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Design of a Post-Completion Auditing System for Organizational Learning

ABSTRACT

The literature suggests that the major objective of 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) 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 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 appear to have a negative effect on learning potential. Furthermore, the findings support the contention that reliance on alternative methods of managing

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investment knowledge (e.g. utilising central expertise and experienced internal resources) can diminish the willingness of smaller companies to develop PCA as an OL tool.

Keywords: *Post-completion auditing; Capital investment; Organizational learning; Management control system.*

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).[1] 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 are a large number of companies conducting PCA in the Anglo-Saxon countries, and many companies in other countries have also adopted PCA.[2] Research suggests that a 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).[3]

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 has the potential to aid a company to avoid 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. Chenhall and Morris (1993) suggest that PCA feedback can enhance managerial learning

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

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

3 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 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).

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) has emphasised 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 realisation 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) emphasises the importance of the quick and efficient transfer of learning experiences as a prerequisite for OL. Consistent with this point, PCA scholars emphasise the fact that the appropriate design of PCA systems, particularly with regard to PCA reports and aspects of their communication, 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 aspects of PCA design are related to the selection of projects for PCA, timing of PCA, the location of responsibility for the PCA system, persons conducting 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[4] 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 the PCA system appears to be more centralised 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

4 It is worth recognising that even significant positive associations (e.g. between objectives 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.

for PCA were more likely to generate OL benefits than were those investigating all the projects.[5] However, because none of these studies focuses on the relationship between PCA design and OL per se, 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*[6]. In addressing the design of PCA systems, this study focuses specifically on PCA reports and aspects of their communication – an area that has been highlighted by scholars, but neglected by researchers.

Research aims

First, drawing upon the PCA literature, and on Huber's (1991) categorisation of OL constructs (knowledge acquisition, information distribution, information interpretation, and organizational memory), an OL-conducive PCA design was synthesised. As a second step, the compiled PCA design was used as a benchmark for presenting and analysing empirical findings. This study has explorative elements; with the aid of qualitative and quantitative data it addresses communication-related issues in PCA that have received only minor attention in prior literature. For the purposes of this study, I conducted 49 face-to-face interviews in the 30 largest Finnish manufacturing corporations. This paper specifically addresses 14 of the 16 identified PCA adopters: those that emphasise 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.

This study 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. Simultaneously, the paper makes an attempt to respond to Haka's (2007) recent call to examine why PCA systems seem to be ineffective by addressing this issue from the PCA design point of view. According to Haka, PCA systems cannot properly convey feedback about experiences of capital investment outcomes; consequently companies continue to fund underperforming projects. With regard to the practical implications of the study, enhanced understanding about the relationships between PCA design and OL may help companies to develop their PCA systems more effectively.

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

5 Otherwise, he did not find significant correlations between OL benefits and (1) the timing of the first PCA, (2) the location of PCA auditors (local vs. centralised), and (3) the structure of the team conducting PCA.
6 In line with Azzone and Maccarrone (2001) and Neale (1991a) I assume in this paper that the companies have also implemented PCA according to their design, i.e. design refers to implemented design in use.

2. AN OL-CONDUCIVE PCA DESIGN

In this section, I draw primarily on Huber's (1991) constructs of OL and on the PCA literature to synthesise an OL-conducive PCA design. This model serves as the basis of the comparison for discussing the empirical results of the 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. In this theoretical section and in the empirical & discussion section information distribution and interpretation are dealt with together under a common heading because they are intrinsically intertwined. 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.[7] Nevertheless, I recognise that in addition to explicit knowledge, which can be explicated or formalised, tacit knowledge (skills and know-how) can play an essential role in organizational learning processes (Nonaka and Takeuchi, 1995; Polanyi, 1966).

In investigating PCA design aspects and OL, this study does not explicitly attempt to assess the explicit outcomes of OL[8] related to PCA, nor does it directly address whether PCA design or PCA design-related OL is associated with the performance of the capital investments or the firms making the investments. I provide, however, indicative evidence about the companies' perceived satisfaction with their PCA system as an OL-tool. Based on the prior literature in OL and PCA, it is assumed that an appropriate PCA design (i.e. OL-conducive PCA design) will facilitate enhanced learning. In this paper the PCA system and OL process are not considered to be two separate constructs or processes having potential explanatory links. Rather, here the PCA system illustrates one application of Huber's OL process model, i.e. the PCA system is regarded as a realisation of OL in a company.

Knowledge acquisition

PCA reports play a major role in communicating the results of PCA in an organization, and consequently enabling OL. In the PCA context, we can assume that knowledge acquisition occurs

7 Huber's OL 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).
8 Outcomes of learning can be e.g. (1) developed organizational routines/standard operating procedures (Levitt and March, 1988), (2) cognitive systems (Hedberg, 1981) or (3) a collective mind (Weick and Roberts, 1993).

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 the PCA system, and the 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 their major capital investment projects for PCA*. Consequently, a company will inherently select at least the major part of the investments with a great deal of learning potential, such as repetitive, pilot and complex investments. The definition of major capital investment project can vary from company to company.

The appropriate *timing of PCA* depends upon the objectives set for it (Gadella, 1986). Based on his empirical study, Neale (1991a) suggests that the timing has an important bearing on the benefits relating to the control of ongoing investments, whereas it is not so critical in obtaining learning-related benefits for future projects. Accordingly, if a company uses PCA to assist the detection of underperforming investment projects and for analysing the appropriate actions required (correction/abandonment), an early enough PCA after commissioning is essential (see also Neale and Holmes, 1991). Nevertheless, with regard to enhancing learning for future projects, the prerequisite for obtaining reliable PCA data is that PCA will be conducted for a suitably long period after commissioning when stable working patterns are discernible. In other words, after teething troubles at the start of the project have been resolved and the investment is up and running (Neale, 1995). The timing of PCA is a trade-off decision between PCA's role in providing

well-timed assistance for planning subsequent investment projects and the accuracy of PCA data. Consequently, earlier conducted PCA's may be appropriate for providing valuable learning experiences for projects under consideration, whereas later PCAs can provide more comprehensive and accurate feedback about the success factors of an investment. On the other hand, late timing may cause worthlessness of PCA reports due to radical changes in premises of capital investments such as changes in technology and business environment. Neale and Holmes (1991) report that two-thirds of the companies they studied conducted their first PCA around one year after 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).

To sum up, the literature suggests that the choice of PCA timing is not especially critical to enhancing OL provided that PCA is not conducted too early after commissioning when a project's teething troubles are still unresolved, and its stable working patterns are not yet discernible. Additionally, very late timing of PCA may make lessons learned worthless because of changes in technology and business environment. *Hence, it is suggested here that a company would conduct PCA after an investment has reached a relatively settled state, but however, not too late in order to ensure that lessons learned are still useful.*

The location of responsibility for the PCA system can reside centrally at the corporate level or locally in divisions or in their sub-sets (e.g. business units). The unit responsible for the PCA system has ownership of PCA activities and is in charge of tasks such as the development of the PCA system and the general functioning of PCA activities (providing policies, giving instructions and ensuring that companies adhere to them). Additionally, such tasks may include the selection of investment projects to be included in PCA, the selection of PCA auditors, and the checking of draft PCA reports. Azzone and Maccarrone (2001) report that in over 80% of studied large Italian companies the responsibility for the PCA system resides at the corporate level, and that the responsibility was more centralised in companies stressing OL as their PCA objective. They suggest that the communication aspects such as the need for generalisation and dissemination of PCA results can explain this. *Accordingly, it is proposed here that a centralised responsibility for the PCA system would better enhance the harmonisation of PCA procedures and ensure the dissemination of investment experiences within the entire corporation.* Nevertheless, in highly diversified corporations where investment experiences in various divisions would inherently be more industry-specific, the responsibility for the PCA system can potentially be delegated to divisions without jeopardising OL. Hence, centralised responsibility in the proposition means corporate level, or alternatively division level in highly diversified corporations.

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 specific detailed knowledge. Yet it could be difficult to obtain objectivity if the investment project group members were allowed to review their own investments. They could present the situation subjectively or even be tempted to utilise 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 business units making the investments are reported to be the key resources (Kennedy and Mills, 1993; Azzone and Maccarrone, 2001). In larger companies, Scapens et al. (1982) and Corr (1983) found that responsibility for conducting PCA was more likely to be delegated to division management, whereas in the smaller companies corporate staff was more involved. 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 appears that it is not critical if a PCA auditor comes from the business unit making the investment or from outside, provided the quality of PCA in terms of accuracy and objectivity can be ensured. *Hence, in designing an OL-conducive PCA design, it would be relevant to connect people from the business unit making the investment 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 business unit making the investment 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 the 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.

With regard to 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 the required comparisons. However, Farragher et al. (1999) report that companies do not always use the same methods. A company can consider various aspects of the content of a PCA report:[9] (1) the language used; (2) a standard versus non-standard format of 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 can reduce reliability and understanding of ex-post calculations and their underlying assumptions, thereby hindering OL. *Additionally, a common PCA reporting language and standard format would be used for PCA reports*. Especially in multinational companies, the choice of a common language[10] for internal communication can have a broad impact on cross-cultural communication, knowledge transfer and management (Welch et al., 2005, Piekkari et al., 2005). The adoption of a shared language can facilitate formal reporting between units in the various foreign locations, enhance informal communication and information flow between subsidiaries, and assist in fostering a sense of belonging to a global family (Marschan-Piekkari et al., 1999). A standard format can be expected

9 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.

10 Language can be considered a multifaceted construct containing various interconnected layers, such as everyday spoken/written language, company specialised internal language, and technical & professional language (see e.g. Welch et al., 2005). Here I refer to companywide adoption of a shared everyday language for PCA reporting purposes in contrast to using local languages.

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, during 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, facilitating the interpretation of the results and generating 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; for instance, relevant proposals can be omitted. The major investments will typically be examined and approved by the divisional or corporate executive group meeting, and the largest ones additionally by the board of directors. Hence, it would be appropriate to also present the PCA results to them in order to provide feedback for learning purposes. *Accordingly, in order to enhance OL, it seems reasonable to suggest that companies would have a forum in which interactive discussions and presentations of PCA results occur, and additionally they would present the results to the approvers of an investment (executive group meeting and board of directors).*

The dissemination of PCA reports has received little attention in previous empirical PCA studies, although there are exceptions. Mills and Kennedy (1993) emphasise the importance of the 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 the 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 everyone involved in the planning, approval, implementation, and PCA phases of a reviewed investment project.*

Organizational memory

Walsh and Ungson (1991) 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;

Huber, 1990; Croasdell, 2001) and organizational forgetting (Carmona and Grönlund, 1998) have been pinpointed as the major threats for losing lessons of history. Broadly defined, OM comprises information stored in various memory locations: individual memories, organizational culture, organizational structures, organizational transformations (processes and procedures), workplace ecology[11], information repositories (databases/archives, systems, manuals), and external archives (see Walsh and Ungson, 1991; Ackerman, 1994; Van der Bent et al. 1999). Consequently, OM comprises both explicit and tacit knowledge (Nonaka and Takeuchi, 1995).

PCA researchers have virtually neglected OM issues in their studies. The formal control systems and their documents (i.e. information repositories within a company including codified explicit knowledge) have been identified to be essential for developing organizational memory (Huber, 1991; Levitt and March, 1988). Accordingly, 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. This choice is also motivated by Mäkinen (2002), who suggests in her literature review and conceptual analysis that OM is most often defined in the scientific literature to comprise of explicit documents and reports.

Advanced information technologies can make it easier to share and disseminate explicit knowledge within a company (Huber, 1990, 2001; Croasdell, 2001). Specifically, tools such as local area networks and intranets can support the concept of organizational memory (Cross and Baird, 2000; Nilakanta et al., 2006; see also McNamara et al. 2004). Hedstrom (2002) suggests that remotely discoverable and accessible knowledge retained in on-line access systems is utilised more frequently than their physical counterparts, because they can be utilised regardless of time and distance. Furthermore, according to Huber (2001) electronic repositories can be specifically suitable for communicating explicit, factual knowledge among a community that share similar knowledge, background, and experience. Although retrieving codified information (e.g. digital documents) does not necessarily require interaction with other persons, human mediation can, however, play an important role in helping users to locate knowledge within on-line access systems (Anand et al., 1998; Cross and Baird, 2000; Hedstrom, 2002). Without human mediation knowledge seekers may have difficulties in selecting from the available documents those that are most appropriate for their needs and interpreting them (Markus, 2001).

I propose that in order to ensure OL, companies would have a database or a set of archives for PCA reports including a register of its content. The existence of a database/archive and its content would be widely known for relevant persons. Additionally, these persons could conveniently find and retrieve appropriate PCA reports from the database/archive. In other words, it is proposed that all these criteria would be simultaneously fulfilled in order to provide an appropri-

11 Workplace ecology relates to physical structure of a workplace (e.g. office layout).

ate platform for OL. Hence, a relevant person cannot conveniently retrieve PCA reports from a database/archive if it does not exist, s/he does not know that there is such a database/archive, or s/he does not know what is in it. Following Jennex and Olfman's (2003) views, I suggest that PCA report databases/archives do not necessarily have to be computer-based, although it is reasonable to expect that an integrated technical infrastructure (network, databases, and computers) could result in a better system quality. Additionally, convenient retrieval of PCA data can be hindered by internal policies; companies may prevent managerial access to sensitive information (Newman, 1985).

The synthesised OL-conducive PCA design is summarised in Table 1. This design profile is used as a benchmark to empirically investigate PCA designs in the companies.

Although this study focuses on explicit knowledge residing in written PCA reports, individual memory and standard operating procedures are also discussed to some extent, because they appear to be further potentially appropriate OM locations with regard to PCA knowledge. Walsh and Ungson (1991) specifically emphasise the role of long-tenured individuals as sources of memory. Organizational learning can be embedded in standard operating procedures (see e.g. Feldman, 1989), such as capital investment manuals and PCA instructions. Furthermore, in order to obtain a more comprehensive understanding of the capital investment knowledge management in the companies, the study is extended to also cover alternative (i.e. "non-PCA") methods to manage this knowledge.

3. RESEARCH METHOD

Data for the empirical analysis were gathered between 2002 and 2004 from the 30 largest Finnish manufacturing corporations[12] through 49 face-to-face interviews. The primary interviewee – the person considered to be most knowledgeable about the issues investigated 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 investment policies in corporate management or major divisions. Every person who was approached agreed to be interviewed. The interviews were conducted at the interviewee's premises, the average duration 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 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.

12 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.

TABLE 1. The OL-conducive PCA design.

OL phases/design properties	Proposed criteria
Knowledge acquisition:	
Selection of projects for PCA	**– all major capital investment projects selected**
Timing of PCA	**– after an investment has reached a relatively settled state, but not too late in order to ensure that lessons learned are still useful**
Location of responsibility for the PCA system	**– centralised; corporate level, or alternatively in highly diversified corporations also division (not business unit level)**
PCA auditor	**– can be from business unit making the investment or outside (both expected to be involved in making PCA reports)**
Information distribution and interpretation:	
Content of PCA report	**– the same capital budgeting calculation methods used ex ante and ex post** **– detailed comparisons of ex-ante and ex-post calculations** **– comments on the achievement of objectives** **– common PCA reporting language** **– standard format** **– proposals for future investing**
Presentation forums for PCA reports	**– at least one formal forum for interactive discussion and presentation of the reports** **– executive group meeting (if investment approved by it)** **– board of directors (if investment approved by them)**
Dissemination of final PCA reports	**– extensive dissemination: at least to all people involved in the project (planning, approval, implementation, PCA)**
Organizational memory:	
Archiving and filing of PCA reports	**– database or archive of PCA reports exist and its existence and content is known for relevant persons** **– relevant persons can conveniently find and retrieve appropriate reports from the database/archive**

Based on information obtained during the interviews, and according to the definition of PCA used in this paper, 16 of these 30 companies were identified as PCA adopters.[13] Among the 16 adopters, two did not regard the enhancing of OL to be the major reason for conducting PCA.

13 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.

This paper specifically addresses the 14 PCA adopters (22 interviews) that regarded the enhancement of 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 was €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.

Past PCA studies have been conducted primarily with postal survey methods. This, in fact, had been the original intention for this study – 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 jeopardised the reliability and validity of the findings. It appeared that face-to-face interviews were required 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 aspects of communication. However, because the purpose of the research was to obtain a wide and comprehensive picture of the topic addressed, a case analysis examining a 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. According to Lillis and Mundy (2005), a cross-sectional field study 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 face-to-face approach adopted in this research had the disadvantage of restricting the number of companies studied and the consequent generalisation 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 interviews consisted of a semi-structured interview and a structured questionnaire completed during the interview. Both the interview questions and the questionnaire were distributed to the participants well in advance to aid preparations for the interviews. 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 researcher read out the questions and recorded the answers. 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 was expected to 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[14] 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 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;[15] consequently, the empirical part of this paper focuses on these 14 companies. The PCA designs of these 14 adopter companies (Companies A-N) are summarised in Appendix B, and presented in greater detail in Appendix C. The important role of OL as an objective for PCA was also illustrated in numerous comments:

> *We emphasise 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 D).

14 In the text I use the following terms to indicate the ratings in the attitudinal questions: non-significant (1), slightly significant (2), moderately significant (3), significant (4), and highly significant (5).
15 Additionally, two PCA adopters emphasised enhancing 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.

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

With regard to the more concrete OL-related benefits, the enhanced accuracy of key components in investment calculations was typically emphasised:

> *Managers have a better understanding about the potential payback of the projects* (Senior Vice President, Investments, Company A).
> *By obtaining concrete evidence about achievability of our targets, the realism of the future calculations is increased* (Vice President of Operations and Sourcing, Company C).

> *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 K).

Additionally, 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 C).

> *This kind of feedback helps us to run the [coming] projects more effectively* (Director of Technical Development, Company E).

> *We can transfer experiences about technical operations and suppliers to the next projects* (Senior Vice President, Investments, Company A).

Furthermore, 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 K).

> *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 C).

Whether or not the companies' PCA designs were in line with the synthesised OL-conducive design is the next topic of analysis. More specifically, first the PCA designs are investigated in the different OL phases by utilising the design profile as a benchmark. Thereafter, the analysis is ex-

tended to cover the firm-specific PCA designs, i.e. it is addressed how well the findings company-wise matched the practices proposed. This is followed by a discussion of whether or not existing alternative methods of managing capital investment knowledge may discourage the development of PCA designs. Finally, the findings and discussion are synthesised.

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. A 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 the PCA system, and persons conducting PCA are the design properties addressed at the knowledge acquisition phase. The companies studied were asked to state their criteria for selecting capital investment projects for PCA. All the companies studied used size – the amount of money invested – as the primary criterion for selection. None of the companies reviewed all of their investments, albeit one company carried out PCA for nearly all of its investments because the limit for PCA inclusion was low (16,000 euros). The highest limit for the 14 companies was €15 million and the median was €1 million. The limits were highest in the most capital-intensive companies making a large number of capital investments annually. Eleven companies reviewed all kinds of capital investments exceeding the size limit. Of these companies, six used merely size, whereas three companies also included all strategic investments below the limit and two companies included selectively smaller investments that did not progress according to plan. Three companies selected only major expansion[16] investments for PCA. These companies emphasised that there are more risks and uncertainties in expansion investments than in investments made to replace or modify existing machines and equipment. On the other hand, they claimed that their only major investments are, in practice, expansion investments. As the CFO of Company H emphasised:

> *We do not carry out PCA's for other investments such as replacement, because they do not exceed our limit for inclusion [€1 million].*

The companies conducted their PCAs between 6 to 36 months after completion of an investment; the typical timing being about one year (see also Appendix C). Only two of the companies already conducted PCA between 6 to 12 months. Among the companies studied, 11 out of the 14 normally conduct only one PCA per project, whereas three companies carry out multiple PCAs. It

16 Typical groupings of capital investments in the companies were expansion (or growth), replacement, rationalisation/productivity, and social/environmental/administrative. The term "expansion" was typically used synonymously with "strategic".

appeared that the companies intentionally waited until investments were up and running before they conducted PCA. As the CFO in Company H, where PCA was conducted between 6 to 12 months, explained:

> *We conduct PCA within one year after commissioning. In fact, six months is nearer. Hence, we carry out PCA as soon as it [investment] is operational. Already at this early stage we know whether our calculations have been accurate or not.*

Additionally, the companies can, as an option, postpone PCA or as in seven companies, to make a follow-up PCA later if the project has not yet reached a settled state:

> *We had a lot of troubles with that investment during the first year. There was no sense to conduct PCA yet. So, we postponed it by one year* (CFO, Company M).

> *If we figure out in the first audit that the investment is not near its optimal production performance and we do not have reliable data, we can make a follow-up PCA* (Executive Vice President of Corporate Strategy and Business Development, Company D).

The companies conducted their PCAs at the latest about three years after an investment had been commissioned. Consequently, it is plausible to anticipate that lessons learned did not become obsolete to the business context in such a short period.

With regard to the location of responsibility for the PCA system, in ten companies the responsibility resided at the corporate level and in four highly diversified corporations at the divisional level. Hence, all the companies had a centralised responsibility for the PCA system, whether at the corporate or divisional level. The responsible persons for the PCA system typically reminded business units about the PCAs. As the Director of Technical Development in Company E stated:

> *It is my duty to remind units about the coming PCAs. Additionally, I check that review processes have proceeded according to our instructions.*

The companies studied had many different variations for the PCA auditor, ranging from self-reviewing project team members to an independent auditor with no affiliation to the capital investment. None of the companies had a full-time resource devoted to PCA, and most of them (8 companies) relied on the business unit making the investment to conduct the audit. These companies explained their choice by emphasising 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. The Executive Vice President of Corporate Strategy and Business Development in Company D explained the company's choice to let the business 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 business units making the investments undertook self-review enhanced the objectivity of PCA reporting by having someone outside the unit comment on draft reports before their presentation and distribution. The outside resources could, for example, be the persons responsible for the PCA system 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 business 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 business unit making the investment. As the Senior Vice President of Corporate Strategy, Investments and Business Planning for Company D 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 six companies, PCA was conducted not by the investment project team members but by outside resources: controllers from headquarters, a senior vice president (investments), members of the divisional investment service function, or controllers from other divisions. However, representatives of the investing business units had the opportunity to suggest alterations to the draft PCA report. This type of procedure was seen to minimise misunderstandings and strengthen the feeling that the report represented the common view held in the company. As noted by the 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, it appears that the companies have designed their PCA in accordance with the synthesised, OL-conducive PCA design for knowledge acquisition phase. With regard to the selection of projects for PCA, the size of the investment was used as a proxy for an appropriate selection. Consequently, it was proposed that if a company selects its major projects for PCA, it will inherently include at least the major part of projects with a great deal of learning potential (i.e. repetitive, pilot and complex investments). Eleven companies selected all their major investment projects, albeit the definition of "major" varied from company to company. Additionally, three

companies selected only their expansion investments. It appeared in these cases, however, that expansion investments were their only major investments, and based on that, they are considered to fulfil the selection criterion in this review. Nevertheless, generally speaking, it is plausible to expect that e.g. large-magnitude replacement investments could be classified as major investments. Regarding the timing criterion, it appeared that PCAs were carried out after an investment had reached a relatively settled state, but not so long after the investments were completed, as to jeopardise the relevance of PCA experiences for future investments. Additionally, the companies had the centralised location of responsibility for the PCA system (corporate level or in highly diversified corporations division level). The centralised location is appropriate to enhancing the harmonisation of PCA procedures and facilitating the dissemination of investment experiences within a company. Furthermore, in each company, both the business unit making the investment and outside staff contributed to PCA reports, thereby ensuring their objectivity and accuracy.

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 F 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 (11) included detailed calculations in their PCA reports and verbally commented upon the achievement of the objectives. The multinational companies had adopted a common corporate language (English) for their internal communication. Accordingly, 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, harmonised 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 five companies used a standard format for reports. It also seems that conductors of PCA sometimes feel free to modify reports or to neglect essential points if no ready format is introduced. Six companies always or often included proposals in their PCA reports, and in only three 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 (13) had at least one formal forum, and typically several forums for presenting PCA results. Various formal forums were mentioned as being the one that was primary (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 business unit; 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 briefly presented along with many other issues on the agenda. The frequency of presenting reports at the primary forum varied from company to company. One obvious reason is the number of major investments.

Most of the companies (8) 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 the purposes of organizational learning. As one Company F manager in charge of investment coordination stated:

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

The other six 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 the Senior Vice President, Investments in Company A emphasised:

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 E'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 E'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 board of directors or the executive group. In fact, only five companies presented PCA results to their board of directors and eleven to the executive group. Additionally, one company merely distributed reports to both these groups. None of the companies routinely distributed PCA reports across the divisions or to internal auditing. However, it appears that people closely involved in the planning and implementation phases, such as the management of the business units making the investment 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 synthesised, OL-conducive PCA design. The 14 PCA adopter companies used the same ex-ante and ex-post capital budgeting calculation methods, and a common PCA reporting language was employed. Additionally, reports typically included detailed comparison calculations and comments on the achievement of set goals. 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 harmonised 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 less than half of the companies did 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 can be considered to sufficiently fulfil the proposed two organizational memory (OM)-related criteria set for an OL-conducive PCA design. In other words, these companies had a database (or archive) of PCA reports and its existence and content was known to the relevant persons. Additionally, these persons could conveniently find and retrieve appropriate PCA reports from the database.

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 emphasise 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, the Vice President of Finance and Administration in Company B said:

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

Both these companies had integrated technical infrastructure (computers, electronic databases and networks) to store and administrate PCA reports and related material. In addition, in Company A, human mediation appeared to play a major role in ensuring that persons planning investments obtained appropriate material for their purposes. In Company B human mediation was not directly linked to the retrieval of PCA reports.

Twelve other companies had no comprehensive databases or set of archives for storing PCA reports. Consequently, the relevant persons at the headquarters or in business units were not fully aware of the reports and their contents; inherently, finding and retrieving appropriate reports was not convenient. As a CFO from Company M 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.*

Additionally, Director of Technical Development in Company E stated:

> *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.*

Hence, although persons planning new investments would typically have had the chance to enquire after the PCA reports from corporate or division head office, the problem was that head office people did not have a necessarily clear picture of the PCAs carried out. In a similar vein, a lack of knowledge about the PCAs conducted and their content hindered business units in searching relevant PCA material. As a Company I manager who coordinated capital investment and PCA activities stated:

> *They can obtain reports from me, but they have to know themselves what they want.*

One additional obstacle in searching and retrieving PCA reports was the report format. They were not at all or only partly in electronic format, i.e. their electronic transfer was not possible without first digitising them. In case of non-digitised reports, paper copies would first have to be taken and then sent by mail or telefax to recipients, for example. Furthermore, the existing technical infrastructure did not support the sharing of PCA knowledge, as the Senior Vice President of Corporate Strategy, Investments and Business Planning, Company D explained:

> *In fact, we are in the process of transferring these PCA reports to the 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.*

Additionally, it appeared that one reason discouraging the active dissemination and availability of PCA reports can be the perceived sensitivity of PCA data. As Company I manager 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. I will first contact the business unit director [of the investing unit] and ensure that he is aware of this inquiry.

In practice, typically persons planning new investments did not actively, but only sporadically, enquire about PCA reports in both this company and in the others. Hence, the companies did not fully exploit individuals coordinating PCA activities as sources of OM (i.e. PCA knowledge). Ideally, these people could be helpful in locating appropriate PCA reports, interpreting their content, and transferring them to the relevant persons.

Moreover, six companies pointed out PCA's role in developing their capital investments processes. As the Group Manager of Manufacturing in Company I said:

This year we have improved our [investment] processes based on feedback obtained in PCA. We have changed forms, documentation, and processes.

Hence, organizational learning can be embedded in standard operating procedures and related explicit materials (e.g. capital investment manuals and PCA instructions). As presented in the previous section regarding harmonisation of PCA procedures (standard report format), OM may also reside in individual memories. In other words, even though feedback from the conducted PCAs does not necessarily lead to changes in written procedures, key actors may remember that certain approaches are appropriate and helpful and will pass this knowledge onto new PCA reports.

To sum up, it appears that the companies had typically not arranged their OM according to the synthesised design profile for an OL-conducive PCA; they had no comprehensive, widely known archives or databases for PCA data from which relevant people could conveniently find and retrieve valuable learning experiences. Additionally, it appears that internal company policies that hinder managerial access to PCA information may discourage companies from developing OM aspects in their PCA systems. PCA-related OM can also reside in explicit standard operating procedures and in individual memories.

4.4 Company-specific PCA designs

The company-specific PCA designs are summarised in Appendix B. Based on the synthesised, OL-conducive PCA design, 17 criteria have been presented. One company fulfilled a maximum of 15 suggested criteria and two companies fulfilled only eight. The companies were asked how they perceived their PCA systems support them in enhancing OL related to capital investments (Likert-5). Additionally, they were asked, whether and how they intended to develop their PCA systems in the near future. Interviewees from the high-scoring companies – specifically Companies A and B, which had the most sophisticated organizational memories for PCA data – were satisfied

with their current PCA systems. They were more likely than other interviewees to say that their systems supported them well in enhancing OL, and less likely to say that they needed to develop their PCA systems. As the 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 deviations, Company B had no formal follow-up procedures for proposals made in the PCA report. Obviously, these criteria were not seen to be critical. Almost all of the other companies (10/12) recognised the need for improvement to their PCA systems in order to better facilitate OL. The needs were clearly focused on improved communication, and, as illustrated in the preceding section, particularly on organizational memory.

The companies with more sophisticated PCA designs appear 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 appears 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, 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 appear to have been based on cost-benefit thinking (cf. Granlund, 2001).

4.5 Alternative 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 typically use many simultaneous means. Utilising central expertise located at the divisional or corporate headquarters level was considered "significant" or "highly significant" in all 14 companies. As Company G's Executive Vice President of Strategy and Business Development said of the centralised investment department:

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

The utilisation of knowledge located within a business unit making an investment was considered "significant" or "highly significant" in almost all the companies (13). In practice, this means that

experienced people within the organization would be connected to new investments. The Senior Vice President of Corporate Strategy, Investments and Business Planning in Company D commented about the importance of using 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 emphasise the importance of personal contacts in transferring tacit knowledge; the kind of knowledge that is considered challenging to transfer via reports. As the Vice President of Operations and Logistics in Company C 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.*

Additionally, the companies used other means for administrating capital investment knowledge: discussions with the 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 also acquired relevant knowledge by making reference visits to other companies, sending partners abroad, utilising steering group experience and networking across their companies.

The use of PCA and alternative 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 analyse and interpret the progress of an investment project and obtain feedback for future investing. As Company E'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.*

By "hard facts" the director referred specifically to data obtained from the company's routine reporting of key production figures, such as production volume, yield, productivity and cost per unit. These are typically critical factors for the success of manufacturing investments.

On the other hand, the companies emphasised 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 methods such as presentations, discussions, site visits, management letters, and other reporting. Another likely 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 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 alternative 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) categorisation of OL constructs and the PCA literature, this paper began with a theoretical section synthesising 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 provide 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 about one year after completion of an investment project (however the range being 6 to 36 months), and only a minority of firms in this study undertook several PCAs (Neale and Holmes, 1991; Mills and Kennedy, 1993; Neale, 1994). In congruence with Azzone and Maccarrone (2001), the location of responsibility for the PCA system typically resided at the corporate level. The controllers in business units making the investments were found 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).

Compared to the proposed OL-conducive PCA design, the companies in this study appeared to fulfil the criteria for knowledge acquisition: the selection of projects for PCA, timing, location of responsibility for the PCA system, and PCA auditor. Fulfilment of these criteria appears to be critical to a functioning PCA system. Nevertheless, I recognise the difficulty of providing catch-all propositions including more precise requirements for the selection of projects (e.g. what is a minor vs. major investment) and timing (e.g. months from the commission per investment type). However, 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 the communication of PCA reports and particularly to issues of organizational memory. Few companies had comprehensive databases or archives 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).

The empirical findings are consistent with the suggestions of researchers (e.g. Jennex and Olfman, 2003; McNamara et al., 2004; Nilakanta et al., 2006) that integrated technical infrastructure (networks and electronic databases) can support the implementation and management of a well-functioning OL system (PCA system). As also suggested by Cross and Baird (2000) and Markus (2001), it appears that human mediation can play a major role in ensuring that users find and utilise appropriate knowledge in PCA reports. Furthermore, OL related to PCA knowledge can be embedded in standard operating procedures that are manifested in capital investment manuals, for example, or it may reside in tacit format in individual memories (Walsh and Ungson, 1991).

Few of the companies regularly included proposals for future capital investments in their PCA reports. Systematic follow-up of the realisation 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 provide support for the validity of the synthesised PCA design. Nevertheless, some of the presented criteria are clearly perceived as 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. This can discourage companies from developing aspects of communication in their PCA systems. More importantly, it seems that reliance on alternative methods such as the utilisation 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 alternative methods. Although it seems that more sophisticated PCA designs could provide a better platform for OL, managers do not necessarily perceive that they are jeopardising the sharing and transferring of investment knowledge because of the various means available. These findings provide support to management control package researchers (e.g. Abernethy and Chua, 1996; Otley, 1999; Malmi and Brown, 2008; Ferreira and Otley, 2009), 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 synthesised and utilised as a benchmark for examining empirical findings.

The empirical data for this research was gathered in the 30 largest Finnish manufacturing corporations, primarily through 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. Being the first study explicitly focussing on this relationship, it can on its part pave way for further studies.

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, this study can be of pragmatic value to organizations. It may provide useful tools for practitioners who seek to design their PCA systems more effectively.

The 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) 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 the suggestion to be made that problems in conveying capital investment experiences 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 the effective conveying of investment experiences to new projects. Other aspects related to the communication of PCA reports may hinder OL: the lack of improvement proposals and their systematic follow-up, a lack of interactive forums for interpretation of results, and restricted dissemination. Additionally, the findings provide indicative 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 a discussion of 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. utilising 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 alternative 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 key decision-making individuals or teams in designing and utilising PCA systems need further investigation (cf. Miller, 1987). The concept of the use of management control systems (e.g. diagnostic and interactive use) could serve as a platform for further analysis of how PCA data is communicated within a corporation (Simons, 1995, Bisbe and Otley, 2004; Ferreira and Otley, 2009). Additionally, aspects of investment control could be investigated in the context of highly integrated major investments; i.e. to study the role of PCA systems in coordinating capital investment across sub-units within the firm and between the firms (see Miller and O'Leary, 1997; 2005; 2007). 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 alternative 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 issues of complementarity in formal PCA and alternative control mechanisms (Fisher, 1995).

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APPENDIX A: Interview questions

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 utilise 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 utilised or could be utilised 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	B	C	D	E	F	G	H	I	J	K	L	M	N	Yes	No
KNOWLEDGE ACQUISITION																
1. Major capital investment projects selected to PCA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
2. PCA conducted after an investment has reached a relatively settled state, but not too late in order to ensure that lessons learned are still useful.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
3. Both investing business 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. Corporate HQ or in highly diversified corporations division HQ responsible for PCA system	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14	0
INFORMATION DISTRIBUTION & INTERPRETATION																
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
ORGANIZATIONAL MEMORY																
16. Databases or archives of PCA reports exist and their existence and content is known for relevant persons	X	X													2	12
17. Relevant persons can conveniently find and retrieve appropriate PCA reports from the database/archive of PCA reports	X	X													2	12
Sum of Yes per company	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
KNOWLEDGE ACQUISITION:							
Selection criteria for PCA projects	Size	Size	Size or unfavourable development	Size or unfavourable development	Size or strategic	Size	Size or strategic
Timing of PCA after completion	About 12 months, follow-up 36 months	Between 24 and 36 months	Almost on monthly basis during 2-3 years	About 12 months	6 to 12 months	About 12 months, follow-ups 24 & 36 months	Between 12 and 24 months
PCA auditor	SVP, investments (Division head office)	Headquarters' controller	Investing unit itself	Investing unit itself	Investing unit itself	Investing unit itself	Divisional investment or engineering staff
Responsibility for PCA system	Division	Division	Corporation	Corporation (minor investments: divisions)	Corporation	Corporation	Corporation
INFORMATION DISTRIBUTION AND INTERPRETATION:							
Content of a PCA report:							
– Detailed comparisons of ex-ante and ex-post calculations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
– Comments on the achievement of objectives	Yes	Yes	Yes	Yes	Yes	No	Yes
– Common PCA reporting language	Yes	Yes	Yes	Yes	Yes	Yes	Yes
– Standard Report format	Yes	Yes	No	No	No	Yes	No
– Proposals for future projects	Always	Often	Often	Often	Seldom	Never	Seldom
– Formal proposal follow-up	SVP, Investments	No formal follow-up	Business Unit technology director	No formal follow-up	Development meeting and director	No proposals	No formal follow-up
Presentation forum for PCA reports:							
– Primary	Investment prioritisation team	Investment team	Corp. Technology & Operations meeting	Corporate Investment Committee	Corporate Development meeting	Corporate BOM	Divisional BOM
– Secondary	(Corporate BOM if something odd)	Divisional BOM	Division BOM	Divisional BOM	Corporate Technical & Operations group	Corporate BOD	Corporate BOM
– Presentation to executive group	Yes (if something odd)	Yes	Yes	Yes	No, only distribution	Yes	Yes
– Presentation to board of directors	No	No	Yes	No	No, only distribution	Yes	Yes
Dissemination of final PCA reports to all people involved in the project	No	No	Yes	No	Yes	Yes	Yes
ORGANIZATIONAL MEMORY:							
Archiving and filing of PCA reports:							
– Database/archive exists and its existence & content is widely known	Yes	Yes	No	No	No	No	No
– Convenient retrieval of PCA reports from database/archive	Yes (via intranet)	Yes (in LAN)	No database	No database	No database	No database	No database
– PCA reports can be requested from	SVP, investments	Controller at HQ	SVP, Operations & Sourcing	Corporate Investment Office	Development Meeting and Director	Corporation Investment Staff	Investment service

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

	H	I	J	K	L	M	N
KNOWLEDGE ACQUISITION:							
Selection criteria for PCA projects	Size and expansion (simultaneously)	Size	Size or strategic	Size	Size	Size and expansion (simultaneously)	Size and expansion (simultaneously)
Timing of PCA after completion	6 to 12 months	Between 24 and 36 months	Between 24 and 36 months	About 12 months	Between about 12 and 36 months	About 12 months	About 12 months
PCA auditor	Headquarters' controller	Investing unit itself	SVP, investments	Investing unit itself	Controllers of other unit	Investing unit itself	Jointly (investing & HQ engineering unit)
Responsibility for PCA system	Corporation	Corporation	Corporation	Division	Corporation	Division	Corporation
INFORMATION DISTRIBUTION AND INTERPRETATION:							
Content of a PCA report:							
– Detailed comparisons of ex-ante and ex-post calculations	Yes	Yes	Yes	No	Yes	No	No
– Comments on the achievement of objectives	No	Yes	Yes	Yes	Yes	Yes	Yes
– Common PCA reporting language	Yes	Yes	Yes	Yes	Yes	Yes	Yes
– Standard Report format	No	Yes	No	No	No	No	Yes
– Proposals for future projects	Never	Seldom	Often	Seldom	Always	Seldom	Seldom
– Formal proposal follow-up	No proposals	No formal follow-up	No formal follow-up	No formal follow-up	No formal follow	No formal follow-up	No formal follow-up
Presentation forum for PCA reports:							
– Primary	Corporate BOM	Corporate BOM	Corporate BOM	Plant BOM	Group controllers' meet.	Division BOM	No forum
– Secondary	Corporate BOD	---	Divisional BOM	Divisional BOD	---	Corporate BOM	---
– Presentation to executive group	Yes	Yes	Yes	Yes	No	Yes	No
– Presentation to board of directors	Yes	No	No	Yes	No	No	No
Dissemination of final PCA reports to all people involved in the project	Yes	No	No	Yes	No	No	No
ORGANIZATIONAL MEMORY:							
Archiving and filing of PCA reports:							
– Database/archive exists and its existence & content is widely known	No	No	No	No	No	No	No
– Convenient retrieval of PCA reports from database/archive	No database	No database	No database	No database	No database	No database	No database
– PCA reports can be requested from	Management Accounting Controller	Operations controller at HQ	CFO; VP, inv.; SVP, inv.	Plant development manager	Operations controller at HQ	Country organization, Financial staff	Report makers, engineering group