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Implementation of an integrated accounting and cost management system using SAP system: a field study

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Abstract

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Keywords

Implementation, integrated, accounting, cost, management, system, using, SAP, system, field, study

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Contribution 13

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ABSTRACT

Not only are in-depth (theoretically informed) longitudinal (reflexive) field studies few and far between, it has been argued in those studies that little is known about the design and implementation of accounting and information systems that operate in today's world-class organizations. Using such an approach this study seeks to illustrate and analyse the implementation processes of an integrated accounting and cost management system using the SAP system at a major steel producer in Australia. It is demonstrated that the technical design of the system is only a part of the implementation process. Keeping 'actor-networks' in line and managing change including behavioural implications on the implementation are also seen as crucial issues, which are outcomes of a continuous translation process.

1. INTRODUCING PROBLEM(S) OF THE STUDY

The implementation of a major system change is a complex process with far-reaching organizational ramifications. Such a major change is the subject of this paper which describes the stages in the implementation of an integrated accounting and cost management system using the SAP system in a major Australian company: a company that had for a long time been an 'icon' in the Australian economy. Through initial field investigations we had identified that from the mid-1980s there had been a continuous effort by the company (viz. BHP-FPD) to understand and improve its costing system both in terms of systems and costing principles. In 1989 (between July and October) a Costing System Review (CSR) team of the company – the researched organization – together with a consulting group (a public accounting firm) carried out a review on its existing cost management systems – its concepts and principles. The team recognized that there were significant shortcomings in existing technologies for its costing (direct integrated costing system – DISC) and other systems. Having recognized such lacks, a team from the Finance and Planning (accounting) department focused on the urgency of developing an integrated system which could supply and manage an online, real-time, flexible and user-friendly accounting and cost management system (CMS). In an endeavour to do so, in April 1990 the costing team examined the possibility of overcoming the technological incapacity by in-house systems development. Following on that examination, during May and June 1990, a team called commercial-in-confidence (three senior executives – two from BHP-FPD and one from BHP-IT) visited ten related world-class companies in the UK and the USA. The visit not only provided a greater awareness of contemporary practices of CMS but also enabled the team to compare the related competitors' data processing technologies with that in the researched organization, specifically in respect of managing the cost management and other systems.

A consequence was the selection of the SAP² system and a preliminary evaluation was carried out during August and September 1990. A part of the evaluation report from the team was as follows:

SAP Evaluation 17/9/1990–21/9/1990

The original timetable for the SAP evaluation did not proceed as anticipated.

Unfortunately the presentation by SAP fell short of expectations. The review team were informed that SAP would provide working examples of SAP modules using SPPD's Data (previous name of BHP-FPD prior to restructuring – Slab, Plate and Product Division).

At the end of session on the 18th, all process costing issues, including budgeting, variance analysis, etc., had been covered.

This, however, left the review team unsure as to SAP's ability to meet SPPD's specific requirements as documented.

We took a decision to cancel the session scheduled for 20/9 and 21/9 to concentrate on our core costing requirements.

We proceeded in the following manner on 19/9 and 20/9:

- Overview of the SAP's job order costing modules;
- Recapped the SAP's cost centre accounting module in specific detail with reference to meet SPPD's requirements;
- Discussed SAP's ability to meet each point outlined in section 4.3, 4.4, and 4.6 of our requirements document.

On the last day, 21/9, we received a general overview of the sessions we had cancelled earlier, such as Accounts Payable, Project Costing, Maintenance Costing, Product Costing, as well as Income Analysis modules.

SAP appears to be able to address most of the costing requirements specified in our document. The methods used within SAP to address those requirements however, are difficult to assess. The sessions we have been exposed to raise many more issues.

The only option available, that will enable a firm decision regarding SAP's suitability, is to proceed with the prototype model. The prototype model will be a simulation of SPPD's costing requirements within the SAP package. Issues regarding interfaces and modifications to existing systems will also be addressed.

SPPD and IT personnel must undertake a series of SAP training sessions in order to learn how to use the SAP system to be able to carry out the prototype

Conclusion

Overall, SAP's package capability in relation to meeting our requirements, was difficult to assess. This difficulty stems from issues such as terminology and definitions, to screen layouts and the general impression that SAP will be difficult for the average person to use. Also, in providing solutions to our requirements, a number of alternative methods were suggested by SAP. Obviously, an overview of a new system is daunting, and familiarity may overcome the perceived problems of use. A 'hands on' working example is therefore necessary to assess SAP's suitability in meeting SPPD's requirements. SAP has an intricate system that shows potential in meeting our requirements.

It is obvious a package will never be an exact fit. The Cost System Review team's prototype must assess the impact within FPD in changing our current systems and procedures to accommodate SAP's structure.

(Source: Company Data – Report on SAP Presentation, September 1990)

From the conclusion, it is apparent that, on the one hand, the team was of the opinion that the task of implementing SAP technology for the development of technologies for the management of CMS in the company would be daunting, while on the other hand, it demonstrates the optimism in the team and the management in the potential of SAP as a replacement for their own unsatisfactory system(s). Consequently, they sought more resources, showdowns, prototypes and training in order to learn, become familiar with and understand the SAP system, which further supports the view of how a few (hesitant) individuals (cf. Preston *et al.*, 1992) took the initial responsibility for evaluating a new data processing technology (the SAP system) for CMS development at FPD. However, this initial SAP system evaluation was 'only the beginning of a long battle' (cf. Chua, 1995) for implementing an integrated CMS in the company.

The next section of this paper outlines the background literature. This is followed by our story of the implementation and/or fabrication processes of an integrated accounting and CMS at the researched organization, which consists of three subsections: discursive conditions for a change at FPD, trial of a standalone CMS development, and multiple happenings and implementation of an integrated CMS. The final section contains our conclusions and implications for such an implementation to (management) accounting.

2. BACKGROUND LITERATURE

Over the last two decades or so, a wide range of reflexive field studies have been conducted using several interpretive (critical) theoretical stances and strategies (for example, Burchell *et al.*, 1980; Berry *et al.*, 1985; Laughlin, 1984, 1988; Broadbent *et al.*, 1991; Armstrong, 1987, 1991; Loft, 1985; Hopwood, 1987; Capps *et al.*, 1989; MacIntosh and Scapens, 1991; Preston *et al.*, 1992; Chua, 1995; Briers and Chua, 2001). Not only are such theoretically informed interpretive (reflexive) field studies supportive of the view that very little is known about the actual functioning of accounting in organizations (Hopwood, 1979; 145; cf. Burchell *et al.*, 1980; Cooper, 1983; Berry *et al.*, 1985; Laughlin, 1987; Preston *et al.*, 1992; Chua, 1995), but they also have advocated that methodological considerations loom large in undertaking and developing accounting theory and research (see Lodh and Gaffikin, 1997).

In this study, we utilized 'sociology of translation' or 'actor-network theory' as a framework to investigate the implementation of an integrated accounting and cost management system using the SAP system at a major steel producer in Australia. In so doing, we used a (reflexive) field research method, which is viewed to be more appropriate to enhance and reflect on a subjective notion of knowledge claims, where 'scientific facts and technical artefacts' (i.e. science in the making) are not viewed as being part of a pre-existing natural order, simply waiting to be discovered by the people in academia and in the commercial world. Rather, they are the result of an elaborate 'process of fabrication' (Preston *et al.*, 1992: 564). This conformed to our intention to become involved in the 'process of fabrication' using the framework of the 'sociology of translation' as has been developed by Michael Callon, John Law and Bruno Latour.

It is Bruno Latour who has introduced the term *techno-science* to emphasize his association with and convergence on, a sociological tradition known as 'science and technology studies'. The most prominent authors in this area include: Donald Mackenzie, Judy Wajcman, Steve Woolgar, Trevor Pinch, Weiber Bijker, Thomas Hughes, John Law, Michael Callon and Bruno Latour. Following on his predecessors' works, Latour (1987) has drawn on two distinctive types of science – one of which is 'ready made science'; the other, 'science in the making'. He refers to this as the 'two-faced Janus' of science (p. 4). Latour relates these orientations of science to the *diffusion and translation* models, representing technological determinism and the social dimension respectively. He then proceeds to relate the diffusion model to the 'inertia' principle of physics. He states, 'according to the inertia principle token [objects] will move in the same direction as long as there is no obstacle' (p. 267). In contrast to the diffusion model, Latour (1986) argues that in the 'translation model', first, 'there

is no inertia account of the spread of a token'; and second, the 'social action' is seen as a continuously 'transformative' process. Third, he proclaims that the chains of actors are actively participating (*performatively* rather than *ostensively*) in the shaping of facts and artefacts. In this translation model the concept 'power' is treated as a composition, that is, 'the composition of a set of actors who are temporarily enrolled in the schemes of the powerful and who accordingly lend their efforts to his/her project' (Law, 1986: 17). One of the central leitmotifs of this translation or actor-network approach is that there is not a background, a determinant social structure that may be observed by social scientists. Rather, 'what may be observed are sets of different people trying to define the nature of social structure, and then trying to persuade others to subscribe to that definition' (Law, 1986). Thus, this authority advances a methodological corollary that 'social scientists should stop trying to determine the nature of the social structure that they believe generates these conflicts, and instead treat the latter as data'. In other words, Law argues that 'society is not seen as the referent of ostensive definition, but rather is seen as being performed through the various efforts to define it' (p. 18). 'The new allies shape the idea or artefact to their own will – they do not so much transmit as translate it' (Cockburn, 1992: 34). Thus, the concept of *sociology of translation* is determined.

Preston *et al.* (1992) used this translation approach in carrying out a reflexive 'field-work' of the budgeting fabrication [implementation] processes at the NHS (National Health Service) in the UK. They urge that

[J]ust as the study of science has moved into the laboratory (Latour and Woolgar, 1979) so it may be fruitful if students (and researchers) of accounting in action also examine the practices and discourse of management consultants, systems analysts, software engineers and designers, and accountants involved in fabricating [implementing] accounting and budgeting systems [p. 590].

They further advocate that:

Our investigation of the fabrication of budgets was particularly informed by three guidelines from Latour's [1987] rules of method. Firstly, we chose a controversial accounting and budgeting technology to facilitate the identification of alternative possibilities. Secondly, we mapped networks of resource, support and use, both historically and across conventional organizational boundaries, in order to examine the multiplicity of people involved in the fabrication process. The third guideline was to attempt to be present in the fabrication process before the black box is closed and debates have died down.

(Preston *et al.*, 1992: 567)

Another example is a study by Chua (1995) who also employs notions developed by Latour (1987) and Callon (1986) and their colleagues. She applies a 'translation' or 'actor-network' approach in investigating and writing up a 'critical ethnography' of the fabricating processes in the implementation of a case-mix DRG system (a cost accounting technology) at three public hospitals in Australia. She argues that:

...the work of Latour and Callon draws attention to the persuasive power of non-human resources such as visual inscriptions, academic texts and 'centres of calculation' (Latour, 1988). Paperwork such as formulae, graphs and charts are argued to possess many rhetorical advantages: they are mobile, immutable, recombinable and are perceived to be built on many 'facts'. Most important of all, inscriptions make 'black-boxes' visible [pp. 115–16].

Briers and Chua (2001) also carried out a field study using the 'actor-network theory' to illustrate 'how an organisation's accounting system can be changed by a heterogeneous actor-network of

local and global actors and actants'. Robson (1991: 550) relates the concept of 'the sociology of translation' to understand the processes through which accounting and the social can be interrelated. In conceptualizing and relating this translation model to accounting changes, Robson (1991: 550) argues that the 'translation will refer to the process through which often pre-existing accounting techniques, and their associated roles, are articulated discursively, in ways that construct individuals' and groups' interest in those techniques, and may subsequently provide motives for producing changes in accounting'. According to Robson (1991: 566), the concept of translation can be seen as a construct for understanding the specific associations, connections or 'positive' relations that are made between accounting and its social context. Thus, Robson (1991: 566) argues that

in examining accounting change, it is necessary to attend to the process through which particular accounting statements, calculations and techniques are subject to a translation into wider social, economic and political discourses not normally associated with the apparently neutral, technical discourse and practices of accounting.

In our study, we used this approach to understand the translation processes of the implementation of an integrated accounting and cost management system using the SAP system and, in particular, our concern was with the changing ideas about how technology is built and used and the procedures and calculations that are made possible by the technology which can give rise to various new emerging roles of accounting and a cost management system in an organizational context.

Field research processes: a note

We had been trying to gain access into a large organization for more than a year where restructuring or change process was under way. Eventually, we gained access to the researched organization at the time when the SAP system implementation project was in progress. We carried out 'active field work' (cf. Briers and Chua, 2001) over a period of two years during 1992-94. There were various modes of reflexive field research processes followed in this study. These processes included attending various meetings, review sessions and training courses to 'hands-on' and understanding the computer system; collecting a wide range of project design-related documents, minutes, discussion papers and other materials; conducting interviews (both formal and informal) with various levels of officials. For most of the involvement diaries were kept. Most of the interviews were tape-recorded. Initially, some interviews were not tape-recorded but were written up based on the notes taken during the interviews. These were conducted mainly to familiarize, maintain and develop further inter-actions in order to keep track of, and update, the implementation processes. Interviews were conducted with a general range of questions prepared before interviews and conducted with a focus on particular key questions depending on the nature and works with which the interviewee was involved. The questions were not followed up in a fixed order, and issues raised by subjects were pursued. These interviews, in fact, supplemented a vast body of comments and information gleaned from informal discussions. Extensive notes were also taken.

Access to the quasi-laboratory⁴ – the implementation project – was well accepted and there were very few obstacles to collecting the documents. Various internal documents (viz. a range of design papers, occasional papers, project design manuals both current and historical, various booklets of differing initiatives of the fabricating CMS and other systems) were collected through various actions with the various officials both inside and outside the quasi-laboratory. Sometimes, extra copies of some of the design-related documentation were specially made available to the researcher. There was no shortage of co-operation. All the members became friendly, co-operative, open and supportive, and seemed to genuinely value the researcher's interest in the investigation of the complex activities of the project. Sources of secondary information (historical data) included the library of the researched, local newspapers, published books, special monographs, memorandums and journals about the researched. Most of the secondary information about SAP International AG Ltd

was collected through personal interactions with the consultants and from their Australian head office.

Preston *et al.* (1992) have argued that in order to examine the multiplicity involved in any fabrication process there is a need to map various networks of resources both historically and across conventional organizational boundaries. However, it was not possible to attend all the meetings and note the utterances of the various players (actor-networks) involved in the fabrication. There were many overlapping meetings and diverse activities, of which one could only hope to get a general view with some specificity over a lengthy period of investigation.

3. OUR STORY OF THE IMPLEMENTATION OF AN INTEGRATED CMS AT FPD

Our story of the implementation of an integrated accounting and cost management system at FPD is divided into three sections. The first is to report why such possibilities emerged; what discursive conditions were there at FPD? The second section reports a story on the initial trial of a standalone system development. The third section reports on the multiple happenings when more actor-networks (other than accounting and finance personnel – engineers and others) were enrolled and involved in implementing the integrated CMS at BHP-FPD using the SAP system. The final subsection contains our conclusions.

The possibilities for improving the CMS at FPD

There were a number of discursive conditions and discrete events that might be seen as motivating the development and improvement of the CMS at the researched organization. Determination of the exact cut-off period (both beginning and ending) for an historical analysis of the emergence of CMS at FPD is difficult. This is because there were various programs carried out with a 'stop and start' syndrome over the last three decades at FPD. For our analysis, the year 1978 is considered as a significant starting point of the CMS development because it is the time when FPD moved for the first time into a computerized mainframe CMS with the introduction of the DISC (direct integrated standard costing) system. Tentatively, however, the period prior to the initiative of the forming of what we call the quasi-laboratory is considered as a cut-off end period. That is, up to the time when a consulting group and FPD in 1989 jointly carried out a study in evaluating the existing costing systems and its concepts and principles. This was the time when the first initiative for changing FPD's old (internal data processing) 'technologies' had begun.

Before elaborating the significant events in improving FPD's CMS, an understanding of its historical development is required.

Historical prelude to the CMS development at FPD

At the time of this study, there was no explicit formal definition of the term 'cost management system' at FPD. However, during the formation of the quasi-laboratory a tentative definition was outlined as a 'cost management (system) is the provision of information needed by the managers to efficiently and effectively carry out their responsibility in regard to cost management'. In addition, it is also noted that cost management information needs can be classified into three broad categories – strategic, operational and financial. Although the focus of a CMS had been staged and framed by advancing these broad constitutive roles, during the early 1990s (i.e. at the early stage of the quasi-laboratory) one of FPD's immediate concerns was to focus on the development of 'technologies' (i.e. computer systems for internal data processing). From the viewpoint of computer technologies (i.e. machines), a general understanding of the notion of a CMS at FPD not only comprises costing systems (i.e. finance and planning systems for data processing) but also all other related feeder systems. Thus, an understanding of a CMS at FPD is that it comprises not only the costing and financial accounting systems, but also other management information systems (MIS).

Since the introduction of the DISC system, there had been a continuous effort to understand and improve the costing system both in terms of systems and costing principles at FPD. However, there were many discrete events that could be seen as attempts at improving FPD's CMS during the period 1978 up to the formation of the quasi-laboratory. From a costing point of view, such developments can be described under the following categories: (a) DISC system and its related systems and costing concepts; (b) planned value control concept; (c) other systems, programs and reviews.

(a) *DISC system and its related systems and costing concepts* On Friday 20 January 1978 the Board of Directors approved a submission recommending the introduction of a new management reporting system known as the DISC (direct integrated standard costing) system in BHP's Steel Division. At the same time, FPD (then the Australian Iron & Steel Co. Pty Ltd) also adopted its divisional costing system. DISC is a mainframe system, which was advanced for its time, albeit complex like any other computerized system. DISC system design supported a direct (marginally) costing system. In the DISC system a complex variance reporting facility existed. Details of such variance analyses were to be found in the operating guide manual of the DISC system (DISC Operating Guide, 1979) and it was claimed that one of the major strengths of DISC was the calculation of detailed variances. This is not to suggest that it was without limitations, such as too many variances sent out to the users, inability to aggregate them for reporting purposes, long paper chase and lot of manual fixes.

Parallel to the DISC modifications, there had been a series of feeder system developments at FPD. These feeder systems are developed either in-house or bought from outside software companies. In fact, FPD's existing cost management systems were designed on the principle of a series of 'feeder systems', each performing their own individual functions, supplying data to a common data pool accessible for different purposes by a range of costing and related systems (Costing System Review, 1989). In particular, the major association of FPD's existing costing systems comprise cost data collection system (CCS), DISC system, capital costing system (CCS), general ledger system (CLG) and numerous several feeder systems (see Figure 1).

Figure 1 FPD's existing costing system

Source: BHP, Costing System Review (1989: 26a).

The Costing System Review (1989) team concluded that there was nothing wrong with the existing costing system architecture. Rather, the team recommended that existing constraints were largely due to technology limitations including the lack of databases for convenient access. However, the team identified a number of deficiencies of the existing systems. They include (a) errors and reporting delays limit the effectiveness for cost control, (b) constraints on multi-level reporting limit effectiveness for responsibility accounting, (c) the systems were rigid and inconvenient, (d) extensive manual processing, (e) errors hard to trace, (f) data inaccessible for special analysis, (g) lack of integration, on-line processing, ready data access, (h) DISC was very complex, and both its concepts and associated terminology caused confusion, and aggregation facilities were limited in the DISC system. However, the DISC system brought forth many changes at FPD and enabled costing personnel to look forward to the development of their CMS, both in terms of systems and cost management principles.

(b) *Introduction of the planned value control (PVC) concept into the CMS* During the period 21 July to 8 August 1986, in accordance with a technical co-operation agreement, Nippon Steel Corporation (NSC) conducted a field study at FPD (then SPPD) for the introduction of planned value control (PVC) into the CMS matrix of the steel works. Together with PVC, NSC also looked at the possibility of introducing integrated quality control systems of how these control systems could be positioned and used in FPD as part of total quality control (TQC).

On the basis of the NSC's report (NSC, 1986), FPD incorporated the PVC concept into their CMS matrix in order to improve the performance measurement (feedback and feed forward control) at all levels. It is a concept of setting co-ordinated plans and reviewing these plans regularly against the actual performance. The PVC concept is involved the setting of specific 'forward-looking' targets for key parameters of operational and cost control and comparing actual performance with these targets. These targets are called planned values (PVs). A key aspect is that these targets are not imposed from above but are set by those people responsible for that performance. The drive for continual improvement is an essential part of the setting of planned values. It is a concept, which supports the PDCA cycle of total quality control (TQC) philosophy in setting PVs.

The PDCA cycle is 'Plan', 'Do', 'Check' and 'Act'. The cycle starts by developing a 'Plan' for what needs to be accomplished in any given time frame. In this phase there is a need for analysing the existing situation so that appropriate objectives can be set to improve present practices. The 'Do' phase incorporates the applications of the plan undertaken. That is, it involves putting the plan into effect. The 'Check' phase involves investigating whether the desired improvements have been attained. In the 'Act(ion)' phase the successful aspects of the plan are identified and become new benchmarks for future improvements. This cycle is a continuous process: no sooner is an improvement made than it becomes the standard to be challenged with new plans for further improvements. That is, the cycle continues by returning to the 'Plan' phase to set objectives for further opportunities that have been identified.

It is claimed that PVC was one of the founding platforms for the introduction of TQC at FPD. In addition, it has been considered a systematic and formalized way of improving CMS by encouraging cross-functional involvement at all levels such as production, supply, maintenance, finance and planning, and human resources departments (see Lodhi, 1995). From a costing and budgeting point of view these planned values are targets or standard values that form the basis of evaluating operating results. In a way, the PDCA cycle aims at formalizing a process structure that enables active involvement and participation at all levels from top management down to the shop-floor level.

Although the PVC concept has been used at FPD to manage various facets of the business at FPD, it has not been without limitations. The Costing System Review (1989) team identified several problems concerning the operations of the PVC concept at FPD. For example, it was stated that:

It is difficult to determine the effect of changes to 'planned values' prior to submission and acceptance. The current method of setting PVs is unsatisfactory as it involves multiple handling of data. Changes to PVs are made without the users' knowledge. The time delay in effecting a change to a PV is unacceptable to the user departments. It takes 8 weeks for changes to be reflected in the cost reports.

(Costing System Review, 1989)

This is one of the reasons why FPD's finance and planning department had looked forward to implement an IBS system to improve its CMS.

(c) *Other systems and programs* During the 1980s various initiatives, including the engagement of consultants, were undertaken by FPD for various systems developments and programs attempting to improve its CMS. This resulted in numerous management programs being initiated over the years, but also made management more aware and gave increased 'visibility' to its existing programs and systems. Pressures from the corporate BHP Steel group in the late 1980s also resulted in numerous programs such as a performance management program along with other initiatives such as working capital management and value-based management programs, to improve the cost management practices throughout the BHP Steel divisions. However, the analyses of all the details of the existing systems and programs that can be included in the CMS matrix at FPD were not attempted.

Trial for a standalone CMS development

As has been stated earlier, there were a number of discursive conditions out of which emerged the possibility of the implementation of the CMS and the impetus for forming the quasi-laboratory at FPD in 1989. Upon returning from the visits to world-class companies (four of them were in the UK and six were in the USA) in June 1990, the 'Commercial-in-Confidence' reported the outcomes. An interesting aspect of this report is that it is a representation of the real actors (commercial-in-confidence) attempting to compare the 'global actors' (see Briters and Chua, 2001) in order to improve their 'organization of social life' (Habermas, 1984, 1987) or organizational practice of CMS. In other words, a world-class company (the researched organization) investigated its related competitors' cost management practices in order to improve its own cost management practice. However, some general findings, as extracted from the report, are as follows:

- No company [which they visited] has shown a clear lead in all areas of cost management systems. Rather, the companies have been developing in areas of their need and status of existing systems – which ranges from delivery system to strategic costing information, a considerable amount of prototype with pilot exercises being the norm.
- Costing information is used to meet differing needs such as fulfilling financial, operational and strategic requirements.
- Performance reporting systems were focused on business requirements with special emphasis on the effective use of performance management being widely recognized.
- On cost reporting, the companies are experiencing problems such as accuracy and credibility of costing information, timeliness of information, inability to measure and audit trail issues regarding stored information.
- Centralized commercial systems (profit and budget reporting, sales, payroll and purchasing) across divisions within a company were the practice.
- Activity Based Costing primarily used for (i) strategic costing such as product and target costing, and (ii) cross functional analysis to identify value and non-value adding activities.

- Design of management and performance reporting system not entirely done by Finance & Planning department – team efforts with finance participation.

For management information system – use of Mainframe for data collection with processing occurring on PC and departmental computers. The companies are attempting to move towards commercial packages wherever possible with features such as low risk, lower cost and quicker implementation.

- Reliance on non-financial KPIs (Key Performance Indicators) – many KPI's being introduced by line personnel to enable them to monitor their performance daily and weekly, and emphasis given down to the shop floor.
- Strong focus on customer requirements with systems designs and reporting on issues such as customers' requirements of delivery, lead times, scheduling, and quality.
- Focus on managing organizational change and recognition of difficulties of interfacing various stand-alone systems.
- Operating personnel were taking a higher profile role.
- There is recognition for consistency in approach to central database. Overall recognition for better understanding and better uses of cost management as a strategic tool and where it fits into overall future direction of the company.
- Each organization has its strengths and is looking to develop from different starting points.

While visiting companies in the UK the team gathered information that many world-class companies were using the SAP commercial software package world-wide in order to manage data processing for various business applications. However, at the time, the team had doubts about the SAP system's user friendliness. They also viewed that interfacing existing systems with SAP might be difficult. Although this scepticism was unsurprising, there were appraisals as well, such as – 'SAP system is reliable', 'it is a proven package', 'go for a big-bang implementation', 'SAP system is a big-bang system' and so on. Following the visit, however, tenders for commercial software packages to replace FPD's existing CMS data processing technologies were called for.

The question remains – how much of the field study can be reported in an ethnography (cf. Mehan and Wood, 1975; Chua, 1995)? However, we are reporting only a partial story of the proposed implementation at FPD. In the following, first, we examined the processes and events prior to and including the formation of the quasi-laboratory. Second, we examined the initial implementation processes of the quasi-laboratory covering the period March 1991 to June 1992 when a trial for implementing the standalone CMS using the SAP technology was undertaken at FPD. Finally, we examined why the trial for the standalone CMS development did not succeed.

Tender for 'machines' – presentations, showdowns and evaluations

In September 1990 the task of evaluating the SAP system was assigned to a review team. From the initial presentations made by SAP International AG the review team submitted an evaluation report. It was an evaluation for convincing technical choices of SAP system functionality over the existing technology from the FPD's costing and budgeting point of view.

The team reported that the 'SAP package is an integrated system' and its success is based on the integration and the interdependency of all of its modules. Arguably, the abilities of an integrated CMS are to a large extent determined by the systems of classifying costs and other segmental information in a manner that permits easy access to stored data on a real-time basis. This requires organizations to be structured with different segments so that unique information can be kept and retrieved when required. In the SAP system there are four such segmental hierarchical levels available. Each segment is an identifier of particular classified hierarchical information. Figure 2 is representative of an integrated CMS structure of the SAP system.

Segment A in Figure 2 is representative of an identifier for a client or group company. Segment B is an identifier for a company (or subsidiary company). Segment C represents 'Plant' in the case of RM (material masters and equipment management RM-INST) and fiscal year or business area in the case of general ledger master file management. Segment D is an identifier of a storage location, which resides in the material master file. As the cost accounting system in SAP is designed for only one company, all cost centre hierarchies come under the company segment, that is, B Segment. Each segment contains several levels of information, which can be customized to satisfy specific needs of the organization. For example, in SAP's RF general ledger system each installation can have up to 99 clients, each client can have up to 99 companies and each company can have up to 99 years. This segmental information is used to maintain the account master file in the general ledger system. To maintain these hierarchies several transactions need to be run and tables set up. There are numerous technical details (inscriptions) of these operations.

From October to November 1990 further demonstrations and training took place on some SAP R/2 Basis system's modules in costing and financial accounting areas such as On-line Functions (RS 210), Cost Centre Accounting (RK 010), Cost Centre Planning (RK 020), Job Order Accounting (RK 110) and Job Order Settlement (RK 112). On return from the training courses the costing team prepared a document which contained descriptions of the functional requirements of FPD's CMS to be implemented using the SAP system based on what they could gather and see as significant at the time. On the basis of these functional requirements, at a later date, a set of questionnaires was prepared seeking a response from SAP. The questionnaires were stacked ranging from a general overview of the system, general features of the system and concerning costing and general ledger requirements. It was in February 1991 that the costing team (viz. the Finance and Planning department) took a decision to prototype the suitability of the SAP system in replacing FPD's existing CMS technologies, that is, the DISC and other feeder systems at FPD.

Figure 2 SAP's integrated CMS Structure

After obtaining formal approval from the group general manager, in March 1991 our 'quasi-laboratory' was formed. This was followed by a plan for the 'cost system review (CSR) - Stage I implementation'. A structure for the quasi-laboratory was also designed. The CSR Stage I implementation plan suggests that during March to May 1991 the structure of the quasi-laboratory was supposed to be put in place.

Fabrication via conceptual design.

This conceptual design (CD) stage of fabricating the standalone CMS was primarily set out for identifying the weaknesses and strengths of the existing systems and procedures, and for defining

the terminology and scope of the work. Initially, there were various discussion papers that dealt with depicting the scope of the laboratory. However, at the time the team identified seventeen standalone conceptual design issues to be looked at in the costing area. These CD issues included cost centres and hierarchy, job numbers, general ledger, cost collection/recording, monthly cost procedures, reporting, stock ledger, budgeting, system administration, standards/policies, security, operations, others - systems conversation (old to new), manuals and documentations, training, labour costing redevelopment and job costing. The initial structure of the quasi-laboratory was in fact designed based on those identified requirements which were aligned to fit SAP systems requirements. There had been a series of discussion forums and meetings to prototype the above standalone costing issues. Outcomes of these prototypes resulted in numerous documents on each of these CD issues.

During June and July 1991, for example, several discussion forums had taken place on the 'training issue' (which was one of the seventeen CD issues) of creating a CMS by implementing SAP's commercial software packages. Various tactics were followed to prototype and lead the discussion on the training issue. As evidenced from a discussion paper (a costing system update, dated 24 June 1991), there were several tactics followed to lead the discussions and prototype the training issue concerning fabricating CMS at FPD using the SAP system. These tactics included: preamble and general discussion; issues and questions to be resolved; work breakdown for training and project awareness; recommendations, reasons and justification for recommendations; system administration and its role and functions; and comments and opinions. Similarly, various deliverables were also the subjects of discussion under each of these above tactics and were discussed in closed sessions by the members who were initially enrolled in the quasi-laboratory.

It is obvious that detailing all the conceptual design issues would require time and space well beyond the scope of this paper. However, the theoretical relevance of mentioning this is to show how the costing team was 'hesitant' (Preston *et al.*, 1992; Briers and Chua, 2001) in benchmarking the beginnings of a major change that is fabricating an integrated CMS at FPD using SAP technology. However, the training in understanding the proposed systems - understanding the SAP system - in order to translate them to users and to design and prototype the new implementation from an outside developer without developing necessary skills for ongoing system maintenance and support in-house is something like 'the lady saved in half, it isn't done at all'. In a similar vein, for example, the project co-ordinator of the standalone CMS project stated in a conversation that: 'Bringing in consultants may expedite a quicker implementation of a project but that knowledge may well walk out through the door when they leave the client's premises.'

Initial issues in the quasi-laboratory were not only focused on identifying the weaknesses and strengths of the existing systems, defining terminology and identifying the scope of the work, but also on fortifying strategic concerns of the CMS implementation. As indicated earlier, a focus of FPD's CMS development not only comprised the costing and financial accounting systems but also other management information systems. By demonstrating, for example, the relationship of the CMS development scope to FPD's total MIS at a very broad level, at the time the initial 'fact-builders' (the costing team) focused on two levels of strategic plans. One was for 'world class cost management' (as they called it) and the other was for the costing system review (which was an initial scope of the quasi-laboratory). At the time, the way in which the costing team staged and framed the concept of 'world class cost management' was as follows:

World class cost management is the provision of information needed by the managers to efficiently and effectively carry out their responsibility in regard to cost management. Cost management information needs can be classified into three categories: strategic, operational and financial.

(Source: company data)

The objectives and their achievement strategies were also carefully staged and framed. This *staging and framing* was necessary to 'win over' actor-networks (i.e. allies). Preston *et al.* (1992: 574-5) argue, 'the text has to defend itself from malevolent readers by explaining how and to whom it should read'. Referring to Latour (1987), Preston *et al.* (1992) further argued that 'framing statements provide an agenda for debate, an object for criticism, a framework for controversy, a benchmark for evaluating success or failure, a text to read between the lines of, and infer hidden meanings in, and a focus for dissent' (p. 575). It is possible that the costing team framed their cost management development strategies for such reasons. However, in a steelworks like BHP-FPD, where over the years engineering personnel have dominated the decision-making and management control system; where there exist many contemporary concepts and philosophies such as TQC, TQM, PQC, TPM (total performance management); where there exist controversies, friction and cultural barriers within various departments perhaps, at one level, it might be that selling another concept such as 'world class cost management' to the non-finance actor-networks was thought to be a difficult task. On another level, it is possible that it may have been to determine the scope of the costing system development at that stage.

So far, the above story of the fabrication of the CMS at FPD has addressed how the initial strategic concerns of the CMS development were staged and framed and how some aspects of the initial CD issues were dealt with by the initial participants in the quasi-laboratory. In respect to the strategic concerns as to why such an initiative was being instigated at FPD, a question was posed to some 'key informants' who were involved in the quasi-laboratory, one of whom responded as follows:

First of all the initial emphasis was drawn from the need to replace an outdated costing system, which had been in place for some time, about 15 years. There were lots of dissatisfactions amongst the wide range of user groups who are, if you like, to the existing costing system was not terribly user friendly in that regard. That was the empower to manage costs and other strategic matters at lower parts within the business. Whereas the key thing that started the process off ... If you look at our [existing] system architecture ... you can see, the system architecture in place was very complicated and old ... most of those systems had been developed in a time when flexibility and capability to do things and the efficiency which things can be done was quite different to what exists now.

(Mr. Jim Hall, Chairperson of the Phoenix 21 Project and Manager of the Finance and Planning department at the time, 20 November 1992)

Most people we interviewed¹¹ believed that the project of the standalone cost management system development was instigated from within the Finance and Planning department in order to replace their old DISC system, which, as mentioned by most respondents, was incapable of meeting the information need of the management. However, after the conceptual design stage of the standalone CMS development, it was decided to prototype various functionality through functional design.

Prototype via functional design

Preston *et al.* (1992: 574) argue that 'stacking' involves bringing in figures, pictures and numbers to convince the reader and to enable the text (which were scientific papers to Latour) to fortify them. In the quasi-laboratory, there was substantial paperwork that resulted in various prototype documents and design papers. Drawing figures, graphs, pictures, complex system diagrams, charts, use of system's related acronyms, symbols and specialized system languages are part of the everyday activities of the participants (accountants and others) in the quasi-laboratory and there were many system-context diagrams prepared by them as a part of stacking information in order to prototype and design the new CMS at FPD using SAP technology. Areas that were taken to prototype at the time included: RF-S general ledger system, RK-A job costing system, labour costing system, RK-A service centre costing, RK-S budgeting system, RK-D process costing system, RK-S cost

centre hierarchy system, RM-Mat stocks/materials system and BARS (BHP's accounting and reporting systems) interface system. Detailing all the functionality or business processes was not considered an agency of this paper nor has it been assumed. However, representing the researched organization's total management information system (MIS) would certainly require a considerable amount of time and space.

Between January and March 1992 various functional design papers were prepared on the areas mentioned above, which were known as the functional design prototypes of the standalone CMS fabrication trial. During the period 23 March to 1 April 1992 these design papers were reviewed in closed sessions. Most of the discussions of these review sessions were centred on the 'convincing technical choices' between the differences of the existing system and the proposed SAP system in respect of functionality, of highlighting issues encountered, of recommending solutions where appropriate, and listing benefits and limitations of the proposed system implementation. The language of the discussions was specialized. Expressions such as ABAP, TK 31, TB 01, RK-S and RK-A are SAP system's language. Without knowing the meaning of these symbols and acronyms it is difficult to follow the discussions of the actor-networks.

During 8 and 9 April 1992, these functional design papers were presented before the team leaders of various groups in the quasi-laboratory and a specialist SAP consultant. In each of the presentation sessions some time was allowed to raise questions and issues. During the question time, there were heated debates between the specialist consultant and the presenters and the team leaders concerning diverse matters for fabricating the CMS. It was a battle for 'convincing technical choices' between the SAP system's functionality and the FPD's existing DISC and other systems.

Consultants are always alert to respond to any questions posed by the participants. For example, whenever any team and/or presenters stumbled on a new controversy dealing with the question of convincing technical choices for the proposed CMS implementation using SAP technology, the consultants always had an answer for them. Consultants, in this case, not only were the suppliers of the software but also agreed to provide an initial ongoing system support. There are many modules, hundreds of inscriptions and functions, which, it is claimed, make the SAP system an integrated package and the company a leading supplier of a mainframe commercial package in the market.

On 14 April 1992, some of the functional design papers were presented before the steering committee of the quasi-laboratory. Not only was the steering committee represented by the executives from the Finance and Planning department but also by other actor-networks within the researched organization such as Maintenance Engineering, Supply, Human Resources and BHP-Information Technology. This steering committee had been acting as an 'obligatory passage point' (cf. Callon, 1986) through which all the higher-level decisions concerning matters of the quasi-laboratory had to be passed. It was not just a matter of rhetoric or impressive presentations or stacking paperwork for 'convincing technical choices' that would convince or win over the steering committee (SC) to make the decision in favour of the proposed CMS implementation using the SAP system. Rather, it (SC) needed to be convinced that the later users were going to accept the proposed system; that it was user friendly, flexible and able to be implemented in a cost-effective manner and so on.

In order to mobilize the participants to continue fabrication or to 'maintain the chain', Chua (1995: 125) argues that 'new converts would need to be formed, critics silenced, competitors overcome, sceptics convinced and technology shown to "work" in many, diverse workplaces'. The issue was then to convince the actor-networks within the organization and convert them to join the costing team. These others (allies to Finance and Planning) not only were sceptics, they were watchful of what had been happening within the other parts of the business. Some wanted to become part of the implementation team from the beginning. For example, the Manager of Maintenance Engineering made the following response to a question:

I joined this project about November 1991 when the project was only a costing system project. It was a year after the Phoenix 21 project was initially conceived by the Finance and Planning people. We had to do a hell of a lot of very strong arguing with the accountants to let us be part of it. We had to argue that Maintenance should have some representative in the original Phoenix 21 costing project. It was only when we got a new manager of Finance and Planning [Jim Hall] we actually achieved that.

Likewise, it was possible that there were other sceptics and actor-networks/allies (such as the Supply and Human Resources departments) might have kept their eyes from a distance on what was happening at the time within other parts of the business. Despite such possibilities, management did not force them to join the implementers (initially the costing team) immediately. Rather, they were asked to participate via the steering committee.

During the period May to June 1992 various meetings were held to prototype further 'work-break-down' structure (as they called it). Some of these meetings were aimed at reviewing the individual work progresses in the quasi-laboratory. At the time, the members of the quasi-laboratory were mainly busy with stacking information, prioritizing SAP's functionality for various business processes and selecting the modules in order to prototype and design the new CMS. As they opened up more and more areas and looked at the required interfaces that were necessary if the standalone CMS was to be implemented, they found such an implementation was going to be a daunting task, especially considering the cost and time required for customizing interfaces between cost management and other systems. For example, the manager of the test/build team asserted in a meeting on 4 June 1992 (which was after more than a year of the prototyping of the SAP system) that:

...Don't over-design the systems. That's what SAP consultants keep telling us. There is lots of functionality we don't even know. ...We are not intending to build anything special at this stage in addition to the standard functionality of the SAP system. Of course, we will have limited function, limited drill down facility ...we are trying to minimize costs.

These utterances by the development manager (at the time) were basically a reflection of what might have been informed by the steering committee and the management. That is, the fate of the standalone CMS development had become doubtful as it progressed with the expense of developing (customizing) interfaces with other standalone systems which were found to be more expensive than the cost of introducing more SAP modules in order to have integration in those areas.

Fate of the standalone CMS development trial: what's gone wrong?

On Monday 22 June 1992 in a management meeting a change in direction of the quasi-laboratory was endorsed, which determined the fate of the standalone CMS development trial at FPD. The content of change, as stated in an update of the implementation project, was as follows:

- Stop the Phoenix 21 project introducing a standalone cost management system in June 1993 based on SAP release 4.4c.
  - Recommence the Phoenix 21 project as an integrated business system to incorporate modules in SAP release 5.0 in:
    - cost management - expanded to include: general ledger, cost centre accounting, work order costing, accounts payable and possibly projects and assets;
    - supply and maintenance management - to include management and costing.
  - Introduce Phoenix 21 integrated business system to FPD in June 1994.
- Nothing had gone wrong concerning the standalone CMS development; rather it was getting stronger day by day as more enrolments of actor-networks (both human and non-human) occurred.

Also, the initial instigators, the costing team, were not to blame for such happenings. Most of the people interviewed or spoken to supported the opinion that the work done during the standalone CMS development was not wasted. Rather, it provided them with a benchmark to further the scope of the quasi-laboratory.

Referring to Latour (1987), Preston *et al.* (1992) argue that 'the fate of a technology does not lie in the hands of designers or initial supporters but with those who come after - actors, who are often possessed of different interests and subject to different pressures'. Similarly, the fate of the standalone CMS development trial also became subject to change as more internal actor-networks (such as Maintenance Engineering, Supply and others) became part of the team and who certainly possessed different viewpoints, management styles and requirements. Moreover, in FPD, there existed controversies, friction and cultural barriers amongst various departments, teams and groups, which were sometimes labelled as a 'them and us' conflict. Reference to 'them' or 'us' is made depending on the area a person belongs to. Over the years the expression 'them and us' has been used to refer to the conflicts between engineers and non-engineers. Nowadays, it has been extended to various standalone entities such as Engineering versus Accounting, Accounting versus Information Technology (IT), Supply versus Engineering, Engineering versus IT.

On 23 June 1992 a meeting was called to which all the members of the quasi-laboratory were required to attend. The meeting was called to indicate some of the future directions of the project; the development manager mentioned, 'We are looking forward to the status of FPD's costing system to adapt the best practices in the world'. He confirmed that recommendations were made by the steering committee on 22 June 1992, such as: 'adopt an integrated business system approach', 'install the latest version of SAP (release 5.0C - R3 system)', 'implement by June 1994'. He also announced a change in the scope of the project. There were various issues raised in that meeting. What should be the management of the overall SAP implementation? What would be the long-term strategy for such an implementation?

It seemed again a stop/start syndrome. They were learning by making mistakes as well as knowing the impact of others. To mobilize the process, some words of encouragement were made by the development manager to the members as follows:

Look, so far what has been done is not wasted. We are looking forward to one overall design. Our major concern is change management ...need a lot of work to be done on the change management. ...We are looking forward to the next two years from now. We need to re-visit the change management plan. Two years is not a long time for a project like this. From FPD's point of view ...going for a commercial package from a third party ...what happens if something goes wrong!

(Tuesday 23 June 1992)

More queries, interventions and questions were raised: what should the members of the quasi-laboratory do then? How long would it take for them to re-organize again?

More enrolments and a new beginning

The standalone CMS development project did not succeed as planned. There were many considerations for stopping the standalone CMS project and its subsequent reorganization. The steering committee could not work out with any precision what the cost of 'interfaces' would be if they were to develop and customize them in-house (of course, with the help of the regional branch of BHP-IT at Wollongong). Not only did the costs rule out taking such a decision, but the time and effort required to develop valid integrations within all the required feeder systems as well as managing change were also major considerations. Rather, buying standard modules from SAP AG Ltd, which integrated with various feeder systems, was seen as a preferred option. With such a shift of focus

more enrolments were taking place in the quasi-laboratory. These enrolments included Supply, Maintenance Management, Engineering and Human Resources departments.

With such increasing enrolments in the quasi-laboratory, the focus of the project was redirected from the development of a standalone CMS to an integrated business system (IBS). Although it was a new beginning, at the time, 'things' seemed to be more familiar or visible as compared with the original situation, at least to the Finance and Planning team (the initial design team), when, for the first time, they evaluated some of the SAP's modules (namely, RF general ledger, RK cost accounting, RK-A order accounting, RM materials and other technical support modules).

Once again, many questions surround this development. For example, why had the emphasis been shifted to develop an IBS rather than a standalone CMS? What was the role of accounting? What tensions were created as a result of the change? Why had reaching this conclusion taken so long? What were the implications on the future roles of (management) accountants (or otherwise) within the researched organization? What possible communicative (behavioural) implications do the various occupational groups (the users of the integrated system) have in sharing and managing information under the proposed system at the researched organization? What constraints did the system design team face to build, implement and deploy the technology (the SAP system)? How did FPD reshape (customize) the technology? How can the technology (the proposed integrated CMS) shape and influence the 'lifeworld' at FPD? In Latour's terms, 'Before a machine is built many debates take place to determine its shape, functions and costs' (1987: 28). Is it any different in the case of FPD's cost management and other systems' implementation using the SAP system? There are numerous factors involved with installing and/or developing information technologies. The SAP system is no exception. During the last three decades or so, the SAP AG Ltd has been involved in developing a wide range of data processing modules for differing business applications. At this stage, most of the modules of the SAP system are considered as standard integrated packages. A question can then be raised: why is it necessary to recreate the SAP system at FPD? To FPD, success of such creation is dependent on the successful handlings of change management issues. For example, users have to be trained. There is a need for tying up 'human' and 'non-human' actor-networks (Latour, 1987) together in order for the effective implementation of CMS.

A new structure, plan and scope of the quasi-laboratory

It was another beginning for the design team of the quasi-laboratory. That is, a new revised implementation date of 1 July 1994 was endorsed to develop an integrated business system (IBS) by stopping the standalone CMS development project (which was previously scheduled to be implemented by 1 July 1993). As mentioned earlier, not only were the considerations of costs and efforts that would have required customizing interfaces 'ruled out', stopping the standalone CMS development using the SAP system, but also there were many other issues which forced the steering committee to make such a decision. Interestingly enough, whenever the steering committee had tried to quantify any benefit concerning the IBS development (at least, at the early stage of its development), there were no immediate answers or clear statements. Factors such as complexity and invisibility were to blame. As, at the time, most of the controversies were focused on the issues of integration within various feeder systems (or sub-systems), an emphasis was placed on forming cross-functional teams to carry out the proposed design at FPD. Following such a decision, six functional teams were formed. The teams included Finance, Supply, Maintenance Management, Engineering, Human Resources and Technical Support teams. Except for the Technical Support team some members in each team were assigned cross-functional responsibilities. Each functional team was headed by a team leader and a functional owner. At one level upward in the project hierarchy, there were two managers – a project manager development and an implementation manager. These two managers were headed by a project director who then reported to the project chairperson and the steering committee. However, with the increasing enrolment of internal actor-networks into the quasi-laboratory, it was expected that there would be some fierce controversies and 'political

struggles' or conflicts amongst various occupational groups such as accountants, engineers and IT specialists. With this in mind, a *neutral* person was appointed as a project director. The new director was neither an accountant nor an engineer, or even an IT specialist. Rather, his educational background was in journalism, and he had worked with the health and safety department of the researched organization for some time. A reason for such an appointment might be to 'keeping the interested groups in line', especially for keeping the longstanding conflicts (or cultural barriers) amongst various occupational groups within the researched organization to a minimum.

The organization of the quasi-laboratory was in fact restructured on the basis of the agreed scope of the IBS project. An outline of the new scope of the IBS project is represented in Figure 3. In addition to the initial scope of fabricating the IBS as shown in Figure 3, a technical support group was also created outside the cross-functional teams in the quasi-laboratory. The interested members of this group were from BHP-IT, which had been providing services for computing and information technology to the researched organization. Not only was the technical support group interested in providing technical services for setting up the initial systems for the design and prototyping of the SAP modules, but they were also involved in developing such strategies as system operating procedures, quality assurance of the system, system administration, programming effort, security, service level agreements, performance measurement, project management and production system. These strategies had been further sub-divided into major tasks to be accomplished. For example, 'change control procedures', 'programming standards', 'walkthrough procedures', 'estimation matrix' and documentations are examples of some of the sub-divided tasks of the 'quality assurance' strategy for the technical support group. The 'programming effort' strategy is sub-divided into such tasks as interfaces, conversion and implementation, problem support and resolution, system testing, system modifications and special system information.

A new project plan was put up on the wall of the laboratory. Targets were also set to accomplish the scheduled plans. Besides the project plan and set targets, there were three key principles to be followed in fabricating the proposed IBS implementation, which were also put up on the notice board. These are: 'make minimal changes to standard SAP system', 'focus on "core" functionality only' and 'maintain business-wide perspective'.

As well, there were many 'project milestones' and many clashes of priorities between various functional areas. Newly enrolled allies (internal actor-networks) such as Maintenance, Supply and Human Resources were asked to expedite and catch up with the existing finance and planning work. As usual, new entrants into the quasi-laboratory seemed as if they were 'weak hesitant' (see Preston *et al.*, 1992) and were sceptical about many happenings in the quasi-laboratory. There were heated controversies, differing opinions, interests and persuasions. At FPD, it was the first time that various occupational groups broke through a very strong cultural barrier to a situation whereby they would be sharing each other's requirements and needs. To them, it had been a longstanding cultural battle. A team leader of the accounting and finance function in the quasi-laboratory once said to a local news agency: 'no longer will it seem a one-way exercise' (*Kembla News*, 1993).

The diagram illustrates the integration of various business systems into a central hub. The systems are arranged in overlapping circles around the center. The systems include:

- RI-GL, PKs, RIA & RK-E Systems
- Cost Management & Finance
- General ledger, Cost accounting
- Accounts payable, Order accounting
- Payroll and labour accounting
- Asset and capital accounting
- Disposability accounting
- Process coding, Forecasting
- Management reporting
- RK-P & RM - System
- Engineering and Works Administration
- Work registration
- Performance monitoring and reporting
- Project topotyping and asset accounting
- RK-OSS System
- Quality Assurance
- RM-INST Systems
- Plant Maintenance Management
- Maintenance costing and budgeting
- Maintenance equipment and location
- Work scheduling
- Performance monitoring and reporting
- RK-PFS Systems
- Production Planning & Control
- RP System
- Human Resource Management
- Employee records
- Training administration
- Occupational health & safety
- Selection and remuneration
- RVC-Systems
- Sales & Distribution
- RMA-HAT Systems
- Supply management
- Cataloguing
- Requisitioning
- Inventory control
- Warehouse and stock management

The good news is that the GGM [Group General Manager], Graham Parker, has signed the approval for stage one of the new direction for Phoenix 21. This means approval for expenditure to complete activity including functional design by May 1993. It will also allow for consultancy assistance once the requirement definitions are completed late next month [i.e. October 1992].

Although the signature of the group general manager was obtained in September 1992, the implementation/fabrication process of the development of cost management and other systems did not stop. Rather, it was a continuation of the work that had been carried out by the teams of the standalone CMS project since July 1992, the time when the redirection of the Phoenix 21 took place in order to develop an integrated business system (IBS).

The new project was initiated with the 'requirement definitions' (RD) phase. The major objectives set out for this phase were as follows (source: company data):

- To uncover all potential opportunities for improvement.
- To ensure that no current requirements are overlooked in the system.
- To identify what the Phoenix 21 system should do, expressed in users' terms: what information the proposed system should present to the users; what input data must be captured to produce the required outputs; what business controls are necessary to regulate the proposed system
- To identify all relevant business processes.

During this phase, there was a series of meetings held in the quasi-laboratory to identify the scope of the work and prototype that the business processes required to develop and implement the IBS at FPD. As the design moved towards its functional design phase, it seemed as if 'all the elements' were being drawn together. This was because each individual team and individual team member was busy setting up and checking the internal logic (validity) of system's functionality and 'inscriptions'.

Similar to the RD phase several objectives were also set out for the functional design (FD) phase of the implementation of the IBS project. Most of the meetings and discussions in this phase were dominated by the convincing technical choices (functionality of the system). The contents of the papers are full of process diagrams, flow charts and descriptions of the business processes and system inscriptions that are required to create and maintain online data processing functions in an integrated SAP system's environment. For each of the business processes there were several decomposed business processes, which needed to be maintained. Several tables were set up and transactions run and maintained in order to create, plan and report these decomposed business

processes. For example, to set up the company-specific preliminary information using the SAP system there was a need for setting up several tables.

Exhibit 1 Contents of labour costing RD (draft) paper

1. Functional Area Scope and Objectives
2. Systems
  - 2.1 Current Systems Assessment
  - 2.2 Current Systems Diagram
- 2.3 Proposed System Context Diagrams
3. Business Processes
  - 3.1 List Decomposed Business Processes
  - 3.2 Business Process Charts and Description
    - 3.2.1 Set Up Master Data
      - 3.2.1.1 Define Labour Categories
      - 3.2.1.2 Identify Provisional Base Percentage
    - 3.2.2 Process and Calculate Budget Detail
      - 3.2.2.1 Calculate Total Number of Employees per Cost Centres
      - 3.2.2.2 Calculate Budget Rates
      - 3.2.2.3 Budget Hours Per Cost Centre
      - 3.2.2.4 Calculate Budget Provision Costs
      - 3.2.2.5 Calculate Performance Related Payment
    - 3.2.3 Process and Calculate Actual Details
      - 3.2.3.1 Calculate Total Number of Employees per Cost Centre
      - 3.2.3.2 Calculate Actual Costs
      - 3.2.3.3 Calculate Actual Provisional Charges to Cost Centre
      - 3.2.3.4 Review Performance Related Payments
      - 3.2.3.5 Review General Ledger Accounts
    - 3.2.4 Perform Planned Value Review
      - 3.2.4.1 Review Provisions
    - 3.2.5 Calculate Workers' Compensation
    - 3.3 Opportunities for Improvements

4. Proposed Interfaces

Source: BHP-FPD data.

There are many intricacies and considerable flexibility in the operation of the SAP system. Take, for example, activity planning in CCA (cost centre accounting), which is a central concept of cost centre planning and budgeting in the SAP system's environment. It is a basis for establishing unit measures. In the SAP system, 'activities' are classified into two broad categories: 'normal' and 'statistical' activities where the normal activities measure what a particular cost centre does, such as machine hours and labour hours. Thus, in a machining process centre 'machine hour' could be taken as a measure of unit. It is the basis on which the output will be measured. At FPD, these activities are known as 'standard determinants'. The normal activities, in the SAP system, can also be further broken down to sub-activities. For example, repair work, a main activity, can be broken down to three sub-activities such as emergency, normal and preventive repairs.

The statistical activities are the activities which are used as an allocation base for distributing indirect costs such as square feet and head counts. Moreover, a normal activity cost can be related to activity or it may be cost independent of activity. However, once again, this ethnography does not attempt to elaborate the details of how the activity planning in the SAP system operates nor does it assume the agency here. There are various tables to be set up and transactions to be run in order

to create and maintain the activity planning in the SAP system, such as transactions TK 04, TK 05, TK 06, TK 10, TK 20 and tables T202, T202R, T202T which are used for activity planning. We could give many examples. Theoretically, more examples would lend further support to our earlier argument that 'an organizational internal control system is no more than tying together the human and non-human actor-networks within and across various functional areas (both internal and external)'. That is, it would further enhance our understanding of how various occupational groups at FPD such as Finance and Planning, Supply, Engineering, Maintenance Management and Human Resource departments have attempted to fabricate the IBS by tying themselves to information systems that become a common platform.

Detailed design phase

The field research in the quasi-laboratory was completed before any paper on the detailed design was produced. As the name suggests, the aim of such a phase was to prototype and design in detail functionality of the SAP system that were required to implement the IBS. Some objectives of this phase might also include the following: to specify the data conversion from old to new, to build and test all requirements of the machines and inscriptions (SAP system modules), to estimate the hardware requirements, to redesign systems and procedures, to train the users and prepare for the actual installation of the system.

4. CONCLUSIONS AND IMPLICATIONS

The design of the system is only a part of the implementation process (Preston *et al.*, 1992: 567). To achieve a victory of the successful implementation of a major system, managing change is a crucial issue. Throughout our analysis it is vindicated that there are many stop/start syndromes in a major change such as this implementation of SAP system at FPD. Not only is managing change seen to be limited to convince the actor-networks, but also to win over various sceptics and detractors, obtain commitments from higher-level management and overcome various 'stop/start' syndromes as well as train the users. Thus, change is not just a constant; rather, it is an outcome of a continuous translation process. This has been the focus of many recent authors in management accounting research as well (cf. Burris and Vaivio, 2001; Granlund, 2001; Seal, 2001). At FPD, at the time, it was expected that out of 8,000 employees about 3,000 would use the proposed system. It was not thought to be an easy task to convince all the actor-networks. For example, a key informant responded to an interview question – 'why does it take a long time to manage a change?' – as follows:

I don't think it necessarily takes a long time to manage a change. It depends on the level of change. Simple changes are easy to make. Changes that people have been wanting are easy to make. Changes can be made within a couple of days are not very complicated, and easy to make. If there is a need for complex change, such as changing the direction of an organization that takes a long time. A reason it takes a long time is that I think there is usually perceived change required and that the type of change, that is -- change to what, is often unknown or at least to be worked out, and more frequently has, to achieve that new change, become complicated. If you take the SAP project, for instance, it's a complicated change required, a very big part of our operations in terms of the way we manage (our business). So it's not a change that can be made lightly and one that's going to take a short time because to get through change really requires [regarding] what impact it has on our business and how we can manage our business in the future. It also requires change in a lot of people in terms of skill and knowledge and in their approach to the job they do. So what is necessary, therefore, is for a lot of ownership of the change to occur ..because a lot of people are involved. And, assessing this will take time, because there will be issues and concerns people raise that are contrary to the direction we

are taking. These have to be addressed before those people can accept the change that has been proposed. All of this discussion takes time and [needs to be] worked out, discussed and negotiated.

It should be mentioned that this reflexive field study is not intended as a complete analysis of change management issues. Rather, it shows the processes involved in how accounting-in-action persuades, fabricates, constrains and deploys technology. At this stage, it should be noted that the fabrication of this CMS had many consequences in terms of organizational behavioural implications at FPD, in general, and for the accounting and finance discipline. These behavioural implications are elaborated under the following categories: ownership of information and its behavioural implications, structural differences of the SAP system and its implications of integration, changes of focus terminologies due to integration, change of accountability and responsibilities and changes of focus of the roles of future accountants.

Ownership of information and its behavioural implication

Since a major focus of this study is to analyse the processes of implementing the integrated business system (IBS) development at FPD, an immediate behavioural issue, as we see it, would be the struggle for the *ownership of information* by the interested groups (i.e. actor-networks) involved in such fabrications. The ownership of information in an IBS environment is something like the source of power in managing the management control system (MCS) of an organization. In the SAP system's environment such sources of power can be tied up with actor-networks via the setting up of a range of SAP inscriptions including 'tables' behind the screens. This is the reason why the SAP system is sometimes referred to as a *table-driven system*. In other words, the way in which the tables (in general, inscriptions) would be set up to *block and/or unblock* the information which would reflect the ownership of information. This would be a kind of battle over which the various occupational groups and departments at FPD would have to fight over.

Structural differences and implications of integration

In the SAP system's environment, different hierarchical segments (see Figure 2) can be used for integrating the sub-systems. For example, maintenance management can use either the RM or the RK-P project structure instead of the RK-S cost centre accounting structure. In such circumstances, integration may not be achieved and, as a result, this can give rise to behavioural implications after the proposed system implementation. At the time of the field study, for example, the Maintenance management demonstrated that they would be using a project structure (RK-P) instead of a cost centre (RK-S) structure in designing the RM-INST hierarchy. Although there is a need for further research, a prediction is that the differences in the use of differing hierarchical segments can give rise to conflicts amongst various occupational groups including engineering, supply, IT, human resources, and finance and planning.

Change of terminology

There would be many changes in terminology if the proposed IBS were implemented at FPD. The consequence of such changes can have immediate behavioural implications. When any terminology is used for a long time it becomes an acculturated issue. For example, changes in the existing job numbering system may have some immediate behavioural implications. For example, at FPD, the 50 series numbers are used for capital costing commitments. If the new system were implemented they would be using different numbering systems.

Accountability in managing the IBS and various occupational groups

An understanding is that the lack of clear accountability in managing future IBS at FPD is not unexpected. Throughout the interviews and conversations with the project and non-project members it was evident that there would be some struggle for such a settlement after the implementation of the proposed system at FPD (see Lodh, 1994, for detailed interviews).

Role of future accountants in managing CMS and other systems at FPD

King *et al.* (1992: 294) argue that 'anyone involved with leading organizations over the past decade has witnessed an emerging new culture in which managers have become increasingly able, proactive and innovative'. According to King *et al.* (1992), the development of IT (information technology) and its relationship to management accounting is an example of such a culture. Such an emergence has not only created new opportunities and pressures for management accountants, but also challenges their traditional roles as well as the boundaries of what can constitute the nature and scope of management accounting. This ethnography on the implementation of the CMS in an IBS environment has also focused on such opportunities and pressures.

To gather together some information about the future role of accountants a question was posed to a few team members of the quasi-laboratory: 'What major roles do you think accountants will play in the future under the proposed system implementation?' The summary of the responses is as follows:

- Information technology is a challenge for accountants.
- Accountants are business process analysts.
- Accountants are involved with process improvement at all levels.
- In an IBS environment there will be less number crunching for accountants. Rather, they will be doing more analysis and reporting types of work.
- Accounting is moving to the two extreme points, that is, to users' desk or input desk and to the centrally controlled offices.
- Accountants need to have multidisciplinary knowledge with a cross-functional focus such as assets' management, maintenance management, sales and marketing, supply and warehousing, and production operations, because the process of deriving the plans necessitates cross-functional communications and commitments.
- Accountants need a change in attitude to manage cost management systems on a real-time basis.
- Accountants will have more direct control in activity inputs or business processes.
- Some accountants will become (information) systems' administrators.
- There is a greater scope for change to open up new opportunities for managing cost management and other systems in an IBS environment than in the financial accounting as far as data processing and the integration side of it is concerned, of course, in an SAP system environment.

A concluding note

The final cut-off date of involvement of this field study was October 1993, at which time the project was ongoing and which was endorsed to 'go live' on 1 July 1994. At the time, the project members entered another phase, which they called the detailed design phase. Also, at the time they were heavily engaged in the training of the users. The question remains as to when such an investigation process into the quasi-laboratory can be considered 'enough'. However, our story on the fabrication of an integrated business system using the SAP system would further support what Preston *et al.* (1992: 590) urge:

Just as the study of science has moved into the laboratory (Latour and Woolgar, 1979) so it may be fruitful if students (and researchers) of accounting in action also examine the practices and discourse of management consultants, systems analysts, software engineers and designers, and accountants involved in fabricating accounting systems.

It is clear from our study that there are many stop/start syndromes in a major change. That is, when the actor-networks (both human and non-human) of any complex change cannot be visualized with certainty, to mobilize the change processes further it is factors such as complexity and invisibility that were to blame. Thus, keeping actor-networks in line and managing change are a crucial part of implementing/fabricating any accounting information system in organizations. Change is not just a constant; rather, it is an outcome of a continuous translation process, which has also been framed in many recent studies, including Burns and Vaivio (2001), Briers and Chua (2001) and Grantlund (2001).

The research organization (then BHP-FPD) successfully (otherwise) implemented the SAP system in 1995. At this stage, we suggest further research be carried out to investigate how such implementation has influenced the actor-networks, including accountants, IT professionals, engineers and the organization as a whole.

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NOTES

- 1 FPD (Flat Product Division) (then SPPD, which stands for Slab & Plate Product Division), is one of the eight major divisions of the (then) BHP Steel Group (BHP Steel) which performed one of the three main businesses of the group whose other businesses were petroleum and minerals. In addition, BHP incorporated various services and specialist operations including transport, engineering, research and development and information technology. For many years, BHP was considered the most successful Australian and international resources company. In 1991 BHP ranked 120th on the *Fortune Global 500* list of the world's largest industrial companies (Factsheet, 1992). It is considered one of the world's most technically advanced producers of quality steel products. This subsidiary company was restructured in 2002.
- 2 SAP stands for Software, Applications, Products Ltd, a German-based commercial software developer for a wide range of data processing and business applications. At the time of the study SAP was an actively new player in the Australian market and the latest version of this software was to be installed. Since then, newer versions have been issued by the company with the organization updating as necessary.
- 3 It should, however, be mentioned that there have been inputs into this concept of 'sociology of translation' or actor-network approach by other techno-scientists such as Michael Callon and his colleagues (cf. Latour and Woolgar, 1979; Callon, 1980, 1986; Law and Callon, 1992) including Latour's work after the publication of *Science in Action* (1988, 1992, 1993).
- 4 The formal name of the quasi-laboratory was kept as 'Phoenix 21 Project', a name designed to demonstrate that the forthcoming CIMS (at a later date Integrated Business System) implementation would extend FPD's data processing technologies well into the twenty-first century.
- 5 They also suggested that the strategic information category should support management in making decisions, including product pricing, make/buy, capacity utilization, investment justification and new product introduction. An operational information base should facilitate measuring performance indicators.

- 6 Many accounting researchers may share a view that cost management focus is not only limited to cost accounting, but also to manage a wide range of business processes (cf. Miller, 1992; Murphy and Braund, 1990; Cooper, 1988a, 1988b, 1991; Johnson and Kaplan, 1987; King, 1991; Eiler and Campi, 1990; Gannell and McNair, 1994).
- 7 Most of the members in the quasi-laboratory interviewed also felt the same. That is, the SAP system is an integrated system.
- 8 A 'transaction' in the SAP system means a series of steps that leads to accomplishing a certain task. That is, a transaction usually consists of several screens. For example, one can use transactions to create an invoice, display a maintenance plan or a cost centre plan, etc. Each transaction has a particular code. In the SAP system transaction codes are represented by four character symbols such as 'Tm 08, TK 31, TL 11, TB 03'. Where the transaction Tm 08 is used to call up tables, TK 31 calls up cost centre planning, while TB 03 is used for posting a financial entry. There are numerous such transactions which are the key to call up and operate a particular business process.
- 9 It is possible that the newer versions of the SAP system might be using a different data technology for managing such processes.
- 10 Again, due to the space limitations the Stage 1 implementation plan and the structure of the implementation project are not shown here (see Lodh, 1994).
- 11 For the details, list of interviewees and their transcribed responses see Lodh (1994).
- 12 It may not be possible to provide a complete set of answers for all these questions in this paper. However, posing them would certainly give rise to some of the possible consequences of such implementation.
- 13 Owing to space limitations we could not provide such tables.
- 14 Although these changes of focus in respect of the roles of future accountants under the proposed implementation of IBS are summarized from the responses taken from various key informants at FPD, they may be taken as a 'frame of reference' for the changing role of accountants that is emerging in world-class organizations.

REFERENCES

- Armstrong, P. (1987) 'The rise of accounting controls in British capitalist enterprises', *Accounting, Organizations and Society*, 12: 415-36.
- Armstrong, P. (1991) 'Contradiction and social dynamics in the capitalist agency relation-ship', *Accounting, Organizations and Society*, 16: 1-25.
- Berry, A. J., Capps, T., Cooper, D., Ferguson, P., Hopper, T. and Lowe, E. A. (1985) 'Management control in an area of the NCB: rationales of accounting practices in a public enterprise', *Accounting, Organizations and Society*, 10: 3-28. BHP-SPPD's documents and references (see list at end).
- Briers, M. and Chua, W. F. (2001) 'The role of actor-networks and boundary objects in management accounting change: a field of an implementation of activity-based costing', *Accounting, Organizations and Society*, 26: 237-69.
- Broadbent, J., Laughlin, R. and Read, S. (1991) 'Recent financial and administrative changes in the NHS: a critical analysis', *Critical Perspectives on Accounting*, 2: 1-29.
- Burchell, S., Clubb, C., Hopwood, A. C., Hughes, J. and Nahapiet, J. (1980) 'The role of accounting in organizations and society', *Accounting, Organizations and Society*, 5: 5-27.
- Burns, J. and Vaivio, J. (2001) 'Management accounting change', *Management Accounting Research*, 12: 389-402.
- Callon, M. (1986) 'Some elements of a sociology of translation', in Law, J. (ed), *Power, Action and Belief: A New Sociology of Knowledge*. London: Routledge & Kegan Paul, pp. 196-233.

Callon, M., Law, J. and Rip, A. (1986) *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*. London: Macmillan.

Capps, T., Hopper, T., Mouritsen, J., Cooper, T. and Lowe, T. (1989) 'Accounting in the production and reproduction of culture', in Chua, W. F., Lowe, T. and Puxty, T. (eds) *Critical Perspectives in Management Control*. London: Macmillan, pp. 217-44.

Chua, W. F. (1995) 'Experts, networks and inscriptions in the fabrication of accounting images - a story of the representation of three public hospitals', *Accounting, Organizations and Society*, 20: 111-45.

Cockburn, C. (1992) 'The circuit of technology: gender, identity and power', in Silverstone, R. and Hirsch, E. (eds) *Consuming Technologies: Media and Information in Domestic Spaces*. London: Routledge, pp. 32-47.

Cooper, D. J. (1983) 'Tidiness, muddle and things: commonalities and divergences in two approaches in management accounting research', *Accounting, Organizations and Society*, 8: 269-86.

Cooper, R. (1988a) 'The rise of activity-based costing - part one: what is an activity-based cost system?', *Journal of Cost Management*, Summer: 45-54.

Cooper, R. (1988b) 'The rise of activity-based costing - part two: when do I need an activity-based cost system?', *Journal of Cost Management*, Fall: 41-8.

Cooper, R. (1991) 'A structured approach to implementing ABC', *Accountancy*, 107 (June): 78-80.

Cooper, R. and Kaplan, R. S. (1991) *The Design of Cost Management Systems: Text, Cases, and Readings*. Englewood Cliffs, NJ: Prentice-Hall.

Eiler, R. G. and Campi, J. P. (1990) 'Implementing activity-based costing at a process company', *Journal of Cost Management*, Spring: 43-50.

Gannell, F. and McNair, C. J. (1994) 'Jumping the growth threshold through activity-based cost management', *Management Accounting*, September: 37-46.

Granlund, M. (2001) 'Towards explaining stability in and around management accounting systems', *Management Accounting Research*, 12: 141-66.

Habermas, J. (1984) *The Theory of Communicative Action. Vol. 1: Reason and Rationalization of Society* (trans. McCarthy, T.). London: Heinemann.

Habermas, J. (1987) *The Theory of Communicative Action. Vol. 2: Lifeworld and System: The Critique of Functionalist Reason* (trans. McCarthy, T.). Cambridge, MA: MIT Press.

Hopwood, A. G. (1979) 'Editorial', *Accounting, Organizations and Society*, 4: 145-7.

Hopwood, A. G. (1987) 'The archaeology of accounting system', *Accounting, Organizations and Society*, 12: 207-34.

Hughes, H. (1964) *The Australian Iron and Steel Industry 1848-1962*. Parkville: Melbourne University Press.

Johnson, H. T. and Kaplan, R. S. (1987) 'The rise and fall of management accounting', *Management Accounting*, January: 3-29.

Kelly, D. (1989) 'Technology, work and management: workplace industrial relations in steelmaking at Port Kembla Steelworks, 1967-1987', Unpublished M.Com. (Hons) thesis, University of Wollongong, Australia.

King, M. (1991) 'The current status of activity-based costing: an interview with Robin Cooper and Robert S. Kaplan', *Management Accounting* (USA), September: 22-6.

King, M., Lee, R. A., Piper, J. A. and Whittaker, J. (1992) 'Information technology and the changing role of management accountants', in Ashton, D., Hopper, T. and Scapens, R. W. (eds) *Issues in Management Accounting*. Englewood Cliffs, NJ: Prentice Hall, pp. 294-311.

Latour, B. (1986) 'The power of association', in Law, J. (ed.) *Power, Action and Belief: A New Sociology of Knowledge*. London: Routledge & Kegan Paul, pp. 264-80.

Latour, B. (1987) *Science in Action*. Milton Keynes: Open University Press.

Latour, B. (1988) 'The price for machines as well as for machinings', in Elliott, B. (ed.) *Technology and Social Process*. Edinburgh: Edinburgh University Press, pp. 20-43.

Latour, B. (1991) 'Technology is society made durable', in Law, J. (ed.) *A Sociology of Monsters: Essays on Power, Technology and Domination*. London: Routledge, pp. 103-31.

Latour, B. (1992) 'Where are the missing masses? The sociology of a few mundane artefacts', in Bijker, W. E. and Law, J. (eds) *Shaping Technology/Building Society: Studies in Sociotechnical Change*. London: MIT Press, pp. 225-58.

Latour, B. (1993) *We Have Never Been Modern*. Hemel Hempstead: Harvester Wheatsheaf.

Latour, B. and Woolgar, S. (1979) *Laboratory Life: The Social Construction of Scientific Life*. London: Sage Library of Social Research, pp. 225-8.

Laughlin, R. C. (1984) 'The design of accounting systems: a general theory with an empirical study of the Church of England', Unpublished Ph.D. thesis, The University of Sheffield, UK.

Laughlin, R. C. (1987) 'Accounting systems in organization theory: a case for critical theory', *Accounting, Organizations and Society*, 12: 479-502.

Laughlin, R. C. (1988) 'Accounting in its social context: an analysis of the accounting systems of the Church of England', *Accounting, Auditing and Accountability*, 1(2): 19-42.

Laughlin, R. C. (1991) 'Environmental disturbances and organizational transitions and transformations: some alternative models', *Organizational Studies*, 12(2): 209-32.

Law, J. (1986) *Power, Action and Belief: A New Sociology of Knowledge?* London: Routledge & Kegan Paul.

Law, J. and Callon, M. (1992) 'The life and death of an aircraft: a network analysis of technical change', in Bijker, W. and Law, J. (eds) *Shaping Technology/Building Society*. Cambridge, MA: MIT Press.

Lodh, S. C. (1994) 'Fabricating cost management and other systems in a mainframe integrated business system (IBS) environment: a critical accounting study', Unpublished Ph.D. thesis, University of Wollongong, Australia.

Lodh, S. C. (1995) 'An application of planned value control (PVC) concept into the cost management system (CMS) matrix', *CIMA In-Focus*, November/December: 6-8.

Lodh, S. C. and Gaffikin, M. J. R. (1997) 'Critical studies in accounting research: rationality and Habermas: a methodological reflection', *Critical Perspectives on Accounting*, 8: 433-74.

Loft, A. (1985) 'Towards a critical understanding of accounting: the case of cost accounting in the UK, 1914-1925', *Accounting, Organizations and Society*, 10: 137-69.

MacIntosh, N. B. and Scapens, R. W. (1991) 'Management accounting and control systems: a structuration theory analysis', *Journal of Management Accounting Research*, 3(Fall): 131-158.

McLennan, I. (1974) *The History of the Australian Steel Industry*. St Lucia, Queensland: University of Queensland Press.

Mehan, H. and Wood, H. (1975) *The Reality of Ethnomethodology*. New York: John Wiley.

Miller, J. A. (1992) 'Designing and implementing a new cost management system', *Cost Management*, Winter: 41-53.

Murphy, J. C. and Braund, S. L. (1990) 'Management accounting and new manufacturing technology', *Management Accounting* (UK), February: 38-40.

NSC (Nippon Steel Corporation) (1986) 'Introduction of planned value control and integrated quality control to BHP, SPPD, Port Kembla Steelworks; BHP, CPD, Port Kembla Works', October (marked confidential document).

Preston, A., Cooper, D. J. and Coombs, R. D. (1992) 'Fabricating budgets: a study of the production of management budgeting in the National Health Service', *Accounting, Organizations and Society*, 17: 561-93.

Robson, K. (1991) 'On the arenas of accounting change: the process of translation', *Accounting, Organizations and Society*, 16: 547-70.

Robson, K. (1992) 'Accounting numbers as "inscriptions": action at a distance and the development of accounting', *Accounting, Organizations and Society*, 17: 547-70. Sent, W. (2001) 'Management accounting and the challenge of strategic focus', *Management Accounting Research*, 12: 487-506.

Trengrove, A. (1975) *What a Good Story for Australia...! The Story of BHP*. Melbourne: Cassell Australia Ltd.

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Draft paper on the functional design on engineering

Draft paper on the functional design on assets accounting

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Draft paper on the functional design on cost centre accounting

Draft paper on the functional design on plant maintenance

Draft paper on the functional design on supply and services

Draft paper on the functional design on engineering

Draft paper on the functional design on assets accounting

Draft paper on the functional design on BARS (BHP's accounting and reporting systems) information systems

Draft paper on the functional design on human resources management

BHP - SPPD costing update 24 June 1991

BHP - SPPD costing system review (CSR) 1989 by the PA consulting groups and costing team.

BHP - SPPD DISCO Operating Guide 1979

BHP - IT company profile 1993

BHP - SPPD reports on SAP presentation evaluation, September 1990

BHP - SPPD SAP's written response to SPPD, January 1991

BHP - SPPD various minutes on the affairs of Phoenix 21 project

BHP - SPPD document VisitoUS And UK Vol. 11990 Kenha News, December 1993, Issue No. 441, p. 11

SAP system's manuals and documents:

R/2 system: summary of applications, release date 12/1/1989

RK system: description of functions, cost accounting, release date 02/01/1990

RA system: functions description, fixed assets accounting, release date 03/01/1987

RM system: description of functions, production planning and control, purchasing, material management, invoice verification and plant maintenance, release date 02/01/1990

SAP system - getting started with the R/2 system, release 4.3/4.4, SAP systems documents:

RK-System: On-Line Functions Cost Centre Accounting, Part 1, Vol. KO4.2, Release 4.3/4.4, dated 9/1/90

RK-System: On-Line Functions Cost Centre Accounting, Part 2, Vol. KO4.2, Release 4.3/4.4, dated 9/1/90.

RK-System: On-Line Functions: Job-Order Settlement and Expanded Functions, KO4.2, Vol. 6, Release 4.3/4.4, dated 8/1/90.

RF System: User Documentation, G 04.2, Vol. 2, Release 4.3, dated 10/1/89 Quick Reference Card RF Application Chart, Release 4.3, dated 01/01/89

RK Quick Reference Card 4.3 dated 2/1/91 RM Quick Reference Card Release 5.0 June 1992

SAP's Management Report (1992)

SAP's Training folds

RF 010 system -- Organizational Element 1

RK 110 and RK 112 training fold on job order accounting and settlement

RK 20 and RK 30 training fold on cost centre accounting

RM 002 and RM 001 RM system training fold on material and plant maintenance

RK 001 training fold on overview and integration