Enterprise resource planning: analysing the impact

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Abstract
Describes a study that set out to evaluate the performance impact of a SAP R3 implementation. The SAP system was implemented by a major multinational business in four of its European plants. Qualitative and quantitative data were collected over a two-year period, through surveys and interviews with systems users and by accessing company records. While users were able to identify the operational benefits of SAP, they were still doubtful at the end of the evaluation process whether the system had resulted in any significant positive financial benefits for the business. Two themes related to this observation are explored. First the time lag between operational improvements and subsequent financial impact. Second the importance of learning as a means of reducing the time lag. Learning in this context is a multi-dimensional concept and covers learning how to use the system, learning how to improve the system and learning how to improve the implementation process.

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Introduction

The last five years have seen an explosion in the implementation of enterprise resource planning (ERP) systems, such as those offered by SAP, Baan and PeopleSoft. Recent research indicates that the market for ERP applications will grow by 32 per cent over the next five years and that the total market will reach $66.6 billion by 2003 (AMR Research, 1999a), representing 43 per cent of the applications' budgets of organisations (AMR Research, 1999b).

ERP systems are intended to provide standard application programmes that support the execution of activities throughout the organisation. In theory they enable the integration of operations, through common data processing and communications protocols. In addition to these theoretically appealing advantages, practical and immediate concerns of the late 1990s, such as the Y2K bug and the introduction of the Euro, further stimulated the market for ERP solutions.

Despite the proliferation of implementations very little attention appears to have been paid to ERP by the academic community (Wortmann, 1998). Increasing numbers of reports in the trade press are calling into question the practicality of ERP and the effectiveness of facilitated implementations. High profile clients, such as Bang & Olufsen, who experienced "a total halt in deliveries for eight days", at a cost to the business of £8.5 million, are starting to air their frustrations openly. Yet academic studies of the performance impact of ERP systems are still few and far between. The aim of this paper is to begin the process of closing this gap in the literature, by reporting the results of a two-year study into the performance impact of a major ERP implementation in a significant multi-national European business.

The main body of the paper consists of eight sections. The first two deal with the background literature, the first describes the evolution of information systems that resulted in the current popularity of ERP systems, the second provides a brief review of the key trends in the IS evaluation literature. One of these key trends is the increasing requirement to be able to evaluate the strategic impact of IS investments. This theme is explored in the third section, as the framework used to gather data during the course of this research is explained. In the fourth section the data collection methodology is detailed. In the fifth, sixth and seventh sections the results of the research are presented. These highlight the ways in which the performance impact of an ERP system can be observed at different levels within the organisation. The final section reviews the implications of this research for both the academic and practitioner communities.

The evolution of ERP systems

As discussed in the introduction, the adoption of ERP systems has been widespread. The origins of ERP systems can be traced back to the development of standard systems for the planning and control of manufacturing. Early systems were purely manual, relating to ordering material, hiring and firing people, following up and chasing work (expediting), until reorder point and economic order quantity (EOQ) techniques were added for the ordering of parts (Plossl, 1985). The development of materials requirements planning (MRP) in the 1960s and 1970s made it possible to plan material requirements based on future product requirements, rather than reordering based on past usage (Orlicky, 1975). The master production schedule was developed to drive MRP,

relating material plans to products and options demanded by the customer (Vollmann *et al.*, 1997).

The addition of shop floor control, capacity requirements planning and purchasing added a "closed loop" element to the planning system. The development of manufacturing resource planning (MRP II) further extended the planning and control activities to include production planning, business planning, financial and distribution systems within one computer system (Wallace, 1990).

ERP systems further developed the scope of standard software systems providing systems to support all business functions. Many organisations have implemented ERP systems in order to take advantage of the standardisation and integration of business systems supporting transaction execution and decision making. It is suggested that such standard, integrated systems are cheaper to maintain that home-grown systems, should enable implementation of best practices in all areas of the business, trigger business process re-engineering and support quality drives such as ISO 9000 (Wortmann, 1998). Because of the very broad scope of ERP systems, their impact on the businesses in which they are implemented is potentially vast. However this scope also brings with it considerable complexity and the implementation process will often be lengthy, cumbersome and costly. The lack of academic attention paid to ERP systems (Wortmann, 1998), and the fact that the business value of IT is a complex and multi-dimensional construct (Tallon *et al.*, 1997) have limited the investigation of the pay back on the considerable investment in ERP systems. The study reported in this paper seeks to address this gap by answering the question "what impact do ERP systems have on business performance?"

IS evaluation: recent trends and emerging themes

Numerous authors have commented on the fact that many IS investments fail to provide the productivity and efficiency benefits that are expected (Willcocks and Lustre, 1996). Often this is because information systems are used simply to automate existing processes and practices, rather than radically rethink them (Hammer, 1990). In recent years increasing effort has been made to exploit the strategic as well as operational benefits of information systems, with the result that growing numbers of managers are looking for ways of achieving competitive advantage through information systems (Rotemberg and Saloner, 1991). In parallel, investment levels are rising and constraints on spending are becoming tighter, with the end result that executives are becoming increasingly concerned about the strategic performance impact of their investments.

It is generally accepted in the IS literature that practitioners are dissatisfied with the methods of IS evaluation currently available (DeLone and McLean, 1992; Farbey *et al.*, 1994, 1995; Willcocks, 1994, 1996). In fact it is argued that the difficulties practitioners encounter constrain IS investment, as they result in uncertainty over whether particular investments will deliver an acceptable payback (Willcocks and Lester, 1996). One of the problems with the IS evaluation literature is that it concentrates primarily on evaluating the system and its immediate impact, rather than focusing on its strategic potential (Rotemberg and Saloner, 1991). Even those evaluation frameworks that purport to explore the strategic impact of IS investments tend to provide financial evaluations, such as return on investment and cost benefit analysis. Little attention is paid to the non-financial factors, such as customer service, operational efficiency, etc. (Galliers, 1995; Jurison, 1994). Given that managers and executives are now seeking to gain strategic value through IS investment, they are increasingly going to require evaluation frameworks that will allow them to establish whether their investments have delivered the predicted strategic benefits.

The question raised by these observations is how can the strategic impact of an IS investment be evaluated. And it is this question that is addressed in the section that follows.

Evaluating the strategic impact of IS investments

As reported in the previous section there is now a clear trend towards strategic investment in information systems. Increasingly executives are recognising that the way data and information are handled and manipulated in organisations can significantly affect the organisation's competitive position. One of the implications of this observation is that increasingly senior managers are looking to evaluate the impact of their investments in information systems on the basis of strategic, rather than operational performance measures. Traditionally information systems experts have evaluated the impact of information systems in terms of speed of data processing, accessibility of information, user

satisfaction, etc. Few have attempted to link explicitly the implementation of the information system to changes in business performance, such as delivery performance, customer service, inventory levels and operating efficiency. The researchers involved in this study deliberately set out to design an evaluation framework which would enable data at both these micro and macro levels to be gathered.

The most widely accepted and applied framework for evaluating IS investments at the micro level is the one proposed by DeLone and McLean (1992). This suggests that data about information systems be gathered against six key dimensions (see Figure 1).

The DeLone and McLean framework is widely accepted as one of the more complete IS evaluation frameworks and has been used extensively in empirical research (Ballantine *et al.*, 1996). Some shortcomings of the framework have, however, been identified. These mainly relate to the extraneous variables, both internal and external to the organisation that might affect the impact of the information system (Ballantine *et al.*, 1996; Seddon, 1997; Bonner, 1995). DeLone and McLean themselves accept that issues such as the organisation's strategy, its environment and the characteristics of the information system have to be considered when applying their framework. Other comments and criticisms include the lack of clarity in the definitions proposed for the terms used in the framework (Bonner, 1995) and questions about whether the hypothesised causal links actually exist (Ballantine *et al.*, 1996).

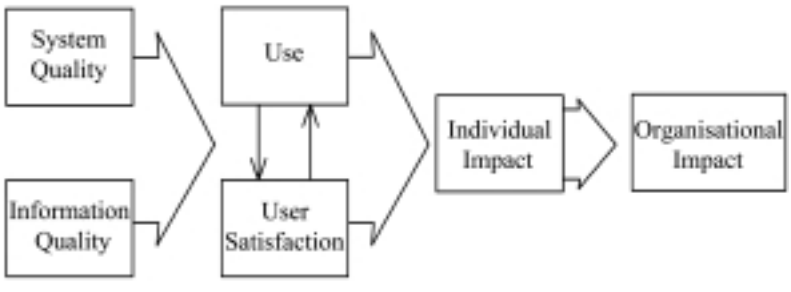
An additional weakness is that the DeLone and McLean framework makes no detailed attempt to explain what should be measured when the organisational impact of the information systems is being considered. In recent years, however, numerous organisations have addressed this issue by adopting variants of Kaplan and Norton's balanced scorecard (Kaplan and Norton, 1992), which consists of four perspectives:

1 Financial perspective: how do we look to our shareholders?
2 Customer perspective: how do we look to our customers?
3 Internal operations perspective: what must we excel at?
4 Innovation and learning perspective: what can we do to continue to innovate and create value?

This study is no exception. Hence the organisational impact element of DeLone and McLean's framework is expanded as it is converted into a modified balanced scorecard. Modified, because a fifth perspective – the supplier perspective – is added for the purposes of this study (see Figure 2).

The addition of the modified balanced scorecard to the DeLone and McLean framework enables more in-depth understanding of the impact of the information system on the organisation as a whole. As previously discussed, ERP systems are designed to support operations and decision making throughout the organisation. As planning and control of manufacturing activities is central to ERP systems architecture, their implementation is clearly designed to affect the co-ordination of suppliers and operational activities to deliver products and services to the customer. As a result it is essential that evaluation of ERP systems explicitly considers the impact on operational efficiency and effectiveness and hence the profitability of the organisation as a whole. Collection of data relating to the evaluation framework in Figure 2 enables a more in-depth understanding of the impact of the ERP system.

Figure 1
IS success model



Source: DeLone and McLean (1992)

Data collection and analysis

The researchers were fortunate in having access to four comparable plants within the same organisation, each of which was in the process of implementing SAP. The plants were based in different European states, but manufactured the same products using comparable technologies. As the SAP system was not implemented concurrently in all of the plants, the cases provided an ideal opportunity to conduct a quasi-experimental study because while one plant was undergoing the change it was possible to use the other plants as control sites (Gill and Johnson, 1997). Such research designs make it possible to explore whether the changes in performance that are observed

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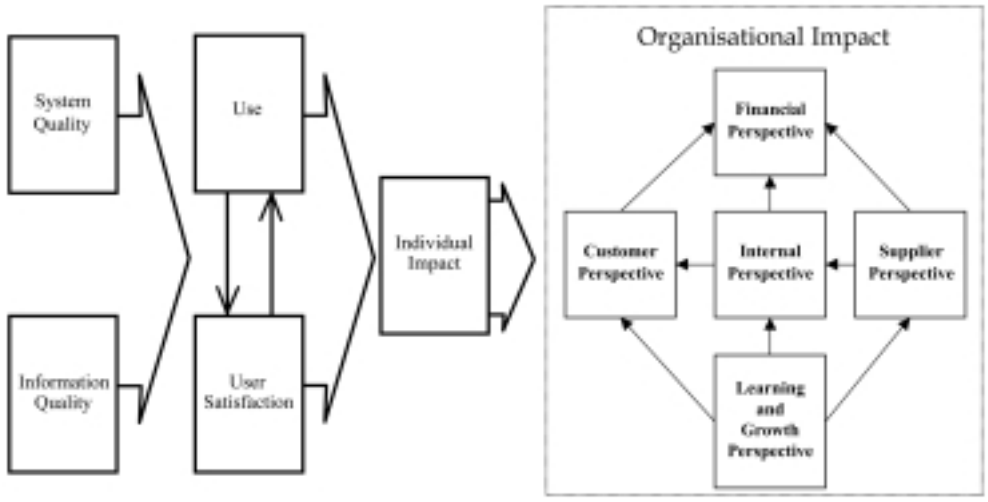
Figure 2
The evaluation framework

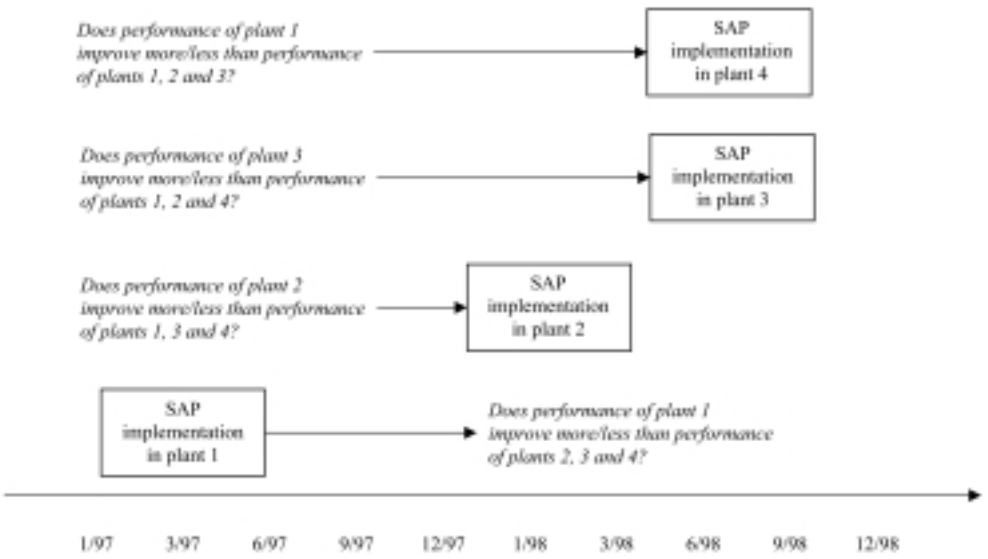


are a result of the changes being introduced in specific sites at particular points in time, or whether they are the result of more general business trends (Cook and Campbell, 1979). In the context of this study, the fact that SAP was introduced into different sites at different points in time allowed the researchers to establish with more certainty whether the changes in business performance observed were a result of SAP or due to some other extraneous factors. Figure 3 illustrates the research design, showing implementation time scales and the underlying research questions in relation to each site.

Data about the SAP implementations were collected over a two-year period. These data allowed a longitudinal analysis of the performance impact of the SAP system to be conducted. During the course of the study three broad sets of data were collected:

1 *Business performance data*. Comparable performance data for each of the four plants studied was gathered for the duration of the study. These data allowed the performance of the different plants to be compared as each plant introduced SAP. Typical measures captured at this level include those on the balance sheet and profit and loss accounts, as well as

Figure 3
Quasi-experimental design



specific production and personnel data.

2 *Survey of system users*. In addition to the hard facts and figures, questionnaires were issued to SAP system users to assess their perceptions of the system. The questionnaires sought to elicit views of users both about the impact of the system and the effectiveness of the implementation process. The questionnaire was structured around the evaluation framework shown in Figure 2. The first part of the questionnaire investigated user perceptions of changes in business performance over the period of the study and the impact that they thought the SAP system had. These questions were focused on performance in relation to the objectives of the SAP system implementation and were structured around the five dimensions of the modified balanced scorecard.

The second part of the questionnaire investigated users' perceptions of the impact of the ERP system by asking about the remaining five categories of the information systems success model (i.e. system quality; information quality; use; user satisfaction and individual impact). Thus data were collected through the surveys that enabled the impact of the system to be assessed at both the individual and organisational levels.

3 *Interviews with system users*. To supplement the data gathered through questionnaires, interviews were held with various system users in the first two plants to go live with SAP. These interviews were used to explore the themes raised by the data reported through the questionnaires.

The research design provided the researchers with the opportunity to compare each of these data sets for each of the sites over the two-year period (as illustrated in Figure 3). This comparison of performance over time and between sites, given the characteristics of the study, strengthens the interpretation that changes observed can be attributed to the stimulus of the system implemented. This comparison allows causal relationships to be inferred and is supplemented by qualitative data collection to add rigour to the research. Opportunities to undertake such research are few, hence they should be exploited when they arise (Wall *et al.*, 1986). The rigorous methodology and data capture tools are designed to maximise the benefits of the study given the rarity of the opportunity.

Performance impact of the SAP implementation

The data gathered during the course of this study allow the impact of the SAP implementation to be assessed at four discrete levels: corporate, plant, functional and individual. At the corporate and plant levels the primary data available relate to financial performance, especially return on sales and inventory levels. These data are collected centrally within the business and hence are comparable because all of the separate plants report the data in a consistent format. Figures 4-7 show the return on sales figures for the four plants for the duration of the study. Although actual return on sales performance varies between sites, depending on the size of the operation, the data show very similar trends in performance. No one site demonstrated exceptional performance improvement in comparison to the others. These data show the underlying seasonality in the business, but the SAP implementations appear to have had no direct impact on the return on sales performance of any of the plants. This, of course, was one of the themes explored by the researchers during the interviews, which found that most users were not convinced that the SAP system had resulted in a direct positive impact on financial performance to date. Typical comments include the one made by the financial controller for plant 1, who said the system "has affected information flows and information availability, but has had no observable impact on profitability".

Interestingly, people across the business were confident that positive financial benefits would accrue over time. Several interviewees commented on the fact that data were now available far more rapidly at a pan-European level. The central purchasing manager, for example, commented:

> It is now possible to obtain and analyse data more rapidly. For example it is now possible to analyse the whole spares stocks of all major plants within three days. Previously it took three to six weeks to obtain data before any analysis could begin. The data is now readily available at the desktop of central employees rather than having to obtain the data from the business units requiring extra work from other employees including programmers. Data can now be collected and compared more quickly and easily, improving responsiveness to changing circumstances.

Similarly, the vice-president of finance and control said:

> It is now possible to compare performance of all business units within days and without needing additional effort and cost of collecting data.

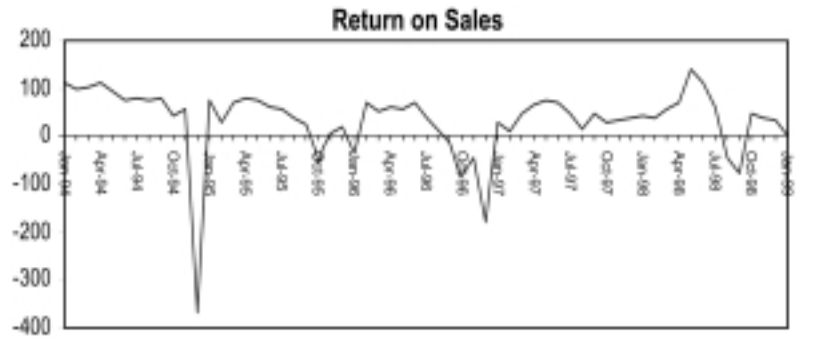
Some tangible benefits at the European level were also identified. The vice-president of finance and control, the SAP implementation project sponsor, suggested that the principal reasons the business had adopted SAP were to:

- ensure common operating systems and procedures across the business;
- enable standardisation of reporting systems; and
- provide European oversight of the business.

Figure 4
Financial impact – plant 1

Figure 5
Financial impact – plant 2

Figure 6
Financial impact – plant 3



The majority of senior managers appeared to believe that all of these objectives were achieved and several were able to identify specific additional benefits, including:

1 *Improved efficiency and control*. Several efficiency improvements are reported as a result of SAP implementation. On the whole, administration has reduced and is expected to reduce still further. Use of standard company and plant codes has considerably assisted in record creation as all plants now use the same codes, rather than creating new ones. Whilst this brings reduction of administration, there is the additional benefit of standard codes allowing centralised control and visibility. This in turn enhances the ability of the business to make decisions at a pan European level. Centralised billing and invoicing is also now also possible. This eliminates the need for such activities to take place locally. Hence headcount can be reduced and interactions with customers and suppliers can be more co-ordinated and controlled.
2 *Rationalisation of European inventories*. The transparency of spares stocks and the ability to analyse variances has allowed inventories to be rationalised and obsolete stock to be identified and eliminated. Better stock turns and age control has already resulted in a 10 per cent stock reduction and a new purchasing strategy for capital equipment. Similar benefits have also been experienced with finished goods inventory:

> The system has allowed more transparency about spares stocks and ability to analyse variances. The system has also allowed better control of stock turn and age leading to further stock reduction and has already changed purchasing strategy on capital equipment. Reduction of spares of 20 per cent in Europe is expected within two years (10 per cent already achieved). Further 5 per cent identified as obsolete (central purchasing manager).

3 *Cross-border capacity optimisation*. Central, on-line insight into production planning and stock levels enables prompt response to exports that are dealt with centrally. This will include faster action to steer production or stock from one business unit to another as required. Prior to the implementation of SAP, this process had to be handled via fax and e-mail. The ability to remotely interrogate inventory records eliminates the need for faxes and e-mails, and the inevitable data transcription errors that result. Additionally the business now has the capability to plan capacity and inventory

on a pan European basis. This allows the business to manage capacity across all of its production sites, thereby eliminating the need to produce excessive product in one site, while another has equipment that is left idle.

> Central on-line insight into production planning and stocks enables prompt response to exports to be dealt with at a centralised level and the steering of production or stock from one business unit to another as required (central logistics and planning manager).

4 *Increased leverage on suppliers*. Consolidation of inventory and material usage information facilitates the negotiation of contracts at a central level, as there is a better understanding of future material requirements. This is particularly relevant for this business as each plant uses the same suppliers. Negotiating larger and longer term contracts centrally provides significant buyer power, which in turn allows better terms to be established. At the same time the SAP system allows the individual plants to act locally and specify appropriate delivery schedules for suppliers. Without the pan European implementation of SAP this dual functionality would not have been achieved. As the senior European logistics and planning manager explains, SAP has furnished the business with "the ability to negotiate globally, but act locally".

5 *Improved planning*. Several interviewees highlighted examples of improved planning. At a central level the system allows greater and more complex "what if" analyses to be conducted. This includes the ability to make investment decisions and undertake operational planning at a European level. Improved information availability also allows more informed decisions to be made regarding customer orders, in theory allowing the selection of orders that will maximise the company's profitability, bearing in mind the capacity constraints that the business faces on a pan European basis.

A second planning advantage is that it is now also possible to monitor and guard against fluctuations in raw material prices at a European level. This enables inventories to be manipulated in order to ensure that raw materials are purchased at the most advantageous price. One senior purchasing manager referred to this as "the ability to protect the company from upcoming surprises".

It is interesting to note that despite these identified benefits there is little hard evidence (see return on sales figures) that the ERP system has yet had an impact on financial performance. One theme that underpins this observation is the notion that there is a significant time lag between improved operational and improved financial performance. It is as if the system was enabling the company to develop capabilities to do things better, pan European stock and capacity management, etc. but the company had not yet begun to exploit fully these capabilities. This theme, learning to exploit capabilities, is one that crops up again when the plant, functional and individual impact of the system is analysed.

Figure 7
Financial impact – plant 4

Performance impact at the plant, functional and individual level

The previous section explored some of the benefits of the SAP implementation at the corporate level. At the plant level there was initially more scepticism about the system. Interestingly the level of scepticism varied according to: how long ago the SAP system was implemented, what function the respondents operated in, and whether the plant was the first to receive the SAP system or the last.

The SAP system was implemented in plant 1 in March 1997. Surveys of systems users, and subsequent interviews, conducted in July 1997 and March 1998, found that there was a relatively high level of frustration with the system. Typical comments from users include:

> The system has lots of useful data, but I don't know exactly what is available or where to find it.

> I keep seeing pieces of information that would be useful to me, but then I am unable to find them again.

Data collected during the survey of system users in plant 1 suggest that the implementation of the system may have been

at fault. A significant number of system users complained about the lack of training and inadequate documentation. A repeat set of interviews, some eight months later, found a very different situation. By then, it appears that users had begun to understand the system and its capabilities. At this stage, typical comments included:

> Integration of production planning, material planning and sales processing systems allows quicker conversion of customer orders into schedules and material orders. Having more notice of customer requirements means we can schedule to make better utilisation of resources and more achievable schedules (manufacturing manager, plant 1).
>
> Implementation of the system has allowed increased control of the business with less effort, freeing my time to undertake more proactive planning (production planner, plant 1).
>
> The system has allowed safety stock levels to be reduced easily to the minimum level (purchasing manager, plant 1).
>
> Reduced data entry reduces the number of mistakes in recording stock transactions (inventory controller, plant 1).

In plant 2, users were much more positive about the implementation at a much earlier stage. It appears that the experience gained from the first implementation had been used to ensure that the second was better managed. Although once again, respondents from the procurement function appeared to be the most positive:

> Spares stock held by different business units at the same time have been identified allowing obsolete stock to be eliminated (purchasing and logistics manager, plant 2).
>
> The increase in the accuracy of stock records means we have better understanding of what is in stock so that the right parts can be ordered to satisfy production (purchasing and logistics manager, Plant 2).

Analysing the strategic impact of the SAP system involved assessing its contribution at plant level against the five dimensions of the modified balanced scorecard financial, customer, internal operations, supplier and innovation and learning. As has already been discussed, the financial impact of the system at the plant level has been limited to date. The interviews with users of the system investigated the impact of the system in relation to each of these dimensions of performance and suggested that the system has offered some significant operational benefits at both the pan European and individual plant levels. These operational benefits are likely to result in improved financial performance, but with a significant time lag. Hence the 10 per cent reduction in pan European inventory levels will be reflected in the financial figures, but only once the actual inventory in the system has been eliminated. To date, the inventory that can be eliminated has been identified, but the action plans have not yet been put in place to eliminate it. In terms of the customer perspective, it is believed that the system will have limited impact in the short term, but that in the longer term customer service will improve. The reason for the time delay is that the SAP system provides data that allow the business to analyse its processes and identify ways in which they can be improved. Only when these process improvements have been completed will the customers see significant changes in service. One example would be increased responsiveness, which results from the integration of sales and production planning systems. The availability of production plans and current inventory data on line enables sales personnel to more accurately respond to each customer enquiry and quote accurate delivery dates. Having taken an order, the necessary inventories and production capacity can be secured. This integrated process replaces the separate planning and control systems that used to exist in the business. While these benefits will undoubtedly accrue, at the time of the evaluation users were still learning how to use the system and hence had not yet been able to maximise its value.

In plant 2, and in the second round of interviews in plant 1, many users could identify internal operational improvements, which were going to have an impact on both efficiency and supplier performance. Numerous interviewees commented that they now had increased visibility of stock and that they had been able to automate processes that had previously been manual. This, in turn, freed purchasing personnel to spend more time analysing data and building relationships with suppliers. The increased visibility and understanding of future material requirements also allowed the plants to give their suppliers more notice about their future requirements, which in turn would make it easier for suppliers to improve their delivery performance.

> Through closer relationships with suppliers and more rapid conversion of customer requirements the company can provide its suppliers with information more quickly to help them to plan more effectively (logistics manager, plant 2).

Innovation and learning

One of the key themes which underpins the analysis presented in this paper is the

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importance of learning. The fact that by the end of the evaluation phase few people were able to identify any direct financial impact of the system was significant. It appears that the improvements in operational performance – inventory record accuracy, planning and control procedures, etc. – have not yet been converted into financial gains. It is obvious that these should, however, result in financial gains and so an important question is why these benefits have not yet been realised. One explanation is that there is a time lag between the identification and implementation of improvements. Identifying that stock levels can be reduced or processes streamlined is one thing. Acting on this insight to achieve the benefits is another.

The initial frustrations reported during the first round of interviews in plant 1 introduce another dimension of complexity. It appears that they were a function of poor implementation. Users reported that they were given inadequate training and documentation. They expressed concern about the level of support available to them both from IS professionals within the firm and the consultants who facilitated the implementation. It was only when they began to experiment with the system and learn how to use it that they began to see the potential benefits. The importance of this point is illustrated by comments, such as:

> There is lots of useful data but the reports that come out of the system are not in a useful format. I have to download data to spreadsheets in order to manipulate the data into the format I want. This takes added time and effort.

The implication is that users have to learn how to use the system. They have to explore and experiment with it, so they can begin to understand its potential. In plant 1 the poor training and support appears to have made this learning much more difficult, hence the initial hostile reaction to the system during the first round of interviews and the much more positive reaction during the second.

In fact there is evidence that the system users not only learnt how to use the system, but as they became more comfortable with it they began to learn how to improve the system. Users in plant 1 reported that as they became more familiar with the system, they became more willing (and able) to request system modifications. They developed the ability to articulate their frustrations in a language understood by the system implementors, who were then able to show them how to modify reporting formats or elements of system functionality as appropriate. This in turn encouraged the users to experiment with the system more and further enhance their ability to exploit it. The resultant virtuous learning loop ensures that the full potential of the system can be realised (see Figure 8)

At the user level, then, there are two distinct forms of learning that appear to be taking place – learning how to use the system and learning how to improve the system. These two forms of learning are synonymous with Argyris's (1978) work on single and double loop learning. Learning how to use the system is effectively single loop learning. Learning how to improve the system is double loop learning. And both of these learning modes have to be in place before users can exploit the full benefits of the system and identify how to improve operational and financial performance.

In addition to the two forms of learning already identified – learning how to use the system and learning how to improve the system – there is also evidence of a third form of learning – learning how to improve the implementation process. Support for this assertion is provided by the fact that the implementations in plants 2, 3 and 4 were far smoother than the implementation in plant 1. The survey of users in plant 2, for example, showed considerably greater user satisfaction with system training, documentation and support. The company adopted a standard template configuration for all implementations following the first one. They establish communities of key users in the second, third and fourth implementations, individuals responsible for championing and demonstrating the potential of specific aspects of the system.

Implications for theory and practice

The key themes raised by the data collected during this study are the questions of how practitioners can best ensure a virtuous learning cycle during the implementation of ERP systems (see Figure 8) and how they can ensure that progress around this learning cycle is as rapid as possible. The virtuous learning cycle illustrates each of the three forms of learning identified during the course of this research and how they affect the performance impact of the system. The theoretical benefits delivered by ERP, especially at a pan site level, are significant. The changes, however, to working practices and methodologies are also substantial. In this case the first plant to receive ERP reacted negatively to it. Lack of training, lack of documentation and perceived lack of

support meant that people in the plant saw ERP as a burden rather than a valuable strategic tool. As can be seen from the data gathered during the interviews with system users, the organisation studied managed to turn this situation around over a period of eight months. Hence people in plant 1 started to see the value, and even more importantly communicate the value, of the ERP system.

An ERP system is complex. Not because the theory that underlies ERP is complex, but because the system suddenly offers users an opportunity to access data that they have never been able to see before. The first stage of ERP implementation, then, has to be to encourage users to experiment with the system, to test its boundaries and capabilities, to establish what the ERP system allows them to do. Only then can users begin to move into the second phase of learning – learning how to improve the system. At this stage they really begin to use the system as a strategic tool. For now they are starting to request new reports, new data, new communications protocols that will allow them to manage better the resources at their disposal. In terms of implementation, the key theme becomes how do the implementors encourage system users to engage in this learning process first to learn how to use the system, and then later to learn how to improve the system.

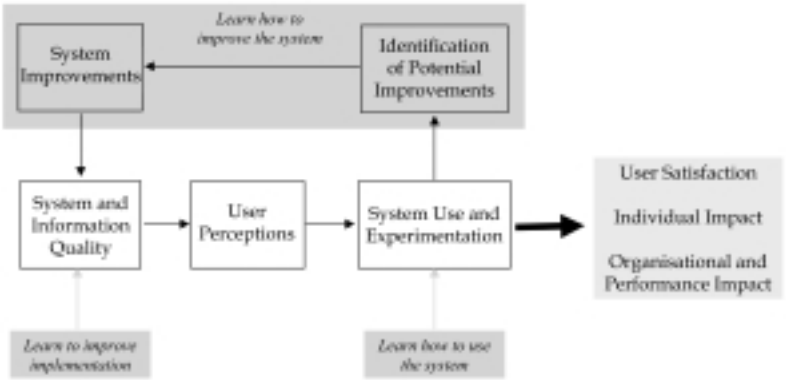
The company studied during the course of this research managed this process effectively, although not particularly efficiently. The first implementation – the pilot – really was an experiment. Little attention was paid to the needs and views of the users. Little thought was given to the issue of how they would be encouraged to experiment with the system. The pressure from corporate level was to get the system implemented and to move on to the next site. It was only on reflection that members of the implementation team realised that what had happened was that they had learned how to manage the implementation process and that a key dimension of this was encouraging users to learn how to use the system.

The second theme that is particularly relevant to practitioners and academics is the time lag between observed operational improvements and financial improvements. The SAP system went live in plant 1 in March 1997. By the end of the evaluation period, some 21 months later, managers throughout the business were still not convinced that the system had delivered a positive financial impact. Given the reported operational improvements reduced stocks, better ability to plan and control, global negotiation power, better customer service, etc. it is inconceivable that financial performance has not improved. If stocks are reduced by 10 per cent and all other things remain equal, then return on sales must improve. So why can no improvement in return on sales be observed? And why do so many managers within the business still question whether the system has had a positive financial impact?

There are two possible reasons. First, it may be that management is right, that the system has not yet had a positive financial impact. And the reason for this is that operational improvements have been identified, but not yet implemented. If this is the case, then the issue for the business becomes why have the improvements not yet been implemented. What are the barriers that are preventing people from acting on the insights that have been gained? Once again this comes down to learning. The problem is that the system does not yet have sufficient credibility within the business. As a result people still doubt the data and hence are not willing to act on them.

The second possible explanation is that in fact the system has had a positive impact on financial performance, but this has not yet been recognised. Again this comes down to credibility. The frustrations with the first implementation were so great that people felt there was no way it could ever have a positive impact on the business and they are still reserving judgement. In any event the issue that underpins these themes is still learning. Although the system, in this context, delivered operational benefits, these benefits were not forthcoming as rapidly as they should have been. Nor was the impact of the system on financial performance as significant as it could have been. And the reason for this is that people were not encouraged early enough to enter into the virtuous learning cycle – learning how to use the system, learning how to improve the system and learning how to improve the implementation.

Figure 8
The virtuous learning cycle



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