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# ERP implementation: lessons from a case study

ERP  
implementation

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**Abstract** *Many organizations have moved from stand-alone business information systems applications to integrated enterprise-wide systems, enterprise resource planning (ERP). The implementation of ERP packages has created an opportunity to re-engineer business processes within and beyond the organizational scope. Most notably, SAP R/3 has been widely implemented to create value-oriented business processes that enable a high level of integration, improve communication within internal and external business networks, and enhance the decision-making process. Though many organizations have reported dramatic improvements from SAP R/3 implementation, others have experienced difficulties in getting the R/3 modules aligned with other business components and systems. This paper describes a case study of a failed implementation of SAP R/3 to re-engineer the business processes of a major manufacturer. Lessons in terms of factors that led to failure and their future implications are discussed in the light of the contrasting experiences of several best practice companies.*

## Introduction

A useful tool that businesses are turning to, in order to build strong capabilities, improve performance, undertake better decision making, and achieve a competitive advantage is the enterprise resource planning (ERP) package. The ERP package aims to integrate all key business activities through improved relationships at all levels to achieve a competitive advantage (Al-Mudimigh *et al.*, 2001; Davenport, 2000). IT-enabled re-engineering is an important approach used to achieve dramatic improvement in business processes.

The development of ERP systems was a result of the increasing demand for re-engineering, combined with the advent of client/server technologies (Buck-Emden, 2000). There was also a desire to replace MRP systems which fell short of supporting multiple plants, multiple suppliers and multiple currencies, and did not include functions such as inventory control, plan management and order processing (Kalakota and Whinston, 1997). ERP systems can be considered as an IT infrastructure able to facilitate the flow of information between all business processes in an organization (Martin, 1998). In particular, SAP R/3 has emerged as the dominant leader in ERP systems, and is now one of the most used tools to optimize and re-engineer business processes (Cooke and Peterson, 1998; Keller and Teufel, 1998). Siemens and Lucent, for instance, have implemented SAP R/3 to improve the integrity of their supply-chain (Elliott, 1997).



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SAP R/3 is an integrated suite of financial, manufacturing, distribution, logistics, quality control and human resources application systems (Bancroft *et al.*, 1998). SAP R/3 brings together several core business functions into one integrated data model to provide for one-time data entry and the sharing of a fast, seamless access to one single facet of information (Martin, 1998; Rick, 1997). However, not all organizations embarking on SAP R/3 implementation realize its benefits (Bancroft *et al.*, 1998). The reason is that SAP R/3 implementation is a difficult undertaking, in that its success necessitates managing adequately a complex context, which involves organizational changes across various key areas related to strategy, technology, culture, management systems, human resources, and structure. The exclusive focus on technical aspects, at the cost of change management elements, has proved to be a major source of failure.

This paper describes a failed implementation of SAP R/3, in conjunction with re-engineering efforts, at a major middle-eastern manufacturer (Comp Group), which represents a network of complementary companies (Comp1, Comp2, Comp3, and Comp4). The reported case in this paper represents a complementary study to a major research project on the implementation of re-engineering to improve business performance. The objective of this case study is to explore the implementation process of SAP R/3-enabled business process re-engineering. This involves a study of change drivers, strategies, approaches, human aspects, structural change, cultural change, IT enabling role and factors of failure.

### **Research methodology**

This study adopts grounded theory research approach, and seeks to explore the SAP R/3-enabled business process re-engineering context, and thus build theory for further research (Benbasat *et al.*, 1987; Merton, 1968; Strauss and Corbin, 1990). As supported by Benbasat *et al.* (1987) and Kaplan and Duchon (1988), a qualitative case study technique was used for data collection to gain insights into the topic being investigated. To expand the scope of the study and minimize any data bias, a triangulation approach was adopted (Bryman, 1995; Chadwick *et al.*, 1984; Jick, 1979; Patton, 1990). Semi-structured interviews, observations and documents related to change efforts were the main sources used for data collection. Following the contact with key informants in the company, interview schedules were agreed on. All interviews were taped to ensure accuracy of written data, and to enable a better collection and use of evidence. More than one appointment was needed to finish interviewing all subjects. Follow-up phone calls were also made to seek clarification or further information. All data taken from the main sources were consolidated and linked together to create a full picture of the entire process of change. Content analysis was used to discover important patterns from the data. The analysis focused on distilling factors of failure, and to describe the approach followed, as well as tactics and techniques

used to operationalize the change plans. In an attempt to analyze the data further and facilitate explanations and comparisons, several secondary case studies of leading organizations were chosen from the literature and analyzed for the success elements in their SAP R/3 efforts.

### **Impetus for change**

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In 1993, Comp Group faced new challenges in the form of:

- The growth of intensifying competition.
- Changes in the world of business and the threats and opportunities of globalization.
- The increasing need for Comp to become a customer-focused business, and the huge impact that this would place on the current organizational structure.
- The need to improve quality in order to provide cost-effective, flexible, reliable and timely products and services to clients.
- The length of time the company had been in business (more than 17 years). This resulted in many of the procedures and functions in use during that period becoming outmoded.
- The need for Comp to look at ways of reducing costs through the elimination of overlapping activities, inefficiencies and handoffs.
- Comp's desire to increase empowerment, accountability and ownership by decentralizing its activity to points where they could most effectively be carried out. A study of the current organizational structure of Comp2 showed that, with the current organization chart supporting between 55 and 60 positions of manager and above, there was an opportunity to remove 10-20 percent of these positions. The managerial positions identified as unneeded were found responsible only for mediating the flow of information between the top and the bottom echelons of the organization, and thus affecting negatively both business productivity and quality.
- The outdated IT infrastructure. Since the early years of its establishment, some of the company's major operations, such as production, sales, shipment, and inventory, had been supported by one application system written in a third-generation language, COBOL, and running on a super-mini NCR operating system. There were also a number of loosely coupled departmental and application-specific piecemeal systems. Accumulating alterations to these systems had resulted in problems such as complex code, data redundancies and poor documentation, and hence in enormous maintenance costs. In 1991, Comp began to migrate some applications systems to an Oracle database environment, and expanded them to handle more business functionalities. However, this process resulted in little flexibility within the internal architecture of the system.

At that time, there was a strong case for changing the Comp Group's business. Management realized that the key to achieving the change would be to revamp the current outdated IT infrastructure and migrate to a new, flexible applications system that would create an effective supply-chain that would be more responsive to customers' needs.

In 1993, Comp conducted a survey to determine which were the most experienced companies that would be able to assess the group's situation and develop a complete solution package. Six consulting companies were selected and invited to study the case. One of the proposals put forward was to embark on re-engineering. The Comp Group management recognized that merely changing the current application system would not greatly benefit the company. Thus, a decision was made to implement a new system in conjunction with a re-engineering effort. In early 1994, a leading consultant company (ConsCo) was selected by top management to provide support on technical and methodological aspects of re-engineering. In March 1994, ConsCo reviewed the current systems and operations and identified the major problems to be tackled in the re-engineering initiative.

As changing the IT infrastructure was seen by ConsCo as a key determinant of the amount and scope of the efforts needed to carry out the entire re-engineering initiative, a particular focus was initially placed on assessing the current IT infrastructure. ConsCo identified shortcomings with the current IT infrastructure in four main areas (Table I).

As a result of this assessment exercise, ConsCo proposed two main alternative IT infrastructure sourcing approaches to improve the company's operations, namely upgrading current systems, or selecting a world-class package. Based on a comparison carried out by ConsCo on the possible risks

*Network*

- Multiple brands of network components in use
- Selection process not proceduralized
- Sizing and benchmarking never performed
- Preventative maintenance not exercised

*Organization*

- Systems department skills not aligned with current technology
- Limited specialized training in key technology areas
- Limited training on functionality and industry best practices

*Platforms*

- Several platforms of servers, PCs and operating systems

*Applications and data*

- Lack of flexibility in current applications
- Lack of support to some required business functionalities
- Lack of parameterization, standardization, and documentation
- Servers' selection not based on data storage requirement analysis
- Limited integration of applications and systems

**Table I.**  
Key findings of  
current status  
assessment exercise

and benefits of the two alternatives (Table II), the company chose to go to the global software market to select a world-class package that best suited its current needs, and would serve future visions and trends. ConsCo suggested that the company needed an enterprise-wide information system (EIS), which would fit the needs of the company, and would gain value from the re-engineering effort. It also developed a high-level architecture of how such a system would be organised across the group's major business units. The aim of this architecture was to help the Comp Group evolve from a separated set of business units into a single integrated system which is linked with common business processes. It also aimed to simplify and improve the flow of information across various departments, providing a business-wide, seamless, and real-time access to information.

### Implementation approach

The Comp Group realized the need to improve dramatically its IS and business functions. Therefore, it launched the Comp Operations Reengineering (CORE) project. To pilot the project, the Comp Group decided to narrow the scope of the CORE project to cover only its operations at Comp2. Therefore, it subscribed to a high-level business model for Comp2, when an overall IT strategy had been recommended for the entire Comp Group. The business model was considered a tool by which Comp2 could describe how it wished to conduct its business, and identify the interfaces between various business entities' internal processes, its customers, and suppliers.

| Upgrading current systems                                   | Selecting world class package                                                  |
|-------------------------------------------------------------|--------------------------------------------------------------------------------|
| <i>Risks</i>                                                |                                                                                |
| Long-term operational costs                                 | Initial expenditure on application software license                            |
| Reliance on skills and knowledge of individuals             | Ongoing application software maintenance charges                               |
| Resulting systems will remain inflexible                    | Need to rework some business processes or perform minor software modifications |
| Potential technical limitations and performance issues      | Potentially long lead-time before benefits can be realised from new system     |
| Need to continually upgrade and maintain system             | Need to retrain users and systems department                                   |
| Interim support for users                                   |                                                                                |
| Scale of estimates may be underestimated                    |                                                                                |
| <i>Benefits</i>                                             |                                                                                |
| Leveraging of IT investment to date in application software | Classical approach to software selection                                       |
| Direct costs limited to salaries of development team        | Best functional fit for group software                                         |

**Table II.**  
Pros and cons of IT  
infrastructure's two  
main sourcing  
approaches

The Comp Group IT strategies (Table III) were recommended based on the current status assessment of the existing systems, applications, and data structures, along with the analysis of the business model developed by the re-engineering team.

The CORE project activities were planned in three major phases:

- (1) *Visioning and alignment* – involved delivering two high-level strategies for both future business operations and their supporting IT infrastructure.
- (2) *Conceptual detailed design* – aimed at delivering detailed plans for both business process re-engineering (BPR) in Comp2 and the new IT infrastructure.

| Strategy                                                       | Anticipated benefits                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Application software strategy</i>                           |                                                                                                                                                                                                                                                                                       |
| Implement packaged software solution                           | Avoiding reinventing wheel<br>Full integration, and reduction of data entry<br>Upgradability, portability, and adaptability<br>Applying best practices<br>Minimizing development and installation time<br>Properly documented for ease of portability, implementation and maintenance |
| <i>Technology strategy</i>                                     |                                                                                                                                                                                                                                                                                       |
| Use open system, application software driven, Unix-based       | Versatile<br>Scalable<br>Support business' current and future needs<br>Increasing numbers of vendors and support in market<br>Leveraging investment to date                                                                                                                           |
| <i>Data strategy</i>                                           |                                                                                                                                                                                                                                                                                       |
| Continue with use of oracle data base management system (DBMS) | Already being used<br>Ease of portability<br>Allowing for standardization                                                                                                                                                                                                             |
| Capture and store data at source                               | Minimizing errors<br>Approach to real time<br>Minimizing access time<br>Reducing communication cost<br>Allowing working independently in case of common failure                                                                                                                       |
| Integrate shared data                                          | Electronic integration to reduce data entry and errors<br>Eliminating duplication of effort<br>Reducing time to perform transactions<br>Decision making with "full picture"                                                                                                           |
| <i>Group strategy</i>                                          |                                                                                                                                                                                                                                                                                       |
| Use enterprise system                                          | Standardization to one application software<br>Sharing of group-wide data<br>Executive reporting and decision making                                                                                                                                                                  |

**Table III.**  
IT strategies for  
Manco Group

- (3) *Implementation* – planned to cover several aspects of installing the new system, developing its documentation, and training.

When ConsCo was first hired in March 1994, they only committed to phases 1 and 2. Phase 3 was to be considered later. ConsCo subsequently proposed that phases 2 and 3 should be combined to make the re-engineering efforts more efficient. After phase 1 was completed, and a high level strategy developed (including the Comp2 business model and IT strategies), the re-engineering team felt that using a tool to begin mapping the business processes would save time and make possible early adjustments based on the way the package proceeded. Thus, it decided to cease scheduled efforts, and to select an EIS software package which would satisfy the needs identified early on by the current assessment exercise, and one which would align with the developed strategies. As a result of this decision, a delay occurred in selecting the package while the company waited for ConsCo to present their findings on the available packages in the market.

ConsCo had undertaken a three-phase software selection exercise to identify the application package which best met the business requirements. Of more than 30 packages initially identified (e.g. Oracle Financials, SAP R/3, Triton (BAAN) and EMIS), a short-list of four packages was created. Two areas of selection criteria were identified to evaluate the short-list packages, namely functional and strategic. Functional criteria represented the extent to which a selected package covered sales, production, purchasing, and inventory operations.

Only SAP R/3 and Triton (BAAN) were found to be the ones most qualified to fit the business requirements of Comp Group. Therefore, the vendors of the two packages were asked to provide an initial high-level overview of their software to the Comp Group management. Two further detailed functional demonstrations were given by each of the vendors to key Comp Group functional users from the areas shown in Table IV.

The results of the final evaluation revealed that, tactically, Triton offered a shorter implementation time, lower cost, and potentially less risk involved in the implementation. Strategically, SAP R/3 was found to be more likely to support Comp's medium and longer-term requirements. SAP's size and market positioning would ensure that the R/3 software package would stay at the leading edge of incorporating world class business process functionality and

| Comp1                   | Comp2                                                            | Comp3               | Comp4      |
|-------------------------|------------------------------------------------------------------|---------------------|------------|
| Inventory<br>Purchasing | Sales<br>Customer service<br>Production<br>Planning<br>Technical | Sales<br>Production | Production |

**Table IV.**  
Key Comp Group  
functional users

future technologies. For this reason, the Comp Group recommended SAP R/3 as the platform for their EIS of the future.

The company, therefore, resumed its efforts in February 1995, and continued until the early months of 1996. The initial focus of the efforts was on the logistic cycle (complete auto-processing cycle). The logistic cycle focused on encompassing all elements from the enquiry through to the auto-processing and high-level manufacture, including the materials management involvement, as well as the finance aspects. In other words, re-engineering efforts focused initially on four core processes that were supported by SAP R/3, namely sales and distribution (S&D), material management (MM), finance (FI) and production and planning (PP).

Based on ConsCo's scope, re-engineering implementation with SAP was planned to take 18 months, beginning in April 1995. However, ConsCo's involvement ended in January 1996, when just the FI and MM modules of SAP had been implemented, with completion rates of 90 percent and 80 percent respectively. Since then, both FI and MM modules have been subjected to continuous improvement efforts.

In early 1998, the Comp Group began implementing the S&D module using the on-line support services (OSS) linked directly to the SAP company in Germany. At the same time, the legacy system ran in parallel, owing to unresolvable problems in the sending out of invoices to customers. Currently, more than 50 percent of the S&D module has been implemented, and once completed, it will be handed over to the end-users. Recently, the Comp Group has begun implementing the PP module, and part of it is currently being tested. The company plans to continue implementing the remaining group of applications, switching off the old systems on completion.

Configuration and customization of the SAP modules were undertaken by the IT department. Configuration was mainly focused on process mapping, and setting-up supporting tables. Migration of legacy systems was done automatically, since SAP had interfacing facilities which recognize databases created with Oracle. This process was beneficial, in that it offered an opportunity for data cleaning by eliminating unused and repetitive data from the system.

### **Discussion**

At Comp, few people considered the change efforts to be successful. For example, the day-to-day managers who worked on the CORE project suggested that, with the aid of SAP R/3, they were able to change some outdated functional operations in four business areas to modern processes, notwithstanding the fact that the results did not fully satisfy the expectations. However, other people, including the president himself, regarded the BPR efforts as a failure because of budget excess, long delays, and lower benefits than previously expected. Overall, the Comp BPR efforts can

only be regarded as a failure, since the efforts could not bring about dramatic improvement and fundamental changes in the Comp Group business processes, despite the high investment amounting to \$2.8 million.

As a consequence of this failed experience, employees have a negative perception of re-engineering, and an increased sensitivity towards any change effort in the future. This failure also cost a great deal of time and money, and had a negative affect on the trustworthiness of some managers. However, the Comp Group's management decided to start the whole effort all over again, and to face the tough challenges created by this experience. Their current vision is to institutionalize a process-orientation thinking and structure throughout the group business units, by making more effective use of SAP R/3 applications.

An analysis of the case indicates that it was not so long after the Comp Group had commenced its BPR efforts that failure began to take root. There were several main reasons for the failure of the CORE project. Each of these reasons is discussed next.

#### *Scope creep*

The case description demonstrates the CORE project's shift in focus from BPR to functional optimization efforts. The strong resistance engendered by the manpower reductions resulted in BPR-related change principles being compromised. In fact, the CORE project management got carried away by the immediate organizational problems and the daily business demands, and as a result, concentrated on less important optimization and automation aims. This approach can by no means fall under Hammer and Champy's (1993, p.32) definition of BPR. Based on a global survey of SAP R/3 implementation in 186 companies, Cooke and Peterson (1998) identify that managing against well-defined milestones and making rapid, and empowered, decisions at the proper levels, both help avoid scope creep, and keep implementation efforts on track.

#### *Lack of ownership and transference of knowledge*

The Comp Group marginalized its participation in the SAP R/3 project, and retained a minor managerial responsibility for its employees in the efforts. Consequently, and with the absence of progress and performance measures, this situation led the consultants to making decisions that, transparently and negatively, influenced other major roles in the company. This clearly demonstrates how BPR's potential can be compromised in early stages, when ownership of the effort lies in the wrong hands. However, best practice organizations, like Kodak and Owens Corning, have all taken a clear approach to emphasizing their ownership of their SAP projects, and to ensuring an effective transfer of knowledge and expertise. At Owens Corning (Antia, 1996; Bancroft *et al.*, 1998; Romei, 1996), the consultants were used for two specific tasks:

- (1) facilitating early process design, and
- (2) training on technical aspects, especially in the SAP components and the client/server.

To maximize the technical expertise of the consultants, and build new capabilities internally, Owens Corning adopted the concept of knowledge transfer, by which transference of all necessary skills to Owens Corning's employees at the end of the project was ensured.

#### *Lack of change management*

In the case of the CORE project, a list of savings resulting from manpower reduction was presented to justify change and convince top management of the need to re-engineer. This, nonetheless, led management to look at those savings before implementation took place to take the decision to make personnel redundancies. The Comp management failed to give sufficient credence to its employees' distress that was generated by massive change. Although SAP implementation inevitably involves some annoyance, there were steps which could have been taken to manage change hurdles. For example, Amoco (Jesitus, 1997), a leading US oil company, developed a series of "job impact analysis" documents which were reviewed by the implementation teams and then by middle managers, to "force" them to become involved, and thus minimized their resistance.

As a consequence of this failed experience, the IT function was not sufficiently equipped to carry out the SAP implementation. Scarcity of experienced staff, lack of training and education, and increasing overload have all contributed to the failure of the efforts. SAP R/3 is a complex application, which places on IT staff the responsibility of supporting end-users on a daily basis. This requirement was underestimated at the beginning, and end-users resisted the new system because they were not given enough skills to work with it. Besides empowering the IT function with the necessary training and resources, it should also be prepared to meet the IT management challenges that SAP brings about, such as:

- reduced need for development programmers,
- reliance on complex architectures,
- higher user involvement, and
- user ownership of systems and data (Bancroft *et al.*, 1998).

#### *Lack of communication*

The importance of communication stems from the fact that it could build the competence of the whole organization in re-engineering efforts, and gain everyone's commitment, support and response. In their SAP R/3 implementation initiatives, both GTE (Caldwell, 1998), Lucent (Francesconi, 1998) and Owens Corning (Antia, 1996; Bancroft *et al.*, 1998; Romei, 1996)

established extensive internal communications channels, including focus groups, newsletters, e-mail and Web-based archives, to help keep employees informed about new developments, and answer questions about the SAP implementation. However, at Comp, there was no formal communication strategy that identified effective mechanisms to ensure cascading of change rationales and plans to everyone affected by the efforts. Although considered by the CORE project management to be the most difficult part of BPR, communication to, and involvement of, people was approached through newsletters and ad hoc social events. However, the CORE project management believed that more communication should have taken place, but the reason for not doing so was a lack of support from the human resources (HR) department.

#### *Lack of performance measurement*

Having a comprehensive measurement system provides a feedback mechanism to track implementation efforts, identify gaps and deficiencies in performance, and recommend the necessary actions to fine-tune the situation in hand in order to achieve the desired business-centered outcomes. Kodak (Stevens, 1997), for instance, uses a well-disciplined “phases-and-gates” approach that moves projects through a series of steps of assessment and planning, design and prototyping, and delivery and absorption. However, although Comp developed some measures to estimate the anticipated impact of their BPR efforts, these measures fell by the wayside as efforts proceeded further. The CORE project manager offered this explanation:

The progress of the CORE project and its resulting benefits were not measured. Although some parameters were developed, such as turnover, manpower, collection (cost reduction), inventory, cycle time, they were not followed up.

#### *Propensity to isolate IT from business affairs*

It is obvious from the case description that the CORE project management had adopted a technical perspective, viewing IT as a force affecting, and leading to, a certain organizational form. This situation indicates a lack of alignment between business strategy and IT strategy. This might be put down to a lack of developing, and thereby cascading, a solid and well-defined business-centered case for the entire change initiative. Experiences reported by best practice companies show how the business case for SAP implementation can be developed to address both organizational vision and operational measurements. To secure a leading position in the global marketplace, Owens Corning launched a two-year initiative (Anita, 1996; Bancroft *et al.*, 1998; Stevens, 1998; Romei, 1996). Among the aggressive goals the company has defined are the following: the target of \$5 billion in sales by the year 2000, solid brand recognition, continued productivity improvement, and expansion into new products, applications and markets. Other goals are a 6 percent

### Conclusion

In its future attempts to re-engineer its business processes, Comp will have a difficult task ahead in convincing employees that this time it can be successful, and in regaining their trust. In order to succeed, Comp will have to learn from best practice companies. They will have to identify, amongst other valuable lessons, how the successful companies avoided implementation pitfalls. Reported experiences in SAP-enabled supply chain re-engineering implementation have shown that effective implementation requires establishing the following five core competencies:

- (1) Change strategy development and deployment.
- (2) Enterprise-wide project management.
- (3) Change management techniques and tools.
- (4) BPR integration with IT.
- (5) Strategic, architectural and technical aspects of SAP installation.

In today's global market, organizations aiming to attain a competitive advantage would require to have a robust, integrated and seamless approach to BPR supported by a powerful IT infrastructure. What seems to have arisen from this study is that all of the benefits that could occur from re-engineering are only possible if there is total commitment, leadership and persistence within an organization.

### References

- Al-Mudimigh, A., Zairi, M. and Al-Mashari, M. (2001), "ERP software implementation: an integrative framework", *European Journal of Information Systems*, Vol. 10 No. 4, pp. 216-26.
- Anita, L. (1996), "Getting in the pink", *Management Review*, Vol. 85 No. 5, pp. 18-23.
- Bancroft, N., Seip, H. and Sprengel, A. (1998), *Implementing SAP R/3: How to Introduce a Large System into a Large Organisation*, Manning Publications Co., Greenwich, CT.
- Benbasat, I., Goldstein, D. and Mead, M. (1987), "The case research strategy in studies of information systems", in *MIS Quarterly*, September, pp. 369-86.
- Bryman, A. (1995), *Quantity and Quality in Social Research*, Routledge, London.
- Buck-Emden, R. (2000), *The SAP R/3 System: An Introduction to ERP and Business Software Technology*, Addison-Wesley, Reading, MA.
- Caldwell, B. (1998), "GTE goes solo on SAP R/3", in *Information Week*, No. 685, pp. 150-1.
- Chadwick, B., Bahr, H. and Albrecht, S. (1984), *Social Science Research Methods*, Prentice-Hall, Englewood Cliffs, NJ.
- Cooke, D. and Peterson, W. (1998), *SAP Implementation: Strategies and Results*, Research Report 1217-98-RR, The Conference Board, New York, NY.

- Davenport, T. (2000), *Mission Critical: Realizing the Promise of Enterprise Systems*, Harvard Business School Press, Cambridge, MA.
- Elliott, H. (1997), "Don't be late for those important dates", *Electronic Business Today*, Vol. 23 No. 7, pp. 34-6.
- Francesconi, T. (1998), "Transforming Lucent's CFO", *Management Accounting*, Vol. 80 No. 1, pp. 22-30.
- Hammer, M. and Champy, J. (1993), *Reengineering the Corporation: A Manifesto for Business Revolution*, Harper Business, New York, NY.
- Jesitus, J. (1997), "Change management: energy to the people", *Industry Week*, Vol. 246 No. 16, pp. 37-41.
- Jick, T. (1979), "Mixing qualitative and quantitative methods: triangulation in action", *Administrative Science Quarterly*, Vol. 24 No. 4, pp. 602-11.
- Kalakota, R. and Whinston, A. (1997), *Electronic Commerce – A Manager's Guide*, Addison-Wesley, London.
- Kaplan, B. and Duchon, D. (1988), "Combining qualitative and quantitative methods in information systems research: a case study", in *MIS Quarterly*, December, pp. 571-83.
- Keller, G. and Teufel, T. (1998), *SAP R/3 Process Oriented Implementation*, Addison-Wesley, London.
- Martin, M. (1998), "Enterprise resource planning", *Fortune*, Vol. 137 No. 2, pp. 149-51.
- Merton, R. (1968), *Social Theory and Social Structure*, Free Press, New York, NY.
- Patton, M. (1990), *Qualitative Evaluation and Research Methods*, Sage Publications, London.
- Rick, M. (1997), "IT integration programmed for global operation", *Chemical Week*, Vol. 159 No. 6, pp. 21-7.
- Romei, L. (1996), "New technology strengthens new commitment", *Managing Office Technology*, Vol. 41 No. 7, pp. 18-20.
- Stevens, T. (1997), "Kodak focuses on ERP", *Industry Week*, Vol. 246 No. 15, pp. 130-5.
- Stevens, T. (1998), "Proof positive", *Industry Week*, Vol. 247 No. 15, pp. 22-8.
- Strauss, A. and Corbin, J. (1990), *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, Sage Publications, London.

### Further reading

- Braddely, P. (1999), "Managers look to supply chain to cut costs", *Logistics Management and Distribution Report*, Vol. 38 No. 1, pp. 21-2.
- Davenport, T. and Short, J. (1990), "The new industrial engineering: information technology and business process redesign", *Sloan Management Review*, Vol. 31 No. 4, pp. 11-27.
- Oakland, J. (1998), *Total Quality Management: The Route to Improving Performance*, Butterworth-Heinemann, Oxford.