Preface

This is a book about Enterprise Resource Planning (ERP)/Enterprise Systems (ES) implementation. At the same time, it is also a book about business operations and information systems to support business operations. The question is, why did we decide to unite these three seemingly disparate topics? There are a large number of books treating ERP implementation, operations management, and information systems, separately. At the same time, books dedicated to all three topics applied to practical issues of ERP implementation are scarce. Brady, Monk, and Wagner (2001) say that according to their experience teaching, ERP merely as software did not work. In uniting these three topics in one book, they hope to avoid the problems they encountered, and therefore, better educate the students. They discovered the ERP education was flawed because it was based on the following faulty assumptions:

1. All students understand how businesses and functional areas operate. In fact, many students do not yet have a good grasp of how profit-making organisations operate.

2. All students understand the problems inherent in unintegrated systems. In fact, even the most advanced undergraduate and MBA students do not truly grasp what goes on in real companies, where people in different functional areas must work together to achieve company goals.

3. All students understand how an information system should help business managers make decisions. In fact, some students do not understand this well.
These same assumptions are also applied to ERP/ES implementation team members. When a company decides to implement an ERP system, usually a team is formed consisting of at least two groups of specialists:

**Group 1.** Operational staff of the company under implementation; and
**Group 2.** System analysts from the software or consulting firm, specialised on ERP implementation.

Sometimes there are other groups like information systems (IS) specialists from the company under implementation, or software professionals from the software company, and this makes the team more inconsistent.

Considering the two basic groups, assumptions 1 and 2 may frequently be incorrect for Group 2, while assumptions 2 and 3 rarely are true for Group 1. For successful implementation, both groups need an understanding that ERP can solve the problems that arise from having unintegrated information systems, for example, that data sharing in real time throughout a company’s functional areas is increasing the efficiency of operations, and is helping managers to make better decisions.

Jang and Lim (2004) argue that the use of a commercial Enterprise Resource Planning system is now integrated into Industrial Engineering (IE) curriculum. The ERP system, a business information system that considers all facets of a business, provides an integrated presentation that is needed to educate future managers. It also creates an active-learning environment that uses modern technology. The integration also simulates real employment and addresses educational concerns. Teaching the industry’s needs to students, and introducing them to a state-of-the-art ERP/ES system, can foster their future development.

This explains why we think that a book uniting the three above topics is vitally important for implementation specialists as well as for students.

The adoption of Enterprise Resource Planning in the business world may, in fact be the most important development in the corporate use of information technology in the 1990s (Davenport, Harris, & Cantrell, 2004). ERP systems appear to be a dream come true for managers who have longed for an enterprise-wide, integrated, information systems solution. ERP systems are packaged software applications that connect and manage information flows within and across complex organisations, allowing managers to make decisions based on information that truly reflects the current state of their business.
ERP systems also automate complex transaction processes, and thus have the potential to reduce costs (Davenport et al., 2004). Integrated information systems provided by ERP-enabled organisations to react quickly to competitive pressures and market opportunities, achieve lower inventory, and maintain tightened supply chain links. ERP technology is even more appealing to organisations due to its increasing capability to integrate with the most advanced electronic and mobile commerce technologies (Al-Mashari, 2002). It is not surprising that the promise of an ERP solution to the problem of business integration is enticing (Davenport, 1998).

ERP systems have successfully enhanced the efficiency of a wide range of businesses by providing them with seamless access to the information they need. Many companies that have implemented an ERP system successfully have enjoyed operational and strategic benefits from the system. But implementing an ERP system is not an easy job. ERP implementation is a complex task that requires substantial time, money, and internal resources. It follows that ERP system implementations fail more often than not (Legare, 2002). One horror story of a failed ERP implementation occurred at Foxmeyer Drug, a $5 billion pharmaceutical company. The company filed for bankruptcy in 1996 and argued that the primary cause of its difficulties was a failed ERP implementation that crippled the business. (Legare, 2002)

ERP systems are business software packages that support daily business operations and decision making. These packages are capable of seamlessly integrating all the information flowing throughout a company, from financial and accounting information, human resource information, manufacturing information, supply chain information, to customer information (Davenport, 2000). For a long time, business organisations have struggled and have invested huge amounts of money in a search for a seamlessly integrated system within and across organisations. Most of these efforts ended up with disappointing results. That is why the promise of an off-the-shelf solution to the problem of business integration is very enticing.

ERP originated from material requirements planning (MRP) and manufacturing resource planning (MRP II) (Chen, 2001; Davenport, 2000). In a typical manufacturing environment, the master production schedule (MPS) determines the quantity of each finished product required in each planning period. Based on the MPS, the organisation then calculates requirements for the parts and raw materials that make up those finished products. MRP is a production planning and control technique in which the MPS is used to schedule production and create purchase orders for the part and raw material.
Following its useful application in manufacturing functions, MRP was expanded to include more business functions. In the early 1980s, MRP expanded to a company-wide system, which was capable of planning and controlling almost all the organisation’s resources. This development was so fundamentally different from the original concepts of MRP, a new term, manufacturing resource planning, was coined. A major purpose of MRP II is to integrate various primary functions (e.g., production, marketing, and finance, human resources) into the planning process.

In the 1990s, MRP II was further evolved into enterprise resource planning, a term coined by the Gartner Group of Stamford, Connecticut, USA. ERP is capable of planning resources not only within an organisation but also across organisations in a supply chain. These capabilities distinguished ERP from MRP II, which only focused on the planning and scheduling of internal resources.

One major feature of ERP is that core organisation activities, such as manufacturing, human resources, finance, and supply chain management, are automated, and improved significantly by incorporating best practices in the industry, thus facilitating better managerial control, quicker decision-making, and lower operational cost (Al-Mashari, Al-Mudimigh, & Zairi 2003).

ERP systems started to gain in popularity in 1994 when SAP, a German based company, released its latest ERP systems package known as SAP R/3. Since then, companies have begun to spend billions dollars for ERP systems offered by SAP and other ERP systems vendors. According to Lea, Gupta, and Yu (2005), most Fortune 500 companies have already adopted ERP systems, and many midsize companies (less than 1000 employees) are planning ERP implementation. Many organisations have successfully adopted ERP systems, yet many more organisations have spent fortunes only to find that business performance has not improved to satisfactory levels within the expected time frame (Robinson & Wilson, 2001). Problems associated with ERP implementation are often classified into technical and organisational aspects. Technical aspects include the technology readiness of an organisation, the complexity of commercial ERP software, data loss due to the compatibility of data architectures between the old legacy systems and the new ERP software, and inadequacies of newly redesigned business processes. Common organisational factors may include employees’ resistance to change, inadequate training, underestimated implementation time and cost, unwillingness to adopt new business processes, and strategic view of technology adoption (Mabert, Soni, & Venkataramanan, 2001).

As a relatively new system, ERP is recognised in the world by several different names. The synonyms for ERP, among others, are integrated standard
software packages, enterprise systems, enterprise wide-systems, enterprise business-systems, integrated vendor software, and enterprise application systems (Al-Mashari et al., 2003; Davenport, 2000). Despite the difference in naming, the definitions of ERP proposed by various authors are relatively the same.

Rosemann (1999) defines an ERP system as a customisable, standard application software which includes integrated business solutions for the core processes (such as production planning and control, and warehouse management) and the main administrative functions (such as accounting and human resource management) of an enterprise. Slightly differently, Gable (1998), defines ERP as a comprehensive package software solution that seeks to integrate the complete range of business processes and functions in order to present a holistic view of the business from a single information and IT architecture. The key points in this definition are that ERP systems cover multiple business functions, and they are packaged systems, not systems that are developed from scratch by user organisations. Shang et al. (2002) pointed out several characteristics of ERP systems, as follows:

• A set of packaged application software modules with an integrated architecture;
• Can be used by organisations as their primary engine for integrating data, processes and information technology, in real time, across internal and external value chains;
• Contains deep knowledge of business practices accumulated from vendor implementations in a wide range of client organisations; and
• A generic product with tables and parameters that user organisations and their implementation partners must configure and customise to meet their business needs.

In short, ERP is a computer system that keeps managers informed about what is happening in real time throughout a corporation and its global connection (Jacobs & Whybark, 2000). In the mid-1990s, the Gartner Group coined the term “ERP” to refer to next generation systems which differ from earlier ones in the areas of relational database management, graphical user interface, fourth generation languages, client-server architecture, and open system capabilities. The integration implies the use of a common database when all the sub-systems “talk” directly to each other, and the data are made available in real time (Jacobs & Whybark, 2000). The information is updated as changes oc-
cur, and the new status is available for everyone to use for decision making, or for managing their part of the business. The decisions made in different functional areas are based on the same current data to prevent nonoptimal decisions from obsolete or outdated data. Expected benefits from ERP implementation include lower inventory, fewer personnel, lower operating costs, improved order management, on-time delivery, better product quality, higher productivity, and faster customer responsiveness (Robinson & Wilson, 2001). A study by Deloitte & Touche Consulting, a consulting company, classified an organisation’s motivations for ERP implementation into two groups, technological and operational (Al-Mashari et al., 2003). Technological motives relate mainly to:

- Replacement of an unintegrated system,
- Improvement of quality and accessibility of information,
- Integration of business processes and the supporting systems,
- Simplification of integration of business acquisitions into the existing technology infrastructure,
- Replacement of older and obsolete systems,
- Compliance to Y2K requirement, and
- Acquisition of system that can support business growth.

Operational motives, on the other hand, are related to:

- Improving inadequate business performance,
- Reducing high-cost structures,
- Improving responsiveness to customers,
- Simplifying ineffective, complex business processes,
- Supporting new business strategies,
- Expanding business globally, and
- Standardising business process throughout the enterprise.

There are many good reasons why organisations should adopt ERP system. Some of them are listed next.
• **Responsiveness.** In today’s business, the speed of an organisation to respond to business requirements can be very vital. With its single database systems and integrated module, ERP systems enable an organisation to make faster and better decisions based on accurate and up-to-date information.

• **Maintenance cost.** The only alternative to the ERP systems is to keep a large number of unintegrated systems, which support various business functions or business process. Maintaining these systems is, of course, very costly, because each system requires a different maintenance programme and different skills.

• **Operational cost.** In an unintegrated systems environment, the data must be entered for each system. Each system may require a different format, which in turn requires data transformation. This “multiple entry” not only costs organisations much more, but also becomes a potential danger for data integrity.

• **Business process improvement.** Since the rise of ERP, many organisations have undertaken business reengineering (BPR) initiatives accompanied by ERP systems implementation, which have led to the invention of the term “ERP-enabled BPR.” One of the best ways to improve a business process is to benchmark from the best practice that which has proven to be superior in the industry. Every ERP vendor advertises that their system is designed based on best business practice.

Swanson and Wang (2005) offered a model that explains a firm’s success in terms of its adoption know-why and know-when and its implementation know-how. They examined this model in an exploratory survey of some 118 firms’ adoption and implementation of packaged business software in the 1990s. Using multivariate methods, they identified business coordination as know-why, and management understanding and vendor support as know-how factors important to success, explaining nearly 60% of the variance.

Firms typically use consultants to aid in the implementation process. Client firms expect consultants to transfer their implementation knowledge to their employees so that they can contribute to successful implementations, and learn to maintain the systems independent of the consultants. Ko, Kirsch, and King (2005), drawing from the knowledge transfer, information systems, and communication literatures, developed an integrated theoretical model that posits that knowledge transfer is influenced by knowledge-related, motivational, and communication-related factors. Data were collected from consultant-and-cli-
ent, matched-pair samples from 96 ERP implementation projects. A behavioural measure of knowledge transfer that incorporates the application of knowledge was used.

An ERP implementation cycle starts when an organisation realises the need for ERP systems. This need leads to the vendor selection process, whereby a solution is sought to meet this need. Then the organisation will have to decide on the implementation approach. Davenport (2000) identified four alternative implementation approaches based on two key dimensions. The two dimensions are speed, which refers to the time it takes to implement ERP, and focus, which refers to the amount of business change and value to an organisation. From the four alternatives, the slow, technical (poor implementation) is the only alternative that must be avoided because technical focus brings little business value. Therefore, it does not make sense to spend a long time on it. The other alternatives are up to the organisation to choose, depending on its business strategy.

An enterprise system is a generic solution which is designed based on a series of assumptions about the way companies operate in general (Davenport et al., 2004). Vendors, as mentioned before, try to structure the systems to reflect best practices, but it is the vendor, not the customer, that is defining what “best” means. In many cases, the system will enable a company to operate more efficiently than it did before (Davenport et al., 2004). In some cases, though, the system’s assumptions will run counter to a company’s best interests. When an organisation chooses strategic focus as an implementation approach, it must decide whether to change their business processes or to customise the ERP package to suit their business processes.

ERP implementation is a huge project that requires a substantial amount of money, time, and other internal resources. A huge project always represents a big risk, which is difficult to manage. For this reason, most organisations prefer to implement ERP systems gradually. It usually starts from accounting and financial modules, followed by manufacturing, supply chain, and other modules. Academics have different opinions about the validity of this approach (Davenport, 2000). Davenport advocates that an organisation should strive for business value in their ERP implementation.

After deciding which approach to be used in ERP implementation, the organisation should create and maintain conditions for project implementation such as
• Establish a project team,
• Define scope of the project,
• Establish procedure for monitoring and managing performance, and
• Provide required training for participants.

And then the implementation begins. At this stage, the organisation should define and develop processes, modify software if necessary, test (pilot) processes, establish and assign responsibilities for processes, design and create documentation, train users, and set up data. After all these steps are completed, the organisation “goes live” with its ERP. During the early stage of go-live phase, the implementation team will need to provide help desk for users before they get used to the new, process execution environment.

Even though ERP has been implemented and executed successfully, the real business value may not be realised quickly. ERP systems implementation is an ongoing process. To fully benefit from the ERP system, once it is installed and used in an organisation’s operations, it needs to be reviewed and improved for better performance. The adoption of a continuous improvement programme after the go-live period enables the benefits of the system to be fully exploited (Davenport et al., 2004).

This book details the most important steps of the design and implementation process, while simultaneously, providing knowledge about its basic steps. Chapter I defines the business process as the most fundamental concept of contemporary business organisation, and discusses the sequence of steps in business process redesign. We discuss at length the mechanisms for identifying key processes.

Chapter II discusses the step that follows the process identification step, namely, modelling the processes, as they exist in the organisation. Then comes process analysis — this part of the overall life cycle is about gathering more information about the processes that we have identified in the very first step. The next key step is process improvement/transformation, after which comes process implementation, which can have two distinct views: organisation point of view and information technology point of view. The next key step in the process is the monitoring and controlling of the processes that go on within an organisation. This monitoring could trigger another cycle of process change, where we move into the process identification, modelling, improvement, implementation and execution.
Chapter III is about the modelling of business processes, which is vital not only for business process management, but also for implementation of enterprise systems. Many frameworks and architectures have been proposed for modelling business processes. One of them is the Architecture of Integrated Information Systems (ARIS) that is tightly integrated with SAP R/3, and described in detail, including Event-Driven Process Chains (EPC). We focus on the ARIS House Of Business Engineering in this chapter because the ARIS models have a one-to-one correspondence to the way SAP R/3 models its business processes.

Implementation of enterprise systems is analysed in Chapters IV and V. Chapter IV focuses on implementation issues, while Chapter V focuses on implementation phases. Unfortunately, none of the traditional software development life cycles seem to capture the complexity of what was going on in the context of enterprise systems implementation. In this chapter, we focus not on the vendor’s life cycle, but on the enterprise system adopter’s life cycle. And we elaborate on what goes on in each of the phases of this life cycle. Three distinct phases in an enterprise system’s implementation are recognised. The first phase is the project phase, in which the software is configured to suit the requirements of the organisation. The second phase is the shakedown phase, during which the organisation moves from the go-live status to the normal operation status. We look at the question, what is the time period that it takes an organisation to get back to normalcy? The third phase is the onward and upward phase. It is in this phase that the organisation attempts to realise all the benefits, or the majority of the benefits, that they believe they could obtain by implementing the enterprise system. After we have looked at all the steps to the implementation of the enterprise system, we consider what would be termed as a successful enterprise system implementation, and enterprise system implementation risks.

There is a variety of systems that go towards supporting processes in an organisation. Chapter VI describes one of them — the SAP Suite. SAP is one of the leading vendors of such integrated information systems. It provides integrated information from accounting to manufacturing and from sales to service. Whenever data is entered in one functional area for one particular transaction, this data is automatically reflected in all the related functional areas. The SAP system supports and integrates thousands of business processes. The core system uses a single database. The SAP system has strengths in certain industries, but it has offerings or reference models that have been specialised to most of the major industries in the world.

All subsequent chapters give an extensive case study. Chapter VII sets the case of SAP Production Planning module implementation at EA Cakes Ltd.
The market forced the company to change its sales and production strategy from “make-to-order” to “make-to-stock.” The decision to change the strategy involved not only the company’s decision to invest much more money in accumulating and keeping stocks of finished goods, it required also a complete redesign of its production planning system, which was an integral part of an ERP system that used SAP software.

In the EA Cakes case study, the management decided to change the production planning system. While there is evidence that the existing system had faults, it had nevertheless been developed to suit the existing situation and the people who managed it. This fact raises the question of where to start when attempting to improve a planning system. It is very rare to be involved in designing the planning system right at the firm’s beginnings, and more often, the planning system has evolved over a period of time, and is designed to suit some form of management goals or objectives, or to suit the existing technology and processes. We can assume in most cases that the existing system has been designed with the best knowledge and understanding of the existing situation. To improve the situation, therefore, needs new knowledge, or the ability to see something that was missed in the original design phase. This is the material placed in Chapters VIII and IX. Chapter VIII concentrates on structural issues, while Chapter IX tackles the design of the capacity management business processes. Chapter X contains case solutions. Chapter XI presents some special topics in production planning redesign. After analysing the competitive advantage from production planning, we concentrate on advanced problems like balancing capacity vectors, and factors of the production environment, most influential in production planning. Chapter XII gives a tutorial case study using a pasta producing company. The case solution is given up to the end of the business process redesign stage. The SAP implementation (quite similar to the one described for EA Cakes Ltd, Chapter VII) is left to the readers of the book, or to the students, if the book is used in education. The main lesson of this case is the following: though the company does not look like EA Cakes Ltd, and the goals of the production planning systems are different, nevertheless, analogous SAP solutions can be used to give computer support to the production planning staff. The concluding Chapter, Chapter XIII, discusses some of the problems with ERP implementation with specific reference to the case, and it also looks at some of the lessons learned.