



2011

The Challenge of Implementing an ERP System in a Small and Medium Enterprise – A Teaching Case of ERP Project Management

Hongjiang Xu
Butler University, xhu@butler.edu

Patrick J. Rondeau
Six Sigma Associates

Sakthi Mahenthiran
Butler University, smahenth@butler.edu

Follow this and additional works at: https://digitalcommons.butler.edu/cob_papers

 Part of the [Business Administration, Management, and Operations Commons](#), [Business Intelligence Commons](#), [Entrepreneurial and Small Business Operations Commons](#), and the [Management Information Systems Commons](#)

Recommended Citation

Xu, Hongjiang; Rondeau, Patrick J.; and Mahenthiran, Sakthi, "The Challenge of Implementing an ERP System in a Small and Medium Enterprise – A Teaching Case of ERP Project Management" (2011). *Scholarship and Professional Work - Business*. 213.
https://digitalcommons.butler.edu/cob_papers/213

This Article is brought to you for free and open access by the Lacy School of Business at Digital Commons @ Butler University. It has been accepted for inclusion in Scholarship and Professional Work - Business by an authorized administrator of Digital Commons @ Butler University. For more information, please contact digitalscholarship@butler.edu.

Teaching Case
**The Challenge of Implementing an ERP System in a Small
and Medium Enterprise –
A Teaching Case of ERP Project Management**

Hongjiang Xu

College of Business
Butler University
Indianapolis, IN, 46208, USA
hxu@butler.edu

Patrick J. Rondeau

Six Sigma Associates, LLC
Carmel, IN 46032

Sakthi Mahenthiran

College of Business
Butler University
Indianapolis, IN, 46208, USA
smahenth@butler.edu

ABSTRACT

Enterprise Resource Planning (ERP) system implementation projects are notoriously risky. While large-scale ERP cases continue to be developed, relatively few new ERP cases have been published that further ERP implementation education in small to medium size firms. This case details the implementation of a new ERP system in a medium sized manufacturing firm. As students explore the case, they will be required to address the many ERP-related project management, procurement, human resource, and management involvement issues raised by it. This case highlights the ERP implementation problems experienced by case company in one of their two divisions. The firm is considering whether or not to implement this same ERP system in its other division. Before proceeding, the firm's board of directors has concluded that a review of the first division ERP implementation is needed. They believe that such an assessment could provide valuable insight and lessons learned, giving rise to improvement of the second division's ERP implementation outcome.

Keywords: Enterprise Resource Planning, Project Management, Case Study

1. INTRODUCTION

Enterprise Resource Planning (ERP) system implementation projects are notoriously risky. Failure rates for ERP projects have consistently been reported as very high (Aloini, Dulmin, Mininno, 2007; Kwahk and Lee, 2008). About 90% of ERP implementations are late or over budget (Martin, 1998), and the success rate of ERP systems implementation is only about 33% (Zhang et al., 2003). In response, today's IS curriculum has expanded to emphasize the need for improved ERP technical skills, the integration of ERP team knowledge, and the acquisition of greater overall business

knowledge (Boyle and Strong, 2006). However, serious deficiencies remain in ERP related project management, procurement, human resource, and top management education (Chen, Law, and Yang, 2009; Davis and Comeau, 2004; Du, Johnson, and Keil, 2004; Smith, Sarkusky, and Corrigan, 2008). In addition, a renewed emphasis on top management involvement in ERP implementation has been identified as an important topic for IS education (Liang, Saraf, Hu, and Xue, 2007; Ifinedo, 2008).

The impact of firm size on ERP implementation success clearly requires greater study. Our review of ERP case research indicates that prior studies have traditionally

focused on major ERP vendors targeting sales efforts toward large firms. Examples for such research are: the case study of implementation of ERP to reengineer the business processes of a major manufacturer (Al-Mashari and Al-Mudimigh, 2003); discussion of the factors that lead to the success or failure of ERP on large construction firms (Voordijk et al., 2003). At many universities this has led to the development of an IS curricula that is biased toward large-scale vendors, such as SAP. As the large-scale ERP market has matured, vendors have increasingly retargeted their sale of ERP software toward medium and small size firms. While large-scale ERP cases continue to be developed, relatively few new ERP cases have been published that further ERP implementation education in small to medium size firms (Winkelmann and Leyh, 2010).

This case is about the implementation of a new ERP system in a medium sized manufacturing firm. As students explore the case they will be required to address the many ERP related project management, procurement, human resource, and management involvement issues raised by it. This case highlights the ERP implementation problems experienced by Custom Engineering Solutions (CES), including senior management's role, in its Electronic Control Systems (ECS) division. The firm is considering whether or not to implement this same ERP system in its Electromechanical Motors & Equipment (EME) division. Before proceeding, CES' board of directors has concluded that a review of the ECS ERP implementation is needed. They believe that such an assessment could provide valuable insight and lessons learned that could improve EME's implementation outcome.

2. COMPANY BACKGROUND

Custom Engineering Solutions (CES) is an engineering services company specializing in custom electronic industrial controls and the remanufacture of heavy, electro-mechanical industrial equipment. It was initially formed after World War II to repair and rewire large electric motors used in a wide range of sophisticated applications, including industrial machinery, generators, and aircraft engines for example. The founder, who was a mechanical engineer, grew their business by delivering custom engineering services to local companies of various sizes. In the past decade, global companies have come to demand CES' products and services, especially its electronic industrial controls. As it has grown, it has begun to source assemblies required for production from Ireland and China.

Currently, CES produces approximately 1,500 different active products, with a mix of around 300 of these products and on average 3,600 units shipped to its customers every month. Their sales are distributed through 8-10 wholesalers, and a few of them are large national distributors with significant bargaining power. For example, Power Mason in St. Paul Minnesota is one of their largest distributors. Additionally, CES also sells directly to 50 regular customers. Sales are also seasonal and thin-out during economic downturns. Production must be ramped-up and down for these seasonal peaks and valleys. Hence, the company both builds to stock and to customer orders.

CES has two major divisions. Its oldest division, Electromechanical Motors & Equipment (EME) is also its

largest division, representing approximately 75% of CES' sales revenues. Its youngest division, Electronic Control Systems (ECS), manufactures semi-custom electronic control systems featuring user-configurable control panel hardware and customer-specific software modifications. CES' EME division can best be characterized as a remanufacturer of low-tech, electromechanical industrial equipment. In contrast, its ECS division can best be characterized as a manufacturer of new, high-tech, custom electronic control systems.

As CES has grown, it has found differences between its two divisions' business models have created significant management problems. From an operational perspective, these differences are evident in the way each division has utilized CES' manufacturing control system in the past. The EME division primarily utilizes maintenance bills of material (BOMs) designed to provide a skeleton set of material, labor, and machine requirements created based on the past history for jobs of a similar type. They are then modified extensively to support the remanufacturing effort and to estimate cost, profit, and price. Each job is essentially custom and unique to the machine, generator, or power system being refurbished.

In contrast, the ECS division has traditionally developed bills of materials for most new products, which are then modified as necessary to create different product configuration options to meet customer orders. However, instead of using a more conventional, APICS (The Association for Operations Management) standard approach to address this BOM flexibility requirement, CES has created unique product numbers for each customer order by copying a standard product BOM, then adding custom components and routing steps. This resulted in many thousands of "dead" BOM product variations saved in its manufacturing control system due to one time or limited run production orders. These many variants would return to haunt ECS in its future ERP implementation effort, because they greatly increased the complexity of the eventual data conversion process.

In addition, the operational differences between divisions created significant CES cost management and control problems. First, the accuracy of the price quotations for the EME division depended on the skill and experience of the sales managers responsible for pricing actions. The existing manufacturing control system, combined with EME's current approach to job cost estimation, made it difficult to accurately estimate and track the time and cost of a job. Thus, one need CES had was to implement a better, more automated system of analyzing prior jobs to help quote on new work.

Second, the ECS division's approach of modifying standard product BOMs to create many custom products caused problems because this customization of standard products was not captured in labor and materials reporting. While it built semi-custom products, the current manufacturing control system did not capture these costs by job at the point they were incurred. Instead, CES' approach was to back flush costs based on standards, not utilizing the factory data collection and inventory control capabilities to capture actual production costs. This meant that cost variances were incorrectly calculated based on a standard versus "as built" basis. As such, it is not possible to assess

whether production costs are accurate, much less conduct any sort of valid cost variance analysis.

3. ERP SYSTEM JUSTIFICATION

3.1 The Need for New Systems

The need for new information systems eventually became clear to CES' senior management. Using the old systems it was no longer possible to gain a firm grip on product and service costs. The accuracy of the data and reporting was questionable and of significant concern to the senior management. On the factory floor, controlling production jobs was increasingly difficult with parts, materials, and finished goods inventory inaccuracies. In addition, true production capacity and job progress was unclear at best.

3.2 Justifications for a New ERP System

When CES' senior management finally decided to act, they chose to do so for several reasons. These reasons were outlined in detail by the CFO who revealed the following three justifications for CES' purchase of a new ERP system to external consultants.

3.2.1 Support niche market strategy: First, it was evident that CES could no longer compete on price when going head-to-head against large competitors on most standard type products and services. Due to scale economies, larger competitors could always submit a "low ball" price quote that CES could not match. However, on semi-custom and custom products and services that are low volume or unique by larger competitors' standards, CES could compete profitably. This was a market niche in which they have done well in the past. Their unique, remanufacturing capabilities and new, semi-custom manufacturing capabilities and niche products should remain their focus. Therefore, the replacement of their outdated systems with a new ERP system capable of supporting this environment was imperative.

3.2.2 Provide better cost data: Second, while CES cannot challenge competitors on price, it must be prepared to compete on cost when customers and the market dictate final price. CES must be capable of managing its costs to satisfy customer requirements profitably. The new ERP system must therefore provide better cost data for CES to be capable of pricing remanufactured products and new product sales to remain profitable. Improved cost reporting is considered to be imperative to CES' future survival.

3.2.3 Improve the accuracy of financial reporting: Third, and perhaps most important, CES was under pressure from its external investors and bank(s) to improve the accuracy of its financial reporting, especially in the area of cost management and inventory valuation. Related to this, its auditors have stepped up their demands due to pressure on accounting firms to improve the quality of their audits. CES' old systems did not provide the necessary detail and clarity required, or the financial controls to satisfy external parties. Hence, management had no option but to act and to do so soon to avoid negative consequences initiated by the external parties.

3.2.4 Other justifications: There were other, supporting justifications as well. For example, these included: 1) streamlining their value chain so that inventory is not carried at multiple locations, 2) better tracking of sales and the flow of jobs through production, 3) improved sales forecasting, and 4) the implementation of a web store. An interesting side note is that these justifications for the new ERP system were not revealed in full to middle management during the system selection and implementation process. In particular, the pressure from external sources was not revealed, although it may have been the most significant justification for proceeding rapidly with introducing an ERP system.

4. ERP SYSTEM ACQUISITION

The ERP system evaluation process took place in two phases. First, a team of four senior managers contacted ERP software vendors, collected information, and narrowed the list of potential vendors down to a smaller subset. This senior management team included the CFO, COO, and the two sons of the company founder. The two sons of the founder are also the presidents of the two divisions. One criteria used by senior management to solicit ERP vendors was known to be the size of vendors' implementation base within the industry. However, beyond this criterion little else is known about how vendors were solicited to participate in the bidding process.

Second, senior management's primary goal was to choose an ERP system that most closely satisfied the needs of the EME division, not the ECS division. As was stated previously, EME is the larger division, representing approximately 75% of CES' sales revenues. ECS is the smaller division, representing approximately 25% of CES' annual revenues. Therefore, even though ECS was chosen as the first site for the ERP implementation, the requirements of ECS were considered to be secondary.

In developing the ERP selection criteria, members of the senior management team met with the various user groups to become familiar with the functions and features being used in CES' current systems. After doing so, they developed a short list of ERP software vendors, asked these firms to present their system's features, and extended an RFQ to bid on the job. Three potential vendors were then selected to give formal proposals to the management team.

At the conclusion of the process, an ERP system developed by Epicor (<http://www.epicor.com>) was purchased for \$250,000. The final ERP software selection decision was made by the CFO in conjunction with the COO. The firm's IT manager was allowed little input, and was all but excluded from the decision process. Likewise, the firm's middle and line managers were allowed limited input and did not participate in the final decision. While Epicor's ERP software was chosen for implementation, CES' senior management team concluded that the software vendor's services were simply too expensive for CES to engage them to support the system implementation process. Epicor was also deemed as "not being flexible enough" to help CES meet its desired, accelerated go-live date.

5. PROJECT MANAGEMENT ISSUES

There are a number of significant issues surrounding the management of this project. First, Epicor's ERP system was selected and the project approved in November 2007 with an initial "go live" implementation date, set by the CFO, of July 1st, 2008. ECS employees were given just six months to install the software, convert (and cleanup) the data, test the system, and train the employees using ECS' data. However, ECS did not actually begin work on the data conversion and testing effort until early April of 2008. When asked later, the CFO stated that the initial implementation date was fair and that individuals such as the IT manager were simply making excuses for not starting and completing their work on time.

Second, from the start it was not clear who the project manager was. The CFO stated that he assigned the IT manager to be the project manager. However, while the IT manager was assigned responsibility for the project's successful implementation, he was given no decision making authority. All decisions, no matter how small, were to be approved by the CFO. While the IT manager had a Masters degree in project management, he was not allowed to develop a detailed plan using tools such as PERT or CPM that could have shown that the desired final implementation date was not feasible due to insufficient time, money, and manpower resources. The CFO simply stated they would successfully implement the new ERP system on the desired completion date. The IT manager and other project team members simply needed to work harder to get the implementation done on time.

Third, as was stated previously, the tasks and dependencies between tasks were never articulated in a clear project plan. While Epicor provided a 126 step project planning process, CES chose not to follow it closely. Rather, it managed the project via short, very general lists of 12-15 tasks. ECS did not identify a critical path of tasks or perform key resource projections. Task or resource dependencies were only addressed when they became critical, which happened frequently. Finally, while the CEO set a "drop dead" implementation date and CFO stood firm with the date set by CEO, the implementation team did not conduct any sort of backward scheduling exercise to determine if implementation was feasible.

Fourth, like the IT manager, the middle and line managers were told the implementation date was fixed and were given little decision making authority. From a manpower perspective, the CFO resisted requests from ECS division managers to release employees from their existing duties to work on the project. When it became clear that the implementation deadline could not be met without adding significant resources, the CFO continued to dictate that no extra money or resources would be provided. His solution was to implement mandatory overtime. As the economy worsened and the project bogged down, CES proceeded to layoff key personnel who had been supporting the project, further straining the remaining project resources. Few employees complained as good manufacturing related jobs were in short supply.

Fifth, the total project budget had been set at \$500,000 by the CFO. When asked how he developed this estimate, the CFO responded that he had based his project budget on the purchase cost of the Epicor ERP software. Since the ERP

software had cost \$250,000 he reasoned that the total IT implementation costs for both divisions should not exceed the software's initial purchase cost. While the CFO had been told by Epicor, by other Epicor ERP client firms, and by various ERP consultants that the implementation cost could greatly exceed the CFO's estimate, he dismissed their cost projections as greatly exaggerated.

6. SYSTEM IMPLEMENTATION

In small and medium enterprises (SME), the senior management team including the CFO and COO play a critical role in setting the tone from the top for a new system and its use. However, users' existing knowledge set, prior training, professional norms, expectations, and beliefs affect their actions that influence the implementation and training costs related to the new system, which together with the cost of the software make up the total cost of ownership of an ERP system (Busco, 2009). In SMEs, given the power distance in the hierarchical structure, users' reaction to a new system implementation and use often takes the form of passive resistance to change existing processes and non-engagement with the new system. For a variety of reasons, users' concerns may be ignored, that leading to many implementation problems.

In configuring its new ERP system, CES made several setup errors that would significantly impact it later. For example, it was a major mistake to setup two different companies rather than setup two separate divisions within the same company. By itself, this mistake created a host of data integration problems. One such problem was that the interdivisional transfer of finished goods or inventory was now required to be treated as external sales versus a simple internal company transfer between divisions.

Data conversion between the old system and the new system almost proved to ECS' undoing during the implementation. Because much of the data in the old system was obsolete or no longer used, it was necessary to first purge this data before converting it to the new system. For example, during the data conversion 170,000 obsolete part numbers and their associated routings were purged. The data was first exported to Excel from the old system, the obsolete data removed, and the remaining data revised to include additional attributes needed by the Epicor ERP system. Macros were written to make many revisions, but an audit of this process was not conducted that would have allowed ECS to detect and correct many errors.

The users had only been trained using vendor supplied test data. There was no testing or training using ECS data before the go-live date. Hence, users had little opportunity to learn the new system and to identify and point out flaws in the data conversions. Because most employees were doing this work in addition to their existing job, many avoided getting involved in the data conversion effort, hence, important tasks were missed. For example, data critical to product cost buildups was either not input or was not input correctly. In addition, users were not trained to create reports. Because of the lack of training and little understanding of the new system, the users were expecting the new system to produce reports that looked similar to those generated by the old system. Most did not realize that

they would need to use tools such as Crystal Reports to create their own reports.

The impact of poor project planning soon became visible. While there had been milestones for training and data conversion (i.e. clean the data), and for importing the data, key “go/no-go” decisions were not made by the management team. Typically, at weekly meeting users were asked whether they got things done, and if they were not done, they were told to get it done next week. Consequently, there were many moving targets that required continuous attention as ECS approached the ‘go-live’ date.

Fortunately, customers had been informed to expect delays because of the changeover to the new system, and most customers were very understanding. However, the anticipated three month implementation soon stretched out another three months. By six months, ECS realized that their ERP system was not working properly. At one point ECS’ product returns reached 40% of sales due to incorrect configurations or quality problems. It took a consulting firm another three months to fix the data problems. Thus, during the first 9 months of system use, most users reverted to manual, pencil and paper forms or Excel spreadsheets to control inventory, schedule and track production, and perform most business tasks. It was also almost impossible to accurately track and calculate product costs, a key justification for the new system.

The pressure to have the system go live by the top management by the pre-set date, the lack of effective project management during implementation, and errors in importing the data all led to employees’ resistance in using the new ERP system. Eventually, the system was implemented because of “sheer brute force” from the top, and the ERP project teams worked hard to make it happen. The employees’ attitudes changed gradually and most used on-line training to become proficient users. They continue to have weekly meetings where they discuss what has to be done to complete the project implementation.

7. THE IT MANAGERS

As was stated earlier, the CFO had determined that the total ERP implementation budget for both divisions was to be \$500,000. This included \$250,000 to purchase the software and \$250,000 to conduct the implementation process. This budget for the implementation process was split with \$100,000 allocated for ECS and \$150,000 for the EME division respectively. The CFO stated that he withheld this information from the IT manager, instead informing him that he had a budget of \$100,000 to implement the ERP system for both divisions. His explanation was, “I expected the IT manager to show leadership to implement the ERP system at ECS for significantly less than the \$100,000 budgeted for the first division.”

In the end, the IT implementation costs for ECS were \$90,000, effectively leaving only a \$10,000 budget for implementing the system at the larger EME division. Hence, the CFO stated “the IT manager had failed to control costs effectively.” In the fall of 2008 the CFO terminated the IT manager and in November of 2008, a second IT manager was hired. The second IT manager had a Masters in CIS and extensive MIS experience. However, he soon fell out of favor with the CFO. When asked about the project plan, he

stated that, “management does not appear to believe it is important to do the upfront planning work”. CES is currently seeking its fourth IT manager within a three year period.

In addition, four different consultants were engaged by the CFO. One consultant hired by the CFO was deemed to be “not capable” because of the lack of knowledge in manufacturing, and he was not considered an effective change leader. Another consultant performed training but was not considered effective because he could not teach users with ECS company data. Another was hired to advise management regarding the best approach to solve its implementation problems. They were considered not to have provided reasonable solutions. The CFO then hired another consulting firm to cleanup system data when internal users could not identify problems and complete the work.

8. FINAL COMMENTS

After two years, most users reported they were using the ERP system as the information outputs improved. However, significant reporting requirements have still not been met and important system features are not being utilized. When asked to rate their satisfaction with the Epicor ERP implementation, ECS users reported an average score of 1 or 2 on a 5 point scale (1=Very Low, 3=Neutral, 5=Very High). When asked this same question, the CFO reported that he would rate his satisfaction as being at least a 4 or 5.

9. QUESTIONS FOR DISCUSSION

The CES board of directors must now decide how it should proceed. You are to answer the following questions as if you are responding to question raised by the board.

1. Was the CFO’s justification for the need for a new ERP system sound? If yes, state specifically why. If not, state why not, making sure to highlight the flaws in his justification. Your answer should also highlight the role accounting must play for an ERP systems implementation project to be successful.
2. Assume that the CES board of directors has asked you to examine the ERP system implementation process. Please identify:
 - 2.1. Business issues related to ERP system implementation;
 - 2.2. Organizational issues related to ERP system implementation. What would be the best practices for handling those issues?
3. Assume that the CES board of directors has stated that it will setup a project management office (PMO). From the issues related to project management process with the ECS division ERP implementation, specify actions that should be taken related to project management process to ensure the success of the EME division’s ERP implementation.

10. REFERENCES

- Al-Mashari, M., and Al-Mudimigh, A., (2003), “ERP Implementation: Lessons from a Case Study.” *Information Technology and People*, Vol. 16, No. 1, pp 21-33.
- Aloini, D., Dulmin, R., and Mininno, V., (2007), “Risk Management in ERP Project Introduction: Review of the

- Literature." Information & Management, Vol. 44, No. 6, pp. 547-567.
- Boyle, T. and Strong, S. (2006), "Skill Requirements of ERP Graduates." Journal of Information Systems Education, Vol. 14, No. 4, pp. 403-412.
- Busco, C. (2009), "Giddens' Structuration Theory and its Implications for Management Accounting Research." Journal of Management and Governance, Vol. 13, No. 3, pp. 249-260.
- Chen, C. C., Law, C., Yang, S. C., (2009), "Managing ERP Implementation Failure: A Project Management Perspective." IEEE Transactions on Engineering Management, Vol. 56, No. 1, pp. 157-170.
- Davis, C. and Comeau, J. (2004), "Enterprise Integration in Business Education: Design and Outcomes of a Capstone ERP-based Undergraduate E-business Management Course," Journal of Information Systems Education, Vol. 15, No. 3, pp. 287-300.
- Du, S., Johnson, R. and Keil, M. (2004), "Project Management Courses in IS Graduate Programs: What is Being Taught?" Journal of Information Systems Education, Vol. 15, No. 2, pp. 181-188.
- Ifinedo, P., (2008), "Impacts of Business Vision, Top Management Support, and External Expertise on ERP Success." Business Process Management Journal, Vol. 14, No. 4, pp.551 – 568.
- Kwahk, K., and Lee, J., (2008), "The Role of Readiness for Change in ERP Implementation: Theoretical Bases and Empirical Validation." Information & Management, Vol. 45, No. 7, pp, 474-481.
- Liang, H., Saraf, N., Hu, Q., and Xue, Y., (2007), "Assimilation of Enterprise Systems: the Effect of Institutional Pressures and the Mediating Role of Top Management." MIS Quarterly, Vol. 31, No. 1, pp. 59-87.
- Martin, M. H., (1998), "An ERP Strategy." Fortune, February 1998, pp.95-97.
- Smith, H., Smarkusky, D. and Corrigan, E. (2008), "Defining Projects to Integrate Evolving Team Fundamentals and Project Management Skills." Journal of Information Systems Education, Vol. 19, No. 1, pp. 99-110.
- Voordijk, H., Leuven, A. V., Laan, A., (2003), "Enterprise Resource Planning in a Large Construction Firm: Implementation Analysis." Construction Management and Economics, Vol. 21, No. 5, pp. 511-521.
- Winkelmann, A. and Leyh, C. (2010), "Teaching ERP Systems: A Multi-perspective View on the ERP System Market." Journal of Information Systems Education, Vol. 21, No. 2, pp. 233-240.
- Zhang, L., Lee, M. K.O., Zhang, Z., and Banerjee, P., (2003), "Critical Success Factors of Enterprise Resource Planning Systems Implementation Success in China." Proceedings of the 36th Hawaii International Conference on System Sciences, pp. 1-10.

AUTHOR BIOGRAPHIES

Hongjiang Xu is an Assistant Professor in Management Information Systems with College of Business at Butler University. Prior to join Butler, she was an Assistant Professor at Central Michigan University. Her Ph.D. dissertation titled *Critical Success Factors for Accounting Information Systems Data Quality* was completed at the University of Southern Queensland in Australia. She has a master of commerce in information systems degree from the University of Queensland in Australia. She is a member of AIS, IRMA, IACIS, and DSI. Her research interests are in the areas of information quality and security, accounting information systems, ERP systems, and electronic commerce.



Patrick J. Rondeau is a management consultant and partner in Six Sigma Associates, LLC. He holds a PhD in Manufacturing Management from The University of Toledo, is an ASQ Certified Six Sigma Black Belt (CSSBB), and is APICS Certified in Production and Inventory Management (CPIM). He is a former information systems manager with extensive experience specializing in manufacturing, supply chain, and quality systems. Dr. Rondeau has published in many journals including Decision Sciences, Journal of Operations Management, Information & Management, Omega: International Journal of Management Science, Journal of Information Systems Education, and others. He is a member of APICS, ASQ, and DSI.



Sakthi Mahenthiran is the Carl Doty Professor Accounting at Butler University in Indianapolis. He received his MBA and PhD from Temple University in Philadelphia. In 2002-2003, he served as a Fulbright Scholar at MARA University of Technology in Malaysia, and continues to serve as a visiting professor there and visits Monash University - Sunway. He teaches and does research in the areas of management accounting, information systems, and corporate governance. To his credit, he has 19 publications some in top tier journals such as Journal of Management Accounting Research, Journal of Contemporary Accounting and Economic, and Journal of Computing and Information Systems.



Copyright of Journal of Information Systems Education is the property of Journal of Information Systems Education and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.