The integration of ERP into a logistics curriculum: applying a systems approach

Raymond F. Boykin and Wm. Benjamin Martz Jr

The authors

Raymond F. Boykin is Professor of Operations Management and SAP Fellow in the College of Business at California State University, Chico (CSUC), California, USA. **Wm. Benjamin Martz Jr** is an Associate Professor of Information Systems at the University of Colorado at Colorado Springs, Colorado, USA.

Keywords

Distribution management, Curricula, Resource allocation, Systems theory

Abstract

The area of logistics and enterprise resource planning (ERP) have a natural bond in that both deal explicitly with identifying working with business processes. This also generates concerns. For example, typical education and training paradigms implementations are often task-oriented (scientific management) not process-oriented (systems management). This creates a paradoxical situation where those taught to work with logistics and ERP systems tend to focus only on and understand a limited role within the business. We examine the process-oriented versus task-oriented approach used in a high-tech manufacturing organization to validate the conjecture. In addition, we propose that students exposed to the integration of ERP topics in their logistics coursework develop more process-oriented thinking than do those students exposed to more traditional or functional area education. The foundations for a preferred model for ERP education and training are proposed.

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · pp. 45-55
© Emerald Group Publishing Limited · ISSN 1741-0398
DOI 10.1108/09576050410510944

Introduction

> Logistics is the process of planning, implementing, and controlling the efficient effective flow and storage of raw materials, in-process inventory, finished goods, services and related information from point of origin to point of consumption (including inbound, outbound, internal and external movement) for the purpose of conforming to customer requirements (Ratliff and Nulty, 1996).

Ratliff and Nulty (1996) expand the council's definition to recognize that logistics is a major business function or process of an organization. Explicit within their definition is the concept of a supply chain that includes all functions associated with the creation and ultimate delivery of a product or service. Kalakota and Robinson (1999) use the metaphor of a "process umbrella" to expand the definition into the e-business world. Their definition includes more than the company's internal systems. They are more expansive in their definition of "participating enterprises" because they include the suppliers of suppliers, company financiers and even assembly facilities owned by other organizations. The ability for a logistics supply chain to move over and among traditional areas makes it a fundamental business process with growing emphasis.

Current enterprise-wide information systems attempt to address the "related information from point of origin to point of consumption" requirement found in the council's definition above. These information systems, often labeled ERP (enterprise resource planning) systems, force the organization from a task-oriented approach to this newer process view. Unfortunately, some organizations cannot make this change and their ERP implementations are less than successful (Latamore, 1999).

One of the contributors to this lack of success is that training approaches often remain task-oriented. However, business organizations do not shoulder the entire fault here. The same task-oriented (functional area focus) approach is seen in today's business school curricula (Boykin *et al.*, 1999).

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

To break this cycle, business school curricula must provide students with examples of, exposure to, and experience with, enterprise-wide, business perspectives. One of the fundamental concepts enabling this transition is the understanding of business processes. General systems theory creates a powerful linkage between classical concepts of information systems and today's enterprise-wide perspective. In turn, this linkage generates a curriculum and environment in which students are exposed to underlying concepts of enterprise-wide business processes.

'... we present an overview of the integration of an ERP system into the logistics curriculum of an undergraduate business program ...'

We suggest that one must understand the conceptual fundamentals of a process or a system, and this can be accomplished through the integration of an ERP system and its concepts into a business school curriculum. In turn, industry must adopt a more process-oriented approach in its ERP training programs.

Kaplan and Norton (1992) point out in their work on the balanced scorecard methodology for evaluating business processes, that not understanding the basic process (the overall business model in the case of the balanced scorecard) produces a less than effective set of performance measures. The understanding of "what a process is" becomes more salient as organizations try to measure and change processes. In their review of 20 firms engaged in business process reengineering, Davenport and Beers (1995) identify the managing of information about processes as a key success factor. The conclusion one draws from these two works is the underlying importance of understanding business processes as related to organizational success.

In this paper, we present an overview of the integration of an ERP system into the logistics curriculum of an undergraduate business program. Through this integration we hope to witness an improved understanding of business processes. This improved understanding is measured through a simple questionnaire given to business students who are at different points in the program.

Business processes and systems theory

In the broadest sense, ERPs are information systems that must organize and control another complex system – the logistics of an organization. Viewed this way, the ERP must conform to the Ashby's (1961) Law of Requisite Variety. Here, the controlling system, the ERPV, must, by definition, have at least as much variety or "flexibility within" as the system that it is trying to control. As proposed in the initial formulation of this research (Boykin *et al.*, 1999), the vast literature on general systems theory points to some of the richness in variety necessary.

An initial reference point is Churchman's (1979) definition of a system:

> A set of parts coordinated to accomplish a set of goals.

He further outlines five considerations for defining system components. Buffa (1977) traces the general systems theory concept back to 1947 and relates L.V. Bertalanffy's "hallmarks" to a production management perspective by stating:

> ... it [the word "system"] describes so well the general interaction of the myriad of elements entering managerial problems that we can no longer talk of complex problems without using the word.

He adds:

> ... one of the great values of systems concepts is that the concepts help us to order and structure a very complex problem.

From these early definitions, it is not a tough stretch to see the ties to Hammer and Champy's (1993) definition of a business process:

> A set of activities that, taken together, produce a result of value to a customer.

Warfield (1976) creates the concept of a task-oriented transient organization, or TOTO, to address the system characteristic of

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

complexity. In a TOTO, Warfield merges two dimensions of complexity: scope and depth. From that position, he suggests that satisfactory answers to complex problems must concurrently address depth and breadth. This concept, when applied to ERPs, points to education and understanding of both the traditional functional business areas – the depth – along with the business processes – the breadth – of a functioning organization.

Finally, we return to the notion that to understand a system, one must be able to adequately describe the processes and the interactions under study. One example resides in the practice of business reengineering that encompasses the premise of decomposing the basic business processes into subsystems in an effort to change them for the better. Huizing *et al.* (1997) discuss the necessary "fit" needed between breadth and depth for a business reengineering project to be successful. Ratliff and Nulty (1996) recognize the complexity involved when they note that "multiple business functions are impacted" in their fundamental characteristics of logistic design questions.

In summary, ERPs are designed to address the challenge of having a single information system encompass the logistics function of an entire organization. To properly understand how an ERP can be successful, one must embrace the fundamental characteristics of a systems approach:

(1) *Systems have components* – input, output, transform, subsystems and feedback.
(2) *Complexity* – system components combine in multiple ways to create complexity.
(3) *Systems produce feedback* – systems respond to environment with feedback.
(4) *Goal seeking* – systems are in place to achieve a purpose.
(5) *Holism* – local system optimization may be global system catastrophe.
(6) *Basic transform* – systems convert inputs into outputs through a basic process.
(7) *Interdependency* – components rely on/work with other components.
(8) *Self referential* – systems have subsystems which themselves exhibit the characteristics of systems

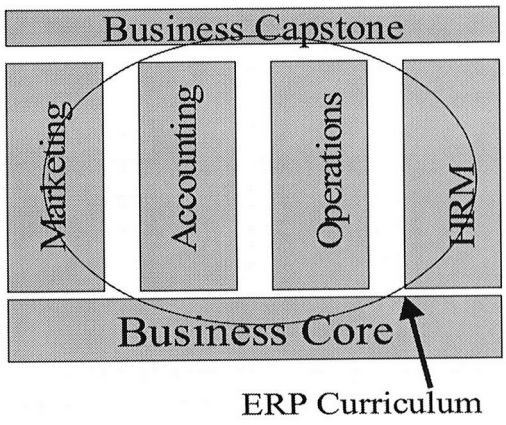
Several significant research, methodological, and practical streams in the business information systems field have grown from this basic premise, including systems analysis and design, business process engineering, logistics and enterprise resource planning. Throughout these streams is the underlying concept of acknowledging and addressing business processes. We propose that it is the understanding of the interactions between processes and functional areas that remain the key topic in the successful education about ERPs.

ERP and business curriculum

ERP systems are defined as integrated sets of comprehensive software. These sets usually include a set of mature business applications and tools for financial and cost accounting, sales and distribution, materials management, human resource, production planning and computer-integrated manufacturing (Bancroft *et al.*, 1996) (see Figure 1).

With combinations of these fundamental software modules, companies are able to model a wide variety of business processes (Denning, 1996). A wide variety of companies such as Coach Manufacturing, Hewlett-Packard, I-Two, Elmer's Products, Bristol-Meyer, Philips Automotive and Baylor College of Medicine (ASUG, 2000) are counting on their ERP systems to coordinate order management, high volume manufacturing, patient care,

Figure 1 Integration emphasis of ERP curriculum



Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

customer service, product inventories, cash flows, financial management, etc. In addition, by interfacing ERP systems between companies, organizations are partnering to create "business-to-business" electronic commerce. Obviously, these systems are large and complex and, by their nature, require the understanding of both a focused, functional perspective and a business-wide perspective at the same time.

'... The more a student knows about the complex interactions inherent in a business and how to capture those interactions in an ERP, the more employable that student becomes ...'

Price Waterhouse (1997) estimated the ERP software market at $3.86 billion in 1996 and that it was growing at an annual rate of 68 per cent! More recent predictions by the Gartner Group show a 25 per cent annual increase (SAP, 2000). Dataquest (2000) – also a division of Gartner Group – predicts a complementary ERP services market of $97 billion by 2003. This incredible growth in the market has created a dire need for employees with a unique set of skills: functionally focused and business literate. Adding further complexity is the fact that the purchase and use of information systems has evolved into strategic and competitive decisions well beyond the scope of one manager or decision maker (McNurlin and Sprague, 1998; Peters, 1992).

Business processes, such as logistics, can become the basis from which to create a natural interaction of functional areas and business processes. Conceptually, the intersection is easily identified. Practically, ERP systems become the linkage within the organization that covers all major business processes, touching all the main functional areas in a business school curriculum just as it touches those areas in the real world. The more a student knows about the complex interactions inherent in a business and how to capture those interactions in an ERP, the more employable that student becomes. The software companies offering this type of software include PeopleSoft, Oracle, Baan, and SAP/AG.

One hurdle is developing a plan that would integrate the software into the curriculum, without resulting in only training students in the use of a software package. The complexity of demonstrating the concepts underlying enterprise information systems required that complex cases be developed for students. Then, to demonstrate the integration needed for successful operations, transaction assignments required the student to navigate through the enterprise software and into several functional areas. Boykin *et al.* (1999), reported an initial integration of ERP software into the operations management curriculum.

As one reads the questions below, we see the linkages and interdependencies predicted by general systems theory. In fact, it is the recognition and understanding of these linkages that produces the value for a student or employer.

- Why are we producing these goods?
- Are the goods for inventory or a specific customer?
- If they are for a customer, what is the ordering history of that customer?
- What information do we need to know about the customer?
- How much will it cost us to produce this good, including allocated costs?
- How much money do we make when we sell this good?
- What are the skill inventories of the workers scheduled to produce these goods?
- Do we have enough worker capacity to meet the production schedule?
- Where do we get information about our suppliers?
- What is their quality record as a supplier to us?

Most likely, students in an operations management class seldom, if ever, ask these questions. If the questions are asked, being able to provide an integrated answer for the student is difficult at best. However, these are some very important questions for a production manager. In fact, dealing with many of these cross-functional issues may be just as important as dealing with the technical issues involved in producing the goods.

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

One academic installation

This section discusses how one academic institution is using business enterprise information system software to expose business students to issues that are more representative of actual business situations.

In 1996, the College of Business at California State University, Chico (CSUC) was selected as the first partner in SAP America's newly-established University Alliance Program. The SAP University Alliance Program is a partnership between the university and SAP in which SAP provides the university with its R/3 software product, a training database, technical support and faculty training. The university uses the software to facilitate student learning regarding the concept and application of enterprise software.

SAP's R/3 product is the leading ERP system in the world with an estimated 30+ per cent market share. The College of Business at CSUC began integrating R/3 into the curriculum in 1996. Today, there are more than 20 courses with R/3 integration. The operations management program has the heaviest integration with all required courses in the program containing a significant R/3 component.

The integration of the R/3 software into the operations management curriculum required a cross-functional approach. Because the software is process-focused and not functional-area focused, faculty from accounting, MIS, and operations management formed a team to accomplish this task.

There were several hurdles in developing a plan that would integrate the software into the curriculum, without resulting in only training students in the use of a software package. First, the students must be taught enough about the software package to use it and to further overall comprehension. Second, the focus needed to be on problems created by the cross-functional process and solved by the software. Finally, the amount of time needed to develop new course materials had to be managed, since faculty availability was very limited.

The solution to these problems involved a multi-faceted approach. First, a MIS class was developed to create a team of students who understood the workings of the software enough to act as consultants for the operations management courses. The second issue was addressed by the development of cases and assignments to illustrate the cross-functional nature of most operations management decisions and processes. Addressing the final issue resulted in the decision that the software would be integrated into operations management classes in a phased approach.

It was decided that the initial integration of the software into the operations management curriculum would occur in four operations management courses:

(1) production planning and management;
(2) production control and scheduling;
(3) quality management; and
(4) procurement.

This would be done at the rate of two courses per semester. The first two courses were production control and scheduling and quality management.

Basis support

The SAP system is an extremely complex piece of software. It contains over 100 million lines of source code and the database stores data in over 10,000 relational tables. The administration of such a complex system is very important to the success of any SAP project. SAP uses the term "basis support" to describe these activities. There is an impressive set of monitoring and administration tools imbedded in the SAP system. However, it is very important that a talented basis support team is formed before the project is even undertaken. An entire semester was spent creating a basis support infrastructure class (enterprise software – system administration) before the system was used in application-oriented classes (quality management and production control and scheduling).

Cross-functional assignments

The complexity of demonstrating the concepts underlying enterprise information systems required that complex cases be developed for students. Then, to demonstrate the integration needed for successful operations, assignments are developed that require the student to navigate through the enterprise software into

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

several functional areas. An example of this is one of the purchasing assignments used in class.

The assignment follows the process of generating a purchase order from a planned order, confirming the current supplier for this material, issuing the purchase order, receiving the material, stocking the material, and paying the invoice. The student is required to perform the following navigational steps in the enterprise software system:

- Access the production module where the planned order is created.
- Move to the procurement module where a purchase order is generated based on the planned order.
- Confirm the supplier and current terms for the material to be purchased.
- Issue a purchase order for the material.
- Obtain delivery information and status.
- Receive the material into the warehouse.
- Perform required quality inspections before releasing material to stock. (This requires the student to access the quality management module.)
- Receive invoice from supplier. (This requires the student to interface with the accounts payable module.)
- Perform invoice verification.
- Issue payment to supplier.

During this exercise the students navigate through several different functional areas in order to complete the purchasing process. As a part of the assignment, the student is required to assess the current process and make recommendations for improvements. Completion of this assignment results in the student acquiring a better understanding of the complexity of the purchasing process, the need for integration between several functional areas of the organization, an exposure to all of the internal and external documents associated with the transaction, and an appreciation for the advantages of enterprise software.

This assignment usually takes several class periods to set up and execute. The different parts of the purchasing process are discussed and the software is introduced in phases. The total time required for introducing the software and completing the assignment is approximately 20 hours. This is spread over three to four weeks.

One key learning experience in the case is that the student cannot complete an operations management problem without dealing with and satisfying the issues from the quality management, the accounts payable and the information systems functions (Figure 2). Historically, this dependency was briefly discussed or briefly addressed in the purchasing class. Now, the dependency becomes a major component.

'... The problem with this approach was that it created a large number of calls to the "ERP help desk", because the user did not understand any of the inputs or outputs to the transactions they were processing ...'

As students have become more comfortable with the R/3 system, more advanced assignments have been developed that require the student to assess the current process, make recommendations for improvements, and implement those in the R/3 system. Overall, the student acquires a better understanding of the complexity of many different logistic processes.

Developing an exploratory study

This section describes restructuring an organization's internal ERP training class providing insights into creating a preliminary design for evaluating the impact of the ERP curriculum.

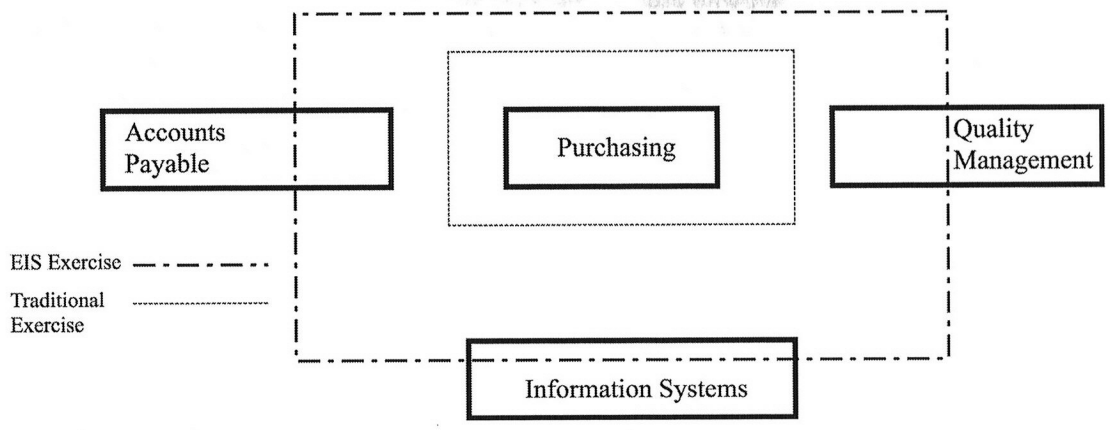
Insights from the field

Recently, a project was undertaken to redesign the ERP training program for a high-tech manufacturer. At the beginning of the redesign effort it was discovered that the existing training program was almost completely task-oriented. Employees were instructed on how to use the ERP system to perform a very limited number of transactions.

In some cases, only one or two transactions (e.g. receiving goods, post goods issue, create

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

Figure 2 Process emphasis of ERP curriculum



purchase order) were used. The problem with this approach was that it created a large number of calls to the "ERP help desk", because the user did not understand any of the inputs or outputs to the transactions they were processing.

This problem relates directly to the research findings of Kaplan and Norton (1992) and Davenport and Beers (1995) concerning the need to understand the business process.

The redesigned training included a significant amount of business process orientation for the user, related to the processes that they were involved in or impacted by. The results of implementing this new ERP training program included the following user comments:

> I finally understand the ERP system now.
>
> Every new user should take this course so they will understand business processes.
>
> Business process integration information is critical.

These comments and the course review indicated that more study was needed on the relationship between using ERP systems and understanding business processes. It is important for organizations to assess the benefits of their training programs. If the goal is to improve organizational performance, the ERP systems and the business processes on which they are built is critical. To further assess this issue a more formal study concerning the relationship between ERP exposure and business process understanding was needed.

Preliminary questionnaire design and data collection

We designed a preliminary study in an academic setting to test whether those students with an ERP curriculum exposure would provide more process-oriented (system-oriented) answers. The study was designed in the spirit of Higgs and Ashworth's (1996) discussion of Zikmund's categorization of business research. Clearly, this preliminary study resides in the exploratory research category that is characterized by "gathering information that will lead to further, higher-level research" (p. 20).

We created a questionnaire containing five multiple choice and four open-ended questions. The same individual, to ensure consistency, scored the opened-ended questions. To confirm consistency, a second individual reviewed the scored questionnaires. Any scoring inconsistencies were resolved. The questions were developed from over two years' experience in designing process-oriented questions. Some questions were directly from tests and homework from the classroom. Others, like "What is an invoice?", are derivatives of process-oriented exercises offered by practitioners (Hansen, 1997). An example of the questionnaire is provided in the Appendix.

We supplied questionnaires to three groups in the study:

(1) recent graduates (GRAD);
(2) students just entering the program (PREPROG) at the freshman level; and
(3) students with significant experience competed in the program (ENDPROG) with less than a year to go.

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

Members of the GRAD group included recent graduates of the business program who are currently employed using process-oriented techniques and skills. The PREPROG group was defined as those students at the freshman and sophomore level (along with any student at any level that defined themselves as undeclared) who were essentially beginning the business program, but who have not had significant exposure to the ERP curriculum. Students with significant ERP course work were assigned the ENDPROG designation.

The questionnaire was attached to a basic e-mail message and sent to 30 recent graduates of the program. Nine replied. The researchers visited the classrooms of the PREPROG and ENDPROG students and conducted the questionnaires on site. A total of 37 valid PREPROG responses and a total of 58 valid ENDPROG responses were collected.

Preliminary conjectures

The program at the College of Business, where this study took place, has implemented a heavy emphasis of ERP classes within the curriculum. These classes should, by their very nature, produce students with more process recognition and understanding.

H1. Those students who have received ERP classes will score higher on the process-oriented questionnaire than those students who have not received the ERP classes.

The fundamental conjecture is that the ERP classes have helped produce the difference in *H1*. To check this assumption, the ENDPROG group should score relatively higher than the PREPROG group, while the GRAD group should score relatively higher than the ENDPROG group.

Preliminary results and discussion

The results of the study are both encouraging and preliminary. The primary hypothesis is supported by the nonparametric Mann-Whitney analysis. There is a significant difference ($p < 0.000$) between the scores posted by PREPROG and ENDPROG groups. Further analysis of the PREPROG and ENDPROG data expands the *H1* proposition, that the more exposure to the program the more a student recognizes the concept of a business process. Table I displays the distribution; it summarizes the scores data using four quartiles. The Chi-square analysis of self-reported, ERP experience (ERPEXP) and score shows a significant difference (Pearson $p < 0.004$).

In addition, there is a significant difference ($p < 0.000$) when the ENDPROG group is compared to the GRAD group. So, within two years of graduation, job experience seems to have made a significant difference in a person's recognition of a business process.

In summary, as exposure to ERP concepts increases, the ability to relate an understanding and awareness of business concepts seems to increase also.

Limitations

As McGrath *et al.* (1982) point out each type of research falls prey to differing limitations. As exploratory survey research, this study maximizes the research concern of "generality over actors", while compromising somewhat on the characteristic of "precision of measurement of behavior" and offers concerns on "context".

First, the questionnaire will have to be refined. It will need to be more completely tested in a more fundamental way before the results can be truly trusted. Second, there are many confounds with the subgroups. Age is a major one. The sample included 18-year-old freshmen and 25-year-old, experienced industry employees. Most certainly, the normal maturing process represents a potential confound. A third limitation is what Kerlinger (1986) names "comparison group self-selection". This limitation surfaces in part to the fact that one of our sample groups (GRAD) was selected because they had been in ERP classes. This same prejudice with PREPROG and ENDPROG groups was somewhat mitigated by the fact that these groups were chosen at random from within the population of business students. Finally, comparisons across differing business programs would increase the confidence of the findings.

Even with these limitations, we believe that that we have been successful in initiating a

Table I Self-reported exposure by score

	Scores (SPSS data-based quartiles)				
Exposure	0-3	4-5	6-10	11-17	Total
0-1	13	18	6	1	38
2-3	2	5	2	1	10
4-5	6	3	10	6	25
6-7	–	1	7	14	22
Total	21	27	25	22	95

stream of research into whether or not ERP content in a curriculum can help students with the broader, more fundamental concepts needed in understanding processes in general and business processes in specific.

Summary

In summary, ERP systems are designed to encompass business processes. These processes display the basic fundamentals found in the study of general systems. In fact, ERPs are positioned as the logical extension of traditional information systems (systems analysis and design) approaches to understanding and coping with complex business processes. One such complex process is an organization's logistics, wherein the fundamental construct of a supply chain crosses traditional organizational boundaries. Interestingly, two growing markets; the e-business supply chain management (SCM) and the enterprise-wide software (ERP) markets recognize explicitly the fundamental need to be able to identify and understand business processes. We propose that, before a business can identify or understand a business process; it first, must have employees that know what a process is!

The ERP training experience at a high-tech manufacturing company is the genesis for a preliminary design into the success of an ERP curriculum. This paper presents the basic conjecture that exposure to an ERP business school curriculum helps students understand the fundamental concept of a business process. The findings support this conjecture, in that scores on a process-oriented questionnaire are higher for a set of students at the end of the program than a set of students at the beginning of the same program. As exploratory research, the findings in this study must be qualified. However, the study provides a basis from which to conduct and formulate additional research concerning the effects of ERP curriculum. Finally, this study provides support for the redesign of the ERP training program for the high-tech manufacturing company that created the impetus for this study. Additional research needs to continue to determine if the results of the survey translate between an academic environment and an industry environment.

References

ASUG (2000), American SAP User's Group, available at: www.asug.org/Members/journal (accessed 18 April 2000).

Ashby, W.R. (1961), *An Introduction to Cybernetics*, Chapman & Hall, London, p. 206.

Bancroft, N., Seip, H. and Sprengel, A. (1997), *Implementing SAP R/3*, 2nd ed., Manning Publications, Greenwich, CT.

Boykin, R.W., Martz, B. and Mensching, J.R. (1999), "The integration of enterprise information systems in the operations management curriculum", *Journal of Computer Information Systems*, Vol. 39 No. 4, p. 68.

Buffa, E.S. (1977), *Modern Production Management*, John Wiley & Sons, New York, NY.

Churchman, C.W. (1979), *The Systems Approach*, Basic Books, New York, NY.

Dataquest (2000), available at: http://gartner12.gartnerweb.com/dq/static/about/press/pr-b9918.html (accessed 24 April 2000).

Davenport, T.H. and Beers, M.C. (1995), "Managing information about processes", *Journal of Management Information Systems*, Vol. 12 No. 1, pp. 57-80.

Denning, M. (1996), *Special Edition: Using Sap R/3*, Que Corp., Indianapolis, IN.

Hammer, M. and Champy, J. (1993), *Reengineering the Corporation*, Harper Business Press, New York, NY.

Hansen, G.A. (1997), *Automating Business Process Reengineering*, Prentice-Hall, Upper Saddle River, NJ.

Higgs, C.A. and Ashworth, S.D. (1996), "Organizational surveys: tools for assessment and research", in Kraut,

A.I. (Ed.), *Organizational Surveys*, Jossey-Bass, San Francisco, CA.

Huizing, A., Koster, E. and Bouman, W. (1997), "Balance in business reengineering: an empirical study of fit and performance", *Journal of Management Information Systems*, Vol. 14 No. 1, pp. 93-118.

Kalakota, R. and Robinson, M. (1999), *E-Business: A Roadmap for Success*, Addison-Wesley, Boston, MA.

Kaplan, R.S. and Norton, D.P. (1992), "The balanced scorecard: measures that drive performance", *Harvard Business Review*, Vol. 70 No. 1, pp. 71-9.

Kerlinger, F.L. (1986), *Foundations of Behavioral Research*, 3rd ed., Holt, Rinehart and Winston, New York, NY, p. 350.

Latamore, G.B. (1999), "Flexibility fuels the ERP evolution", *APICS – The Performance Advantage*, Vol. 9 No. 10, pp. 48-50.

McGrath, J.E., Martina, J. and Kulka, R.A. (1982), *Judgment Calls in Research*, Sage, Beverley Hills, CA.

McNurlin, B.C. and Sprague, R.H. (1998), *Information Systems Management in Practice*, 4th ed., Prentice-Hall, Upper Saddle River, NJ.

Peters, T. (1992), *Liberation Management*, Alfred Knopf, New York, NY.

Price Waterhouse (1997), *Technology Forecast: 1997, Version 7*, Price Waterhouse Technology Center, Menlo Park, CA.

Price Waterhouse Change Integration Team (1995), *Better Change: Best Practices for Transforming Your Organization*, Irwin Publishing, Burr Ridge, IL, p. 134.

Ratliff, H.D. and Nulty, W.G. (1996), "Logistics composite modeling", Technical White Paper Series, The Logistics Institute at Georgia Institute of Technology.

SAP (2000), SAP Web site, available at: www.sap-ag.de/investor/ar_omlin/1999/review_op.html (accessed 24 April 2000).

Warfield, J.N. (1976), *Societal Systems*, Wiley-Interscience, New York, NY.

Further reading

King, W. (1978), "Strategic planning for management information systems", *MIS Quarterly*, Vol. 2 No. 1, pp. 27-37.

King, W. and Zmud, R.W. (1981), "Managing information systems: policy planning, strategic planning and operational planning", *Proceedings of the Second International Conference on Information Systems*, Boston, MA.

Teo, T.S.H. and King, W. (1997), "Integration between business planning and information systems planning: an evolutionary-contingency perspective", *Journal of Management Information Systems*, Vol. 14 No. 1, pp. 185-214.

Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · 45-55

Appendix

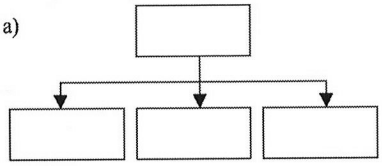
Figure A1 Business process questionnaire

1. Circle all of the following that are business processes.
a) accounting
b) goods receipt
c) order fulfillment
d) marketing
e) human resource management
f) customer credit check

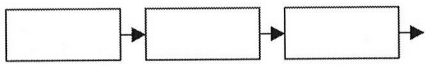
2. A process is:
a) the connection of two functional areas
b) a collection of activities with inputs and outputs that add value
c) the same as a work task
d) a combination of job assignments

3. Which of the following diagrams best represents a process?

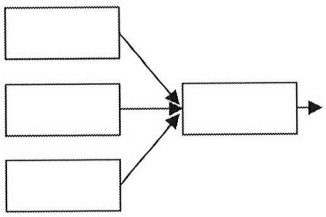
a)



b)



c)



4. A large company will have how many processes?
a) 10 to 20
b) about 50
c) 75 to 100
d) 100s to 1,000s

5. A business process is usually contained within a functional area?
a) True
b) False

6. Describe the steps in the purchasing process.

7. Describe the purpose of an invoice in a business.

8. What would you propose to measure if you wanted to know how well a company is going to do (how profitable they would be) in the future?

9. You have been asked to look over a set of blueprints for a new house. Describe three of the things you would be concerned with in your evaluation.