Accountants and Emerging Technologies: A Case Study at the United States Department of the Treasury Bureau of Engraving and Printing

Ulric J. (Joe) Gelinas Jr.
Bentley College

Janis L. Gogan
Bentley College

ABSTRACT: Based on an in-depth field study of a pilot test of an eProcurement system, this paper introduces the topic of accountants' roles in emerging technology assessments, and presents a teaching case for use in an accounting information systems class. The United States Department of the Treasury Bureau of Engraving and Printing (BEP) was one of three federal agencies participating in the test, which was sponsored by the Treasury's Financial Management Service (FMS). In May 2004 the liaison at BEP reviewed the key accomplishments and challenges in the pilot test, including the reactions of participating suppliers, and considered whether to sign on to participate in another pilot test. The teaching case examines accountants' participation in several aspects of the pilot test. We then discuss the implications for practitioners, and offer suggestions for further research on accountants and emerging information technologies.

Keywords: emerging technologies; pilot testing; Internet; eProcurement; ePayments; risks; controls.

I. INTRODUCTION

This teaching case, based on extensive field research at the United States Department of the Treasury (Treasury), describes technical, organizational, and control issues in the pilot testing of an Internet-based system for transaction processing in a government purchase-to-pay process (i.e., eProcurement).

Teaching Objectives

The case provides an opportunity for students to consider why and how organizations conduct pilot tests of new information technologies, to closely examine the system design,

and to assess controls in the piloted system, all in an interorganizational information system setting. The case has been developed for use in an undergraduate or graduate Accounting Information Systems (AIS) course, to support some or all of the following learning objectives:

- Introduction to the purchase-to-pay cycle (managerial goals, risks, trends);
- Assessment of Purchasing, A/P, and Payments processing system risks and controls; and
- Assessment and testing of emerging technologies.

An early version of the case was used successfully in an undergraduate AIS course to teach and review the elements of the purchase-to-pay cycle, analyze risks associated with that cycle, and discuss controls that can address those risks. Because the case addresses issues at multiple levels—managerial, technical, risk assessment, and emerging technologies assessment—it can also be put to use in an AIS course as a challenging final review or final examination case.

Why this Case?

Rapid advances in hardware, software, and networking technologies and their applications create a challenge for accountants, who need to understand the ramifications for information quality and the protection of organizational resources. Each new IT application brings opportunities to improve process efficiency and data quality, as well as new risks and control requirements for accountants to identify, understand, and address. Yet, few research studies have examined accountants' roles as participants in pilot tests of new technologies or accountants' other roles in assessing emerging technologies. And, little practitioner guidance has been offered to help accountants (and accounting students) understand the unique challenges and risks associated with emerging information technologies and the roles they might play to control those risks.

Accountants who participate in pilot testing can help reveal functionality gaps as well as risks and control requirements in an IT application (Cytron and Tie 2001). The accounting information systems curricula for undergraduate, graduate, and continuing professional education should include materials that can help students and practitioners understand why pilot tests are conducted, the key tasks and issues in pilot testing, and the roles that accountants play during pilot testing. Yet, to date, few current instructional materials address these topics, and even fewer are based on rigorous field research.

This case helps to fill the need for practitioner-relevant research by introducing issues revealed in an actual pilot test of an eProcurement system by the United States Department of the Treasury.

Prior Research on Accountants and Emerging Technologies

Computers, software, and networks have grown more powerful each year, and new software and hardware technologies emerge on a continuous basis. Every new IT application is a double-edged sword, offering tremendous potential while presenting the organization with new challenges. In many organizations the Chief Information Officer is responsible for understanding technology trends and ensuring that promising new technologies are identified, assessed, and (if deemed useful and feasible) introduced to the organization. Some organizations have a separate business unit charged with emerging technology identification and assessment, and others use consultants to monitor IT trends. Numerous observers note that an appreciation of emerging technology opportunities and risks is a matter

of great concern to all members of the senior management team as well as to public accountants (Christensen 1997; Day and Schoenmaker 2000). The American Institute of Certified Public Accountants (AICPA) disseminates an annual list of Top Ten Technologies (Table 1). Some longstanding challenges—such as Information Security—remain top priorities, while new technology challenges are introduced to this list each year. The AICPA Information Technology Center also prepares a "watch list" of five emerging technologies each year.

Thus, the identification of emerging technologies that could affect financial reporting or business processes is an important challenge for accountants (Johnston 2005). One observer notes: "Advances in technology will put an almost universal demand on CPAs to be more computer-literate than ever before." (Harrington 2005). Clearly, computer literacy serves a purpose that goes well beyond improvements in the accountant's own productivity, as Tie explains (Tie 2001, p. 49): "Whether a company is implementing basic or advanced technology, it needs the CPA's expertise to align its technology plans and resources with its business needs and goals." Zarowin (2001) cautions that emerging technology identification and adoption are neither simple nor straightforward processes: "Those who rush to the forefront often pay a high price because the newest and hottest technology is usually the most expensive and the most vulnerable to internal design errors."

SAS No. 94 reminds accountants that information technology use can affect the control environment, risk assessment, control activities, information communication, and monitoring (Tucker 2001). Particularly in light of Sarbanes-Oxley requirements, accountants are increasingly called upon to identify and comment on control issues related to the use of new information technologies (Duffy 2004) as well as the use of external IT resources (Lanz and Tie 2004; McConnell and Banks 2003).

TABLE 1
AICPA Top Ten Technologies, 2003–2005
(source: http://infotech.aicpa.org/)

	2006	2005	2004
(1)	Information Security	Information Security	Information Security
(2)	*Assurance and Compliance Applications*[a]	Electronic Document Management	*Spam Technology*
(3)	Disaster and Business Continuity Planning	Data Integration	*Paperless Office*
(4)	*IT Governance*	Spam Technology	*Database and Application Integration*
(5)	*Privacy Management*	Disaster Recovery	Wireless Technologies
(6)	Digital Identity and Authentication Technologies	Collaboration and Messaging Technologies.	Disaster Recovery
(7)	Wireless Technologies	Wireless Technologies	*Data Mining*
(8)	Application and Data Integration	*Authentication Technologies*	*Virtual Office*
(9)	Paperless Digital Technologies	*Storage Technologies*	*Business Exchange Technology*
(10)	*Spyware Detection and Removal*	*Learning and Training Competency*	*Messaging Applications*

[a] Items in italics are newcomers to the list since the previous year.

The AICPA (http://www.aicpa.org/vision) lists as one of five "Core Competencies" for public accounting: "Technologically adept—able to utilize and leverage technology in ways that add value to clients, customers, and employers." And, Technology Services, Assurance, and Information Integrity are among the five core service areas that the AICPA deems important. Accountants are expected to understand how various technical design choices can impact transaction processing and data quality. Systems Reliability Assurance, for example, emphasizes a "reliability-by-design" model, which involves "rigorous review and testing by the CPA."

Public accountants address emerging technology issues when planning financial audits or conducting risk assessments, and staff accountants and internal auditors are sometimes called upon to participate in emerging technology assessments, including participating in pilot tests. A pilot test can be large-scale, involve many participants, and be broad in scope or it can be small and focused. Often, an organization will design or participate in a series of smaller-scale pilot tests in order to minimize project coordination costs while assessing different aspects at different times. Ideally, whether one or several pilot tests are conducted, the effort should yield valuable information on four important aspects:

- Technical feasibility (does it work?);
- Operational feasibility (how would it fit in?);
- Economic feasibility (is it worth it?); and
- Risks and controls (what can go wrong, and how can we reduce the risks?).

Given how important emerging technologies are to accountants as auditors and consultants as well as users, it is surprising that accounting journals do not report more studies on these topics. An *ad hoc* review of recent issues of the *Journal of Information Systems* and *Journal of Accountancy*, for example, reveals that field research has not examined accountants' roles in emerging technology assessments. Such research could help to guide practitioners as they conduct or participate in emerging technology assessments. This paper helps to address that void.

Research Method

The case study reported herein, which focuses on a test of an eProcurement system, was conducted as part of a larger examination of technical, organizational, and project management issues in interorganizational information-sharing. The Internet Payment Platform (IPP) pilot test was announced in summer 2002 and parts of the system went live at the United States Department of the Treasury (Treasury) Bureau of Engraving and Printing (BEP) in spring 2003. The pilot test, sponsored by the Financial Management Service (FMS) of the Treasury, was conducted in order to evaluate whether an Internet-based e-Procurement system was likely to yield transaction efficiencies and improve buyer-supplier relationships. Also, the sponsors were hoping to use this pilot test to gain experience in using several new technologies, such as biometric authentication and digital signatures. Three governmental agencies participated in the IPP pilot test: the BEP, the Denali Commission, and the U.S. Department of Labor.

Our purpose in conducting the case study was to analyze the pilot test of the IPP system in its context, as used by BEP and its suppliers, and to capture the viewpoints of participants from different organizations and playing different roles in procurement processes. In spring and summer 2003, semistructured interviews (from 30 minutes to two hours each; some face-to-face, some via telephone) were conducted with 20 individuals employed by participating organizations—including four members of the procurement organization, the Chief Financial Officer and accountants in the finance function, IT managers at BEP,

personnel at BEP's two most active participating suppliers, the software vendor (Xign), FMS managers, and personnel at the Federal Reserve Bank of Boston (Table 2). Informants discussed their motivations for participating in the IPP initiative and reflected on business and technical challenges that they had encountered thus far. Between fall 2003 and fall 2004, additional interviews were conducted. All interviews but one were taped and professionally transcribed. To triangulate on key facts and perspectives, various archival documents (such as Treasury's *Concept of Operations* proposal of June 2002), and the results of a survey of participants by the pilot sponsors at the conclusion of the pilot were also examined (FMS 2002).

II. THE CASE
Case Introduction

On May 10, 2004, Robert "Bob" Deans, CPA, Manager, Financial Systems in the United States Department of the Treasury (hereafter, Treasury) Bureau of Engraving and Printing (hereafter, BEP), arrived at 8:45, as usual, at the entrance to the BEP offices. He submitted his briefcase to the security guard's watchful eye before passing through the metal detector and on to the elevator that would take him to his office. Deans briefly regretted stepping into the austere confines of the BEP building; outside, Washington, D.C. was at its springtime best. He made a deal with himself: *I will finish my review of the IPP (Internet Payment Platform) project, and at lunchtime I will take a walk outside.* Cheered, Deans strode into his office and briefly reviewed his notes from the project, in which a new eProcurement system had been tested with some of BEP's suppliers during the past year. The project was sponsored by the Treasury's Financial Management Service, and Bob was the project manager for BEP's piece of it. At 9:30 Bob Deans headed over to a conference room to meet with several BEP employees who had worked on the IPP pilot-test project. Their aim was twofold: review lessons learned from the pilot test and decide whether it would be a good idea to participate in a test of yet another eProcurement system, which at the moment was being referred to as "Son of IPP."

Background: The Bureau of Engraving and Printing

BEP is the U.S. Treasury's manufacturing arm. Its mission: to produce U.S currency, postage stamps, and other government securities. Exhibit 1 depicts the BEP organizational structure. Production took place at facilities in Washington, D.C. and Fort Worth, Texas. In 2003 BEP produced more than eight billion Federal Reserve Notes and nearly ten billion postage stamps. Unlike most other government agencies, BEP did not receive appropriations from the U.S. Congress. Instead, direct and indirect costs of BEP operations were obtained from a revolving fund that is reimbursed through product sales, which means that BEP operates more like a for-profit business entity than most federal agencies.

TABLE 2
Summary of Interviews

	U.S. Treasury Financial Mgt. Service (FMS)	Bureau of Engraving and Printing (BEP)	Federal Reserve Bank of Boston	Xign	Supplier Personnel	Total
Interviews	6	6	4	1	2	19
Respondents	3	11	3	1	2	20

EXHIBIT 1
BEP Organization Chart
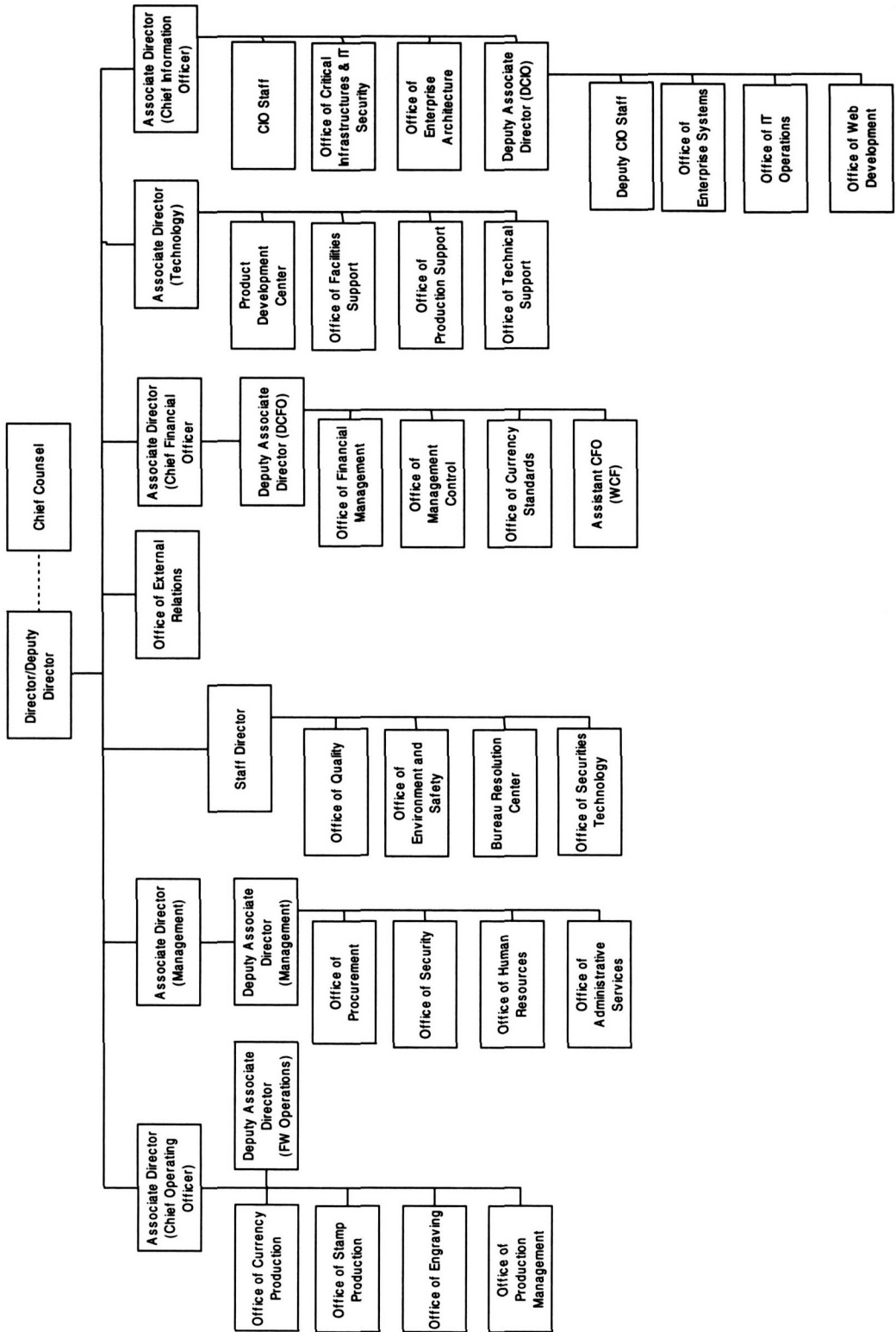
Total annual disbursements for goods and services, excluding payroll, exceeded $277,000,000 in 2003. Approximately 1,000 active BEP suppliers received nearly 9,200 payments annually, for 9,500 invoices. Some suppliers offer early-payment discounts and the 1982 Prompt Payment Act requires that BEP pay vendors within 30 days from either receipt of a proper invoice or acceptance of the goods or services (whichever is later). In 2003, 148 invoices were paid late (1.9 percent of total invoices, just under BEP's commitment of no more than two percent late payments). Late-payment penalties to suppliers amounted to $7,741.

Concept of Operations: Signing on to the IPP Project

The IPP project was one of several Payment Application Modernization projects that Treasury had sponsored (other projects included Pay.Gov and eCheck; see http:// www.fms.treas.gov/). All major Treasury projects are initiated with the preparation and signing of a *Concept of Operations* document. The IPP project, sponsored by Treasury's FMS, was aimed at helping government agencies (such as BEP) send electronic purchase orders to suppliers, who (after providing the goods or services) would convert (or "flip") the purchase orders into invoices and subsequently pay the invoices electronically. The Treasury *Concept of Operations* document of June, 2002 (FMS 2002) described the IPP project:

> The Internet Payment Platform ... is focused on all payment types and accumulating all data involved in the entire life cycle of a transaction, in a centralized database. The IPP ... is designed to provide web-based access for payees and payers to view data, ... manage the workflow associated with that data, verify the identity and authenticity of users and accounts, settle credit ACH transactions, and provide robust reporting. ... The key is that the database continually receives and aggregates data throughout the lifecycle because it is the hub to the entire transaction exchange.

In spring 2002 the *Concept of Operations* document was signed by various authorized managers at FMS, which makes most payments for the U.S. Government. Shortly after, several BEP managers were invited to a presentation that explained the goals of the pilot test. Brett Smith, who worked on research and development projects in FMS's eMoney program, explained that Treasury had previously collaborated with the Federal Reserve, two commercial banks, the U.S. Department of Defense, several IT vendors, and others on an ambitious multiyear project to test eCheck, a payment mechanism that was designed to replace paper checks (see Gelinas and Gogan 1996; Gogan et al. 2003; Gelinas et al. 2003; Gogan 2005). That project began in summer 1998 and ended in summer 2001, at which time Smith initiated planning for a new project which aimed to build upon the best features of eCheck. The scope of the eCheck project had been quite broad (eCheck was designed to replace paper checks for payments between individuals, between businesses, or between individuals and businesses). In contrast, the IPP project would focus on federal agency payments to their vendors. Several participants on the IPP project had previously worked on the eCheck project. Brett explained how IPP would differ from eCheck:

> The eCheck project successfully demonstrated that payments can be made over the Internet, securely and at much lower costs than many other forms of payments (such as paper checks and credit card transactions). In that project we broke a lot of new ground. It was the very first digitally-signed Internet payment. ... We learned from the eCheck project that businesses and federal agencies want to have a way to capture and retain all information related to a particular transaction. ... [and] they want the complete transaction history captured in an appreciating database.

The IPP system was a lightly-customized version of a commercial service sold by a California company, Xign Inc., whose founders had worked on the eCheck project. The system translated data from participating organizations' ERP systems into XML using an "Enterprise Adapter," so very little programming would be required on BEP's part. "The concept is basically plug-and-play," said Brett Smith. The Federal Reserve Bank of Boston, acting on behalf of Treasury, provided the payment processing.

Bob Deans attended Brett Smith's presentation. He, along with managers in BEP's accounts payable function saw the IPP pilot as an opportunity to improve the timeliness of payments, especially to small suppliers who are hurt the most when payments are delayed ("They do not have the funding of a General Motors," stated one BEP manager). Many small suppliers had difficulty complying with the complicated government requirements for invoicing (note that, until an invoice fully meets BEP's requirements, the Prompt Payment clock does not start ticking). Many employees in procurement and accounts payable were excited about participating, because they hoped that IPP would reduce the number of phone calls they would receive from suppliers inquiring about the status of their payment. One contracting officer stated, "Vendors are always calling to say, 'When am I going to get paid for this invoice?' So, you have to go find that invoice and figure out what is going on." Furthermore, all BEP employees were aware that unhappy suppliers had the option of complaining to their Congressmen if they thought BEP was being a difficult business partner, and nobody wanted that to happen. Frustration with the government procurement process had even led a few vendors to stop doing business with BEP. One time, a supplier of corrugated postage stamp boxes refused to send a shipment because they had not received payment for an order they had delivered months before. When the inventory began to pile up, production had to be halted. "When you cannot ship them out, the production process bogs down," one manager recalled.

Legacy Integration Issues

The BEP legacy system, "BEPMIS," used a package which was purchased in 1985; it ran on an IBM mainframe and used IDMS (which, unlike newer databases, was not a relational database). As part of its Y2K compliance initiative[1] BEP purchased the upgraded version in 1997. For use with the IPP system, a new Enterprise Adapter module was written to translate data from BEPMIS into XML.[2] The Enterprise Adapter ran on an Intel server located at Treasury. Communications between the IPP server at Xign and the server at BEP were to be encrypted using standard Secure-Socket Layer (SSL).

Since only a small number of vendors participated in the IPP pilot test, BEP's IT organization also set up a filtering-and-extraction mechanism to pull a subset of BEPMIS transactions over to IPP. At the time of purchase order creation, the IPP system automatically inserted a special bank code (identifying it as an "IPP bank") that made it easy to distinguish IPP transactions from conventional transactions all the way through to the settlement of the payment. Later, when the pilot test came to an end, it was a simple matter to stop using the IPP bank code and resume conventional BEPMIS processing.

---

[1] "Y2K" refers to the "year 2000 problem," which arose because many older systems contained two-digit date fields that would lead to incorrect processing of date-sensitive transactions. In the late 90s business and commercial organizations' Y2K compliance projects were a high priority and consumed many resources. Some organizations found that it was less expensive to purchase an upgraded version of a software package than it would have been to fix the older version's Y2K problems.

[2] eXtensible Markup Language (XML) is a generalized system for the customized tagging of data to enable the definition, transmission, and interpretation of data exchanged by systems over the Internet.

IPP Functionality Challenges

Bob Deans convened a team of individuals from procurement to learn about the IPP design. They identified several important functionality gaps between BEP requirements and the Xign software, which was designed to support typical business procurement processes, but had never been used in a government procurement context.

One problem was that the Xign software allowed no more than 1,024 characters of descriptive text to be included on a purchase order (PO). Because government POs can include many pages of contractual stipulations, BEP requested ½ megabyte (500,000 characters) of text per PO, but Xign was not able to comply with this request (Xign had offered IPP at an attractive price for the pilot test, but with a stipulation that customization would be minimal during the pilot). So, it was decided that during the pilot test, procurement staff would continue to produce paper purchase orders, which would be mailed to the vendor as soon as the corresponding electronic POs were entered into the IPP system. The paper version, containing all necessary contractual verbiage, would be the legally-binding document of record.

As it happens, there was another reason to continue to send a paper copy of the PO: the signature requirements. Federal agencies require a contracting officer's (CO's) signature on a purchase order (COs are authorized by law to financially obligate the U.S. Government.). A digital signature is permitted by federal regulations, but the Xign software did not provide for a CO's digital signature on the PO itself (Xign did have a digital signature for payment authorizations).

A BEP Procurement Analyst explained a third problem:

> In government contracting, when we need to change an existing purchase order, we issue a modification. We continue to issue modifications until we finally close the contract out with modifications, as necessary. In IPP, when you make a change to the original purchase order, it disappears. What you are left with is the changed document, but there is no readily available documentation as to the changes that remain. We need the full audit trail.

To address this problem, Xign implemented the following solution: When a PO was first entered on the IPP appreciating database, designation "modification zero" was added to its ID number. If that PO was changed, the change was made to the PO in BEPMIS, and then transmitted to IPP in the same manner under the original PO. A PO change order was recorded on the IPP appreciating database by overlaying the previous PO with the new PO with the next modification number (1, 2, etc.). Agencies would have preferred to have a complete audit trail of POs and their changes. Bob Deans reported that this solution was adequate for the pilot test but it would not be a feasible long-term solution, because the responsible BEP contracting officer would have difficulty determining which PO/invoice combinations should be paid. He explained:

> The full functionality of the system really depends on the supplier being able to flip the purchase order into an invoice. But IPP does not highlight what has been modified. The system should be able to identify what has changed so that the CO can determine that the PO has been correctly fulfilled and that the invoice should be approved for payment as submitted by the supplier.

BEP accountants in purchasing and accounts payable considered these three problems—allowable text, lack of PO digital signatures, and change-order management—to be "show-stoppers" because they could put the Bureau out of compliance with Federal Acquisition Regulation (FAR), which in turn could cause BEP to lose their procurement authority. For

purposes of the pilot test, however, the use of the modification field in the PO ID and the redundant production of a manually-signed paper PO were felt to be reasonable temporary solutions to the system limitations.

Prepilot Testing

In winter 2003, once the first-versions of the extraction routines and Enterprise Adapter were in place, accountants in procurement and accounts payable participated in prepilot testing, using a separate test server located at BEP. The Chief Financial Officer made it clear that no suppliers would be asked to participate in the pilot test until BEP accountants were certain that the system worked as promised. "We want it to be as smooth as possible for the suppliers," he said, explaining, "We will take the hit if IPP does not work. I am not going to relinquish control over something that involves my suppliers; the Bureau of Engraving and Printing will have to answer for the final product."

In the prepilot testing, BEP took the roles of both vendor and purchaser. Bob Deans explained to his team: "It is our 'product,' in a way. The vendor is going to see a purchase order from the Bureau of Engraving and Printing and if something is wrong, we are accountable." Since BEP employees were essentially doing "twice" the expected work, the testing process took more time than was originally anticipated. Seventy test cases were prepared, in order to verify that IPP worked for a variety of routine transactions as well as for some of the more complicated types of transactions. About a third of those transactions failed the test in the first round, which led to various modifications. Testing was not considered complete until all 70 test cases processed correctly. For each test transaction BEP accountants verified that a purchase order was sent, that it reached the test "supplier" in the right format, and that it included all necessary information. Then, BEP took the role of the supplier, who "flipped" the PO into an invoice and sent it back to BEP.

Instead of taking about a week (the original plan), this prepilot phase took about a month to work through the various technical issues. When completed Bob Deans stated: "Perhaps the original time line was not right, but I am happy to say that the technology is actually working well." And, the Chief Financial Officer stated that he was satisfied that the payment authorizations—digitally signed using thumbprint cards—by the CO at BEP, the disbursing officer (DO) at the FMS Regional Finance Center (RFC) in Kansas City, and an optional approval by the auditor at the RFC, in addition to the extensive use of control totals during the payment process, meant that IPP disbursements were well-controlled. He agreed that suppliers could now be invited to participate in the pilot test.

Spring 2003: Two Suppliers Log On

By March 2003 the testing and integration work had proceeded to the point where the issuance of a purchase order and the payment processing portion of IPP checked out but the function for "flipping" a PO to an invoice was not yet working correctly. So, a decision was made to start issuing payments to only a few select suppliers. The BEP purchasing organization had identified nearly 50 suppliers that would be good candidates for the pilot; BEP typically ordered from these suppliers on average once a week or more. Some vendors were excluded due to complicating factors related to government procurement regulations. For the very first round of testing, the team approached a small supplier and a large supplier.

The small supplier, East Coast Sales, was a "mom-and-pop" operation that acted as an intermediary between BEP and producers of plumbing, electrical, machine, and safety supplies. BEP was their biggest customer and they typically filled about 250 orders per

year. The owner stated, "We are a small business and BEP is a big customer. We are happy to help out."

The large supplier, SICPA Secureink, produced specialty inks used in manufacturing currency and postage stamps. A contract manager there stated: "When your biggest customer asks you to participate in a pilot program, you are sort of inclined to say yes." SICPA offered a small number of products, but in large quantities; they also filled about 250 orders per year. BEP's Chief Financial Officer was particularly concerned that nothing go wrong for SICPA, since it would be very difficult to find and qualify another ink vendor (production of currency ink is a highly specialized skill, due to government requirements that help to prevent production of counterfeit money).

BEP issued its first payment via the IPP in spring 2003 and, after the bugs had been worked out, the first successful purchase order "flip" to an invoice was performed in July. The manager at East Coast Sales indicated that the system worked fine and he liked that he could view the purchase order on IPP a few days before the official paper PO arrived via the mail. As for payments, he noted that the screens were designed in such a way that he had some difficulty determining which payments matched to which invoices when BEP issued a single payment to cover several invoices. He liked that if there was any problem with an invoice, "the IPP screen would show an exception."

> We could get to work on it right away instead of waiting. Previously, we would wait until a payment was overdue, then call BEP to find out why it had not been paid. Now maybe I will be able to figure that out within a week or two. We have not had any exceptions yet, but I look forward to testing that particular aspect.

The contract manager at SICPA mentioned that he was pleased with how well IPP was working, especially for the accounts receivable clerks who were responsible for reconciling invoices and payments. "In the past, our accounts receivable clerks would get telephone calls telling us how much had been paid against each invoice. Sometimes they would not have all of the information at hand. With this system, you can get online and see what invoices have been paid." This manager also wanted to be able to import BEP purchase order data directly from IPP into SICPA's sales order system. He noted, "We want to minimize the number of times we enter information into our system, because that minimizes mistakes."

The IPP Purchasing and Receiving, Invoice and Accounts Payable, and Payment processes are described in detail in the Appendix, along with system flowcharts.

Fall 2003/Winter 2004: More Suppliers Log On

Encouraged by the first two suppliers' responses to IPP, Bob Deans' team began to recruit other suppliers. Eventually, 25 suppliers used the IPP; however, East Coast Sales and SICPA were the two most active participants.

BEP accounting clerks reported an unexpected benefit of their participation in the IPP pilot. In fall 2001, a series of anthrax attacks in Washington, D.C. led to a decision to route all paper mail through an irradiation facility, before delivery to federal offices. Unfortunately, this caused about a week's delay in delivery of paper mail, and also the irradiation process tended to melt plastic envelope windows and caused paper to become brittle and crumbly. BEP employees had experienced great frustration in handling irradiated paper, so the receipt of an electronic invoice was a welcome relief. Suppliers were also happy that invoices no longer were delayed in transit because this meant they would get paid quicker.

The IPP project manager, who worked at the Federal Reserve Bank of Boston (Boston Fed.), reported that things were going well on his end, but he wanted to see a small change in the system. He explained that for an existing invoice the system would indicate several conditions:

- Pending approval;
- Scheduled to pay;
- Paid; and
- Rejected.

Suppliers wanted to add another status indicator: "Approved to Pay," which would follow Pending Approval and precede Scheduled to Pay. Fortunately, the project manager was able to work with the software vendor to implement the requested feature. See Exhibit 2.

Spring 2004: Participants Evaluate IPP

The IPP pilot test was originally scheduled to end in December 2003, and at that point East Coast Sales and SICPA accounted for 81 percent of BEP purchase orders, 86 percent of invoices, and 42 percent of payments. A decision was made to extend the pilot test another six months. This made it possible to test the system with more of BEP's suppliers (also, two other agencies had joined the pilot-test in the fall, and Treasury wanted them to experience more transactions before ending the pilot). By May 2004 other vendors had accumulated 85 purchase orders, 115 invoices, and more than 900 payments. The statistics for the pilot are shown in Exhibit 3.

FMS conducted a survey of participants, and five of BEP's vendors responded. Their feedback is summarized in Exhibit 4. With the statistics and vendor feedback in hand, in May 2004 members of the BEP IPP pilot test team from IT, the procurement office, and finance, met to review the strengths and weaknesses of the IPP system that had been revealed during the pilot test.

A manager in BEP's Office of Systems Development commented that the pilot IT configuration could have been more secure:

> The IPP has a server inside our firewall to which we send purchase order and payment data. That server communicates with the Xign server, out on the Internet. We would prefer to communicate from our trusted systems through our firewall to their systems, outside our firewall, but the design did not permit that. We let it go this way for the pilot but would want to address it again if we go further.

Other than that, he and the Chief Information Officer (CIO) agreed that the IPP pilot had been a worthwhile exercise. The CIO was particularly pleased that IPP added new functionality, yet the legacy system (BEPMIS) could continue to be used.

A systems accountant in BEP's Office of Financial Management, who had been an active participant on the project, commented:

> As far as the accounts payable folks who process invoices in the financial office here, we are not on anybody's Christmas list any more, because they really do not want to stop using IPP. It made life so much easier for them. Their matching of the invoice to the PO was more efficient and effective, and certainly their phones rang less. They are not happy to see this pilot end.

A manager in Procurement reviewed the three "show-stopper" requirements that had been identified in the pilot: need for a contracting officer's digital signature on a purchase order,

EXHIBIT 2
Sample IPP Screen Shot

Xign

Internet Payment Platform

Welcome: Otha | SICPA Securink Corporation | Dec 3, 2003

Home | **Invoices** | **Payments** | **POs** | **Reports** | **Admin** | **Advanced Search** - **Preferences** - **Help** - **Logout**

Quick Search

[   ] [Go]

Advanced Search

Invoice Status

- Draft
- Pending Submission
- Pending Approval
- Approved to Pay
- Scheduled to Pay
- Paid
- In Exception
- Disputed
- Rejected
- Voided
- E-File Status

Payment Status

- Pending Settlement
- Processing Settlement
- Paid
- In Exception

PO Status

- Open
- Closed

Home Page

Quick Links

- ▸ **Create Invoice**
- ▸ **Upload E-File**
- ▸ **Get Invoice Status**
- ▸ **Download Remittance**
- ▸ **Get Payment Status**
- ▸ **Get PO Status**
- ▸ **Buyer Directory**

Overdue Invoices

No overdue invoices found.

Aging Summary

Days Late
■ 0-30
▨ 31-60
■ 61-90
☐ 91-120
■ 120-over

Aging Detail
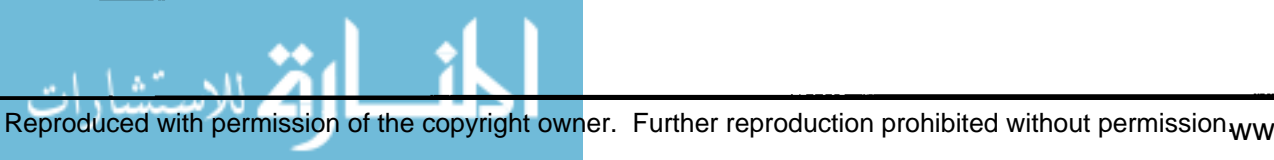
Collections 5 Day Forecast

No collections scheduled for the next 5 business days.

Collections Forecast

Home - Invoices - Payments - POs - Reports - Admin

https://www.ipp.gov/xpsn/payeewebclient/home/home_frame.jsp

12/03/2003

EXHIBIT 3
Summary of BEP IPP Transactions, Spring 2003 through Spring 2004

	East Coast Sales	SICPA Secureink	Other Vendors	Total
Purchase Orders:				
Number	245	120	85	450
Percent of Total	54	27	19	100
Dollar Value	323,392	26,088,853	636,403	27,048,648
Invoices:				
Number	441	264	115	820
Percent of Total	54	32	14	100
Dollar Value	314,332	22,851,855	545,000	23,711,187
Payments: [a]				
Number	435	232	286	953
Percent of Total	46	24	30	100
Dollar Value	458,756	22,621,407	504,627	23,584,790

[a] In addition to these payments, 632 payments for $20,300,000 were made through the IPP between March and July 2003 before the PO and invoice flip features were implemented.

need for an ample amount of allowable text in order for all pertinent terms and conditions to be electronically included in the PO, and the ability to fully track change orders and determine which modified version of an order was the correct one to pay. He observed that each of these functionality gaps would need to be addressed before a full-scale implementation could be considered. Another accountant observed, "We kind of adapted our processes to the commercial software, rather than the other way round. And then we found that commercial software has limitations in a government procurement setting."

Another accountant thought that more extensive testing should have been done. "We did test a variety of transaction types," she said. "But user acceptance testing was not really conducted, and that would have been helpful." Another team member observed: "Our CFO was really the one that said, 'let us go ahead with this pilot test.' So, folks pitched in. It helps to have the attention and support of a senior manager."

After thanking the participants for their review of IPP, Bob Deans noted: "The managers at FMS recently mentioned that they may get funding for a new procurement initiative." He asked each team member to give some thought to whether BEP should participate in yet another pilot test.

The meeting over, Bob Deans dropped his notes at his desk before heading out for his lunchtime walk. He needed a little fresh air to collect his thoughts. Every participant knew at the outset that the primary purpose of this pilot test was to get experience with an Internet-based system and specific technologies such as biometrics and digital signatures. Nearly every participant had suggested one or more changes to the IPP system, yet most suppliers and most participants at BEP—especially in the accounting function—were reluctant to "pull the plug" on the IPP. Still, participation in a "Son of IPP" pilot test would take time and resources, and Bob Deans wondered whether BEP employees would eventually succumb to pilot-test burnout.

EXHIBIT 4
May 2004 Vendor Survey Results (5 of 25 BEP vendors responded)

Vendor 1	+ ease of sending invoice from PO + reduced postage costs – had to print and re-enter into our system "Works great. Had more trouble getting tech support than using service."
Vendor 2	+ ability to track invoice status + immediate access via the Internet + user-friendliness + invoicing process took less time than normal – only one invoice submitted via IPP, versus thousands that we send – data was not moved from IPP into any other system "If more agencies used IPP ... vast reduction of paper flow in office."
Vendor 3	+ less paper work + quicker payments + no lost invoices
Vendor 4	+ liked being able to send invoices online + liked seeing PO online earlier so I can place the order sooner + reduced postage costs "We enjoyed IPP; it has worked for us. We see no reason for it to change."
Vendor 5	+ ease and timeliness of submitting invoices + ease of reviewing the status of delivery orders and payment status + reduced postage costs + less contract administration cost due to ease of accounting for transactions + payments were quicker – could not enter the information into our automated system "We would be willing to work with the U.S. Treasury Department in its efforts to develop future payment systems."

III. DISCUSSION AND CONCLUSIONS

Implications for Accounting Educators

Accounting students in undergraduate, graduate, or continuing professional education programs can use this case to explore the opportunities and challenges they will face when assessing emerging technologies. In discussing the Internet Payment Platform pilot test, the following questions can elicit useful collective insights:

- What system risks and internal control requirements did the pilot study reveal and how?
- What role did accountants play in this pilot test? What did they bring to the table in this emerging technology assessment?
- Would you advise Bob Deans that BEP should adopt the IPP for ongoing use as it is? Why or why not?
- Why would an organization perform a pilot test of a system that they did not intend to put into production? Did BEP do the right thing by performing this pilot test?

- Discuss and describe some of the issues that BEP had to overcome in order to make this pilot test work.

A teaching note explores these issues, along with exercises in systems documentation and control assessment.

The next section briefly discusses the case implications for practice, and offers suggestions for further research on accountants' roles in emerging technology assessments.

Implications for Accounting Practitioners

This longitudinal case study provides an illustration of accountants' roles at several stages in the pilot testing of emerging technologies in a proposed eProcurement application, and revealed some challenges.

Prepilot tasks include designing system tests, doing prepilot testing (in advance of the involvement of external participants such as suppliers), recruiting participants, and setting expectations. While IT professionals and users are sometimes involved in helping to design system tests, accountants are particularly vital in this role because of their training in transaction processing and data quality. During the prepilot phase, accountants at the Bureau of Engraving and Printing were involved in the first-level testing, and their role was considered crucial to protecting BEP's relationship with key suppliers. In this particular pilot, the prepilot testing was aimed primarily at data quality issues (is the information being processed correctly and completely?). In order to shield suppliers from glitches or inconvenience, the decision was made for accountants to take the dual roles of BEP employees and supplier personnel.

As a result of the prepilot testing, personnel in the purchasing function identified the three "show-stopper" problems with the IPP system design (lack of a digitally signed PO, insufficient text for the PO stipulations, and problematic handling of change orders). Bob Deans and the other accountants on the project team ensured that these issues, which were partially addressed in workarounds and system modifications, were addressed before any suppliers were brought in for the pilot test.

Accountants (along with other personnel in the purchasing function) were also involved in helping to select the suppliers who would participate in the pilot test. As described above, a decision was made to initially conduct tests using one small supplier and one large, very important supplier. Accountants participated in this decision by providing information regarding typical transaction volumes, amounts, extent of typical change orders, and other factors that helped narrow down the list of suitable suppliers. As these two suppliers went online, accountants verified that the transactions were being processed correctly and completely. And, once it was established that the first two participants did not feel that they were being inconvenienced, a decision was made to invite other suppliers to participate. Our study did not reveal any unexpected findings in the recruiting process.

Pilot tasks include conducting sample transactions and monitoring the impacts on business processes, system integrity and data quality. BEP accountants were heavily involved in this process, and accountants in the supplier organizations were also asked to provide input on the system functionality, risks, and controls.

Postpilot tasks include summarizing transaction metrics, identifying challenges and lessons learned, and offering recommendations. This pilot test was sponsored by Treasury's FMS, so FMS was responsible for conducting a survey of participants. BEP accountants were asked to respond to this survey, and they also compiled various before-and-after statistics (detailing transaction volumes and amounts, prompt-pay violations, and early-payment discounts, etc.). Also, BEP was asked to develop an activity-based costing model,

which staff accountants helped on. And, it was a BEP accountant who raised issues regarding the thoroughness of the prepilot testing and the desirability of adding another layer of testing that would focus on the user interface.

To summarize, accountants from BEP and vendor organizations played several roles in this pilot test, including planning and conducting system testing, closely examining the system functionality, considering the risks and control implications. Without the input of accountants in multiple organizations, it would be difficult to make an informed go-no-go decision regarding a new IT application—especially when an interorganizational system is involved (as was the case with this eProcurement system). Having looked at the tasks that accountants did perform in this pilot test, it is difficult to imagine how a valid pilot test could be conducted without active involvement of accountants in multiple functions and organizational units.

CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

We have reported on a single case study of the pilot test of an interorganizational system for eProcurement. Further research is needed to develop a richer picture of the range of roles that accountants take (or should take) in participating in such initiatives. At Treasury the IPP pilot was one of several pilot tests that were conducted to assess various e-commerce technologies. So, one fruitful avenue would be to compare accountants' roles and impacts in this pilot test with their roles and impacts in other pilot tests, at Treasury and elsewhere. Further research could aim to develop guidelines for setting pilot-test parameters (such as: Who should be involved? How long should the pilot test run?). Further research could also examine how accountants' roles relate to the varied goals for pilot tests (e.g., technical, operational, and economic feasibility; risk assessment, and controls identification). Another avenue for future studies would be to compare accountants' roles compared with others' roles as participants in pilot testing. What unique contributions do accountants make? For example, accountants' input on software functionality and business process issues is valuable, but not unique. A well-designed pilot test project would include representatives from all the key constituencies, and each different group would be expected to address software functionality and business process issues. For example, IT professionals are best equipped to address issues of technical feasibility.

Thus, accountants represent one of several potentially useful constituencies to include on the pilot-test team. And, accountants do bring a skill-set that is both unique and valuable for helping to address a system's economic and operational feasibility during a pilot test. For example, managerial accountants should be well equipped to assess the economic feasibility of a proposed emerging technology application. Since managerial accountants are trained in the use of tools such as the balanced scorecard, they should be part of the team that measures prepilot and postpilot process and outcome metrics. And, both managerial and financial accountants should be able to contribute to an assessment of operational feasibility, since they are trained to spot threats to data quality, opportunities for fraud, and other problem areas (in other words, the same skills that are used to examine an accounting information system, assess its controls, and propose new or modified controls that can be put to use during a pilot test).

At our nation's money-making factory, accountants played an important role in testing a paperless-processing system which ultimately could put them out of business (some day, perhaps in our lifetimes, paper currency will be seen as a quaint artifact of an obsolete past). The roles that accountants played in this emerging technology assessment provide a glimpse of a future in which their training in IT basics, data quality, and system controls will be more valuable than ever.

APPENDIX A
IPP Purchasing and Receiving Processes

As seen in Exhibit A1, a Contracting Officer (CO) in BEP's Office of Procurement entered purchase orders (POs) into the BEPMIS purchasing module,[3] where they were stored on a database. Because the system did not accommodate a digitally signed PO and did not include sufficient text, POs were printed, signed by the CO, and mailed to the supplier. A routine, written for IPP, was manually initiated each evening to extract and format POs for participating suppliers. The core PO data (vendor, items, amounts, quantities, etc., but not including additional descriptive and contractual text) were extracted, as a batch, directly from the BEPMIS database and sent to the enterprise adapter, which converted the PO data from IDMS format into XML. Once translated and encrypted, the batch was sent to the IPP server at Xign and stored on the IPP appreciating database. Now a PO record existed on both the BEPMIS database and IPP appreciating database. Once a PO was posted to the IPP database, IPP notified suppliers via email.

Having been notified that a PO was issued, an employer at a BEP supplier would log on to IPP, read POs on screen, and subsequently respond by providing the requested goods or services. Suppliers might also enter the PO data manually into their own sales systems (if so, their sales order record duplicated the PO in BEPMIS and the IPP appreciating database). Depending on the nature of the PO and a supplier's policies, its employees might be required to wait for the paper PO before beginning the process of providing goods or services, or they might be permitted to act on the electronic PO. Once goods or services were received, BEP receiving personnel recorded the receipt into BEPMIS (no record of the receipt was recorded on the IPP appreciating database).

APPENDIX B
IPP Invoice and Accounts Payable Processes (see Exhibit A2)

Once goods or services were provided, a supplier employee would log on to IPP for the PO "flip" (to create and record an invoice that was posted to the IPP appreciating database).[4] IPP then sent invoices to the enterprise adapter at BEP where the invoice data was translated from XML into IDMS format for posting to the BEPMIS accounts payable database. The supplier invoice then resided on the supplier database, IPP appreciating database, and BEPMIS.

Once invoices were posted, BEPMIS performed a three-way match of invoice, PO, and receipt.[5] An invoice status change record was then sent to the IPP server. BEP and the supplier could view these records on the IPP database and resolve disputes (e.g., disagreements regarding price or quantity listed on the invoice) as required. As the status of invoices changed, BEPMIS extracted and formatted the change data, used the enterprise adapter to

---

[3] COs are assisted by buyers—who shop for products and services, negotiate prices, delivery schedules, etc., and prepare POs—and by contract specialists who help negotiate, prepare statements of work, and also prepare POs. Duties overlap and all may do data entry.

[4] Suppliers could alternatively have used Xign's "eFile" option for posting their invoices to IPP. If they had, a supplier's system would send relevant invoice data (for products sold/services provided to BEP) to another enterprise adapter (implemented as a server located at the supplier), where it would be translated into XML, and sent to IPP for posting, thus providing an automated connection that precludes the PO flip. Preimplementation testing and validation against agency criteria was conducted to minimize the possibility of eFile invoices being inconsistent with POs in the IPP appreciating database. Only invoices that pass the validation (i.e., match the corresponding PO) would have been transferred to the BEP (or other participating agency's) accounts payable system.

[5] This is really a two-way match because, with the PO flip, the PO and invoice were already matched. We assume here that invoices match receipts and are posted to BEPMIS (i.e., error routines are not shown).

EXHIBIT A1
IPP Purchasing and Receiving Processes
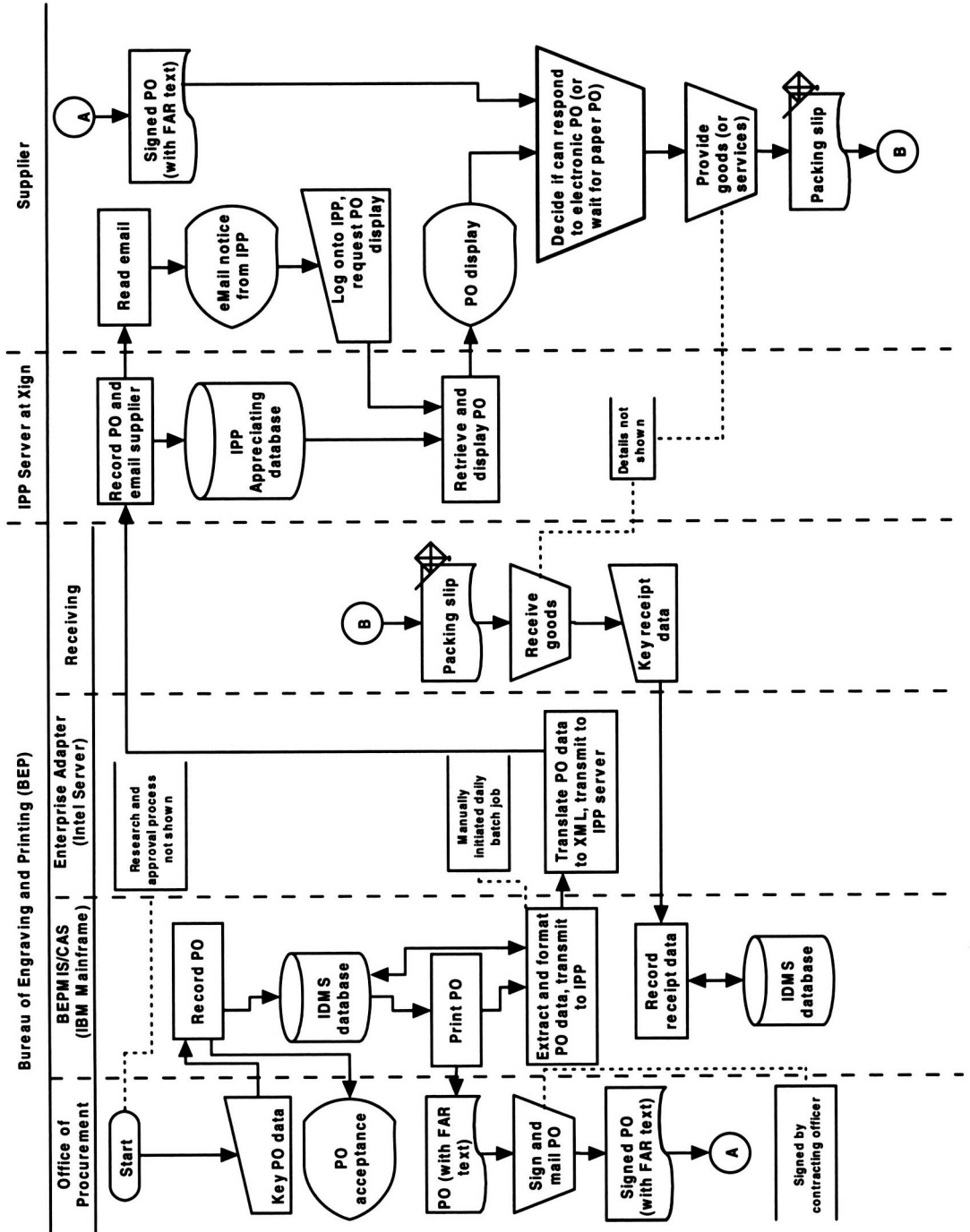
EXHIBIT A2
IPP Invoicing and Accounts Payable Processes
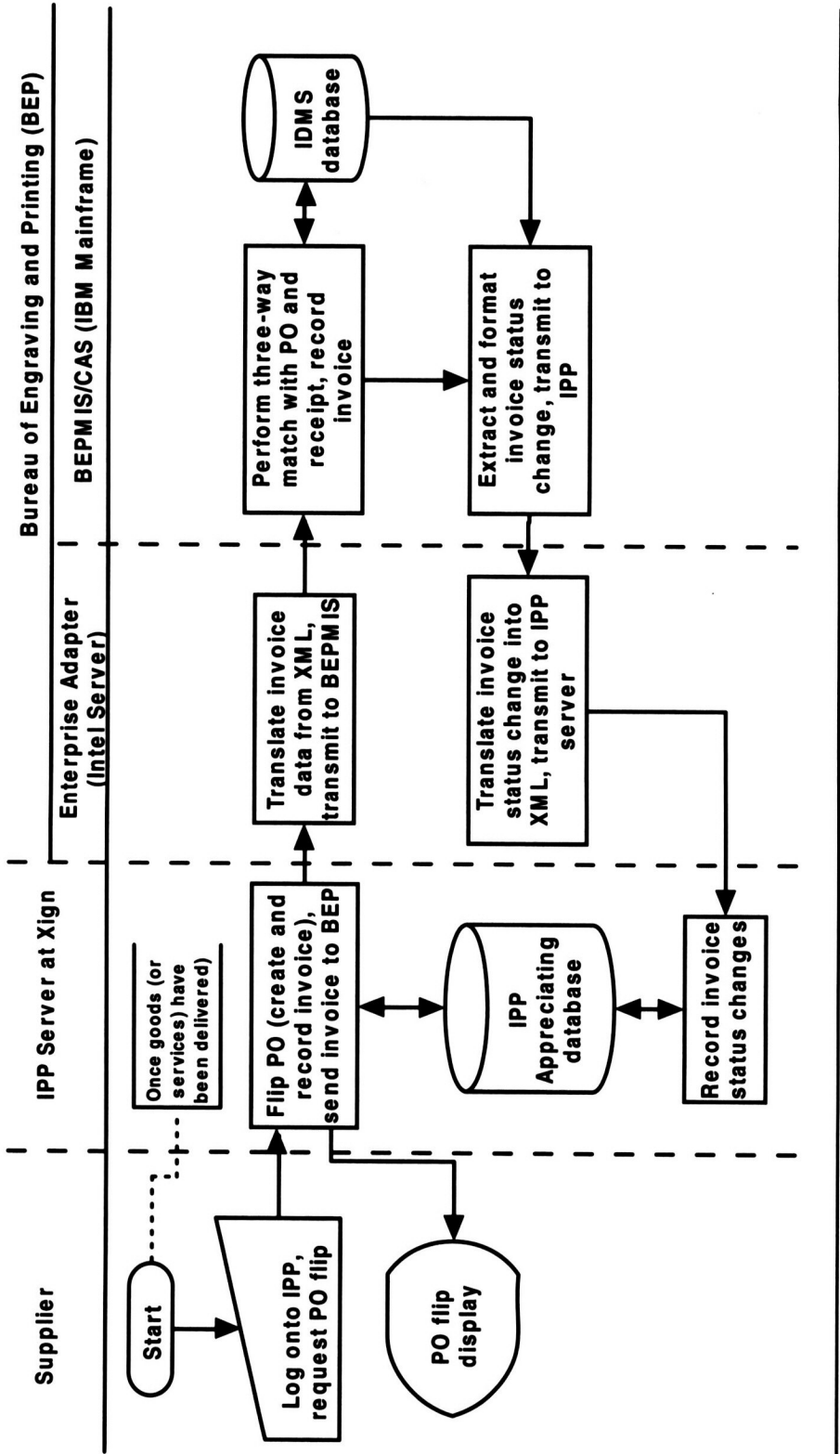
convert it to XML, and transmitted changes for posting to the IPP appreciating database. The supplier could review the status of an invoice on IPP as it moved through the payment generation process (see Appendix C). These statuses were: "Pending Approval," "Scheduled for Payment," "Approved for Payment" (added midproject), "Paid," and "Rejected." BEP and the supplier could each drill down on IPP from the invoice to the PO.

APPENDIX C
IPP Payment Processes (see Exhibits A3 and A4)

Once invoices were posted to the BEPMIS accounts payable database and payment was due, an accounts payable accountant triggered the payment process for all invoices and selected those invoices that were to be paid. BEPMIS then extracted and formatted payments for participating suppliers, generated a payment instruction file (PIF), digitally signed this (using a VeriSign certificate, and transmitted this file to the enterprise adapter for translation from IDMS format into XML. The translated file was then sent to the IPP server where it was posted to the IPP appreciating database. At the same time, a BEP accounts payable accountant manually issued an email notification detailing the number of payments and total dollar amount of payments in the PIF. This notification went to the BEP CO, the FMS DO at the Regional Finance Center in Kansas City, and the Boston Fed. The CO and DO logged on to IPP to approve payment files. Optionally, an auditor in Kansas City might also be required to approve the payment file. COs and DOs used smartcards with a thumb-print reader (a form of biometric identification) to execute these approvals, via any PC that was equipped with a Web browser and smartcard reader.

Following approvals, IPP generated an Automated Clearing House (ACH)-formatted file from the PIF and sent it to the Boston Fed. At the same time IPP automatically sent an email detailing the number of payments and total dollar amount of payments in the ACH file to the BEP accounts payable accountant, CO at BEP, DO at the RFC, and the Boston Fed. Also, IPP notified the supplier via email that a payment was coming. The ACH-formatted file was transferred to the Federal Reserve Automated Clearing House (FedACH) system, where the payment was settled by debiting the U.S. Treasury account at the Fed, crediting the accounts of the supplier's bank at the Fed, and notifying the supplier's bank of these credits. FedACH sent a Bulk Data Acknowledgement to the BEP accounts payable accountant, the CO at BEP, the DO at the RFC, and the Boston Fed, detailing the number of payments and total dollar amount of those payments. The supplier's bank then credited the supplier's account.

TEACHING NOTES

Teaching Notes are available only to full-member subscribers to the *Journal of Information Systems* through the American Accounting Association's electronic publications system at http://www.atypon-link.com/action/showPublisherJournals?code=AAA. Full-member subscribers should use their personalized usernames and passwords for entry into the system where the Teaching Notes can be reviewed and printed.

If you are a full member of AAA with a subscription to the *Journal of Information Systems* and have any trouble accessing this material please contact the AAA headquarters office at office@aaahq.org or (941) 921–7747.

EXHIBIT A3
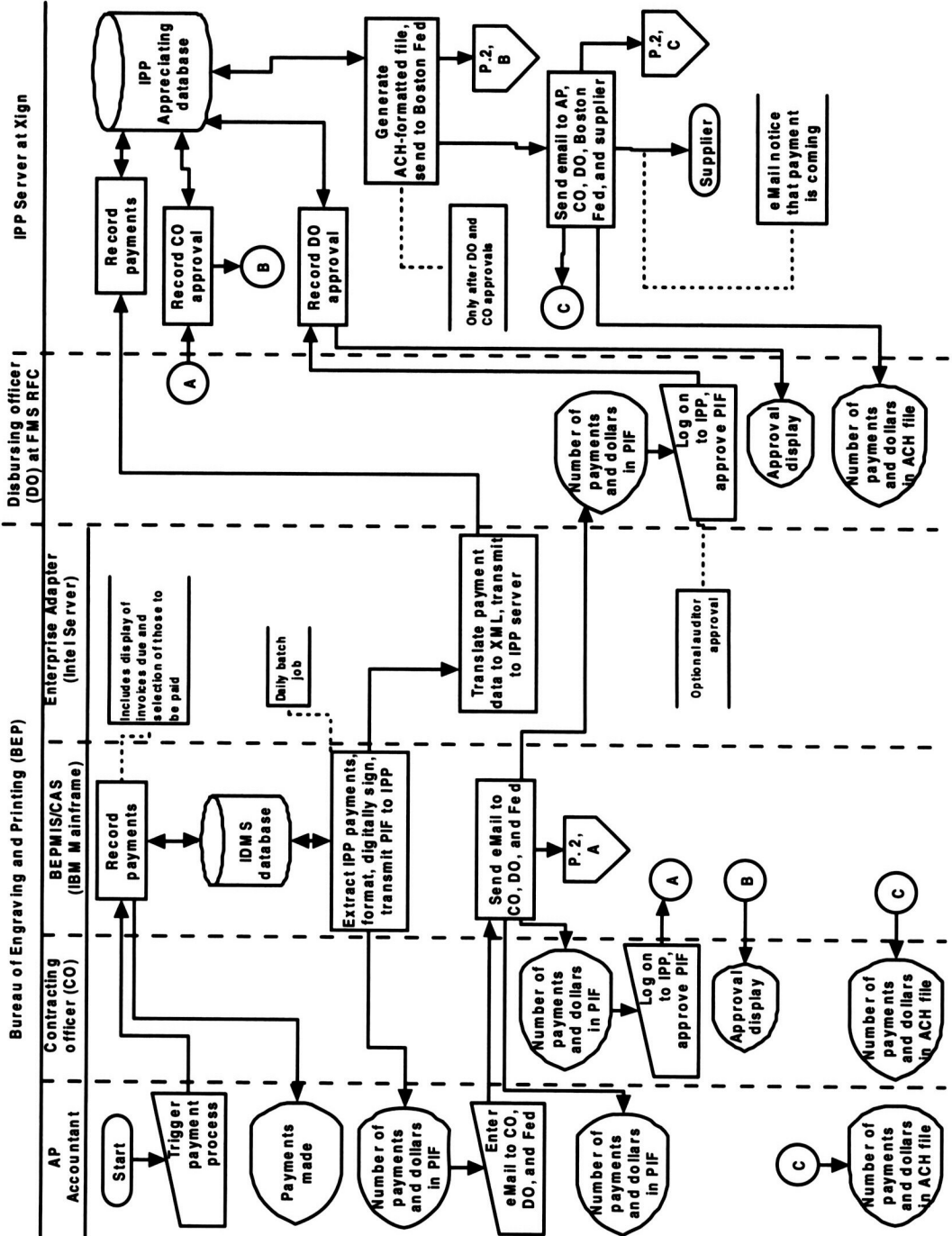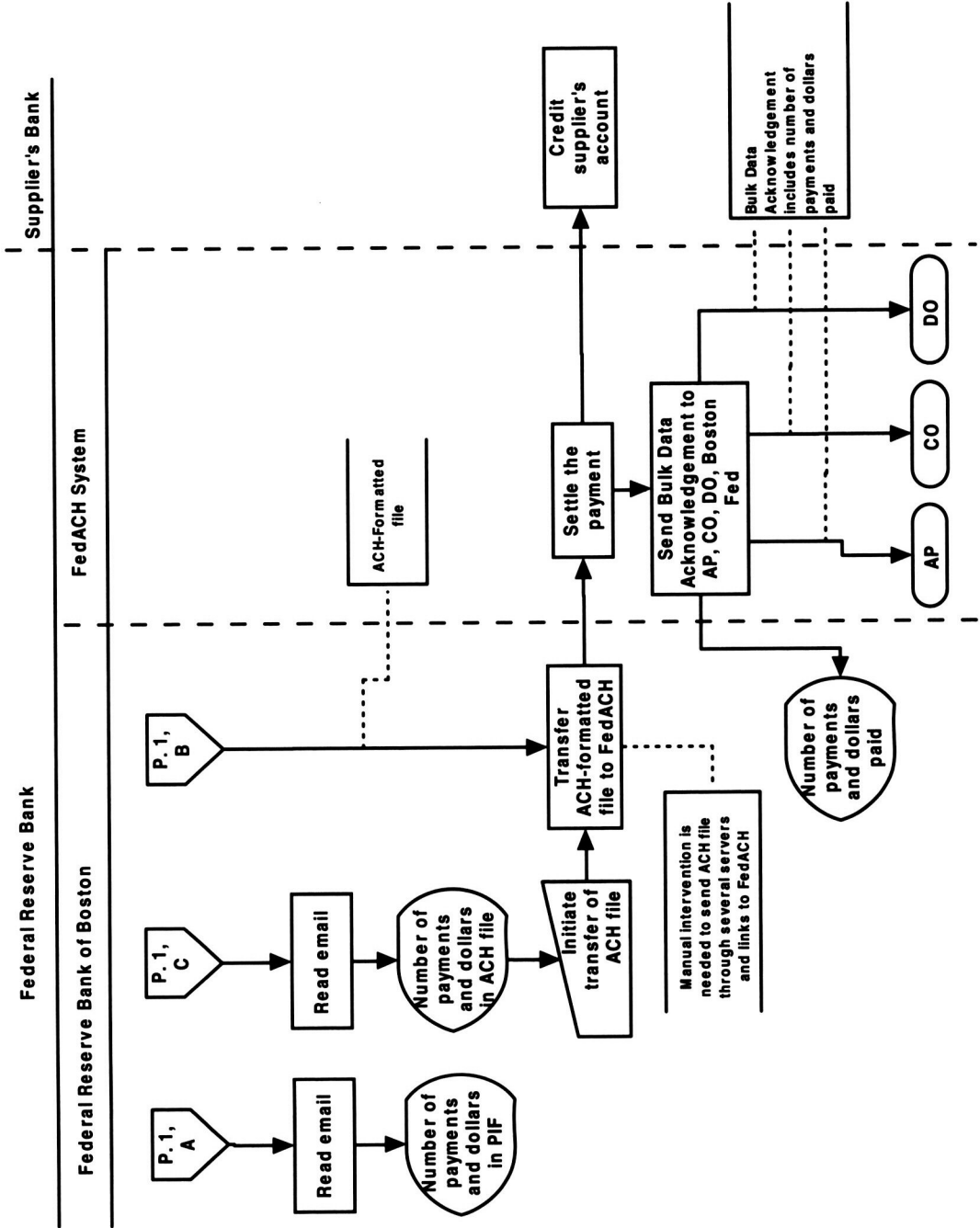**IPP Payment Processes at BEP, IPP, FMS**

EXHIBIT A4

IPP Payment Processes at Federal Reserve Bank of Boston and Banks

REFERENCES

Christensen, C. M. 1997. *The Innovator's Dilemma.* Boston, MA: Harvard Business School Press.

Cytron, S. H., and R. Tie. 2001. A CPA's guide to the top issues in technology. *Journal of Accountancy* (May): 71–77.

Day, G. S., and P. J. H. Schoenmaker. 2000. Avoiding the pitfalls of emerging technologies. *California Management Review* 42 (2) (Winter): 8.

Duffy, M. N. 2004. Section 404 opens a door: The requirement to evaluate a company's controls has created a service niche. *Journal of Accountancy* (May): 55–64.

Financial Management Service (FMS), United States Treasury. 2002. *Internet Payment Platform Operations Concept and System Requirements*, Version 1.8 (June 18). Washington, D.C.: Government Printing Office.

Gelinas, U. J., Jr., and J. L. Gogan. 1996. The FSTC electronic check project. *American Institute of Certified Public Accountants Professor/Practitioner Case Development Program*, Case 96–10. New York, NY: AICPA.

———, ———, and C. Wade. 2003. The U.S. Treasury tests a new payment mechanism. *Journal of Information Systems Education* 14 (3): 259–269.

Gogan, J. L., U. J. Gelinas, Jr., and A. Rao. 2003. Is this pilot test over? *Annals of Cases in Information Technology* VI: 22–40.

———. 2005. Punctuation and path dependence: Examining a vertical IT standard-setting process. *Electronic Markets* 15 (4): 344–354.

Harrington, C. 2005. The accounting profession: Looking ahead. *Journal of Accountancy* (October): 43–48.

Johnston, R. P. 2005. A tour of tomorrow's technology. *Journal of Accountancy* (October): 95–97.

Lanz, J., and R. Tie. 2004. Advise businesses on external IT resources. *Journal of Accountancy* (June): 55–62.

McConnell, G. Y., and D. K. Banks, Jr. 2003. How Sarbanes-Oxley will change the audit process. *Journal of Accountancy* (September): 49–54.

Tie, R. 2001. Get ready for the world of B2B. *Journal of Accountancy* (June): 49–55.

Tucker, G. H. 2001. IT and the audit. *Journal of Accountancy* (September): 41–43.

Zarowin, S. 2001. Facing the future. *Journal of Accountancy* (April): 26–31.