) are tentatively proposed to yield equal performance in achieving the functional demands. Drawing on Gresov and Drazin (1997, p. 414), this type of situation is expected to correspond most closely to tradeoff equifinality, where 'a tradeoff is defined as a substitution of one structure for

another while still achieving the same functional outcome'. Galbraith (1977), Kerr and Jermier (1978), and Eisenhardt (1988) also acknowledge the possibility of a tradeoff (or substitution) effect occurring while performance remains the same. In a tradeoff equifinality situation, managerial preferences affect the structural alternatives that managers will choose (Miller, 1987; Galunic and Eisenhardt, 1994).

The core research problem of this paper – 'why companies do not adopt PCA' – is addressed and theorized about, using PCA benefits as a platform. Although ACICs have been recognized as a reason for non-adoption, we lack a more thorough understanding of their role. Hence, the aim of this paper is to explore *the existing types of ACICs, and if and how companies can evaluate completed investments and achieve the benefits suggested for PCA by using them*. In doing so, this paper also responds to the calls of the MC research: to investigate how alternative control mechanisms can act as complements and/or substitutes for each other (Abernethy and Chua, 1996; Gerdin, 2005). The examination focuses on performance measurement as the core function of PCA, and organizational learning as the major benefit derived from PCA. In addition to informal control mechanisms, formal mechanisms that are not purposefully or primarily aimed at controlling completed investments are considered. *The first working proposition is that PCA adoption may be discouraged because of perceptions within the company that it is facing a tradeoff equifinality situation, in which ACICs yield the same benefits as PCA*. As the ACICs and their effect on PCA non-adoption has received little attention in the literature, this study can be considered to be predominantly exploratory in nature.

Another aim of this paper is to discuss *the circumstances under which ACICs are appropriate for controlling completed investments*. This phenomenon has not been explicitly covered in the literature, but drawing on the more general findings reported by contingency-based research may assist the examination. In this study, the investigations concentrate on organizational size and the characteristics of the capital investments. Absolute tangible assets, turnover and the ratio of tangible assets to turnover are considered to be appropriate estimations of size. Other alternatives could be profits, share valuation and number of employees.

The findings of the contingency-based research suggest that less formal controls are typical in smaller companies (see, e.g. Merchant, 1981; Chenhall, 2003). Bruns and Waterhouse (1975) found that personal controls are associated with small companies, whereas large companies tend to use administrative controls. When an organization grows, managers need to handle greater quantities of information, and they tend to implement controls such as rules, documentation, specialization of roles and functions, extended hierarchies and decentralization (Child and Mansfield, 1972). Khandwalla (1972) suggests that large companies can make greater use of sophisticated controls (see also Merchant, 1981; Chenhall, 2003). An additional discussion in this paper focuses on the ability of the characteristics of capital investments to affect the appropriateness of ACICs. In this context, one could consider several overlapping aspects of

investments: (1) minor vs. major; (2) operative vs. strategic; (3) simple vs. complex; (4) unique vs. repetitive; and (5) low vs. high number of investment projects. *The second working proposition is that smaller companies with fewer major strategic, complex and repetitive capital investments tend to be satisfied with the existing ACICs, and consequently do not adopt PCA.*

To summarize, this study addresses the non-adoption of Post-Completion Audit from a management control perspective. In doing this, I draw on a combination of the literatures on equifinality, organizational learning and contingency-based research. The notion of equifinality plays an important role in this paper. It acts as a trigger and a lens for discovering and discussing ACICs that enable companies to achieve PCA benefits, and also provides an appropriate concept (trade-off equifinality) with which to approach complementarity and substitution issues. The organizational learning literature (Huber, 1991) provides a pertinent construct for approaching PCA benefits related to organizational learning and specifically, to knowledge acquisition in capital investing. Findings in the contingency-based research literature provide additional assistance for examining the circumstances under which managers can perceive ACICs to be appropriate in controlling completed investments.

### **3. Research Method**

The empirical evidence was gathered from the 30 largest Finnish manufacturing corporations ranked according to turnover (Talouselämä, 24 May 2002). All the companies – both adopters and non-adopters – were analyzed in order to find out which companies were actually PCA non-adopters. Additionally, PCA adopters were used as a reference group in comparing and discussing the empirical results, in order to shed greater light on the analysis of substitution and complementarity issues between ACICs and formal PCA, and in order to examine the appropriateness of ACICs in various circumstances.

My original intention was to conduct a postal survey on a larger sample of companies, but during the early pilot phase it became clear that the respondents' potential for understanding the questions incorrectly would have jeopardized the reliability and validity of the findings. The major concern was the inability of the respondents to make clear distinctions between concepts such as pre-audit, monitoring and PCA. It appeared that face-to-face interviews would have to be conducted in order to clarify such issues as they arose. Yet because the aim of the study was to obtain a wide and comprehensive picture of the research topic, a case analysis examining a few companies would not suffice. A cross-sectional field study involving limited-depth studies conducted at non-randomly selected field sites was the method chosen, as it lay somewhere between an in-depth case study and a broad-based survey (Lillis and Mundy, 2005).

The companies studied represent 10 sectors of the manufacturing industry: metal (9 companies), forest (5), food processing (4), chemical & plastics (3), energy (3), building material (2), telecom & electronics (2), printing (1),



packaging (1) and diversified (2). In two conglomerates consisting of largely independent businesses, different policies for PCA were found. In both these companies, two major divisions were studied. Hence, a total of 32 units in 30 companies was studied, 11 of which were identified as PCA non-adopters. In line with the definition set for PCA for the purposes of this paper, all non-adopters shared a common feature of not formally comparing pre-investment estimates of investment projects with actual figures after the projects have been completed and have started to generate cash flows. Nor do they have instructions to do so. All the non-adopters have been presented in Appendix B. The direct quotations made by the non-adopters include reference to the company (A–K and industrial field) and the job title of the interviewee. For purposes of anonymity, more exact references to companies and persons have not been provided.

The empirical evidence based on the face-to-face interviews consisted of two parts: a semi-structured interview and a structured questionnaire (which was completed in the presence of a researcher). The main structure of the interview was as follows (see Appendix C): general; capital investment process; monitoring; and PCA, including informal investment control and organizational learning with regard to investments. The questionnaire comprised 44 factual and attitudinal questions about PCA, covering structural properties, aims, benefits, difficulties and communication. Three of these questions responded to by non-adopters are specifically pertinent to this paper: (1) the primary reasons for non-adoption of PCA (open question), (2) difficulties of PCA and their restrictive role for PCA (14 suggested difficulties), and (3) ACICs to acquire capital investment knowledge (10 suggestions). The two latter questions were closed, but had an open space provided for additional items to be included. A 5-point Likert scale was used to measure the significance of difficulties/alternatives.

Altogether, 49 interviews were conducted between December 2002 and January 2004, 16 with the 11 PCA non-adopters and 33 with the 21 adopters. The main interviewee – the person considered to be the most knowledgeable person in the company – was identified by phone calls to the target company, hints from colleagues from other companies, press releases and seminars. These key people were typically in charge of finance (CFO), technology/production or investments, and simultaneously responsible for capital investing policies in corporate management or major divisions. None of the contact people refused to put me in touch with a potential interviewee and no one refused to be interviewed – neither the 32 key people nor any other relevant persons in the companies from which an interview was sought. The average duration of the interviews was approximately two hours, and all interviews but one were tape-recorded.

In 2001, the turnover of the largest company was €31.2 billion and the turnover of the smallest was €0.5 billion; the median was €1.5 billion. The largest absolute amount of tangible assets was €12.3 billion, the smallest was €0.1 billion, and gross investments were between €11 million and €3.9 billion. The number of personnel ranged from 780 to 57,700; 23 of the

companies are listed on at least one stock exchange. Only four of the companies would be considered local; 28 have international operations, such as production facilities.

#### **4. Results and Discussion**

The PCA non-adopters were asked to state two or three main reasons for not adopting PCA (see Appendix D). In line with the prior survey-based literature (Appendix A), respondents typically identified reasons relating to the scarcity of relevant capital investments and difficulties. The difficulties included changes in the business environment, uniqueness of investment projects and difficulties in separating cash flows.<sup>12</sup> These findings were consistent with those of prior studies (Neale and Holmes, 1991; Pierce and Tsay, 1992). There was, however, an additional reason identified in the present study: lack of support from top management can discourage PCA adoption.<sup>13</sup>

If and how companies can achieve benefits suggested for PCA by using ACICs and whether or not these alternatives discourage PCA adoption is the next topic of discussion. ACICs for evaluating the success of an investment are examined first, followed by a study of ACICs to achieve organizational learning benefits. The substitution and complementarity issues of alternative control mechanisms are further analyzed and discussed next, followed by a discussion of the appropriateness of ACICs in various circumstances. Finally, the findings and discussion will be synthesized. Sections 4.1 and 4.2 merely examine PCA non-adopters, whereas Sections 4.3–4.5 also include references to the PCA adopters studied.

##### *4.1. Alternate Capital Investment Controls in Evaluating the Success of an Investment*

There was a tendency within the companies studied to gain a first impression of the success of a completed investment by observing the *capacity utilization* ratio of the investment.<sup>14</sup> In one of the companies, the follow-up of capacity utilization was identified as a sufficient alternate capital investment control mechanism, and consequently as a reason for non-adoption.

Although an idea of the capacity utilization can be gained merely by walking around inside the factory, a more precise picture can evidently be obtained from a formal production volume follow-up. With regard to capital investments in machines, production lines or factories, it is usual to have a certain production volume as a base target for an investment. In strategic investments, this target is often derived from the sales targets; in operational investments (e.g. replacement and productivity increase investments), on the other hand, the connection with sales volume can be more distant. However, in both cases it is usually easy to notice if a machine is working all the time as planned, for example, or only for one shift a day.



The CFO of Non-adopter I (mechanical engineering) stated the following about the production line investments:

*If we can see that the production line is [after a start-up period] running over 50% of the time, we can assume that the investment has been OK.*

Another CFO (Non-adopter H, mechanical engineering) added, on the topic of machining center investments:

*In these western machine and equipment investments, it is this capacity utilization ratio which is the central criterion. Only by walking around can you see whether it was a good or a bad investment. Our rule of thumb is that it must run at least two shifts per day, preferably for seven days a week, before we do the investment in-house. Otherwise we analyze the buy alternative very carefully.*

Typically, production volume development is also a good proxy for sales volume development. At least in people's minds, it seems, production volumes are often equated with sales volumes.

In addition to pure production-volume-based targets, investment plans typically include other targets for production, such as yield, productivity and cost per unit. In the companies studied, these *key production figures* were usually followed up at least on a monthly basis, and usually more often. In operational investments, these targets (combined with the production volumes) often play a central role, and it is possible to evaluate the achievement of the targets of an investment with the aid of these data. The gaps between plan and actuality typically trigger a detailed analysis of the reasons for differences as one technical director (Non-adopter F, diversified) stated:

*If there is something odd in the sales or key production figures, we certainly have to analyze and report what has happened and what will be done.*

Especially in expansion investments, the central and critical objective is usually *sales*. Some companies have market-share targets for an investment and are able to follow the impact of an investment for that target. The factors influencing sales – sales volume (units) and sales price per unit – are faithfully followed up in many of the companies studied, and in many cases can be allocated to an investment. As one CFO (Non-adopter I, mechanical engineering) described:

*Of course, if we construct a production line for some specific product, sales volumes and prices will be carefully followed up.*

The companies have different levels of profit centers in their organizational structure. It appears that *profit center follow-up* is also considered to be a type of control of completed investments. Typically, profit center follow-up is conducted at least on a monthly basis in connection with monthly reporting. It is often thought that the success of an investment boosts the financial and non-financial key figures of a profit center. A CFO (Non-adopter H, mechanical engineering) commented:

*We know what is going on, because we have divided this corporation into so many little profit centers. Especially the major failure investments have an impact on the profitability. Failures can be seen as a bad return on investment, too.*

The role and power of profit center follow-up as a control mechanism for an investment project is even higher if an investment forms a profit center of its own. This can be the case with extremely large investments. In some cases, there is even a preference for establishing new legal entities in order to facilitate better follow-up of the company's units and investments. As one CFO (Non-adopter J, food processing) said:

*We invested in a big logistical center. We decided to form a legal unit for that in order to be able to follow it up closely. We are going to divide our corporation further into smaller legal units. Then we have full income statements and balance sheets to be followed up.*

Profit-center reporting may also include written comments about the investments, as a technical director (Non-adopter D, forest) explained:

*If the machine is running well after completion, it [performance of a completed investment] is there in the figures and will certainly be commented on. If it is not operating well, you have to comment.*

There were other ways to evaluate the success of an investment found in this study – the *monitoring of investments* during implementation and product/product group profitability follow-up, for instance. The monitoring phase closely precedes the control of completed investments (see, e.g. Mills and Kennedy, 1990). In the monitoring phase, the impression of the success of an investment is typically related to the achievement of the planned schedule, cost budget and technical specification. The borderline between monitoring and PCA is not always clear-cut. Sometimes companies create a written report of a particular investment immediately after the implementation phase. Usually the monitoring reporting is focused on the implementation phase and start-up, whereas the operational phase is not included. The monitoring reporting is usually technology oriented, but it may occasionally include some information

about the operational production phase. Hence, people may gain some understanding of the investment in production in connection with this type of reporting. With regard to simple production investments, for instance, the targets set for the investment may already be achieved in the early operational phase – or at least the targeted performance level has been achieved. In these cases, the achievement of the investment objectives can be stated relatively easily with high probability in connection with monitoring reporting.

Some companies emphasized the *profitability follow-up per product or product group* instead of following the development of an investment as such. As the Controller of Non-adopter G (mechanical engineering) said:

*We are launching 3 to 5 products annually. Now I am following a couple of them. I can see if there is something odd in the figures in comparison with the plans. The investments are there in the figures, too.*

Nevertheless, there is a drawback in relying on product/product group and profit center follow-up in performance measurement; the outcomes can include other simultaneous capital investments and do not provide project-specific investment feedback. As a consequence, it can be challenging to utilize the findings later for organizational learning purposes.

A common way for management to control the status of the investments is to be in *contact with the plant* and ask for reports. Typically, in the companies studied, managers also obtained information about the investments in informal discussions and meetings. In some companies, the status of completed major investments was presented at *different forums*: meetings of the board of directors, board of managers, management groups, controllers and technical people. In one company, the CFO of Non-adopter I (mechanical engineering) explained:

*Our board of directors gets information on the major investments in its meetings. The persons responsible for investments come to the meeting and present the status of the investment. They tell what had been planned and what has happened [predominantly in the implementation phase]. We do not reconstruct investment calculations or formally document this. Actually, there would not be a long way to upgrade this to formal post-completion auditing.*

Furthermore, in some cases, the achievement of the main objectives of an investment can be relatively *transparent*. For example, in a rationalization/productivity investment, the objective can be reduction of a certain number of workers. This reduction can be observed later without any sophisticated analysis.

To summarize, it appears clear that PCA is not the only way for companies to gain an impression of the achievement of financial and non-financial objectives of a completed investment. As presented in Table 1, the companies studied seem to have many different ways of acquiring a sense of the success of an

**Table 1.** Alternate capital investment controls to evaluate completed investments

Method of evaluation		Accomplishment
1.	Capacity utilization	Follow-up of production volume
2.	Other key figures, production	Follow-up of yield, productivity, cost per unit
3.	Sales	Follow-up of sales volume and value
4.	Profit center follow-up	Routine follow-up (e.g. weekly, monthly) of profit centers, large investments as profit centers of their own
5.	Other methods of control	Monitoring of investment projects, profitability analysis per product/product group, contacts with investment sites, presentations and conversations in different forums, transparency (target vs. actual)

investment, even though it is not typical for ACICs to be consciously considered as part of investment control.

The various ACICs for evaluating completed investments in the companies studied can be classified into five groups: (1) capacity utilization, (2) production key figures, (3) sales, (4) profit center follow-up, and (5) other methods of control. It is typical that the companies have formal systems for the first four groups that are not primarily intended to function as control devices for completed investment projects; they have other objectives. With regard to group 5, the companies formally monitor their investment projects during the implementation phase, and many have formal systems for analyzing profitability per product or product group. Visiting investment sites, presentations and discussions can be formally arranged for investment control purposes, but typically they seem to be more informal.

#### *4.2. Alternate Capital Investment Controls to Achieve Organizational Learning Benefits*

Gaining valuable feedback for future investment projects has been suggested as the major benefit of PCA (see, e.g. Corr, 1983; Neale, 1994). With the aid of PCA information, a company can avoid repeating earlier mistakes and can systematically do the right things again. Additionally, PCA is expected to give valuable feedback, not only for investment project-specific activities, but also for improvement of the capital investment process in general (Mills and Kennedy, 1993). Why, then, are these learning-related benefits not necessarily considered important enough for PCA non-adopters to adopt PCA? In order to examine this circumstance, the interviewees were asked to discuss aspects of organizational learning with regard to capital investments. More specifically, the discussion was finally addressed to the question of how companies acquire capital investment knowledge relevant to their future investments by using ACICs. During the discussion,

the interviewees stated the significance of 10 different suggested ACICs compiled with the aid of Huber's (1991) constructs about knowledge acquisition.

The alternative ways to acquire capital investing knowledge can be classified into three main groups according to the location of the knowledge: (1) knowledge existing within an investing unit, (2) knowledge existing elsewhere within a corporation, and (3) knowledge existing outside a corporation. It appeared that all the non-adopters consider utilizing central expertise located at the divisional or corporate headquarters level to be significant. One CFO (Non-adopter H, mechanical engineering) emphasized the role of central expertise:

*We have a plant services group, which is a company of its own. It is widely used for constructing our own capital investments.*

A divisional technical director (Non-adopter D, forest) added, on the topic of using central expertise:

*There is always a corporate representative in all the major investments. He is involved in other divisions, too. He is active and he has all the knowledge.*

Additionally, the utilization of knowledge located within an investing unit (factory, profit center) is considered significant in almost all the companies. In practice, this means that experienced persons within the organization will be connected to new investments. A divisional technical director (Non-adopter F, diversified) noted the importance of using experienced people:

*This [using experienced people] is the central way for us to work. At the planning stage of the project we think about the critical success factors for the project from a personnel resource point of view. We try to identify and find the right persons. It can be, for example, technical, geographical, marketing, or project management abilities that we are looking for.*

On the same topic, a director (Non-adopter K, energy) added:

*Using experienced people of our own is very important, of course. They know what to do and we know what they can do. It is not always possible to transfer knowledge by telling or writing. There is so much tacit knowledge in these projects.*

Other means for acquiring capital investment knowledge, such as discussions with persons involved in previous projects, going through documentation of the previous projects, transfer of experts/remote assistance and relying on external suppliers/consultants, seem to be typical in almost all the companies. Also, some interviewees stated that they can obtain relevant capital investment

knowledge by taking reference visits to other companies, sending partners abroad, utilizing steering group experience and networking across their companies. Nevertheless, these means are not considered the main means; they are auxiliary to central expertise and experienced internal resources. All the companies consider at least one means significant.

#### *4.3. Alternate Capital Investment Controls as Substitutes and/or Complements to PCA*

The empirical evidence shows that PCA does not have exclusivity in evaluating the success of an investment and in achieving the organizational learning benefits suggested for it. The PCA non-adopters have typically many simultaneous means of evaluating the success of an investment. They can rely on the existing formal and informal systems and procedures that provide data for following up capacity utilization, production key figures and sales. Additionally, as Scapens *et al.* (1982) has found, profit center follow-up seems to play an essential role as a control mechanism for capital investments. Non-adopters can get an impression of the success of an investment by monitoring the implementation phase and by analyzing profitability per product or product group. Management can also control the investments by having informal and formal discussions and meetings with the investing unit.

The non-adopters seem to have many ways to acquire relevant knowledge for their future investment projects and improvement of the capital investment process. The utilization of central expertise and experienced internal resources seem to be crucial, and the companies studied place greater emphasis on the utilization of experience within their corporation than they place on vicarious learning (i.e. acquiring second-hand experience outside the corporation; cf. Huber, 1991). Huber (1991) suggests that organizations can obtain knowledge by acquiring new members who possess knowledge not previously available within the organization. However, in the companies studied, acquiring new members outside the corporation was not considered relevant; remote assistance and transfer of experts within a corporation were used to some extent, however.

Following the tradeoff equifinality notions, it was tentatively proposed in Working Proposition 1 that managers may perceive that their companies face a tradeoff equifinality situation, in which ACICs yield the same benefits as PCA, thereby discouraging the adoption of PCA. Thus, the existence of ACICs could lead to a tradeoff decision between ACICs and formal PCA (see also Gresov and Drazin, 1997), and consequently affect PCA adoption. ACICs and PCA can be considered tradeoff equifinal if they are able to perform PCA's functional demands (here evaluation of success of an investment and learning for project/process) equally well, and potentially substitute for each other. In a tradeoff equifinality situation, a company would base its adoption decision on management preferences.

It is obvious that companies can achieve benefits that are at least similar to those suggested for PCA by using a package of ACICs, but it remains open to discussion if the outcomes will be exactly the same. However, it is possible that this is not a critical issue with regard to PCA non-adoption decisions, to the extent that managers perceive that a sufficiently equivalent effect will be achieved with ACICs. In line with this reasoning, Otley (1980, p. 421) and Abernethy and Chua (1996, p. 598) present in the MC package connection the notions of 'partial substitute' and 'sufficient substitute', respectively, implying that substitution would not require the achievement of exactly the same functional outcome – but would require a similar one. On the other hand, there are aspects that do not support the existence of a pure tradeoff equifinality situation. It is unlikely that the influence flows in the opposite direction – that PCA could be sufficiently influential to achieve the objectives set for subcomponents of ACICs – profit center follow-up, for example. Consequently, it appears, the non-adopters use ACICs widely, regardless of PCA, and the potential adoption of PCA would not likely affect their usage. Thus, PCA adoption would cause incremental rather than alternative costs for the company. Additionally, it is implied that the existence of a substitution process would require that companies are aware of formal PCA and its potential benefits, and make a conscious choice between ACICs and PCA. However, PCA non-adoption is not necessarily a conscious decision, as observed by one of the non-adopters.

In spite of the nonexistent tradeoff equifinality situation, ACICs seem to discourage companies from adopting PCA. Previously, only personal contacts within an organization were explicitly brought up as an ACIC and as a reason for PCA non-adoption (Neale and Holmes, 1991; Azzone and Maccarrone, 2001). The role of personal contacts was also confirmed by this study. These findings also suggest that many other potential ACICs enable companies to evaluate the success of an investment and achieve PCA benefits, thereby discouraging PCA adoption. In particular, the literature was extended by the discovery of alternate ways of acquiring capital investing knowledge.

The examination of ACICs was further extended to the PCA adopters. The results indicate that the PCA adopters and the non-adopters use similar ACICs to evaluate the success of an investment. The ways in which they acquire capital investment knowledge and the significance of these ways are similar, as well. Similar to the non-adopters, it seems that ACICs are, in any case, used by the adopters, irrespective of PCA, and that adoption of PCA does not affect their use. The adopters typically state that there are advantages in having a formal PCA program, and perceive that ACICs and PCA cannot be considered to yield equal performance. The adopters state that PCA assists them in systematically acquiring relevant capital investment knowledge for the evaluation of investments and for learning purposes, aids in sharing and interpreting information, and facilitates appropriate communication of the findings. Hence, the PCA adopters perceive PCA to be a complement to ACICs rather than a potential substitute – that the use of ACICs and PCA simultaneously is superior to the use



of ACICs alone in meeting the functional demands. Accordingly, Gresov and Drazin (1997) suggest, in a situation of this type when an organization faces a singular or a set of consistent functional demands and the design situation is constrained, that it would be possible to find an ideal (or optimal) profile to perform the function(s).

Furthermore, it appears that the interrelationships between ACICs and formal PCA are ambiguous for the adopters, and as a consequence they do not design their capital investment control with a broad package perspective in mind. This observation lends support to Otley's (1999) suggestion that it is unlikely that managers consciously design each control to play a different, cohesive role in a total MC package (see also Macintosh and Daft, 1987).

Our findings are consistent with the suggestions of the researchers (e.g. Abernethy and Chua, 1996; Otley, 1999), who maintain that in studying MCS it is appropriate to adopt a broad and holistic perspective and not to examine them in isolation of their wider context. A broad enough perspective (i.e. a MC package approach) enables the examination of the interrelationships between various control system elements and allows them to be explained. Furthermore, in line with Waterhouse and Tiessen (1978) and Merchant (1985), it was found that different types of controls can complement each other.

#### *4.4. The Appropriateness of Alternate Capital Investment Controls in Different Circumstances*

This section examines the circumstances under which ACICs can be appropriate in controlling completed investments. It was tentatively proposed in Working Proposition 2 that smaller companies with fewer major strategic, complex and repetitive capital investments can perceive the existing ACICs to be sufficient, and consequently do not adopt PCA.

Although all the companies studied can be considered large in terms of turnover and absolute amount of tangible assets, there are significant size differences between them. If we study the correlation of company size and PCA non-adoption by comparing the largest 15 with the smallest 15 companies, we can see that there are more non-adopters among the smaller companies, as measured both by turnover and by the absolute amount of tangible assets (see Table 2). In this presentation, we consider two companies in which the largest divisions had adopted PCA as PCA adopters, giving us a total of 30 companies. Additionally, there are more non-adopters among the companies with lower tangible asset-to-turnover ratios. If we tentatively choose only the companies that have both a high absolute amount of tangible assets (over €0.5 billion) and a high tangible assets-to-turnover ratio (over 40%), we find that only 1 out of 11 companies is a non-adopter. Hence, it seems that non-adoption is associated with the following two factors: the company does not have a critical mass of tangible assets or the relational importance of tangible assets is low for the company.



**Table 2.** PCA non-adoption by company turnover, tangible assets and tangible assets/turnover ratio

	PCA non-adopters No./%	PCA adopters No./%	Total No.
Ranked by turnover:			
Largest 15	3 (20%)	12 (80%)	15
Smallest 15	7 (47%)	8 (53%)	15
Total	10 (33%)	20 (67%)	30
Ranked by tangible assets:			
Largest 15	3 (20%)	12 (80%)	15
Smallest 15	7 (47%)	8 (53%)	15
Total	10 (33%)	20 (67%)	30
Ranked by tangible assets per turnover:			
Largest 15	4 (26%)	11 (74%)	15
Smallest 15	6 (40%)	9 (60%)	15
Total	10 (33%)	20 (67%)	30

The results confirm the results of prior studies suggesting that smaller company size is associated with the likelihood of PCA non-adoption (Scapens *et al.*, 1982; Neale, 1989, 1994). Furthermore, it is suggested here that if companies do not have a critical mass of tangible assets or the tangible assets-to-turnover ratio is low, they are less likely to adopt PCA. As one Group Controller (Non-adopter E, diversified) stated:

*Our annual investment volumes are at such a low level that we think we are able to control commissioned projects satisfactorily by relying on monthly reporting and informal follow-up. It would not be cost-efficient to build-up a bureaucracy [i.e. to launch a PCA program] in order to obtain a better picture of our investments.*

Hence, because implementing and running a PCA system is not free of charge, companies with no critical mass of tangible assets are less likely to find PCA appropriate from the cost–benefit point of view. These results also support previous findings suggesting that less formal controls are typically used in smaller companies (e.g. Waterhouse and Tiessen, 1978; Merchant, 1981).

Partly as a consequence of their low level of tangible assets, the non-adopters typically have few major and strategic investments (see Appendix B); nor are they typically complex. In these kinds of circumstances, it seems likely that a company would perceive ACICs to be appropriate for evaluating the success of an investment, as supported by the comment of a technical director of a PCA adopter (forest):

*The bigger and more strategic investments we are talking about, it is not only the physical implementation and production, but there are a lot of other things. If these projects were not mirrored by this kind of formal PCA, it would be hard to understand what has really happened. For smaller and easier investments, you can see the hard facts elsewhere.*

Furthermore, the organizational learning potential is lower in minor, operative and simple investments. It is suggested that PCA is useful for companies in identifying successful processes that can be repeated in future investments (Neale and Holmes, 1991). Nevertheless, the non-adopters studied do not typically have major repetitive investments. A director of industrial operations (Non-adopter F, diversified) said about the role of unique capital investments for discouraging PCA adoption:

*Our major capital investments are unique as snow flakes: there are no two similar ones. That is why it is not easy to fully feed-forward the learning experiences. I am convinced that we would conduct PCA, or at least seriously consider it, if we had repetitive major investments as they have, for example, in the paper industry.*

In summary, it seems that smaller companies not having major strategic, complex and repetitive capital investments can perceive that the package of different simultaneous ACICs yields a performance that is equal to PCA or sufficiently close to equal, and consequently do not adopt PCA.

#### 4.5. Synthesis

Building on the MCS research suggesting that different control systems can act as alternatives for each other, and hence affect adoption of new ones (see, e.g. ABC: Innes *et al.*, 2000; PCA: Neale and Holmes, 1991), this paper made an effort to augment our understanding of the black box of ACICs and their influence on PCA non-adoption. In addressing PCA non-adoption, this study drew on a combination of the literatures in the areas of equifinality, organizational learning and contingency-based research. The investigation focused on ACICs to evaluate the success of an investment (a core function of PCA) and ACICs to achieve organizational learning benefits, which are considered to be the major benefits of PCA (e.g. Neale, 1989). Huber's (1991) constructs were used to structure the potential ACICs to enable organizational learning.

The investigation resulted in the discovery and mapping of ACICs that discretely or as a package enable companies to achieve benefits suggested for PCA. With regard to the evaluation of success, it was discovered in this study that many different means were used by companies to help them understand whether or not the targets of an investment are being met. These means include formal systems for routinely following up key production figures, sales

and profit centers. Also, visiting investing sites, presentations and discussions can be formally arranged for investment control purposes, but typically seem to be more informal. Furthermore, it was discovered that companies acquire relevant capital investment knowledge for OL purposes in many ways. In particular, the utilization of central expertise and experienced internal resources seems to be crucial.

Drawing on the notions of equifinality literature on substitution, there was an examination of the question: can ACICs and PCA act as substitutes for each other, and consequently constitute a reason for non-adoption? Nevertheless, the contention that different control systems can act as substitutes for each other (e.g. Fisher, 1995) does not seem to be valid in the PCA context. Because tradeoff alternatives (ACICs and PCA) cannot reciprocally carry out each other's tasks, the launching of PCA would not likely replace any or all ACICs. Hence, choosing PCA would not substitute ACICs, but rather complement them.

This study also addressed the relationship between the appropriateness of ACICs on the one hand, and company size and characteristics of the investment on the other. Although ACICs and PCA cannot be considered to be pure trade-off substitutes, the empirical evidence of this study supports the contention that the management of smaller companies not having major strategic, complex and repetitive capital investments can perceive that ACICs yield an equal or sufficiently close to equal performance to PCA. Hence, the existence of ACICs can discourage PCA adoption, because the non-adopters seem to base their decision not to adopt PCA primarily on cost–benefit thinking (cf. Granlund, 2001).

## **5. Concluding Remarks**

This study examined reasons why companies do not adopt formal post-completion auditing (PCA) of capital investments, although the extant research maintains that PCA can be beneficial in providing valuable feedback for ongoing, and especially for future investments. My intention was specifically to explore the alternate capital investment controls (ACICs) that exist, and if and how companies can evaluate completed capital investments and achieve PCA benefits by using them. ACICs related to the evaluation of the success of an investment and organizational learning (OL) were focused upon, because evaluation is a core function of PCA and a prerequisite for achieving any PCA benefits, and OL is suggested to be the major benefit of PCA. Substitution and complementarity between the ACICs and PCA were analyzed, drawing primarily on the notions of equifinality. Furthermore, the appropriateness of ACICs in different circumstances (organizational size and characteristics of an investment) was discussed.

The empirical evidence for this paper was based primarily on semi-structured interviews conducted in the 30 largest Finnish manufacturing companies;

however, some questions were simultaneously discussed following a questionnaire. The focus was on studying the 11 PCA non-adopters identified; the PCA adopters acted as a reference group. The intention of this predominantly exploratory study was to theorize about the PCA non-adoption behavior of companies, and to improve our understanding of this phenomenon. This study adds to the extant MC Package and PCA literatures. To the best of my knowledge, it is the first explicit attempt to assess the role of alternative control mechanisms in discouraging the adoption of control systems, and the first study of PCA non-adoption to use empirical data from interviews.

The results indicate that ACICs to achieve benefits suggested for PCA do exist, and that formal PCA, therefore, do not have exclusivity in achieving these benefits. Accordingly, this implies that PCA non-adopters do not necessarily jeopardize successful capital investments. Furthermore, the empirical results allow for the suggestion that the existence of ACICs can discourage adoption of PCA. This finding is congruent with the suggestions of Innes and Mitchell (1995), Innes *et al.* (2000) and Speckbacher *et al.* (2003) with regard to adoption of ABC/BSC: that the existence of control systems can discourage companies from adopting new ones. Neale and Holmes (1991), and Azzone and Maccarrone (2001) had earlier suggested that personal contacts between managers can be a reason for PCA non-adoption. This paper contributes to the extant PCA literature by discovering and mapping many other ACICs, enabling companies to achieve PCA benefits and potentially discouraging PCA adoption. In particular, the investigation of alternate ways to acquire capital investing knowledge and their relation to (non)adoption decisions had previously been neglected.

This paper makes an additional contribution by providing a discussion of the circumstances in which companies can perceive ACICs to be appropriate. Based on the empirical data, it is argued that smaller companies with fewer major strategic, complex and repetitive investments can perceive ACICs to be sufficient, and consequently do not adopt PCA. The research adds to the MCS and equifinality literatures by extending the use of the equifinality concept to cover MCS (non)adoption analysis. With the aid of the equifinality concept, this paper discusses whether or not ACICs and PCA can act as trade-off alternatives (substitutes) for each other and consequently affect non-adoption. Nevertheless, it appears that ACICs and PCA cannot reciprocally carry out the tasks of each other. As a consequence, companies would use ACICs, despite the adoption of PCA, and the launching of PCA would not likely replace any or all ACICs. In practice, therefore, companies do not face a tradeoff decision-making situation between ACICs and PCA. Moreover, the empirical evidence supports the contention that PCA adopters perceive PCA as offering superior performance compared with ACICs, and regard PCA as a complement to ACICs.

The approach of this paper, to examine non-adoption of control systems (here PCA) on the basis of potential alternative ways of yielding equal performance

(i.e. equifinality concept), was considered fruitful. In future studies, this approach could also be adopted in examining Management Control Package issues (i.e. substitution/complementarity) and, consequently, (non)adoption of management accounting innovations such as Activity-Based Costing, Balanced Scorecard and Value-Based Management. Additionally, it would be worthwhile to investigate the roles of human factors like key decision-makers or teams in connection with non-adoption (see, e.g. Miller, 1987).

Studies covering reasons for PCA adoption could potentially cast more light on non-adoption. Accordingly, researchers could further study the circumstances (e.g. capital-intensity, characteristics of investments, size, technology, strategy and organization structure) for which companies perceive ACICs to be insufficient and adoption of PCA appropriate. One could approach PCA (non)adoption by drawing on theories of institutional sociology (e.g. Meyer and Rowan, 1977; Powell and DiMaggio, 1991) and management fashions (Abrahamson, 1991, 1996). Such studies have earlier been conducted in MC regarding ABC adoption (see Malmi, 1999; Carmona and Gutierrez, 2003). By means of the lenses of institutional sociology, we could examine how companies attempt to legitimate their PCA (non)adoption decisions and whether coercive, normative and mimetic pressures (or lack of them) can explain their behavior. Furthermore, by applying the notions of management fashion theory, researchers could investigate to what extent motives related to managerial fads/fashions or efficient-choice affect PCA (non)adoption decision.

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### **Notes**

<sup>1</sup>Adoption rates reported in different studies: (1) in UK, 98% (Arnold and Hatzopoulos, 2000) and 79% (Neale, 1991b); (2) in USA, 76% (Gordon and Myers, 1991) and 90% (Klammer and Walker, 1984); (3) in Norway, 41% (Neale, 1994); and (4) in Italy, 71% (Azzone and Maccarone, 2001).

<sup>2</sup>This definition is in line with the PCA definition suggested by Gadella (1986), Pierce and Tsay (1992), Chenhall and Morris (1993), and CIMA (2000, p. 7), but is more explicit with regard to criterion (3). Nevertheless, we recognize the difficulty of providing a catch-all definition of PCA including more detailed requirements such as the type of projects selected, the format,

who does it, who is responsible for it, when and how frequently it is conducted, and how the results are communicated.

<sup>3</sup>During the implementation phase, it is typical to follow up on the cost budget, scheduling and technical specifications, to see that they are progressing according to plan. In practice, monitoring of the implementation phase and PCA are overlapping concepts, because monitoring is, to some extent, a prerequisite for PCA. However, monitoring alone cannot be considered as fulfilling the criteria for PCA. In the monitoring phase, it is typically too early to estimate whether or not an investment project will achieve its targets.

<sup>4</sup>Internal and external routine reporting (monthly, trimestral, annually, etc.) do not usually fulfill all the criteria required for PCA. For example, routine reporting is typically: (1) not project-focused, but profit-center or cost-center focused, and (2) does not compare the pre-investment objectives of an investment project with the actual achievements.

<sup>5</sup>In some PCA benefit studies, evaluating the success of an investment has been explicitly mentioned as a distinct benefit (Neale, 1994; see also Pierce and Tsay, 1992), but Neale (1989), for example, has not included it.

<sup>6</sup>Organizational learning has also been found to be the major aim (objective, goal) for PCA adoption (Neale and Holmes, 1990; Neale, 1994; Azzone and Maccarrone, 2001).

<sup>7</sup>Furthermore, Argyris (1977, 1990) distinguishes between two types of organizational learning: single-loop and double-loop learning. Single-loop learning focuses on problem solving and does not address the reasons for the problems arising in the first place. In double-loop learning, organizations do not only detect and correct the errors, but also question the underlying policies and goals. In a similar vein, Senge (1990) suggests that adaptive learning (Argyris' single-loop) must be joined by generative learning (Argyris' double-loop) to expand the organization's capacity to create its future.

<sup>8</sup>Similarly, Neale (1989, 1991a) and Mills and Kennedy (1990, 1993) suggest that PCA would encourage greater realism in project appraisals. Both researchers use the words 'realistic' and/or 'realism' in this connection. Nevertheless, because of the potentially overlapping meaning of these words, they are not used here (e.g. it can be unclear whether 'realism' improvement is related only to enhancing the integrity of project appraisals or if it is also related to organizational learning).

<sup>9</sup>Because of asymmetric information distribution, managers may be in a position to play games in the capital investing process. They may use their information advantage to enhance their self-interest objectives – by focusing on certain aspects of information, filtering information or manipulating information, for example.

<sup>10</sup>In addition, there are some studies about the adoption of management accounting innovations, such as Activity-Based Costing (ABC) and Balanced Scorecard (BSC) with minor discussions on reasons for non-adoption (for ABC studies, see Innes and Mitchell, 1995; Bjornenak, 1997; Clarke *et al.*, 1999; Innes *et al.*, 2000; for a study on BSC, see Speckbacher *et al.*, 2003). Nevertheless, the adoption of these innovations may not be a perfect reference for PCA, because, unlike PCA, both ABC and BSC can be regarded as consulting innovations surrounded by elements of fads and fashion (see, e.g. Malmi, 1999, 2001).

<sup>11</sup>However, Neale and Holmes (1991) conducted a few follow-up interviews among the PCA non-adopters after their survey was completed.

<sup>12</sup>The significance of these reasons was further confirmed by a separate question in which the companies discussed the influence of 14 potential difficulties on PCA non-adoption (see Appendix E). The difficulties were compiled from earlier studies (Neale, 1989; Holmes *et al.*, 1991; Pierce and Tsay, 1992; Mills and Kennedy, 1993; Huikku, 2001).

<sup>13</sup>However, Brown *et al.* (2004) suggest that top management support (and the support of an internal champion) is associated with ABC adoption.

<sup>14</sup>There are many different views about which baseline capacity estimates (e.g. theoretical, practical, normal or budgeted capacity) would be the most appropriate for capacity utilization measures, and consequently for *ex ante* product cost calculations (see, e.g. McNair and Vangermeersch, 1998).



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Appendix A

**Table A1.** Studies on reasons for non-adoption of PCA

	Ghobadian and Smyth (1989)	Neale and Holmes (1991)	Pierce and Tsay (1992)	Azzone and Maccarrone (2001)
General	Survey in the UK: 150 companies (stratified) among 'The Times 1000'. Response rate 34%, PCA adoption rate 55%	Survey in the UK: all the companies among 'The Times 1000' + some financial sector enterprises, including some follow-up interviews. Response rate 39%, PCA adoption rate 49%	Survey in the USA: 200 companies (random) among 'Fortune 500'. Response rate 37%	Survey in Italy: 124 biggest companies (turnover/value added). Response rate 27%, PCA adoption rate 71%
Main reason for non-adoption of PCA	Lack of resources to carry out PCA	Rely on personal contacts between corporate and divisional managers	Few or no benefits	PCA useless, given the very different nature of projects and the high degree of environmental turbulence
Second reason	Lack of data necessary to carry out PCA	Few expected benefits when a project cannot be changed	Cannot separate specific project profit	Gap between (certain) costs and (uncertain) benefits
Third reason	–	Too many costs and benefits to enable isolation	Changed assumptions	Inadequacy of the tool, given the particular kind of investments

(Table continued)

Table A1. Continued

	Ghobadian and Smyth (1989)	Neale and Holmes (1991)	Pierce and Tsay (1992)	Azzone and Maccarrone (2001)
Fourth reason	–	Insufficient expertise	Information obtained is not useful	Conceptual and practical problems in modifying the ongoing investments
Next reasons	–	In others: PCA not suitable	The audit is too costly	Already good relationships between operating managers and controllers
	–	In others: PCA not relevant	Lack of qualified personnel	Scarcity of human resources
	–	In others: insufficient investments	Resentments of audited personnel	Lack of qualified personnel for implementation of PCA
	–	–	–	Unwillingness to modify existing information systems
	–	–	–	Lack of relevant investments
Other comments on non-adoption	–	Menu of four responses given and possibility for others. All responses towards trivial end	Menu of seven responses given + others. Only ranking order, no importance asked	A menu of nine responses given, no others

## Appendix B

Table B1. PCA non-adopters

	Non-adopter A	Non-adopter B	Non-adopter C	Non-adopter D
Industry	Telecom/electronics	Metal (mechanical eng.)	Metal (mechanical eng.)	Forest
Turnover (€)	Over 2 billion	Over 2 billion	Over 2 billion	Over 2 billion
Tangible assets/ turnover	0–10%	10–20%	0–10%	30–40%
Manufacturing type	Assembling	Machining, drilling, assembling	Machining, drilling, assembling	Process
Typical manufacturing investments	Assembly lines within a factory, equipment for assembly lines, seldom whole factories	FMS, CNC, assembly lines, tooling	FMS, CNC, tooling, assembly lines	Small paper and board machines
Major strategic investments	Unique	Unique	Unique	Similarities exist
Any major mfg units abroad	Yes	Yes	Yes	Yes
The most important ways to learn from the past investments	Manufacturing network, Central expertise, Expertise in investing unit	Expertise in investing unit, Suppliers of equipment	Expertise in investing unit	Central expertise, Suppliers of equipment, Consultants Expertise in investing unit
	Non-adopter E	Non-adopter F	Non-adopter G	Non-adopter H
Industry	Diversified	Diversified	Metal (mechanical eng.)	Metal (mechanical eng.)
Turnover (€)	1–2 billion	0.5–1 billion	0.5–1 billion	0.5–1 billion
Tangible assets/ turnover	10–20%	30–40%	20–30%	0–10%
Manufacturing type	Assembling	Process	Machining, drilling, assembling	Machining, drilling, assembling

(Table continued)

Table B1. Continued

	Non-adopter E	Non-adopter F	Non-adopter G	Non-adopter H
Typical manufacturing investments	Assembly lines, packaging equipment, logistical centers	Equipment for chemistry and food processing, packaging equipment	CNC, machining, drilling, tooling, assembling equipment	FMS, CNC, assembly lines, tooling
Major strategic investments	Unique	Unique	Unique	Unique
Any major mfg units abroad	Yes	Yes	Yes	Yes
The most important ways to learn from the past investments	Expertise in investing unit	Expertise in investing unit, Central expertise	Expertise in investing unit, Central expertise	Central expertise
	Non-adopter I	Non-adopter J	Non-adopter K	
Industry	Metal (mechanical eng.) (and diversified)	Food processing	Energy and power supply	
Turnover (€)	0.5–1 billion	0.5–1 billion	0.5–1 billion	
Tangible assets/turnover	20–30% (estimation for metal)	30–40%	Over 100%	
Manufacturing type	Machining, drilling, assembling	Food processing (e.g. cutting, packaging)	Energy and power supply	
Typical manufacturing investments	FMS, CNC, assembly lines, tooling	Equipment for food processing (refrigerators, cutting, packaging)	Power plants and their equipment	
Major strategic investments	Unique	Unique	Similarities exist	
Any major mfg units abroad	Yes	Yes	No	
The most important ways to learn from the past investments	Central expertise, Expertise in investing unit	Central expertise, Suppliers of equipment, Consultants	Central expertise, Expertise in investing unit, Old documents	

## Appendix C

**Table C1.** A theme interview structure**General**

- Description of the person to be interviewed (education, career, main tasks and responsibilities now)
  - How is the person to be interviewed participating in the capital investment process?
  - What kinds of investment proposals and decisions do you make?
  - How often do you propose/reject investments?
  - Do you have a written investment policy and instructions (please, copy if possible)?
  - Who is responsible for instructions?
  - What kinds of investments do you make?
- Capital investment process**
- Describe your investment process.
  - What kinds of investment calculations are prepared?
  - Who makes the calculations?
  - Are bonuses somehow related to the success of capital investments?
  - How are internal auditors involved with your capital investment process?
  - How realistic are investment proposals in your corporation?
- Monitoring** (= control of costs and timetable of investment before the start-up)
- How do you follow cost accumulation and timetable per project?
  - Who does it, when, tools used, forums for presentation of follow-up, dissemination of results, final report?
  - Are there cost overruns?

What happens if costs are exceeded?

**Post-audit of capital investments** (= control or evaluation of the investment after the start-up)

- This issue will be covered mainly by an interview with a separate set of questions.
- Please give an example of your post-audit report
- How do you otherwise control your investments (other methods than formal monitoring and post-audit)?

(Table continued)

Table C1. Continued

<div><div>– How do people motivate their statements about the success of the investment project if post-audits are not conducted?</div><div>– Do you feel that post-audit reports are sometimes manipulated?</div></div> <div>Organizational learning and capital investments</div> <div><div>– Question 44 in a separate set of questions. Please describe more in detail your practices to utilize existing knowledge related to capital investing.</div><div>– What kinds of issues can be learnt in capital investment process? (Please consider all the phases in investment process):<div>Examples of learning experiences?<div>How have learning experiences been utilized/could be utilized in your coming projects?</div><div>How have learning experiences affected your investment process?</div><div>Examples of potential learning cases in your business?</div></div><div>– What is the role of central investment expertise (e.g. engineering unit, investment unit, investment council, technical director, etc.) in your capital investments?</div><div>– How do you ensure that you learn from your investment projects?</div><div>– Are you satisfied with the learning processes related to your capital investment activities?</div></div></div>
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**Table D1.** The main reasons for non-adoption of PCA identified by the non-adopters

The main reasons for non-adoption of PCA	Reason category	A	B	C	D	E	F	G	H	I	J	K	Tot.
Scarcity of investment projects	Basic reason	X		X		X		X					5
Changes in business environment	Difficulty		X		X				X		X		4
Uniqueness of investment projects	Difficulty		X	X	X		X						3
Lack of support from top management	Difficulty			X	X		X				X		3
Difficulties in separating cash flows	Difficulty		X						X				2
Change of responsibility	Difficulty											X	1
Focus on capital utilization instead of PCA	Alternative ways	X											1
(PCA is considered unnecessary)	(General statement)	X		X		X	X	X	X		X	X	8



Appendix E

Table E1. Difficulties restricting PCA usage

Technical	Organizational	Economic
Changes in business environment	Top management does not show enough interest	Costs of doing PCA
Separation of incremental effects	Lack of personnel resources	
Changes in own organization	Reluctance of people	
Estimation of future periods	Risk aversion may increase due to PCA	
Difficulties in choosing correct projects	Other: change of responsibility	
Difficulties in planning material		
Difficulties in choosing correct timing		
Reliability of PCA reports		
Language problems		

## **ARTICLE 2**

# **Managerial uses of post-completion auditing of capital investments**

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JARI HUIKKU

# Managerial uses of post-completion auditing of capital investments

## ABSTRACT

*This study examines the different managerial uses of post-completion auditing (PCA) of capital investments. The empirical data come from the 16 PCA adopters that were identified in face-to-face interviews conducted in all of the 30 largest Finnish manufacturing companies. Although PCAs are reported to be common in large companies, we still have little empirical evidence about the significance of the different managerial uses of PCA. Accordingly, drawing on the concepts of cybernetic control systems, this study assesses the significance of PCA in measuring performance and controlling current investments (assisting correction/abandonment decisions), enhancing the integrity of investment appraisals, and in evaluating personnel. The paper also elaborates and maps the beneficial effects of PCA related to organizational learning. It adds specifically to the extant literature by providing empirical support for maintaining that not only timing-related issues, but also alternate control mechanisms (e.g. quality systems, routine reporting, visits, presentations, and discussions) diminish the relevance of PCA in controlling current investments and enhancing the integrity of investment appraisals. Moreover, the findings provide support for prior studies, which suggest that enhanced organizational learning for future investments is perceived as the major benefit from PCA, whereas PCA's relevance in controlling current investments can be minor.*

**Key words:** Post-completion auditing, capital investments, managerial use, field study

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## 1. INTRODUCTION

Post-completion auditing<sup>1</sup> (PCA) of capital investments can be described as a formal process that checks the outcomes of individual investment projects after the initial investment is completed and the project is operational (Chenhall and Morris, 1993). Hence, PCA can be regarded as one formal control system within a company's total management control system package, which comprises various formal and informal controls (see e.g. Otley, 1999). PCA is reported to be common in large companies.<sup>2</sup> PCA scholars (e.g. Neale, 1991a; Pierce and Tsay, 1992) suggest that the major perceived benefits from PCA are specifically related to its enhancement of organizational learning (OL), which is known to lead to improvements in future capital investment by a company. Additionally, the scholars (ibid.) suggest that PCA can be used to measure the performance of an investment, to provide feedback for controlling current investments, to enhance the integrity of investment appraisals, and to evaluate management. Nevertheless, we still have little empirical evidence about the relevance of PCA for these uses. *The purpose of this study is to assess the significance of different managerial uses of PCA.*

The basic prerequisites for functioning traditional control systems – also called cybernetic control<sup>3</sup> or feedback systems – are the existence of ex ante targets, the ability to measure outcomes against them, and the ability to undertake necessary corrective actions (Flamholz et al., 1985; Otley, 1999). Accordingly, drawing on the concepts of a cybernetic control system, this paper will first examine PCA's appropriateness in measuring the outcomes of an investment project against its ex ante targets. The performance measurement phase constitutes a critical platform facilitating other PCA uses (Huikku, 2007). Second, PCA's relevance for controlling current investments (i.e. assisting correction/abandonment decision-making) will be addressed by investigating its ability to undertake corrective actions. Third and fourth, respectively, PCA's relevance in enhancing the integrity of investment appraisals and in evaluating personnel will be examined. Hence, how the awareness of ex-post performance measurement (here PCA) may affect the behaviour of staff involved in investment processes is studied. Finally, PCA benefits related to organizational learning will be mapped.

In addressing these research topics, this paper adds to the extant PCA literature by providing empirically supported insights about the relevance of suggested uses of PCA. The study also res-

<sup>1</sup> Other synonymous terms used are e.g.: post-audit, post-completion review, post-appraisal (of capital investments). Post-completion audit and post-audit seem to be the two terms that have been the most often presented in the latest studies.

<sup>2</sup> Adoption rates reported in different studies: 1) In the UK, 98% (Arnold and Hatzopoulos, 2000) and 79% (Neale, 1991b); 2) In the USA, 76% (Gordon and Myers, 1991) and 90% (Klammer and Walker, 1984); 3) In Norway, 41% (Neale, 1994); and 4) In Italy, 71% (Azzone and Maccarrone, 2001).

<sup>3</sup> Cybernetic control systems rely on variance information to correct the progress of the process in question (see Luckett and Eggleton, 1991).

ponds to Neale's (1991b) relatively old but still unanswered call to shed light on concrete PCA effects, and to Haka's (2007, 723) call to study why PCA seems to be ineffective. In a similar vein, the paper is also motivated by Northcott and Alkaraan's (2007, 218) recent suggestion to investigate what managers actually learn from PCA. From a practical point of view, an enhanced understanding of PCA's relevance for different uses may help companies in making their PCA systems more effective.

In this study, PCA is defined as follows<sup>4</sup>: PCA is a *formal* review of a completed investment project fulfilling the following criteria: (1) it takes place after an investment has been completed (commissioned) and has begun to generate cash flows (or savings); (2) reporting is at least partly focused on a comparison between the pre-investment estimates of an investment project and the actual figures/achievements after completion; and (3) PCA is systematic and regular, and there are instructions for it. This definition of PCA rules out other capital investment controls such as the monitoring of capital investments<sup>5</sup> and routine reporting.<sup>6</sup>

For the purpose of this study, the 30 largest Finnish manufacturing corporations were interviewed. The face-to-face interviews consisted of two parts: a semi-structured interview and a structured questionnaire (which was filled out in the presence of a researcher). The paper specifically addresses 16 companies that were identified in the interviews as PCA adopters. This is the most extensive study of PCA using face-to-face interviews. The focus of the paper is on tangible capital investments such as factories, production lines, machines and equipment.

The article is organized as follows: after this introductory part and the following literature part, the third section describes the research method. The fourth section presents the empirical results, and the fifth section analyzes and discusses them. Finally, conclusions follow in section 6.

<sup>4</sup> This definition is in line with the definition of PCA suggested by Gadella (1986), Pierce and Tsay (1992), Chenhall and Morris (1993), and CIMA (2005, 60), but is more explicit with regard to criterion (3). Nevertheless, I recognize the difficulty of providing a catch-all definition of PCA including more detailed requirements such as the type of projects selected, the format, who does it, who is responsible for it, when and how frequently it is conducted, and how the results are communicated.

<sup>5</sup> During the implementation phase, it is typical to follow up on the cost budget, scheduling, and technical specifications, to see that they are progressing according to plan. In practice, monitoring of the implementation phase and PCA are overlapping concepts, because monitoring is, to some extent, a prerequisite for PCA. However, monitoring alone cannot be considered as fulfilling the criteria for PCA. In the monitoring phase, it is typically too early to estimate whether an investment project will achieve its targets.

<sup>6</sup> Internal and external routine reporting (monthly, trimestral, annually, etc.) usually do not fulfill all the criteria required for PCA. For example, routine reporting is typically (1) not project-focused, but profit-center or cost-center focused, and (2) does not compare the pre-investment objectives of an investment project with the actual achievements.

## 2. MANAGERIAL USES OF PCA

PCA scholars suggest that PCA can be beneficial in providing feedback both for current and future capital investments (Neale, 1989 and 1994; Pierce and Tsay, 1992). The benefits<sup>7</sup> for current investments are project-control oriented, whereas future benefits are connected to better appraisal and planning of projects, and to improvement of the capital investment system in general (Neale, 1991a; see also Mills and Kennedy, 1993). Additionally, Neale (1991a) suggests that PCA benefits are likely to be associated with the aims specified for it. Next, with the aid of prior empirical literature, PCA's relevance to various managerial uses will be reviewed, and specific research gaps identified.

*Performance measurement* (evaluating the success of a completed investment) is a core function of PCA. In practice, companies do it by comparing and analyzing the ex-post outcomes of an investment project with its ex-ante objectives (Neale and Holmes, 1991). However, PCA's appropriateness in performance measurement has been much neglected in research. Consequently, I will make an attempt here to fill this research gap by specifically investigating whether and how the technical measurement difficulties<sup>8</sup> encountered by companies affect PCA's measurement ability. The prior literature has reviewed PCA difficulties *per se*, but their practical impact on PCA is still ambiguous. According to Neale (1989), changes in the business environment and the presence of qualitative factors are two major difficulties in PCA. In his later research (1994), the Norwegian companies ranked separation of the incremental cash flows of investment projects as the primary difficulty. Similarly, Linder (2005) found in his review of empirical PCA studies that this was the most often mentioned and first-ranked difficulty in conducting PCA.

In some studies, performance measurement has been explicitly mentioned as a distinct PCA benefit (Neale, 1994; see also Pierce and Tsay, 1992)<sup>9</sup>, whereas Neale (1989) and Mills and Kennedy (1993) have not included it in their studies. Consequently, there is still ambiguity about the independent beneficial role of using PCA for performance measurement purposes. Here it will be explicitly elaborated whether performance measurement has managerial relevance *per se* or whether it is only a prerequisite function supporting other uses, as Huikku (2007) suggests.

PCA could potentially be valuable with regard to current underperforming projects by giving early warning information or helping companies to analyze different *correction/abandonment*

<sup>7</sup> Prior literature (e.g. Neale, 1991a, 1994; Pierce and Tsay, 1992; Mills and Kennedy, 1993) uses the term "PCA benefits" broadly in this connection covering simultaneously the uses (functions, roles) of PCA potentially leading to achievement of the benefits. In this paper, I use the word "use (of PCA)" to cover both PCA benefits and uses.

<sup>8</sup> Here the word difficulty is perceived to include other related words such as problem, shortcoming, drawback, disadvantage, and challenge.

<sup>9</sup> In Neale (1994) performance measurement is called "verification of actual profitability of project" and in Pierce and Tsay (1992) "identification of past errors".

alternatives.<sup>10</sup> The beneficial role of PCA in providing feedback for assisting decision-making for corrections is perceived within companies to be of minor, but not negligible importance (Neale, 1989; Pierce and Tsay, 1992). Based on empirical evidence, Neale (1991a) suggests that the earlier the first PCA, the greater the ability of a company to successfully modify an investment project. It is also suggested that benefits regarding modifications might arise primarily from regular monitoring of projects before commissioning rather than from PCA (Neale and Buckley, 1992). Nevertheless, we are still hesitant about whether PCA is relevant in assisting corrections of already commissioned projects at all (as an early warning system or an analysis tool), and whether the respondents in the prior surveys eventually had benefits from monitoring of the implementation phase in mind. This paper addresses these research gaps by specifically focusing on timing-related issues.

Howe and McCabe (1983) (see also Gaumnitz and Emery, 1980) suggest that a company should abandon a commissioned investment if the abandonment value exceeds the NPV for the remaining life-time of the investment. Furthermore, Statman and Caldwell (1987) maintain that formal investment control could diminish the potential of managers to hide unsuccessful investments and delay decisions to abandon.<sup>11</sup> Accordingly, Smith (1993) found a positive association between abandonment decisions and firm performance in companies with a PCA system; i.e. the existence of a PCA system in a company increases the probability of timely abandonment decisions and of avoiding unjustified ones. Nevertheless, Corr (1983) and Neale (1991a) cite the relative insignificance of PCA in assisting abandonment decisions. One reason for the low importance may be that the main focus in cases of an underperforming investment is on improving its performance, and not on terminating it (Neale, 1989). To sum, we are unsure about the role of PCA in assisting abandonment decisions because of the contradictory suggestions in the extant literature. Hence, I will examine here whether and how PCA is coupled with investment project abandonments.

Investment project appraisals can include intentional biases upwards (or less often downwards), because managers may exaggerate project cash flows in order to gain approval for their proposals (see e.g. Pruitt and Gitman, 1987; Pohlman et al., 1988). Pierce and Tsay (1992) suggest that companies consider PCA beneficial in *enhancing the integrity of investment project appraisals*.<sup>12</sup> Similarly, Lumijärvi (1990) argues that PCA is the only factor diminishing game

<sup>10</sup> See e.g. Busby and Pitts (1997), Smit and Trigeorgis (2004, 108) and Shapiro (2005, 105) about the various alternatives that companies have to deal with underperforming investment projects.

<sup>11</sup> In practice, e.g. psychological reasons, such as difficulties in confessing one's own failure decisions, may prevent or delay management's desire to abandon investments (Northcraft and Wolf, 1984). Kanodia et al. (1989) suggest that a manager's value in the labor market may weaken if he has to abandon an investment that he has advocated.

<sup>12</sup> Similarly, Neale (1989, 1991a) and Mills and Kennedy (1990, 1993) suggest that PCA encourages greater realism in project appraisals. Both researchers use the words "realistic" and/or "realism" in this connection.



playing<sup>13</sup> behavior in capital investment processes. In addition to intentional biases related to game playing, the project appraisals may include unintentional biases by managers who believe that they are acting in the best interest of shareholders (Roll, 1986). Managers may be overconfident and/or overoptimistic in connection with investment decisions and overestimate the returns of their investment projects.<sup>14</sup> Here it will be investigated whether and in what kinds of circumstances do the companies studied perceive that PCA enhances the integrity of their investment project appraisals.

*Personnel evaluation* elements are typically an integral part of a cybernetic control system (Flamholz et al., 1985). Accordingly, facilitating evaluation/rewarding the personnel involved in the capital investment process has been suggested as one of the purposes for conducting PCA (Neale, 1989; 1994). However, we know little about the couplings between PCA and personnel evaluation. According to the scholars, few companies use PCA in formal evaluation of managers (Smith, 1994) or consider it beneficial in evaluation (Neale, 1994). It is plausible that timing problems may discourage companies from integrating PCA into their evaluation systems, e.g. into reward systems. One problem in trying to connect PCA and personnel evaluations can be the long time interval between the investment appraisal and PCA. This may mean that the people involved in the appraisal phase are already in other positions. Another difficulty may be that evaluation systems are often related to the financial year, whereas this frequency is not necessarily optimal for PCA purposes. The existing literature has neglected to study empirically whether the above tentatively suggested reasons or other reasons explain why the benefits related to personnel evaluation/rewarding have been perceived as marginal. As a consequence, this paper will address these questions.

The major perceived benefits from PCA within companies are related to its enhancement of *organizational learning*, which is known to lead to improvement in future capital investment (Neale, 1991a and 1994; Pierce and Tsay, 1992). OL involves the sharing of knowledge, beliefs, or assumptions among individuals, and it is influenced by a broader set of social, political, or structural elements; it is not merely a sum of individual learning within an organization (Marquardt and Reynolds, 1994). In an organizational learning process the organization responds to changes in its environment by detecting and correcting them in order to maintain its central features (Argyris, 1990). Furthermore, Argyris (1977, 1990) distinguishes between two types of

**13** Because of asymmetric information distribution, managers may be in a position to play games in the capital investing process. They may use their information advantage to enhance their self-interest objectives for example by focusing on certain aspects of information, filtering information, or manipulating information.

**14** Following the notions of Roll's (1986) Hubris hypothesis, Malmendier and Tate (2005) define overconfidence as overestimation of one's (a manager's) own abilities and outcomes relating to one's own personal situation, and over-optimism as a general overestimation of future life events (see also Heaton, 2002; Baker et al., 2007). Furthermore, Aktas et al. (2007) suggest that the learning process can allow managers to progressively correct overconfidence and over-optimism.

organizational learning: single-loop and double-loop learning (cf. Senge, 1990). Single-loop learning focuses on problem solving and does not address the reasons for the problems arising in the first place. This is characteristic of cybernetic control systems (Preble, 1992). In double-loop learning, organizations not only detect and correct errors, but also question underlying assumptions.

Management control systems can have a major facilitating or hindering role in organizational learning processes (Kloot, 1997; Carmona and Grönlund, 1998). According to scholars, information obtained from PCA can aid a company in identifying successful processes that can be repeated in the future capital investment projects, and help in avoiding previous mistakes (e.g. Neale, 1989, Mills and Kennedy, 1993). In a similar vein, Chenhall and Morris (1993) maintain that PCA can enhance managerial learning at the project definition stage of the capital investment process. Mills and Kennedy (1993) also suggest that PCA can be conducive to learning for capital investment processes in general – not merely for project-specific investment activities. The PCA feedback may, for example, trigger improvements in investment procedures and instructions.

According to Huikku (2007), PCA is not the only method companies use to manage their capital investment knowledge and enhance OL; companies typically use other approaches such as central expertise and experienced internal resources. He further contends that particularly the management of larger companies having major strategic, complex and repetitive capital investments perceive that PCA offers superior performance compared with “non-PCA” ways, and regard PCA as an appropriate complement to them. Nevertheless, the practical OL benefits of PCA are still ambiguous and consequently this paper maps them and additionally discusses the extent to which they are related to the single/double-loop type of learning.

Besides the above presented uses of PCA, Neale (1989) has studied whether companies use PCA for reducing management autonomy at local level. The findings indicate, however, that the companies studied consider this kind of use trivial. In addition, Neale (1991a) has examined whether companies perceive PCA to be beneficial in improving corporate performance, but in my paper this is ruled out as an ultimate, catch-all use. Consequently, in the empirical part I will study the perceived significance of the following managerial uses of PCA: 1) performance measurement, 2) assisting corrections/abandonment of current investment projects, 3) enhancing the integrity of project appraisals, 4) evaluation of personnel, and 5) enhancing organizational learning for projects and investment process development.

### 3. RESEARCH METHOD

The empirical evidence was gathered from all of the 30 largest Finnish manufacturing corporations. The companies were ranked according to turnover (Talouselämä 24.5.2002). This paper

addresses the 16 (out of 30)<sup>15</sup> companies which were identified as PCA adopters according to the definition of PCA used for the paper. Additionally, four companies conduct PCA only on an ad hoc basis (lack of regularity, systematic ways, and instructions) and 10 companies do not formally compare pre-investment estimates of investment projects with actual figures after the projects have been completed and have started to generate cash flows. The 16 PCA adopters represent seven sectors of the manufacturing industry (see Table 1). In 2001, the turnover of the largest company was €13.5 billion, the largest absolute amount of tangible assets was €12.3 billion, and the largest gross investments amounted to €3.9 billion.

**TABLE 1. Descriptive statistics of PCA adopters (n = 16)**

In € million	Mean	Std. Dev.	Median	Min	Max
Net Sales	4199	3968	2418	585	13509
Tangible assets	2839	3869	1045	169	12335
Gross investments	609	938	242	33	3850
<b>Industry statistics:</b>					
Industry	Nr				
Paper	4				
Metal	4				
Food processing	3				
Chemical/Plastics	2				
Building material	1				
Energy	1				
Others	1				
<b>Total</b>	<b>16</b>				

My original intention was to conduct a postal survey on a larger sample of companies, but during the early pilot phase it became clear that the respondents' potential for understanding the questions incorrectly would have jeopardized the reliability and validity of the findings. A major concern was the inability of the respondents to make clear distinctions between concepts such as pre-audit, monitoring, and PCA. It appeared that face-to-face interviews would be more appropriate to clarify such issues as they arose. Yet because the aim of the study was to obtain a wide and comprehensive picture of the research topic, a case analysis examining a few companies

<sup>15</sup> In two conglomerates consisting of largely independent businesses, different policies for PCA were found. In both companies the larger divisions were PCA adopters and they were chosen to represent the whole company.

would not be sufficient. Consequently, a cross-sectional field study conducted at non-randomly selected field sites was chosen as a method, as it lay somewhere between an in-depth case study and a broad-based survey (Lillis and Mundy, 2005). Lillis and Mundy suggest that field studies can be particularly appropriate when there is doubt about the precise specification and measurement of variables, their empirical interpretation, or relationships among them. This is the case regarding specification of various PCA uses and their relevance.

The empirical evidence based on the face-to-face interviews consisted of two parts: a semi-structured interview and a structured questionnaire (which was completed in the presence of a researcher). The aim of the semi-structured interviews was to gain a general understanding of the company to be interviewed and especially the capital investment projects, policies and procedures of the company in question. The main structure of the interview was as follows: general; capital investment process; monitoring; and PCA, including informal control and OL with regard to investments. The nine-page questionnaire comprised 44 factual and attitudinal questions about PCA, covering instructions, structural properties (i.e. the type of projects selected, the format, who does it, who is responsible for it, when and how frequently it is conducted), aims, uses/benefits, difficulties, communication, and ideas for future development of PCA in a company. Likert-5 scaling was used in the attitudinal questions. The questionnaire was developed with the aid of prior normative and empirical studies, and the researcher's own experience in PCA.<sup>16</sup> In the early phase of the interviewing process three academics and two outside experts with a great deal of capital investment experience were asked to comment on the questionnaire. The early interviewees in particular were also encouraged to comment on it. The comments gained herewith helped to formulate some questions more effectively and thus to avoid misinterpretations. During the interviews the interviewees were also asked to present examples of their PCA reports.

Specifically pertinent for this paper, the interviewees were asked to discuss and rate the perceived significance of the following seven suggested PCA uses (Likert-5 scaling)<sup>17</sup>: (1) performance measurement, (2) assistance in decision-making for corrections, (3) assistance in decision-making for abandonment, (4) evaluation of personnel involved in the capital investment project, (5) enhancing the realism/integrity of investment appraisals, (6) OL for projects, and (7) OL for process development. In a similar vein, the companies studied were asked to discuss the significance of 14 suggested potential PCA difficulties, and to rate their significance. The difficulties were compiled from prior studies (Neale, 1989; Pierce and Tsay, 1992; Mills and Kennedy, 1993; Huikku, 2001). In this paper I will specifically focus on investigating whether technical difficulties

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<sup>16</sup> The researcher had previously worked 13 years in one of the companies studied at both the divisional and profit center level, holding various controlling and general management positions.

<sup>17</sup> 1 is insignificant use, 5 is very significant use. Additionally, in the text I use the following terms to indicate other ratings: slightly significant (2), moderately significant (3), and significant (4).

such as separation of incremental cash flows, changes in business environment, and estimation of future cash flows challenge PCA's performance measurement ability. Additionally, the interviewees were asked the following questions related to PCA uses: (1) has PCA in practice assisted an investment project correction or abandonment decision, and (2) what are the concrete PCA benefits in your companies (examples asked)?

Altogether 49 interviews were conducted between December 2002 and January 2004, 25 with the 16 PCA adopters. Typical interviewees were CFOs/controllers and persons in charge of technology, investments, production or business development in corporate management or major divisions. The idea was to identify through press releases, newspapers, phone calls, hints from colleagues in other companies, and seminars the most knowledgeable person with regard to capital investment control in each of these corporations as the main interviewee. In some cases other relevant persons involved in capital investing were also included. These were typically cases where responsibility for capital investment coordination was partly the joint responsibility of the CFO and a person representing technology or production. All of the contacted persons agreed to be interviewed. The duration of one interview was on average about 2 hours, and all interviews except one were tape-recorded. In some cases, the interviewees were contacted afterwards by email or phone in order to check on some interpretations of their answers or to obtain further comments on details.

Prior studies dealing with beneficial effects of PCA uses have mainly been conducted by using postal survey methods relying on statistical methods. However, the intention of this study is to explore and shed more light on the reasons why various uses of PCA are perceived as (in)significant within the companies, rather than to find statistical support regarding, for example, whether beneficial effects are associated with the aims or design of PCA system. Even though the face-to-face approach adopted in this research had the disadvantage of restricting the number of companies studied and consequently generalization of the results, it significantly increased the reliability and validity of the study. This approach made it easier to explain the definitions in detail, to pose further questions, to return to the earlier answers, and to go through real examples of PCA reports. This study is the most extensive PCA study using face-to-face interviews. Another PCA study, which used face-to-face interviews in combination with a formal questionnaire, is Kennedy and Mill's (1993) study of 16 UK companies.

## 4. RESULTS

In this section the significance of different PCA uses will be empirically investigated. First, PCA's appropriateness in performance measurement is examined by drawing on the two prerequisites of cybernetic control systems, namely existence of *ex ante* targets and ability to measure the

outcomes. PCA's performance measurement ability will be specifically addressed by studying whether and how technical difficulties affect it. Second, drawing on the third prerequisite of cybernetic control systems (ability to make corrections) PCA's relevance in assisting correction/abandonment decision-making for current investments will be examined. Other elements closely related to cybernetic controls such as integrity of the investment appraisals and evaluation of personnel will be addressed next. Finally, the benefits related to organizational learning will be mapped.

The interviewees were asked to discuss how they perceive the significance of different PCA uses, and additionally to rate them by using Likert-5 scale. As can be seen in Table 2, performance measurement, enhancing realism/integrity of investment appraisals and enhancing OL for projects/processes were the highest rated uses (ratings per company can be seen in Appendix A). Only one company perceives PCA as significant in evaluating personnel. In a similar vein, using PCA to modify current investments has received low ratings. Furthermore, all the companies perceive PCA's role in abandonment decisions totally insignificant.

**TABLE 2. Perceived significance of PCA uses (n = 16)**

	1	2	3	4	5	N	Mean	Std dev.	Median	Min	Max
Performance measurement	1	1	2	7	5	16	3.9	1.15	4.0	1	5
Enhancing realism/integrity of investment appraisals	0	3	4	7	2	16	3.5	0.97	4.0	2	5
Organizational learning for future capital investments	2	2	4	6	2	16	3.3	1.24	3.5	1	5
Org. learning for capital invest. process development	4	3	5	3	1	16	2.6	1.26	3.0	1	5
Evaluation of personnel involved in investment project	6	5	4	1	0	16	2.0	0.97	2.0	1	4
Assistance in decision-making for corrections	7	5	4	0	0	16	1.8	0.83	2.0	1	3
Assistance in decision-making for abandonment	16	0	0	0	0	16	1.0	0.00	1.0	1	1

Frequencies of responses on a Likert scale are presented in columns 1 to 5

1 = insignificant, 2 = slightly significant, 3 = moderately significant, 4 = significant, 5 = very significant

### PCA's appropriateness in performance measurement

The first prerequisite for a cybernetic control system is the existence of ex ante targets. This requirement is fulfilled in the companies studied because all of them have documented their investment appraisals, and this material includes monetary and often also non-monetary targets. All the 16 companies use investment calculation techniques such as IRR, NPV, or discounted payback, and 10 companies state that they use all three techniques frequently. ROI, EVA, and ROCE were mentioned as auxiliary methods.

The second prerequisite is the ability of the control system to measure the outcomes. Here this is approached by examining whether and how the technical PCA difficulties encountered challenge PCA's functioning as a performance measurement device. According to the empirical data, the major technical difficulties encountered were separation of incremental cash flows, changes in business environment, and estimation of future cash flows. Although in 6 companies at least one of the three difficulties is perceived as significant, none of the difficulties is significant at the aggregate level.<sup>18</sup>

The separation of cash flows is perceived to be the primary difficulty in PCA. As the senior vice president of corporate strategy, investments, and business planning (company 2 in Appendix A) explained:

*Many times it is a challenge to separate incremental cash flows. For example, if we expand one part within a pulp factory. The question is how to separate it.*

However, usage of sophisticated cost accounting systems, such as ABC, seems to help companies in separating incremental cash flows. Furthermore, it was often pointed out that with regard to capital investments forming an integrated entity, the companies do not try to separate their cash flows but regard them as a package. The separation problem actually arises already ex ante. Hence, in the planning phase, a company can consider selecting objectives for an investment that are as measurable as possible.

Changes in business environment, such as an unexpected collapse of the market, may be considered problematic from the PCA point of view as explained by one CFO (company 16):

*We invested in manufacturing pipes and pipelines for cable networks. The market collapsed and consequently we started to market these products for totally different purposes. It was not easy to make a profitability calculation afterwards.*

Nevertheless, it appears that changes in business environment do not necessarily technically hamper the conduct of PCA, although they may diminish the value of PCA feedback for correcting the negative variances.

Estimation of future cash flows is among the major PCA difficulties encountered in the companies. In practice, only when the payback time of an investment is short and PCA can be conducted at the end of the life-cycle, is it possible to base the performance measurement of an investment on actual figures alone. There were two main approaches regarding how to deal with

18 Average ratings and number of companies out of the 16 that perceived the difficulties as significant or very significant: (1) Separation of incremental cash flows, 2.8 (4 companies), (2) Changes in business environment, 2.6 (4 companies), and (3) Estimation of future cash flows, 2.5 (3 companies). Likert-5 scaling: 1 = insignificant difficulty, 5 = very significant difficulty. The above mentioned difficulties were also the top three among all the 14 difficulties (technical, organizational, and economic) examined.

future cash flows in ex post calculations. Nine companies reconstruct their investment calculations, i.e. they update the original calculations with regard to future estimates according to their best knowledge as one director of technical development (company 3) commented:

*Yes, we update our investment calculations in connection with PCA. The actual is actual, but we also have to make new estimations regarding the coming cash flows. This is challenging, and that is why we try to make it a team effort.*

Other part of the companies do not make estimates about future cash flows, but merely focus on comparing actual and ex ante figures for key components, e.g. volume, price and profitability. The manager of corporate investment coordination (company 5) motivated their choice as follows:

*We do not want to give managers the possibility to focus the discussion on unsure future cash flows; we want to stick to cold actual facts.*

It appears that companies can diminish the technical drawbacks e.g. by using sophisticated cost accounting systems, considering investments as a larger package, and focusing only on actual figures. Consequently, companies do not perceive the technical difficulties to greatly challenge PCA's ability to technically measure the investment project outcomes. The senior vice president of corporate strategy, investments, and business planning (company 2) commented accordingly:

*Sure, some difficulties can be somewhat challenging, but they do not affect the conduct of our PCA at all.*

12 companies studied rate that using PCA for *performance measurement* is significant or very significant. Nevertheless, further discussions revealed that the companies do not perceive performance measurement to be beneficial as such, but a prerequisite function supporting other PCA uses as the vice president of finance and administration (company 14) commented:

*Performance measurement facilitates achievement of other PCA benefits. That's why it is important.*

The manager of a process development group (company 12) added the following about PCA's performance measurement function:

*Performance measurement is not beneficial as such. It is history. If I make a long report on a capital expenditure and just state that this is it. There's no benefit. However, if it [performance measurement] leads to some actions, then it is beneficial, indeed.*



To sum up, it seems that technical difficulties do not dramatically challenge PCA's appropriateness in measuring investment project performance. Additionally, empirical evidence was found to maintain that measuring performance is not considered managerially relevant (or a distinct PCA benefit) *per se*, but a prerequisite function supporting other PCA uses.

### **PCA in assisting correction/abandonment decisions**

The third prerequisite for a cybernetic system is its ability to undertake corrective actions. Here PCA's relevance in assisting detection of underperforming investment projects and analyzing the appropriate actions required (correction/abandonment) will be addressed. Based on the findings, none of the companies studied perceives PCA to be significant in assisting decision-making for corrections and few recalls a project modification where PCA had a role. The main reason for the diminishing ability of PCA to assist corrective actions seems to be its inherently late timing (i.e. PCA is conducted after completion/commissioning of the investment). The interviewees had the following to say about late timing:

*It is too late to do anything. Your pants are already wet* (CFO, company 16).

Additionally, already commissioned projects seldom were abandoned in the companies. It occurred that the first alternative used by the companies with underperforming projects is to correct their progress, not to terminate them. With regard to PCA and terminations, all the companies studied perceive PCA's role in assisting decision-making with regard to abandonment as insignificant; none could remember any investment project termination where PCA had played a role.

The choice of timing for conducting PCA is evidently essential especially if a company conducts only one PCA per investment and aims to support decision-making for current investments. Among the companies studied, 12 out of 16 normally conduct only one PCA per project, whereas four companies carry out multiple PCAs. All the multiple PCA conductors and six of the others conduct the first review within one year of commissioning. However, they do not justify early PCA with a desire to obtain feedback for current investments. Instead, some companies advocate early PCA because of its potential to provide timely feedback for other similar investments under simultaneous consideration.

It appeared that PCA seldom revealed negative variances that had not been previously detected. Instead, it was found that quality systems, routine reporting, and informal ways (visits, presentations, discussions) provide information that triggers corrective actions. In one company (2), the senior vice president of corporate strategy, investments, and business planning explained:

*Such indications for modifications come earlier [before PCA]. In PCA one can of course*

*actively discuss how to change the progress of a project, but the organization is already aware of the situation and there are plans for what to do.*

A manager of process development (company 12) stated in line with this:

*We pursue a continuous improvement policy in our factory. In practice this means that as soon as somebody has noticed something needs to be improved and developed, the issue is brought to the table. And the issue will be handled immediately. There would be no sense in waiting for formal meetings and [monitoring or PCA] reports to make these corrections.*

As in the case of assistance for correcting decisions, the triggers for abandonment analysis seem to come from other sources (i.e. routine reporting, and informal ways) as an executive vice president of corporate strategy and business development (company 10) stated:

*We have abandoned some completed capital expenditures for business reasons; the market situation has changed dramatically. However, the information has come from other sources, not from PCA.*

Furthermore, it appears that the companies apply various ad hoc types of analysis to investigate whether to modify or abandon investment projects. In other words, when the companies notice an underperforming project, a separate “just-on-time” investigation can be conducted beyond regular PCA. In addition to timing issues, the ad hoc analysis may differ from PCA reports in terms of the format and communication aspects.

Nevertheless, in spite of timing-related challenges and existing alternative ways to aid detection/analysis of underperforming projects, four companies consider PCA to be moderately relevant in assisting decision-making for modifications. Typically, these companies conduct PCA relatively soon after commissioning (within one year). Particularly, in mega-investments such as paper machines where commissioning is followed by a long period (e.g. up to two years) of unstable and not yet optimal production performance, PCA may provide feedback for corrections. As one director of technical development (company 3) commented:

*I always talk about developing the machinery or production line [not correcting it] because it sounds more positive. Yes, it happens. Thanks to PCA feedback we have sometimes, for instance, noticed bottlenecks in production and eliminated them.*

The vice president of operations and sourcing (company 4) added the following about the special features of paper machine investments:

*In this kind of an investment a period of two years after start-up is an intermediate learning phase. During that time we make several PCAs and they may lead to modifications.*

PCA may also trigger further investments as the managing director of an engineering unit in one company (15) said:

*Sometimes we have noticed in PCA that the investment has not achieved its production targets. This has triggered further investments to correct the situation. Nevertheless, 80% of the underperforming projects involve something else, like markets, prices, and operating costs.*

In addition to trigger technical modifications, PCA may be relevant in providing feedback to assist in strategic overhauls of the project:

*We may do a strategic overhaul on our paper machinery triggered by a PCA report. We call it asset restructuring (vice president of operations and sourcing, company 4).*

To summarize, it appears that the inherent lateness of PCA is perceived within the companies as a major obstacle for using it in assisting corrective actions. Additionally, the possibilities of companies to detect and analyze underperforming projects by using alternative means seem to diminish PCA's relevance in assisting corrections/abandonments. Nevertheless, it seems that especially companies having major capital investments with a long running-in phase after commissioning may find PCA moderately significant in assisting corrective actions.

### **PCA in enhancing the integrity of investment appraisals**

Five companies perceived using PCA for enhancing the integrity of investment appraisals moderately significant.<sup>19</sup> Specifically, these companies emphasize that awareness of coming ex post performance measurement can reduce intentional over-optimism in investment appraisals:

*We think that the integrity of project appraisals has been enhanced. In the planning phase you have to keep in mind that your promises will be reviewed afterwards (operations controller, company 8).*

*Awareness that you will be measured enhances realism in plans and diminishes over-optimism (senior vice president of corporate strategy, investments, and business planning, company 2).*

The rest of the companies studied, however, do not perceive intentional exaggeration of project cash flows or other game-playing to be problematic, and consequently they do not consider using

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<sup>19</sup> Although nine of the companies rate that PCA is significant in enhancing realism/integrity of the investment appraisals (Table 2), it was revealed in the further discussions that they refer *per se* to aspects related to enhancing organizational learning, not to enhancing integrity of appraisals. The correlation analysis between the PCA uses supports this finding: there is a statistically significant positive correlation between enhancing OL and enhancing realism/integrity of the investment appraisals (see Appendix B).

PCA relevant for these purposes. Additionally, the existing alternate ways to evaluate the success of an investment appear to diminish the relevance of PCA in this sense. In other words, the managers may gain an impression of the achievement of the objectives by using alternate methods such as routine reporting. Furthermore, the major investment appraisals go before approval through many presentation forums where the main cash flow components are discussed and the over-optimistic estimations are questioned.

To conclude, the perceived status of the integrity of investment appraisals seems to affect whether companies consider PCA relevant; i.e. if the status is good, PCA is not considered relevant. Additionally, the existing alternate methods to evaluate the success of an investment and pre-approval reviews seem to diminish the relevance of PCA in enhancing the integrity of investment appraisals.

### **PCA in evaluating personnel**

11 companies perceive PCA's role in evaluating personnel involved in the capital investment projects insignificant or slightly significant, four moderately significant, and one company significant. Only in one company is PCA and the formal incentive system occasionally connected. On the contrary, the achievement of implementation phase targets of an investment (planned schedule, cost budget, technical specifications) is often included in the companies' bonus schemas. The empirical evidence supports that appropriateness of PCA in formal staff evaluation is reduced by timing-related issues such as a long interval between an investment appraisal and PCA, and the custom of companies to tie their bonus targets with the financial year. As the CFO (company 16) said:

*To have PCA results as a base for bonuses...That would make the perspective too long. We have annual bonus systems.*

In a similar vein, the manager of a process development group (company 12) emphasized:

*We have to settle the bonuses for the past financial year [calendar year] in the following January. However, we conduct PCAs continuously during the year. The timing simply does not fit.*

Additionally, it appears that the already existing bonus measures discourage companies from launching additional measures such as those related to success of a completed investment. A senior vice president, investments (company 1) commented:

*I proposed that we should have emphasized the role of investment project directors with new bonus triggers [related to PCA], but it was complicated. We would have had too many overlapping bonus targets for the same people.*

Five companies perceiving PCA's role at least moderately significant in personnel evaluation refer to aspects related to informal evaluation:

*It is not our aim to evaluate [staff], although they are in practice evaluated to some extent informally. We do not want to put that aim on paper. It would be interpreted negatively (executive vice president of corporate strategy and business development, company 10).*

Hence, it also seems that in order to avoid reluctance to conduct PCA, companies do not want to state officially that in practice PCA is used informally to evaluate staff expertise. The informal evaluation can have some direct and indirect impacts on selection of project personnel and attitudes towards managers proposing investment plans:

*PCA can send a message to the superiors. We have made organizational changes, changed personnel if the calculations are not OK. However, PCA is not directly used for evaluating people, but indirectly it is behind the evaluations (vice president of finance and administration, company 14).*

*PCA provides evidence about who can make appropriate plans and who can implement them (manager, investment coordination, company 5).*

*It is not a formal evaluation process. However, the outcomes of earlier [investment] projects affect the credibility of managers (CFO, company 16).*

To sum up, the companies may perceive PCA to some extent relevant in providing (informal) information about the expertise of staff in planning and managing investments. However, timing-related aspects seem to diminish the potentiality for using PCA in formal personnel evaluation and rewarding. Existing bonus measures and avoiding staff reluctance to conduct PCA also discourage companies from integrating PCA and incentive systems.

### **PCA in enhancing organizational learning**

Almost all the companies studied<sup>20</sup> perceive PCA to be at least moderately significant in enhancing organizational learning. Relevance of PCA's role in OL is also clearly supported by the numerous comments of the managers advocating PCA's concrete impacts. Additionally, the comments also reveal that companies often seem to consider performance measurement and enhancing realism of investment appraisals *per se* conducive to OL, making the clear distinction between the different uses ambiguous. The major OL impacts are related to obtaining valuable feedback

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**20** 12 companies have rated PCA's role in enhancing OL for projects at least moderately significant. In addition, two (out of four) other companies perceive that learning can aid them in enhancing realism of their investment appraisals.

for the planning and implementation phases of the future capital investments as stated by a CFO (company 6):

*I would say that the value added from PCA comes from transferring learning for future investments. Just to measure what happened does not give you anything. But when we learn and transfer the knowledge. That is the point.*

The following quotes illustrate what kinds of specific benefits the companies have derived from PCA. The enhanced accuracy of key components in investment calculations was typically mentioned as a major benefit:

*To enhance realism via organizational learning, yes. When we have more similar cases, bad or good, we are in a better position to use our experience for making more accurate investment proposals (vice president of production, company 12).*

*Managers have a better understanding about the potential payback of the projects (senior vice president, investments, company 1).*

*By obtaining concrete evidence about achievability of our targets, the realism of the future calculations is increased (vice president of operations and sourcing, company 4).*

The managers refer frequently to PCA's usefulness in providing valuable feedback on managing implementation and start-up:

*PCA aids our resource planning. We can better estimate how much resources [money, human resources and time] are required to reach the targets (vice president of operations and sourcing, company 4).*

*We can transfer experiences about technical operations and suppliers to the next projects (senior vice president, investments, company 1).*

*This kind of feedback helps us to run the [coming] projects more effectively (director of technical development, company 3).*

Additionally, the benefits for start-up/early operational phase were emphasized:

*Learning concerning the start-up period is important. We have to be able to minimize "the bad quality period". I think that this kind of learning comes with the aid of PCA (vice president of production, company 12).*

*In paper machinery investments the quality classification of paper changes at the outset of operational months. PCA information helps us to plan and market our product portfolio accordingly (factory controller, company 4).*

Anticipation of PCA also seems to affect the behaviour of staff by directing their attention to proper documentation of planning and implementation material as the operations controller (company 8) said:

*Awareness of potential PCA also improves documentation, and not only the accuracy of calculations.*

On the same topic, senior vice president of corporate strategy, investments, and business planning (company 2) added:

*Improved documentation enables a proper ex post performance measurement and facilitates learning for coming projects.*

Furthermore, six companies refer to the concrete benefits of PCA in developing the investment process. As the group manager of manufacturing (company 8) commented:

*This year we have improved our [investment] processes based on feedback obtained in PCA. We have changed forms, documentation, and processes. I think that this kind of benefits will more or less disappear when the process finds its optimal form.*

It seems likely that PCA can be relevant for process development mainly during the first rounds after its adoption. Thereafter, its role will probably decline. The importance of process development is also decreased by the long intervals between capital investment process modifications as the senior vice president, investments (company 1) said:

*We have not dramatically modified our capital investment processes during the last five years. Consequently, PCA's role in process development has been minor.*

To sum up, the companies clearly perceive PCA's role relevant for double-loop learning. PCA appears to help them in addressing the reasons for the problems arising in the first place. Accordingly, PCA aids in revising the assumptions and goals for future capital investments. Specifically, feedback for enhancing the accuracy of key components is emphasized. Hence, the empirical evidence supports that double-loop learning benefits related to future capital investments are the major advantages of PCA, whereas PCA can be marginally beneficial in assisting problem detecting/solving (single-loop learning) for current investments.

## 5. DISCUSSION

### **PCA as a cybernetic control device**

Drawing on the concepts of cybernetic control systems (see e.g. Merchant and Otley, 2007), this paper first examined PCA's appropriateness in measuring the ex post performance of an investment

project and its ability to assist correction/abandonment decision-making. In assessing PCA's performance measurement function, technical difficulties encountered in PCA were addressed as potential reasons for inappropriateness. Based on the evidence, however, it seems that companies do not perceive that technical difficulties jeopardize PCA's measurement ability to a great extent. This argument is also supported by a number of comments from managers according to which the difficulties have no effect on PCA usage. For example, the companies seem to be able to reduce the difficulties related to separation of incremental cash flows by using sophisticated cost accounting systems and by regarding integrated investments as an investment bundle, i.e. a package of investments (see also Miller and O'Leary, 1997). Additionally, it appears that performance measurement is not perceived to be beneficial *per se*, as the companies state in Pierce and Tsay's (1992) and Neale's (1994) studies, but it is instead a prerequisite function supporting other PCA uses.

Next, the ability of PCA to assist correction/abandonment decision-making for current investments was investigated. The prior survey-based studies (Neale, 1989; Pierce and Tsay, 1992) report that at aggregate level, PCA's beneficial role in providing feedback for assisting decision-making for corrections is perceived within companies to be of minor importance. Providing support for these findings it was found that only a few companies consider using PCA for these purposes moderately significant. Nevertheless, it was identified that especially companies having major capital investments with a long running-in phase after commissioning may find PCA data beneficial for assisting project modifications and even for strategic overhauls. It remains open for discussion, however, whether the running-in phase control should, in fact, be regarded as monitoring of implementation phase, and not pure PCA. Furthermore, in congruence with Corr (1983) and Neale (1991a), who suggest the limited importance of PCA in assisting abandonment decisions, my findings indicate that PCA can be perceived as totally insignificant in this context. The findings here may imply that the different suggestions of previous studies about the relevance of PCA in assisting abandonment decision-making (Smith, 1993) may be partly explained by a still unestablished definition of PCA or by the companies' perception of this definition. It appeared that late or inappropriate timing and the alternate control mechanisms of companies seem to diminish the importance of PCA in assisting companies with correction/abandonment decision-making.

According to Flamholz et al. (1985) (see also Simons, 1995, 70) formal personnel evaluation/rewarding is a fundamental element for a properly functioning cybernetic control system. However, consistent with the findings of prior studies (Smith, 1994; Neale, 1994), coupling of PCA with the formal evaluation/rewarding of personnel involved in the capital investment process seems to be rare. Specifically timing-related reasons, such as a mismatch of PCA results with bonus targets based on financial years and a long interval between an investment appraisal and PCA, seem to diminish PCA's linkages to it. As a consequence, these timing reasons reduce PCA's



effectiveness as a (cybernetic) control system for current investments (see Otley, 1999). Instead, with regard to planning of future investments, PCA may have a role in providing informal information about the expertise of staff.

Responding to the calls of Neale (1991b), Haka (2007, 723), and Northcott and Alkaraan (2007, 218) the impacts of PCA were addressed. Supporting the prior empirical literature (e.g. Neale, 1991a), this study allows to contend that the major perceived PCA benefits are related to organizational learning. Specifically, it appears that PCA can enhance double-loop learning (Argyris, 1977) by providing feedback for improving the accuracy of underlying assumptions and goals in the future planning material. On the contrary, PCA's appropriateness in enhancing single-loop learning seems to be questionable due to timing-related issues. In other words, PCA does not necessarily provide timely feedback that would facilitate corrective actions for current projects in a cybernetic control sense (Preble, 1992).

### **Alternate capital investment controls affecting the relevance of formal PCA**

Huikka (2007) suggests that companies use various alternate control mechanisms in order to evaluate the success of an investment (performance measurement) and to achieve benefits related to OL, and that this diminishes the exclusive role of formal PCA. Contributing to this literature, it appeared here that companies use alternate mechanisms such as routine reporting and informal ways (visits, presentation, and discussions) also in detecting underperforming projects and analysing correction/abandonment options. In other words, they may obtain information about current underperforming investment projects from "non-PCA" sources and use timely ad hoc analyses to investigate the relevant actions required. The companies do not consider these analyses part of their regular (formal) PCA system due to different timing, format and communication aspects. Also, alternate mechanisms for evaluating the success of an investment seem to reduce the relevance of PCA in enhancing the integrity of investment appraisals.

Moreover, the findings support the suggestions of management control package researchers (e.g. Abernethy and Chua, 1996; Otley, 1999), who maintain that in studying management control systems it is appropriate to adopt a broad and holistic perspective rather than to study various control elements in isolation from their wider context. Here, exploring the interrelationships between PCA and other formal/informal control elements assisted in understanding and explaining the relevance of PCA for the companies.

## **6. CONCLUSIONS**

This cross-sectional field study examined the significance of different managerial uses of post-completion auditing (PCA) of capital investments. The appropriateness of PCA in controlling

current investments was specifically addressed by drawing on the concepts of cybernetic control systems, whereas in examining its role with regard to future investments, references were made to organizational learning literature. The empirical evidence come from the 16 PCA adopters which were identified in face-to-face interviews conducted in the 30 largest Finnish manufacturing companies.

As a contribution to the extant PCA literature, this study provides empirically supported insights with regard to relevance of PCA uses. The support was found to maintain that performance measurement is PCA's core and prerequisite function; it supports other uses of PCA, but it is not beneficial *per se*. Furthermore, the paper investigated the potential difficulties of PCA to find out whether these challenge its measurement function. The evidence suggests that technical difficulties do not jeopardize measurement ability to a great extent. Most importantly, it is argued here that in addition to inherently inappropriate timing, the alternate ("non-PCA") control mechanisms available to companies diminish the relevance of PCA in controlling current investments, and in enhancing the integrity of investment appraisals. The alternate control mechanisms may include e.g. quality systems, routine reporting, visits, presentations, and discussions. Moreover, the findings provide clear support for the contention that the major benefits of PCA are related to better planning of future investments, whereas its relevance in controlling current investments can be minor. As an additional contribution, PCA's practical benefits for organizational learning were mapped.

This study adds specifically to the extant literature by providing empirical support for maintaining that companies use alternate control mechanisms in controlling current investments. Because the role of alternate controls appeared to be essential, the focus in future studies could be on investigating in more detail how the triggers for correction/abandonment decisions actually arise, and how analysis of correction/abandonment options takes place in practice. Furthermore, it would be fruitful to investigate how the feedback obtained from various alternate control mechanisms (formal and informal) is communicated within the companies, and how it is eventually converted into action.

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#### APPENDIX A. Perceived significance of PCA uses per company (n = 16)

Companies (ind.)	Performance measurement	Enhancing realism/integr. of inv. appr.	OL, future capital investments	OL, inv. process development	Evaluation of personnel	Assistance in DM for corrections	Assistance in DM for abandonment
1 (metal)	5	4	4	4	3	3	1
2 (paper)	4	4	4	4	2	2	1
3 (paper)	5	3	3	1	3	3	1
4 (paper)	4	4	3	2	1	2	1
5 (paper)	1	5	5	3	4	1	1
6 (food)	3	3	3	3	1	1	1
7 (food)	4	4	1	1	2	1	1
8 (others)	4	5	5	5	1	1	1
9 (food)	5	2	1	1	1	1	1
10 (metal)	4	4	4	3	3	2	1
11 (metal)	5	2	2	2	2	3	1
12 (metal)	3	4	4	3	1	3	1
13 (build. mat.)	4	3	4	2	2	2	1
14 (energy)	4	4	4	4	2	1	1
15 (chem./plastics)	2	2	3	3	1	2	1
16 (chem./plastics)	5	3	2	1	3	1	1

Likert-5 is used to measure the significance: 1 = insignificant, 5 = very significant.

#### APPENDIX B. Correlation coefficients (Pearson): perceived significance of PCA uses (n = 16)

	PM	Real./integr.	OL, proj.	OL, proc.	Pers. eval.
Performance measurement (PM)	1				
Enhancing realism/integrity of investm. appraisals (Real./integr.)	-0.301	1			
Organizational learning for future capital investments (OL, proj.)	-0.446	0.669**	1		
Org. learning for capital investment process development (OL, proc.)	-0.312	0.548*	0.792***	1	
Evaluation of personnel involved in investment project (Pers. eval.)	0.000	0.286	0.223	-0.110	1
Assistance in decision-making for corrections	0.252	-0.207	0.113	-0.008	0.083

Assistance in decision-making for abandonment has been ruled out in this analysis (all observations 1 on a Likert-5 scale).  
Similar results were obtained by using Spearman correlation coefficients.

\*, \*\*, \*\*\* Statistically significant at 5 percent, 1 percent, and 0.1 percent, respectively.

## **ARTICLE 3**

# **Design of a Post-Completion Auditing System for Organizational Learning**

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Jari Huikku

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# Design of a Post-Completion Auditing System for Organizational Learning

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## Abstract

The literature suggests that the major objective for a company's post-completion auditing (PCA) of capital investments is the enhancement of organizational learning (OL) for future capital investment. PCA scholars further propose that adequate content and communication of PCA reports play a major role in enabling OL. Nevertheless, there is little empirical research on the design of PCA systems in general, and on their communication aspects in particular. Consequently, this field study investigates whether or not the design of PCA systems provides a platform for OL. First, with the aid of Huber's (1991) categorization of OL constructs and the PCA literature, an OL-conducive PCA design was synthesized. It was then used as a benchmark for investigating PCA practices in companies. The empirical evidence comes primarily from the 14 PCA adopters, for which enhancement of OL is the dominant objective of their PCA. These adopters were identified during 49 face-to-face interviews conducted in the 30 largest Finnish manufacturing companies. The findings of this study suggest that PCA design, and specifically aspects related to a PCA report and its communication, can play a major role in facilitating or hindering the extent to which PCA enhances OL. Importantly, it appears that organizational-memory-related issues such as the inappropriate filing of and difficult access to PCA reports inhibit the effective transfer and sharing of investment experiences. Additionally, a lack of improvement proposals, failure to institute systematic follow-up, lack of interactive forums for the interpretation of results, and restricted dissemination of PCA reports seem to have a negative effect on learning potential. Furthermore, the findings support the contention that reliance on alternate methods of managing investment knowledge (e.g. utilizing central expertise and experienced internal resources) can diminish the willingness of smaller companies to develop PCA as an OL tool.

**Key words:** *Post-completion auditing; Post-auditing; Capital investment, Organizational learning; Management control system design; Field study.*

## 1. Introduction

This study addresses the relationship between the design of post-completion auditing (PCA) systems and organizational learning (OL). The PCA of capital investments involves a formal review of a commissioned investment project, focusing on a comparison between the pre-investment estimates and the actual achievements after completion (Huikku, 2007; Chenhall and Morris, 1993).<sup>1</sup> Accordingly, PCA can be considered as one formal control system within a company's total management control system package, which comprises various formal and informal controls (Otley, 1999; Malmi and Brown, 2008). There is a large number of companies conducting PCA in the Anglo-Saxon countries, and many companies in other countries have adopted PCA as well.<sup>2</sup> Research suggests that the company's major objective in implementing PCA is the enhancement of OL for future capital investments (Neale, 1989, 1994; Azzone and Maccarrone, 2001). OL is not merely the sum of individual learning in an organization; it is a process involving the sharing of knowledge, beliefs or assumptions among individuals, influenced by a broader set of social, political or structural elements (Marquardt and Reynolds, 1994). It is a process whereby an organization responds to changes in its environment by detecting errors and correcting them in order to maintain the central features of the organization (Argyris, 1990).<sup>3</sup>

Management control systems can play a pivotal role in facilitating or hindering OL (Kloot, 1997; Carmona and Grönlund, 1998). It has been suggested that PCA information

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<sup>1</sup> This definition is in line with the PCA definition suggested by Gadella (1986), Neale (1991a); Pierce and Tsay (1992), and CIMA (2005, 60).

<sup>2</sup> Adoption rates reported in different countries: 1) In UK, 98% (Arnold and Hatzopoulos, 2000) and 79% (Neale, 1991b); 2) In USA, 88% (Farragher et al., 1999), 76% (Gordon and Myers, 1991) and 90% (Klammer and Walker, 1984); 3) In Norway, 41% (Neale, 1994); and 4) In Italy, 71% (Azzone and Maccarrone, 2001).

<sup>3</sup> Argyris distinguishes between two types of OL: single-loop and double-loop learning. Single-loop learning focuses on problem solving and does not address the reasons for the problems arising in the first place. In double-loop learning, organizations not only detect and correct errors, but also question the underlying policies and goals. In its ultimate form, double-loop learning may lead to the resolution of incompatible organizational norms by setting new priorities or restructuring norms, and to the creation of a new operational paradigm (see also Senge, 1990).

has the potential to aid a company in avoiding previous mistakes and in systematically identifying successful processes that can be repeated in future investment projects (Neale, 1989; Northcott and Alkaraan, 2007). According to Huikku (2008), companies perceive PCA to be relevant in a double-loop type of learning because it helps them address the reasons for problems arising in the first place. Specifically, PCA can aid companies in improving the accuracy of underlying assumptions and goals in their planning material (ibid.). In a similar vein, Chenhall and Morris (1993) suggest that PCA feedback can enhance managerial learning at the project definition stage, particularly in relatively certain operating situations, whereas environmental uncertainty can moderate learning. At the project definition stage, PCA feedback can potentially enhance the development of proposals for new projects, improve the understanding of key factors affecting investment projects, and develop knowledge related to strategy formulation (ibid.). Kolb (1984, p. 38) has emphasized the vital role of concrete experiences in the learning process. Furthermore, Mills and Kennedy (1993) maintain that PCA can be conducive to learning for capital investment processes in general – not merely for project-specific investment activities. PCA information may, for example, trigger improvements in capital investment procedures and instructions.

The effective reuse of knowledge assets that exist within a firm is essential to the realization of a competitive advantage (Teece et al., 1997; Jensen and Szulanski, 2007). Communication plays a major role, by enabling knowledge transfer and knowledge sharing (Ghoshal and Bartlett, 1988; Ghoshal et al., 1994; Tucker et al., 1996). Similarly, Garvin (1993) emphasizes the importance of the quick and efficient transfer of learning experiences as a prerequisite for OL. Consistent with this point, PCA scholars emphasize the fact that the appropriate design of PCA systems, particularly with regard to PCA reports and their communication aspects, is a prerequisite for effective knowledge transfer and sharing, and hence for organizational learning (Azzone and Maccarrone, 2001; Mills and

Kennedy, 1993). Commonly referred-to PCA design aspects are related to the selection of projects for PCA, timing of PCA, persons conducting PCA, responsibility for PCA, and the format and communication of a PCA report (see e.g. Neale and Holmes, 1991; Pierce and Tsay, 1992; Kennedy and Mills, 1993). In spite of the significant role that PCA design plays in enhancing OL, there is little empirical research addressing this relationship within companies – exceptions being Azzone and Maccarrone (2001) and Neale (1991a).

Based on their Italian survey, Azzone and Maccarrone (2001) suggest that the design of a PCA system is associated<sup>4</sup> with the main objectives set for it – organizational learning and decision-making support for current investments. Accordingly, companies have designed their PCA systems to achieve these OL benefits. They have found, for example, that responsibility for PCA appears to be more centralized in firms in which OL is cited as their most important PCA objective. Additionally, in a survey of UK companies, Neale (1991a) examined the association between the objectives and design of PCA on the one hand and the perceived benefits of PCA on the other. He suggests that benefits are associated with the degree of emphasis placed on the objectives (e.g. companies stressing OL-related objectives are more likely to reap the benefits of OL). Furthermore, he found that the companies selecting only the major investment projects for PCA were more likely to generate OL benefits than were the companies investigating all the projects.<sup>5</sup> Because none of these studies focuses on the relationship between PCA design and OL per se, however, our knowledge about this important relationship is in its infancy. *Hence, the purpose of this study is to examine whether or not the design of PCA systems provides a platform for organizational learning.* In addressing the design of PCA systems, this study

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<sup>4</sup> It is worth recognizing that even significant positive associations (e.g. between aims and design or between design and PCA benefits) do not automatically imply an ideal situation, although it is reasonable to expect that they may imply reasonably well-functioning design patterns.

<sup>5</sup> Otherwise, he did not find significant correlations between OL benefits and (1) the timing of the first PCA, (2) the location of responsibility for PCA (local vs. centralized), and (3) the structure of the team conducting PCA.

focuses specifically on PCA reports and their communication aspects – an area that has been highlighted by scholars, but neglected by researchers.

First, drawing upon the PCA literature, and on Huber's (1991) categorization of OL constructs (knowledge acquisition, information distribution, information interpretation, and organizational memory), an OL-conducive PCA design was synthesized. Huber's comprehensive presentation of OL processes is particularly suitable for structuring studies if they cover all OL phases and concentrate on explicit knowledge, as is the case in this study. Nevertheless, I recognize that in addition to explicit knowledge, which can be explicated or formalized, tacit knowledge (skills and know-how) can play an essential role in organizational learning processes (Nonaka and Takeuchi, 1995; Polanyi, 1966). Huber's constructs have been used by management control system researchers for studying integrative strategic performance measurement systems (Chenhall, 2005), organizational memories in accounting consultation units (Salterio and Denham, 1997), and links between management control and OL (Kloot, 1997). As a second step, the compiled PCA design was used in this study as a benchmark for presenting and analyzing empirical findings. Because of the scarce literature in this field, the study can be considered predominantly explorative – a starting point for further research.

This paper contributes to the PCA literature by extending the discussion about relationships between the design of PCA systems and OL. Specifically, it covers aspects of information interpretation, information distribution and organizational memory that have been virtually neglected by previous researchers. Motivated by the recent call of Haka (2007, p. 723-4) to examine why PCA systems seem to be ineffective, the paper is an explicit attempt to investigate the relationship between ineffectiveness and PCA designs. According to Haka, PCA systems are ineffective if they cannot properly convey feedback about experiences of capital investment outcomes; consequently companies continue to fund underperforming projects. From a practical point of view, enhanced understanding

about the relationships between PCA design and OL may help companies to develop their PCA systems more effectively.

For the purposes of this study, I conducted 49 face-to-face interviews in the 30 largest Finnish manufacturing corporations. The primary interviewees were the most knowledgeable persons in each company. The interviews comprised two parts: a semi-structured interview and a structured questionnaire that was completed during the interviews. This paper specifically addresses 14 of the 16 identified PCA adopters: those that emphasize OL as their major objective for PCA. The focus of the study is on tangible capital investments such as factories, production lines, machines and equipment.

The findings of this study suggest that PCA design, and specifically issues related to a PCA report and its communication, can substantially facilitate or hinder the extent to which PCAs enhance OL. Importantly, it appears that organizational-memory-related aspects such as the inappropriate filing of and difficult access to PCA reports inhibit the effective transferring and sharing of investment experiences within companies. Additionally, lack of improvement proposals and their systematic follow-up, lack of interactive forums for interpretation of results, and restricted dissemination of PCA reports seem to have a negative effect on OL potential. Furthermore, it appears that reliance on alternate methods of managing investment knowledge (e.g. utilizing central expertise and experienced internal resources), in particular, can diminish the willingness of smaller companies to develop PCA as their OL tool.

Section two of this paper reviews the relevant OL and PCA literatures and presents a PCA design serving OL objectives. The third section describes the research method, and the fourth presents and discusses the empirical results. Section five offers concluding remarks.

## **2. An OL-conductive PCA design**

In this section, I draw primarily on Huber's (1991) constructs of OL and on the PCA literature in order to synthesize an OL-conductive PCA design. This model serves as the basis of comparison in discussing the empirical results of this study. Huber suggests that OL processes consist of four constructs: knowledge acquisition, information distribution, information interpretation, and organizational memory. Knowledge is first obtained in a knowledge acquisition process, followed by the sharing of information from various sources and the creation of new information or understanding in an information distribution process. In the next step – the information interpretation phase – commonly understood interpretations are attached to information. Finally, in the organizational memory phase, knowledge is stored for later use.

### **Knowledge acquisition**

PCA reports play a major role in communicating the results of PCA in an organization, and consequently enabling OL. In a PCA context, we can assume that knowledge acquisition occurs when a company searches for the knowledge that allows it to compile a PCA report. In Huber's terms, searching can occur in three forms: performance monitoring (i.e. measurement), scanning, and focused searching. In performance monitoring, a company evaluates the success of an investment by comparing and analysing the ex-post outcomes of an investment project with its ex-ante targets (Neale and Holmes, 1991). By scanning its environment for change, a company may find useful information for assessing the future viability of its investments (Daft et al., 1988). In a similar vein, by conducting a focused search of its internal or external environment, a company may obtain relevant information for a PCA report about problems, opportunities, and currently available options.

Essential aspects of PCA design to be considered at the knowledge acquisition phase are the selection of projects for PCA, the timing of PCA, the location of



responsibility for PCA, and persons conducting PCA (e.g. Neale and Holmes, 1990; Azzone and Maccarone, 2001). Regarding the *selection of projects for PCA*, Mills and Kennedy (1990) suggest that the greatest benefit can be achieved by focusing on major investment projects, making it worthwhile to include them in PCA (see also Neale, 1991a). This is especially true for projects that provide the company with substantial potential for learning – pilot projects and repetitive investments, for example. Project size is by far the primary selection criterion for PCA (e.g. Gordon and Myers, 1991; Pierce and Tsay, 1992), and few if any companies conduct PCA for all their investments (e.g. Ghobadian and Smyth, 1989; Neale, 1994). According to Kennedy and Mills (1993), size can be the only selection criterion, or it can be combined with an unexpected outcome or degree of risk in investments. *Accordingly, the literature suggests that for OL purposes, a company would select projects with a great deal of learning potential, such as repetitive, pilot and complex investments.*

*The timing of PCA* is essential – particularly if a company conducts only one PCA per project and uses it to assist decision making for current investments (Gadella, 1986). Neale and Holmes (1991) recommend that if a company's primary objective for PCA is to enhance learning for future projects, it seems sensible to postpone PCA in order to gain more comprehensive and accurate feedback about the success factors. Late timing can diminish the relevance of transferring PCA experiences for future projects, however, for such reasons as technological change. Furthermore, Neale and Holmes (1991) report that two-thirds of the companies they studied conducted their first PCA within one year of project completion, and only a minority of the firms undertook more than one PCA per investment project (see also Mills and Kennedy, 1993; Neale, 1994; Gordon and Myers, 1991). *Hence, the literature suggests that in order to satisfy its OL goals, a company would conduct PCA after, but not long after, the investment project has been stabilized.*

Mukherjee (1987) proposes that it would be appropriate for control purposes to keep the *location of responsibility*<sup>6</sup> for PCA at the corporate level if the divisions have been given a relatively free hand in the capital investment process. In larger companies, Scapens et al. (1982) and Corr (1983) discovered, PCA is more likely to be delegated to a company's divisions. Neale (1994) reports that about half the companies in the UK and Norway had delegated the responsibility for PCA to the divisional level; Italy had a smaller number of companies reporting divisional responsibility (Azzone and Maccarrone, 2001). Additionally, Azzone and Maccarrone (2001) report that responsibility for PCA seems to be more centralized in companies stressing OL as their PCA objective. *This implies that a centralized PCA responsibility (not in the investing unit) would better enhance the harmonization of PCA procedures and ensure the dissemination of investment experiences within the entire corporation or division.*

Researchers have different opinions about who would be the most suitable *person or team to conduct PCA*. According to one approach, objectivity can be achieved by using outside people or a team that has not been involved in the investment project (Gulliver, 1987). Other researchers (e.g. Dillon and Caldwell, 1981) contend that the compilation of a PCA report requires the contribution of people with detailed knowledge. Yet it could be difficult to obtain objectivity if people in the investing units were allowed to review their own investments. They could present the situation subjectively or even be tempted to utilize their information advantage to manipulate figures or exaggerate performance estimations, thereby downgrading the potential for PCA reports to contribute to OL. In practice, the persons and teams conducting PCA appear to vary widely among firms, although controllers in investing units are reported to be the key resources (Kennedy and Mills,

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<sup>6</sup> The persons or teams responsible for a PCA system have ownership of PCA activities and are in charge of tasks such as the development of a PCA system and the general functioning of PCA activities (providing policies, giving instructions and ensuring that companies adhere to them). Furthermore, such tasks may include the selection of investments to be included in PCA, the selection of PCA auditors, and the checking of draft PCA reports.

1993; Azzone and Maccarrone, 2001). Additionally, Farragher et al. (1999) report that there are few companies in which PCA is conducted by persons or teams with no prior involvement in the project. In summary, it seems that it is not critical if a PCA auditor comes from the investing unit or outside the firm, provided that the quality of PCA can be ensured. *Hence, in designing an OL-conducive PCA design, it would be relevant to connect people from the investing unit with outside persons or teams in order to conduct PCA.* In practice, this could occur, for example, by letting outside persons or teams comment on the draft PCA report made by the investing unit or vice versa.

### **Information distribution and interpretation**

Information distribution is a process by which an organization shares information among its units and members (Huber, 1991). In this phase, it is critical to OL that the units possessing information and the units requiring this information have a high probability of finding each other quickly and easily (ibid.). Widespread distribution of information in an organization leads to more broadly based OL (Huber, 1991; Garvin, 1993). In the information interpretation process, distributed information is given one or more commonly understood interpretation(s) (Huber, 1991; Daft and Weick, 1984). Interactive communication (specifically, managerial conversations) constitutes a base for generating meaning for accounting information, and is therefore a critical precondition for OL (Jönsson, 1996; 1998; see also Simons, 1990; 1995). Widely differing interpretations of the same data may hinder an organization from developing shared meanings, which may in turn result in friction and reduced potential for organizational learning (Scapens and Roberts, 1993).

Information distribution and interpretation begin when PCA auditors make their reports. Nevertheless, information interpretation has been investigated in this study, as it occurs in major presentation forums of PCA results such as executive group meetings.

In examining information distribution, the paper focuses on dissemination of the final PCA reports after they have undergone the interpretation processes in presentation forums. This approach is consistent with Chenhall's (2005) study, which presents distribution aspects after interpretation. Because of the intertwined characteristics of information distribution and interpretation phases, I present them under a common heading.

As for the information distribution and interpretation phases, the main issues examined in this paper are *the content of a PCA report*, its presentation forum, and dissemination. The prerequisite for ex-post performance evaluation is the existence of documented investment appraisal material and its availability to PCA conductors. Additionally, using the same ex-ante and ex-post capital budgeting calculation methods enables required comparisons. Farragher et al. (1999) report, however, that companies do not always use the same methods. A company can consider various aspects of the content of a PCA report:<sup>7</sup> (1) the language used; (2) a standard versus non-standard format for reporting; (3) an analysis for both monetary and non-monetary targets; (4) ex-post calculations, including or excluding future estimates; (5) inclusion of detailed ex-post calculations; and (6) proposals for action (suggestions, helpful hints, lessons learned). Although it is likely that proposals can be conducive to learning, few PCA reports include proposals (Azzone and Maccarrone, 2001). Even when they do include a proposal, few companies have a formal mechanism for following up (ibid.).

Based on literature on the content of PCA reports, *it is suggested that companies would use the same ex-ante and ex-post capital budgeting calculation methods*. Hence, the comparisons would be based on updated ex-ante calculations, or at least on the progress of its main components. *Furthermore, PCA reports would include detailed comparisons of these calculations and comments on the achievement of objectives*. A lack of these factors

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<sup>7</sup> See e.g. Ghobadian and Smyth (1989), Mills and Kennedy (1990; 1993), Azzone and Maccarrone (2001). Additionally, e.g. Mukherjee (1988) and Neale and Holmes (1991) have presented models for PCA reports.

can reduce reliability and understanding of ex-post calculations and their underlying assumptions, thereby hindering OL. *Additionally, common corporate language and standard format would be used for PCA reports.* Especially in multinational companies, the choice of language can be important from an OL point of view. Standard format can be expected to facilitate knowledge transfer by ensuring more effective retrieval of required data. *In particular, reports would include proposals for future capital investing.* Proposals can also be presented orally elsewhere, but if they do not exist in writing somewhere, there is a risk of losing important information and feedback.

PCA researchers have almost totally neglected to address the role of a *presentation forum of PCA reports* in enhancing OL. Nevertheless, Azzone and Maccarrone (2001) report that it is typical to have common meetings of PCA auditors and other staff involved in the investment process, in which PCA results are discussed and potential actions are implemented. A common forum can be valuable for three reasons: for disseminating knowledge among the attendees and for facilitating the interpretation of the results and the generation of shared understanding. A common forum can help to confirm that the results and proposals in a final PCA report represent shared understanding in an organization. Without a forum, the readers of the reports may become suspicious about the reliability and general acceptability of the reports; relevant proposals can be omitted, for instance. *In order to enhance OL, then, it seems reasonable to suggest that companies would have a forum in which interactive discussions and presentations of PCA results occur.*

*The dissemination of PCA reports* has received little attention in previous empirical PCA studies, although there are exceptions. Mills and Kennedy (1993) emphasize the importance of effective dissemination of reports to ensure enhanced organizational learning, and Ghobadian and Smyth (1989) report that it is common to disseminate PCA reports to persons responsible for initiating, planning, and implementing the project. Yet, according to Kennedy and Mills (1993), the distribution of final PCA reports tends to be

relatively limited, and routine distribution to other divisions is rare. In fact, Azzone and Maccarrone (2001) suggest that companies pay little attention to the dissemination of PCA results. *In order to ensure feedback for future investments, then, it is suggested that companies would disseminate PCA reports to at least to everyone involved in planning, approval, implementation, and PCA phases of a reviewed investment project.*

### **Organizational memory**

Walsh and Ungson (1991, p. 61) advance the notion that organizational memory (OM) in its most basic sense refers to stored information from an organization's history that can be brought to bear on present decisions. They maintain that large companies often repeat mistakes made in the past because their OM does not function properly. Turnover of personnel (Levitt and March, 1988; Croasdell, 2001) and organizational forgetting (Carmona and Grönlund, 1998) have been pinpointed as the major threats for losing lessons of history.

In a broad sense, OM comprises individual memories, organizational culture and structures, standard operating procedures, internal and external archives, and workplace ecology (Walsh and Ungson, 1991; Ackerman, 1994). Advanced information technologies make it easier to share and disseminate explicit knowledge within a company (Huber, 1991; Croasdell, 2001). PCA researchers have virtually neglected OM issues in their studies. In this study the investigation of OM is primarily focussed on the storage and retrieval of PCA reports – the explicit PCA information that companies possess in their internal archives and databases. *In order to ensure OL, it is suggested here that companies would have databases or sets of archives for PCA results, their existence would be widely known, and relevant persons could conveniently retrieve PCA data.*

The synthesized OL-conductive PCA design is summarized in Table 1. This design profile is used as a benchmark to empirically investigate PCA designs in the companies.

**Table 1: The OL-conductive PCA design**

<b>OL phases/design properties</b>	<b>Proposed criteria</b>
<b>Knowledge acquisition:</b>	
Selection of projects for PCA	<ul style="list-style-type: none"> <li>- repetitive investments</li> <li>- pilot investments</li> <li>- complex investments</li> </ul>
Timing of PCA	- after, but not long after, an investment is stabilized
Responsibility for PCA	- head office level (division or corporation), not investing unit
PCA auditor	- can be from investing unit or outside (both expected to be involved in making PCA reports)
<b>Information distribution and interpretation:</b>	
Content of PCA report	<ul style="list-style-type: none"> <li>- the same capital budgeting calculation methods used ex ante and ex post</li> <li>- detailed comparisons of ex-ante and ex-post calculations</li> <li>- comments on the achievement of objectives</li> <li>- common corporate language</li> <li>- standard format</li> <li>- proposals for future investing</li> </ul>
Presentation forum for PCA reports	- at least one formal forum for interactive discussion and presentation of the reports
Dissemination of final PCA reports	- extensive dissemination: at least to all people involved in the project (planning, approval, implementation, PCA)
<b>Organizational memory:</b>	
<b>Archiving and filing of PCA reports</b>	<ul style="list-style-type: none"> <li>- widely known archives or databases exist</li> <li>- relevant persons have convenient access to reports</li> </ul>

### 3. Research method

Data for the empirical analysis were gathered between 2002 and 2004 from the 30 largest Finnish manufacturing corporations<sup>8</sup> through 49 face-to-face interviews. The primary interviewee – the person considered to be most knowledgeable about the issues investigated

<sup>8</sup> Ranked according to turnover (*Talouselämä* 24.5.2002), as in many of the other studies on capital investment practices and PCA. *Talouselämä* is a journal that annually lists the Top 500 companies in Finland.

in each company – was identified through the company's Internet home page, press releases, seminars, phone calls to the company and tips from colleagues from other companies. The primary interviewee was typically in charge of finance (the CFO), technology, production or investments, and simultaneously responsible for capital investing policies in corporate management or major divisions. Every person who was approached agreed to be interviewed. The interviews were conducted on the interviewee's premises, the average duration of the interviews was approximately two hours, and all interviews but one were tape-recorded. In some cases, the interviewees were contacted later by e-mail or telephone in order to check my interpretations of their answers or to obtain further details. The anonymity of participating companies and interviewees has been preserved in the description of this study.

Based on information obtained during the interviews, and according to the definition of PCA used for the paper, 16 of these 30 companies were identified as PCA adopters.<sup>9</sup> Among the 16 adopters, two did not regard the enhancing of OL to be the major reason for conducting PCA. This paper specifically addresses the 14 PCA adopters (22 interviews) that regarded enhancing organizational learning as their major objective for PCA. These 14 adopter companies represent seven sectors of the manufacturing industry: paper (4 companies), metal (4), food processing (2), building materials (1), chemicals and plastics (1), energy (1), and other (1). In 2001, the median net sales were €2.7 billion, and the net sales of the largest company were €13.5 billion. The largest absolute amount of tangible assets was €12.3 billion, the median being €1.2 billion. Gross investments were between €33 million and €3.9 billion; 13 of these 14 companies had international operations, such as major production facilities.

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<sup>9</sup> In two conglomerates consisting of largely independent businesses, different policies for PCA were found. In both companies, the larger divisions were PCA adopters, and they were chosen to represent the whole company.



PCA studies have been conducted primarily with postal survey methods. That, in fact, had been my original intention – to send a postal survey to potential respondents in a larger number of companies. But the early contacts with the companies revealed that respondents had a difficult time distinguishing among such concepts as pre-audit, monitoring and PCA, which would have jeopardized the reliability and validity of the findings. It appeared that face-to-face interviews would have to be conducted in order to clarify these issues as they arose; provide detailed definitions; pose further questions; return to previous answers; and provide real examples of PCA reports, including communication aspects. Because the purpose of the research was to obtain a wide and comprehensive picture of the topic addressed, however, a case analysis examining few companies would not suffice. Consequently, a cross-sectional field study somewhere between a broad-based survey and in-depth case study was the method chosen (Lillis and Mundy, 2005). Although the face-to-face approach adopted in this research had the disadvantage of restricting the number of companies studied and the consequent generalization of results, it significantly increased the reliability and validity of the study. To the best of my knowledge, this is the most extensive PCA study using face-to-face interviews.

The face-to-face interviews consisted of a semi-structured interview and a structured questionnaire completed during the interview. The main structure of the interview was as follows (see Appendix A): general; capital investment process; monitoring; PCA; and organizational learning with regard to capital investments. The questionnaire, developed with the aid of prior normative and empirical PCA studies, comprised 44 factual and attitudinal questions about PCA. The 27 factual questions relevant to this paper related to the design of PCA systems, and covered the type of projects selected, the format, who conducts PCA, who is responsible for them, when and how frequently they are conducted, how the results are communicated (presented, disseminated, and archived), and how the PCA systems will be developed in the near future. In the

attitudinal questions pertinent to this paper, interviewees were asked to indicate on a 5-point Likert scale<sup>10</sup> the significance of seven potential objectives for PCA and their perceived benefits. The objectives and benefits suggested were related to performance measurement, decision making for corrections and abandonment, OL for projects and process development, the integrity of investment appraisals, and staff evaluation (Neale, 1989 and 1994; Mills and Kennedy, 1993; Azzone and Maccarrone, 2001). The questions were closed-ended, but most were followed by a blank space, allowing additional information to be included. Importantly, in addition to merely answering to the formal questions, the respondents were encouraged to explain their answers, and to discuss the topics addressed. Additionally, in order to obtain a comprehensive picture about OL related to capital investments, respondents were asked to rate ten options on a 5-point Likert scale and to discuss them in order to illustrate how their company manages capital investment knowledge. Interviewees also showed the researcher their PCA reports.

#### **4. Empirical results and discussion**

As previously mentioned, and consistent with the PCA literature (Neale, 1989, 1994; Azzone and Maccarrone, 2001), most of the PCA adopters (14/16) regarded the enhancing of OL as the predominant objective for conducting PCA;<sup>11</sup> consequently, the empirical part of this paper focuses on these 14 companies. The PCA designs of these 14 adopter companies (Companies A-N) are summarized in Appendix B, and presented in greater

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<sup>10</sup> In the text I use the following terms to indicate the ratings in the attitudinal questions: insignificant (1), slightly significant (2), moderately significant (3), significant (4), and highly significant (5).

<sup>11</sup> Performance measurement was, in fact, rated as the companies' most important aim at the aggregate level. Nevertheless, it appeared in further discussions that the companies considered it, in practice, to be a core function of PCA – facilitating achievement of other objectives, rather than a distinct aim. Enhancing the integrity of investment appraisals was also highly rated, but it appeared in further discussions that most of the companies referred to benefits related to OL, rather than to control benefits. In other words, their objective was to learn to make more realistic appraisals. PCA aims of assisting decision making for corrections and staff evaluation were rated at a low level. Additionally, all interviewees believed that assisting decision making for abandonments is an insignificant aim for PCA. Two PCA adopters emphasized the enhancing of the integrity of their investment appraisals as their major PCA aim. In both companies, upwardly biased cash flow expectations in many past projects appeared to be the major driver for this emphasis.

detail in Appendix C. The important role of OL as an objective for PCA was also illustrated in numerous comments:

*We emphasize in our organization that our number one aim for the PCA is to gather feedback in order to accumulate experiences and learn for future projects* (Senior Vice President, Investments, Company A)

*Clearly, our objective for conducting PCA is to enhance organizational learning.* (Executive Vice President of Corporate Strategy and Business Development, Company B).

*The anticipated value added from conducting PCA comes from learning and transferring this experience to future projects. No doubt about this* (CFO, Company F).

Whether or not the companies' PCA designs were in line with the synthesized OL-conducive design is the next topic of analysis. First, the findings of the PCA designs are investigated from the point of view of four OL constructs (Huber, 1991). The firm-specific PCA designs are addressed next, followed by a discussion of whether or not existing alternate methods of managing capital investment knowledge may discourage the development of PCA designs. Finally, the findings and discussion are synthesized.

#### **4.1 Knowledge acquisition**

Organizations acquired the information for PCA reports primarily by searching within and outside the organization. As for major investments, the companies scan their environment to find information for assessing the viability of their completed investments. Focused search is used to obtain information about problems, opportunities, and alternatives for compiling PCA reports.

The selection of projects for PCA, timing of PCA, location of responsibility for PCA, and persons conducting PCA are the design properties to be addressed at the knowledge acquisition phase. All the companies studied used size – the amount of money invested – as the primary criterion for selecting capital investments for PCA, and a few

companies also selected all their strategic and underperforming investments. The companies conducted their PCAs between 6 and 36 months after completion of an investment, with only one PCA round per investment typically conducted. All the companies had a centralized responsibility for PCA, whether at the corporate or divisional level. Corporations consisting of highly diversified divisions tended to delegate PCA responsibility to their divisions.

The companies studied had many different variations for the PCA audit, ranging from a self-reviewing investing unit to an independent auditor with no investing unit affiliation. None of the companies had a full-time resource devoted to PCA, and most of them relied on the investing unit to conduct the audit. These companies explained their choice by emphasizing responsibility (the difficulty of presenting their own bad investments at a common forum), continuity (avoiding the loss of relevant information during the planning and implementation of PCA), and learning by reflecting on one's own activities. Executive Vice President of Corporate Strategy and Business Development in Company B explained the company's choice to let the investing units conduct PCA themselves:

*We think that the managers in investing units learn themselves [about their investments] and can make better investment appraisals and implementations in the future.*

The companies in which investing units undertook self-review enhanced the objectivity of PCA reporting by having someone outside the investing unit comment on draft reports before their presentation and distribution. The outside resources could, for example, be the persons responsible for PCA at the divisional or corporate level. The achievement of set objectives could be relatively transparent. Whether the auditors were internal or external, controllers in the investing units appeared to be the central source of PCA information (e.g. actual figures, estimates, explanations for gaps, and learning

experiences). The controllers were considered to be relatively objective; they were not expected to manipulate the figures because they were commonly expected to report to their superiors in the finance and accounting function outside the investing unit. As Senior Vice President of Corporate Strategy, Investments and Business Planning for Company B explained:

*The plant director is responsible for making a PCA report for his own investment. However, in practice we have the plant controller there as a neutral, objective resource in making it.*

In less than half of the companies, PCA was conducted not by the investing unit but by outside resources: controllers from headquarters, a senior vice president (investments), members of the divisional investment service function, or controllers from other divisions. Representatives of the investing units had the opportunity, however, to suggest alterations to the draft PCA report. This type of procedure was seen to minimize misunderstandings and strengthen the feeling that the report represented the common view held in the company. As noted by Senior Vice President, Investments, Company A:

*Always, after having completed a [draft] PCA report, I distribute it to the investing party to verify whether or not I've understood the case correctly, and to ask them to make their additions.*

In summary, with regard to the knowledge acquisition phase, it appears that the companies have designed their PCA in accordance with the synthesized, OL-conductive PCA design. They appeared to cover most of the projects with a great deal of learning potential (i.e. repetitive, pilot, and complex investments) by including the major investments in PCA. PCA occurred after, but not long after the investments were stabilized, so as not to jeopardize the relevance of PCA experiences for future investments. The companies had the centralized location of responsibility for PCA. The centralized location is appropriate in enhancing the harmonization of PCA procedures and facilitating the

dissemination of investment experiences within a company. Additionally, in each company, both the investing unit and outside staff contributed to PCA reports, thereby ensuring their quality.

#### **4.2. Information distribution and interpretation**

The aspects related to the content of PCA reports, their presentation forums and dissemination play a major role in information distribution and interpretation phases. Regarding the content of PCA reports, all 14 companies documented investment appraisal material, and this material included monetary and often non-monetary objectives. Additionally, all the companies based their ex-post calculations on analyses of the same key components as presented ex ante, or even updated the original calculations with actual figures and future estimates. A manager in Company E justified its choice to focus on actual figures rather than presenting new estimates:

*We don't want to give managers the possibility to focus the discussion on unsure future cash flows; we want to stick to cold facts.*

Most but not all of the companies included detailed calculations in their PCA reports and verbally commented upon the achievement of the objectives. In the multinational companies, PCA reports, or at least their summaries, were written in English, thereby facilitating communication. In all the companies, the format of the PCA report was, at least to a great extent, harmonized by PCA instructions or practice. Although the use of a standard format seems to be OL-conducive, because it ensures more effective retrieval of data, only a few companies used a standard format for reports. It also seems that PCA conductors sometimes feel free to modify reports or to neglect essential points if no ready format is introduced. Less than half the companies always or often included proposals in their PCA reports, and in few companies were proposals systematically followed up and

used in future investments. In Company A, the Senior Vice President of Investments was in charge of these activities:

*I am the one who systematically controls that our organization takes the proposals into consideration when new investments are planned.*

It appeared that almost all the companies had at least one formal forum, and typically several forums for presenting PCA results. Various formal forums were mentioned as being the primary one (i.e. the place where the results were presented and discussed for the first time): executive group meeting at the level of the corporation, division, or profit centre; a separate investment team at the corporate or division level; the corporation's technology and operations directors' meeting and the corporate controllers' meeting. In secondary forums, such as the board of directors' meetings at the corporate or divisional level, PCA results were typically brief reports presented along with many other issues on the agenda. The frequency of presenting reports at the primary forum varies from company to company. One obvious reason is the number of major investments.

Most of the companies did not have a primary interactive forum for presenting the PCA results. The dominating non-interactive forums in these companies were executive group meetings, which characteristically featured one-way reporting of performance measurement issues to decision makers rather than an interactive discussion of issues for purposes of organizational learning. As one Company E manager in charge of investment coordination stated:

*In fact, we do not have any forum where we would reflect what we have learned.*

The other companies had a primary interactive forum for presenting and discussing the results, which was more likely to consist of the people who were planning and implementing investments (members of the investment team and the technology & operations directors' and controllers' meetings). In this type of forum, apart from

performance evaluation, interactive discussion and reflection regarding investments appeared to receive more attention. As Senior Vice President, Investments, in Company A emphasized:

*We have this Investment Prioritization Team. It's a presentation and interactive discussion forum, not only for investment proposals, but also for PCA reports.*

In a similar vein, Company C's Director of Technical Development said:

*We have a monthly Development Meeting, where we go through all kinds of investment-related issues. Three times a year we present and discuss PCA reporting material received from the investing units. In this meeting we have operational, technical and financial people present. The idea is to understand and document what has happened, and consequently learn for the coming projects.*

In all the companies, the divisional or corporate executive group meeting, together with the managing director, examined major investments and approved them. Additionally, the board of directors also had to approve investment appraisals for the largest investments and typically for all the strategic investments as well. As Company C's Director of Technical Development explained:

*The [PCA] reports are automatically disseminated to the approvers. Thus, it depends on the investment whether it is reported only at the executive group meeting or also at the board of directors' meeting.*

Nevertheless, not all the companies reported the success of the capital investments to the executive group or the board of directors. In fact, less than half the companies reported PCA results to their board of directors. Additionally, none of the companies routinely distributed PCA reports across the divisions or to internal auditing. It appears, however, that people closely involved in the planning and implementation phases, such as the management of the investing unit and the project managers in charge of the investment, obtained the PCA reports.

In summary, the contents of the companies' PCA reports were consistent, to some extent, with the synthesized, OL-conducive PCA design. The 14 PCA adopter companies



typically used the same ex-ante and ex-post capital budgeting calculation methods. Additionally, reports included detailed comparison calculations and comments on the achievement of set goals, and common language was used. Yet contrary to the design profile, the use of a standard format for PCA reports and inclusion of explicitly expressed proposals and their systematic follow-up appears to have been rare. As proposed in the OL-conducive PCA design, a standard report format would facilitate knowledge transfer by ensuring more effective retrieval of data. In companies not using a standard format, however, it appeared that PCA instructions or practice had significantly harmonized the format. Yet, there seems to have been a risk that PCA auditors modified reports or neglected essential points if no ready format was introduced. Without explicit proposals, the readers of the reports may find it ambiguous to decide what lessons they were expected to learn that would be of assistance in future investing. Furthermore, according to the proposed OL-conducive PCA design, companies would have a primary interactive forum for discussion and presentation of reports. Although almost all the companies had a formal forum, this forum was usually, however, not intended for interactive discussion and interpretation, but for reporting performance measurement issues. Moreover, it was expected that the dissemination of final reports would cover, at a minimum, everyone involved in the project. The reports were distributed to people involved in the planning and implementation phases; whereas all the companies did not automatically communicate PCA results back to the ultimate approvers of investments – the executive group and board of directors.

#### **4.3. Organizational memory**

Only two of the companies had a widely known archive or database for storing PCA reports (i.e. OM) from which relevant persons could conveniently retrieve needed information. The

Senior Vice President of Investments in charge of capital investments for Company A described their system:

*The PCA reporting is made in Lotus Notes environment [Company A's intranet]. We have about 200 reports there, made in standard format by using templates. The PCA reports are one part of the documentation for each of the projects. The files include all material related to that project – all the planning material and links to all kinds of helpful documentation and material, for example. Reports are available for all those who want to look at them. I give personal reading rights for relevant persons. I mean people who are involved in this capital budgeting process. At the moment, that's about 100 people working with investments: managers and directors of operative units who are the decision makers and the superiors of the people I just mentioned. I'm the only one who has editing rights, so they can't change their reports later. In practice, when somebody is planning a new investment, I automatically forward them links to similar projects and emphasize that they must keep two things in mind: there is a lot of knowledge in Lotus Notes, and that I am available for any questions.*

Similarly, Vice President of Finance and Administration in Company M said:

*We save all the PCA reports in a common hard disc [in LAN]. Our logic is to provide reading rights to relevant persons.*

Most of the companies had no registers or files of old PCA reports or easy access to them.

Consequently, PCA information was not conveniently retrievable.

One reason for restricting the dissemination and availability of PCA reports seems to have been their perceived sensitivity. As one Company H manager who was coordinating capital investment and PCA activities in the corporation commented on the accessibility of their PCA reports:

*We have a policy to keep unit-specific information available to only that particular unit. That's the main reason we don't have these [PCA] reports in our Lotus Notes [their intranet]. Without the permission of the investing unit, you have no authority to see the material. If people want to see each other's material, they contact me – not the investing unit directly.*

It appears that the companies had typically not arranged their OM according to the synthesized design profile for an OL-conductive PCA; they had no easily accessible

archives or databases for PCA data from which relevant people could conveniently retrieve valuable learning experiences. Additionally, company policies seemed to restrict managerial access to PCA information.

#### **4.4 Company-specific PCA designs**

The company-specific PCA designs are summarized in Appendix B. Based on the synthesized, OL-conducive PCA design, 17 criteria have been presented. One company fulfilled a maximum of 15 suggested criteria and two companies fulfilled only eight. Interviewees from the high-scoring companies – specifically Companies A and M, which had the most sophisticated organizational memories for PCA data - were more likely than other interviewees to say that they reaped OL benefits, and less likely to say that they needed to develop their PCA systems. As Senior Vice President of Investments, Company A commented:

*We have no pressure to change our PCA systems. We are satisfied with it as an OL tool.*

Company A fulfilled all the criteria presented, except for the presentation and dissemination of PCA results to the board of directors. In addition to these deficiencies, Company M had no formal follow-up procedures for proposals made in the PCA report. Obviously, these criteria were not seen as being critical.

Almost all of the other 12 companies recognized the need for improvement to their PCA systems to better facilitate OL. The needs were clearly focused on improved communication, and, as illustrated by the quotations, particularly on organizational memory.

*The PCA reports are enclosed as appendixes in the minutes of the development meeting. We do regret that we don't have any common database or register for them. We're thinking about it. Now we have to go through the minutes in order to find information (Director of Technical Development, Company C).*

With respect to OM, a CFO from Company F said:

*Unfortunately, we don't have a register for conducted [PCA] reports. It's a clear deficiency. We don't know what kinds of reports exist and where to find them.*

In a similar vein, Senior Vice president of Corporate Strategy, Investments and Business Planning, Company B explained:

*In fact, we are in the process of transferring these PCA reports to intranet. It will bring information nearer to those who need it all over the corporation. At the moment, the knowledge is not available to everybody. It accumulates here at the corporate staff. Hence, we have to develop our system so that the lessons learned can be effectively transferred in the corporation.*

The companies with more sophisticated PCA designs seem to have better achieved the OL benefits, and to be more satisfied with their existing PCA systems. Why, then, did the companies with less sophisticated PCA designs not necessarily develop their systems accordingly? The degree of sophistication of PCA design in this limited sample does not seem to be associated with organization structure, technology, or environmental context. Rather, it seems that the larger the company (as measured by sales volume and tangible assets), the more likely it is to employ a more sophisticated PCA design. Of the seven largest companies as measured by sales volume and absolute amount of tangible assets, six were among the seven highest scorers. Hence, it is reasonable to infer that companies with a critical mass of capital investment paid more attention to the development of sophisticated PCA designs and vice versa. Consistent with previous findings suggesting that more sophisticated management control systems are used in larger companies (e.g. Merchant, 1981; Waterhouse and Tiessen, 1978; Chenhall, 2003; Al-Omiri and Drury, 2007; Huikku, 2007), the design decisions seem to have been based on cost-benefit thinking (cf. Granlund, 2001).

#### 4.5 Alternate methods to manage capital investment knowledge

The empirical data shows that PCA is not the only option for the companies to manage their capital investment knowledge. They use typically many simultaneous means. Utilizing central expertise located at the divisional or corporate headquarters level was considered "significant" or "highly significant" in all 14 companies. As Company J's Executive Vice President of Strategy and Business Development said of the centralized investment department:

*When you go to the office of the investment team leader, he knows everything and he can help you.*

The utilization of knowledge located within an investing unit (factory, profit centre) was considered "significant" or "highly significant" in almost all the companies. In practice, this means that experienced people within the organization would be connected to new investments. Senior Vice President of Corporate Strategy, Investments and Business Planning in Company B commented about the importance of using the experienced people:

*This is really important. Knowledge is pretty much transferred via people. In practice the senior ones will be connected to the new [investment] projects. This is the best way to transfer knowledge, directly from people to people.*

Specifically, the companies emphasize the importance of personal contacts in transferring tacit knowledge that is challenging to transfer via reports. As Vice President of Operations and Logistics in Company D stated:

*We do not have any register or archive for PCA reports, but people in the organization know that they can ask me, if they need more information.*

Almost all the companies used other means for administrating capital investment knowledge: discussions with persons involved in previous projects, examination of documentation from the previous projects, transfer of experts from other locations in the company, assistance from other locations in the company, and reliance upon external suppliers or consultants. Some companies acquired relevant knowledge by taking reference

visits to other companies, sending partners abroad, utilizing steering group experience and networking across their companies.

The use of PCA and alternate methods appear to have complemented each other in enhancing OL (e.g. Fisher, 1995). Their distinct advantages provided their *raison d'être*. With the aid of the formal PCA, a company can more systematically analyze and interpret the progress of an investment project and obtain feedback for future investing. As Company C's Director of Technical Development commented:

*The bigger and more strategic investments we are talking about, it is not only the physical implementation and production, but there are a lot of other things. If these projects were not mirrored by this kind of formal PCA, it would be hard to understand what has really happened. For smaller and easier investments, you can see the hard facts elsewhere.*

On the other hand, the companies emphasized the importance of personal interaction in transferring and sharing such tacit investment knowledge as skills and know-how (Nonaka and Takeuchi, 1995; see also Zander and Kogut, 1995).

Contrary to the proposed OL-conducive PCA design, the approvers of investments (e.g. the board of directors) did not automatically receive formal PCA feedback in all the companies. Rather, they obtained feedback from the investments with such methods as presentations, discussions, site visits, management letters, and other reporting. Another probable reason for boards of directors not requesting PCA reports may have been their approach of relating the success of the entire company to its capital investment activities (Huikku, 2007) – assuming that the performance indicators (e.g. profit, cash flow, ROI, and EVA) reveal whether or not the major investments have been successful.

In summary, in parallel with the smaller size of a company, the reliance on existing alternate methods of managing capital investment knowledge seems to discourage companies from developing their PCA systems. Consequently, the smaller companies with less capital investment paid little attention to the sophistication of PCA design, because

their managers perceived that their less sophisticated PCA, combined with the package of various methods, provided sufficient OL performance.

#### **4.6 Synthesis**

With the aid of Huber's (1991) categorization of OL constructs and the PCA literature, this paper began with a theoretical section synthesizing an OL-conducive PCA design. In this empirical results and discussion section, the design was used as a benchmark for addressing the question of whether or not the PCA system designs provided a platform for OL.

The findings provided support for prior empirical research concerning many aspects of PCA designs. It appears that the major selection criterion for PCA was project size (Pierce and Tsay, 1992; Neale and Holmes, 1991) and that the companies did not typically select all of their investments for PCA (Ghobadian and Smyth, 1989; Gordon and Myers, 1991; Neale, 1994). PCA was typically conducted within one year after completion of an investment project, and only a minority of firms in this study undertook several PCAs (Neale and Holmes, 1991; Mills and Kennedy, 1993; Neale, 1994). The controllers in investing units turned out to be key resources for PCA reports (Kennedy and Mills, 1993), and persons or teams with prior involvement in the project often conducted PCA (Farragher et al., 1999). A systematic inclusion of development proposals in PCA reports and their follow-up was more the exception than the rule (Azzone and Maccarrone, 2001). The usual method was to distribute PCA reports to the people responsible for initiating, planning, and implementing the project (Ghobadian and Smyth, 1989), whereas distribution to other parties (e.g. other divisions, and internal auditing) tended to be limited (Kennedy and Mills, 1993).

Scapens et al. (1982) and Corr (1983) have suggested that responsibility for PCA is more often delegated to the divisional level in large corporations. Yet in these 14 companies studied, the size of the company did not have an impact on the locus of

responsibility. Instead, it appeared that the corporations with highly diversified divisions had a tendency to delegate PCA responsibility to its divisions.

Compared to the OL-conducive PCA design, the companies in this study appeared to fulfil the criteria for knowledge acquisition: the selection of projects, timing, location of responsibility for PCA, and PCA auditor. Fulfilment of these criteria appears to be critical to a functioning PCA system. Instead, with regard to information distribution and interpretation and organizational memory, the PCA systems did not usually fulfil the proposed criteria. The major deviations were related to communication of PCA reports and particularly to issues of organizational memory. Few companies had easily accessible archives or databases for PCA data from which relevant persons could conveniently retrieve valuable learning experiences. Consequently, companies may repeat past mistakes or, at a minimum, may search for the same data again (Walsh and Ungson, 1991; Huber, 1991).

Few of the companies regularly included proposals for future capital investments in their PCA reports. Systematic follow-up of the realization of proposals was also rare. Furthermore, in many companies the only forum for the presentation of PCA results was a meeting of the executive group or board of directors. In such forums, reporting does not necessarily focus on learning-related issues, but on performance measurement.

The findings provided support for the validity of the synthesized PCA design. Nevertheless, some of the presented criteria are clearly more critical than others in enhancing OL. OM-related issues in particular were perceived to be of great importance in all 14 companies, whereas standard report format for PCA or communication of formal PCA results to board of directors, for example, were not perceived as critical.

Consistent with Newman's (1985) suggestion, companies may have internal policies to prevent managerial access to (sensitive) information. More importantly, it seems that reliance on alternate methods such as the utilization of central expertise and experienced



internal resources can diminish the willingness within smaller companies with lower capital investment to develop communication aspects into their PCA systems. Hence, managers may perceive that their companies achieve sufficiently satisfactory OL by complementing their PCA systems with alternate methods. Although it seems that more sophisticated PCA designs could provide a better platform for OL, managers do not necessarily perceive that they are jeopardizing the sharing and transferring of investment knowledge because of the various means available. These findings provide support for the management control package researchers (e.g. Abernethy and Chua, 1996; Otley, 1999), who maintain that, it is appropriate to adopt a broad and holistic perspective in studying management controls and not to investigate them (i.e. PCA system design) in isolation of their wider context. A broad perspective encourages the investigation of interrelationships between various available controls and allows them to be explained.

## **5. Concluding remarks**

This cross-sectional field study investigated whether or not the designs of post-completion auditing (PCA) systems of capital investments provided a platform for organizational learning (OL). This study focused upon OL as a PCA objective because previous researchers (e.g. Neale, 1989) have suggested that it is the major reason for conducting PCA. By drawing upon Huber's (1991) OL constructs and prior PCA studies, an OL-conducive PCA design was synthesized and utilized as a benchmark for examining empirical findings.

The empirical data for this research was gathered in the 30 largest Finnish manufacturing corporations, primarily with 49 face-to-face interviews comprising two parts: a semi-structured interview and a structured questionnaire (completed in the presence of the researcher). The focus of this paper was on the 14 PCA adopting companies in which the enhancing of OL was seen as the major objective for PCA. This study adds to the extant

PCA literature by being the first explicit attempt to investigate the relationship between PCA design and OL using empirical evidence from interviews. It can be regarded predominantly as an explorative investigation, paving the way for further studies. In addition to serving an academic audience interested in the relationship between PCA and OL, this paper may provide useful tools for practitioners who seek to design their PCA systems more effectively.

This study contributes to the PCA literature by extending the discussion on the relationship between PCA design and OL to cover information interpretation and distribution and aspects of organizational memory. Specifically, this study responded to Haka's (2007, p. 723-4) recent call to examine why PCAs seem to be ineffective in helping firms with their capital investment planning and decision making. The empirical results allow for the suggestion that ineffectiveness can be related to PCA design. In particular, it appears that organizational-memory-related issues such as inappropriate filing and difficult access to PCA reports hinder effective conveying of investment experiences to new projects. Other aspects related to the communication of PCA reports may hinder OL: lack of improvement proposals and their systematic follow-up, lack of interactive forums for interpretation of results, and restricted dissemination. Additionally, the findings provide support for the contention that sophisticated PCA designs help companies to transfer and share learning experiences more effectively.

This study makes an additional contribution to the PCA literature by providing discussion about the reasons behind the variations in PCA design sophistication. In line with the management control system literature (e.g. Chenhall, 2003), it appears that the small size of a company constitutes a likely reason for less sophisticated PCA systems. Other means of managing capital investment knowledge (e.g. utilizing central expertise and experienced internal resources) also seem to affect the degree of sophistication. Thus it may

be perceived in smaller companies that a sufficient OL outcome can be achieved by relying on the combination of less sophisticated PCA systems and alternate means.

Further analyses are required to deepen our knowledge about PCA designs and OL. It would be fruitful, for instance, to study how PCA systems have evolved in companies over time (cf. Hansen and van der Stede, 2004, in budgeting context). The roles of human factors like key decision-making individuals or teams in designing PCA systems need further investigation (cf. Miller, 1987). The relationship between the PCA configuration and perceived OL benefits also requires more examination. Specifically, it is essential to shed more light on aspects of the organizational memory of PCA in transferring and sharing capital investment knowledge. It appeared in this study that alternate methods of managing capital investment knowledge discouraged the development of PCA systems. By drawing on notions in the management control package literature (e.g. Otley, 1999), further examination could address the complementarity issues of formal PCA and alternate control mechanisms (Fisher, 1995).

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## Appendix A: A theme interview structure

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### General

- Description of the person to be interviewed (education, career, main tasks and current responsibilities)
- How is the person to be interviewed participating in the capital investment process?
  - o What kinds of investment proposals and decisions do you make?
  - o How often do you propose or reject investments?
- Do you have a written investment policy & instructions (please, copy if possible)?
  - o Who is responsible for instructions?
- What kinds of investments do you make?

### Capital investment process

- Describe your investment process.
- What kinds of investment calculations are prepared?
- Who makes the calculations?
- Are bonuses somehow related to the success of capital investments?
- How are internal auditors involved in your capital investment process?
- How realistic are investment proposals in your corporation?

### Monitoring (= control of costs and timetable of investment before the start-up)

- How do you follow cost accumulation and timetable per project?
  - o Who does it, when, tools used, forums for presentation of follow-up, dissemination of results, final report?
- Are there cost overruns?
  - o What happens if costs are exceeded?

### Post-audit of capital investments (= control or evaluation of the investment after start-up)

- This issue will be covered mainly by an interview with a separate set of questions.
- Please give an example of your post-audit report
- How do you control otherwise your investments (methods other than formal monitoring and post-audit)?
- How do people motivate their statements about the success of the investment project if post-audits are not conducted?
- Do you feel that post-audit reports are sometimes manipulated?

### Organizational learning and capital investments

- Question 44 in a separate set of questions. Please describe more in detail your practices to utilize existing knowledge related to capital investing.
- What kinds of issues can be learnt in the capital investment process? (Please consider all the phases in the investment process):
  - o Examples of learning experiences?
  - o How have learning experiences been utilized or could be utilized in your coming projects?
  - o How have learning experiences affected your investment process?
  - o Examples of potential learning cases in your business?
- What is the role of central investment expertise (e.g. engineering unit, investment unit, investment council, technical director etc.) in your capital investments?
- How do you ensure that you learn from your investment projects?
- Are you satisfied with the learning processes related to your capital investment activities?

## Appendix B: PCA design properties in the companies studied (n = 14)

	A	M	D	B	C	E	I	G	H	J	K	L	F	N	Yes	No
<b>KNOWLEDGE ACQUISITION</b>																
1. Repetitive, pilot and complex investments selected to PCA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
2. PCA conducted after, but not long after, an investment is stabilized	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
3. Both investing unit and outside staff involved in making a PCA report	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
4. Division or corporate HQ responsible for PCA activities	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
<b>INFORMATION DISTRIBUTION &amp; INTERPRETATION</b>																
5. The same capital budgeting calculation methods used ex ante & ex post	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
6. Detailed comparisons of ex-ante and ex-post calculations in PCA reports	X	X	X	X	X	X	X	X	X	X		X			11	3
7. Comments on the achievement of objectives included in PCA reports	X	X	X	X	X		X		X	X	X	X	X	X	12	2
8. Common language used in PCA reports (at least in summaries)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
9. Standard report format for PCA report	X	X				X			X					X	5	9
10. PCA report includes always or often proposals for future investments	X	X	X	X						X		X			6	8
11. Formal proposals follow-up takes place	X		X		X										3	11
12. Interactive primary forum for presentation of PCA reports exists	X	X	X	X	X							X			6	8
13. Presentation of PCA reports to executive group	X	X	X	X		X	X	X	X	X	X		X		11	3
14. Presentation of PCA reports to board of directors			X			X	X	X			X				5	9
15. Final PCA reports disseminated to all people involved in the project			X		X	X	X	X			X				6	8
<b>ORGANIZATIONAL MEMORY</b>																
16. Widely known archives or databases of PCA reports exist	X	X													2	12
17. Relevant people have convenient access to PCA reports	X	X													2	12
<b>Sum of Yes per company</b>	15	14	14	11	11	11	11	10	10	10	10	10	8	8		



### Appendix C (1/2): PCA designs in the companies studied

	A	B	C	D	E	F	G
<b>KNOWLEDGE ACQUISITION:</b>							
<b>Selection criteria for PCA projects</b>	Size	Size or unfavourable development	Size or strategic	Size or unfavourable development	Size	Size and expansion (simultaneously)	Size and expansion (simultaneously)
<b>Timing of PCA (first round after completion)</b>	About 12 months	About 12 months	6 to 12 months	Almost on monthly basis	About 12 months	About 12 months	6 to 12 months
<b>PCA auditor</b>	SVP, investments (Division head office)	Investing unit itself	Investing unit itself	Investing unit itself	Investing unit itself	Investing unit itself	Headquarters' controller
<b>Responsibility for PCA</b>	Division	Corporation (minor investments- divisions)	Division	Corporation	Corporation	Division	Corporation
<b>INFORMATION DISTRIBUTION AND INTERPRETATION:</b>							
<b>Content of a PCA report:</b>							
- Detailed comparisons of ex-ante and ex-post calculations	Yes	Yes	Yes	Yes	Yes	No	Yes
- Comments on the achievement of objectives	Yes	Yes	Yes	Yes	No	Yes	No
- Common corporate language used	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Standard Report format	Yes	No	No	No	Yes	No	No
- Proposals for future projects	Always	Often	Seldom	Often	Never	Seldom	Never
- Formal proposal follow-up	SVP, Investments	No formal follow-up	Development meeting and director	Business Unit technology director	No proposals	No formal follow-up	No proposals
<b>Presentation forum for PCA reports:</b>							
- Primary	Investment prioritization team (Corporate BOM if something odd)	Corporate Investment Committee	Corporate Development meeting	Corporate Technology & Operations meeting	Corporate BOM	Division BOM	Corporate BOM
- Secondary	Yes (if something odd)	Divisional BOM	Corporate Technical & Operations group	Division BOM	Corporate BOD	Corporate BOM	Corporate BOD
- Presentation to executive group		Yes	No, only distribution	Yes	Yes	Yes	Yes
- Presentation to board of directors	No	No	No, only distribution	Yes	Yes	No	Yes
<b>Dissemination of final PCA reports to all people involved in the project</b>	No	No	Yes	Yes	Yes	No	Yes
<b>ORGANIZATIONAL MEMORY:</b>							
<b>Archiving and filing of PCA reports:</b>							
- Widely known archives or databases of PCA reports exist	Yes	No	No	No	No	No	No
- Convenient access to PCA reports	Yes (via intranet)	No	No	No	No (however, partly via intranet)	No	No
- Reports available from	SVP, investments	Corporate Investment Office	Development Meeting protocol	SVP, Operations & Sourcing	Corporation Investment Staff	Country organization, Financial staff	Management Accounting Controller

### Appendix C (2/2): PCA designs in the companies studied

	H	I	J	K	L	M	N
<b>KNOWLEDGE ACQUISITION:</b>							
<b>Selection criteria for PCA projects</b>	Size	Size or strategic	Size or strategic	Size	Size	Size	Size and expansion (simultaneously)
<b>Timing of PCA (first round after completion)</b>	Between 24 and 36 months	Between 12 and 24 months	Between 24 and 36 months	About 12 months	Between 12 and 48 months	Between 24 and 36 months	About 12 months
<b>PCA auditor</b>	Investing unit itself	Divisional investment or engineering staff	SVP, investments	Investing unit itself	Controllers of other unit	Headquarters' controller	Jointly (investing & HQ engineering unit)
<b>Responsibility for PCA</b>	Corporation	Corporation	Corporation	Division	Corporation	Division	Corporation
<b>INFORMATION DISTRIBUTION AND INTERPRETATION:</b>							
<b>Content of a PCA report:</b>							
- Detailed comparisons of ex-ante and ex- post calculations	Yes	Yes	Yes	No	Yes	Yes	No
- Comments on the achievement of objectives	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Common corporate language used	Yes	Yes	Yes	Yes	Yes	Yes	Yes
- Standard Report format	Yes	No	No	No	No	Yes	Yes
- Proposals for future projects	Seldom	Seldom	Often	Seldom	Always	Often	Seldom
- Formal proposal follow-up	No formal follow-up	No formal follow-up	No formal follow-up	No formal follow-up	No formal follow	No formal follow-up	No formal follow-up
<b>Presentation forum for PCA reports:</b>							
- Primary	Corporate BOM	Divisional BOM	Corporate BOM	Plant BOM	Group controllers' meeting	Investment team	No forum
- Secondary	---	Corporate BOM	Divisional BOM	Divisional BOD	---	Divisional BOM	---
- Presentation to executive group	Yes	Yes	Yes	Yes	No	Yes	No
- Presentation to board of directors	No	Yes	No	Yes	No	No	No
<b>Dissemination of final PCA reports to all people involved in the project</b>	No	Yes	No	Yes	No	No	No
<b>ORGANIZATIONAL MEMORY:</b>							
<b>Archiving and filing of PCA reports:</b>							
- Widely known archives or databases of PCA reports exist	No	No	No	No	No	Yes	No
- Convenient access to PCA reports	No	No	No	No	No	Yes (in LAN)	No
- Reports available from	Operations controller at HQ	Investment service	CFO; VP, inv.; SVP, inv.	Plant development manager	Operations controller at HQ	LAN, (controller at HQ)	Report makers, engineering group



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