Lessons Learned in Electronic Forms Development

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Don’t worry about people stealing your ideas. If your ideas are any good, you’ll have to ram them down people’s throats.

-Howard Aiken
**Introduction**

In May 2006 the Forms Management Program, in partnership with Information Technology, launched a *Proof of Concept Project for Intelligent Electronic Forms* to evaluate the effectiveness and efficiency of electronic forms development and the viability of launching an electronic forms initiative. The project was a success and the initiative endorsed by senior management in October 2006. But as importantly, the project and the process taught the project team very valuable lessons about the differences between developing and managing a paper forms environment and an e-forms environment. The project and the lessons learned form the basis of this paper.

**Background**

Healthcare operates in an environment of advanced technology, where communication is critical to safe and effective care delivery. Yet we struggle to come to terms with the most basic and crucial of communication tools: the form. Business forms and their related work processes define, structure and regulate our foundational efficiency but the potential to streamline those work processes in a paper-based environment is finite. And no matter what we do to standardize and streamline our ultimate success hinges on the effective completion and efficient processing of documentary chart and transactional forms. Examples include purchase orders, HR forms, Financial Transfer Authorizations, MICR cheques, and so on. Even when a process is standardized and the form well designed, the inherent nature of a paper-based system renders it less efficient than its electronic counterparts. Electronic forms offer organizations the opportunity to radically improve information processing by providing a far superior data collection and processing tool.

**Definitions**

**Electronic form (e-form, I-form)**

The term ‘electronic form (e-form/I-form)’ has multiple meanings, both within our organization and the forms industry. To clarify, there are essentially 4 different categories of ‘electronic forms.’

**Intelligent Electronic Form (IEForm)**

An IEForm is a complete database driven solution. Users fill in the form using a computer keyboard and submit it directly to a database. Based on the business process need, a link to the form data may be emailed to another person for review and approval by electronic signature (e.g. expense claims) and, if necessary, emailed a second time for further approval and signature. Each time a signature is added, the data (signature) is added to the database and stored for future reference. Once the data is stored in a database, it can then be imported into an enterprise application that processes the data. This type of form is often referred to as an *intelligent electronic form* (or IEF) to distinguish it from less sophisticated ‘electronic’ forms.
Essentially any form created with a computer qualifies as ‘electronic.’ Other examples include:

**Print and Fill** - Simple images that users print out and complete by hand.

**Fill and Print** - HTML forms that users fill in the form fields using the computer keyboard and then print the completed form.

**Hybrid** - ‘Smart’ Word or HTML forms that users fill in the form fields on the computer keyboard and then submit the completed form via email to the person processing the form who then prints it for manual processing.

### Forms Portal

A portal is a single point of access on the Intraweb to electronic forms that provides data security and access. A portal includes the standard data architecture for data storage, authenticates users, authorizes access and provides detailed audit trails of electronic form activity. Additionally a portal prevents alteration of submitted data and provides security against unauthorized access and deliberate or accidental loss of records.

### History

The need for electronic forms and processes has been a recurring issue for the David Thompson Health Region since the inception of the Forms Management Program early in 2002. Unable to offer electronic form solutions, many departments have gone to IT for custom-made solutions and/or developed and deployed their own e-forms with varying degrees of success. These forms were being created outside the parameters of the regional Forms Management Program and as such, are being developed with no consideration for: ongoing regional initiatives, standard process review, forms design standards, or guidance of a clearly defined electronic forms development strategy. Some examples include:

- **The Employee Status** form (used to communicate with Human Resources about new hires and changes to existing employees). This form is a macro-laden Word document available on the Intraweb, which can be filled in electronically and submitted via email to HR. While utilizing some e-forms features: mandatory fields, field masking and email submission, it lacks a secure data transmission function, fails to eliminate date entry, is dependent on macro enabling and may suffer data corruption during transmission. Further, the form does not meet information security standards, as it relies on the user to know precisely ‘whom’ the email should be directed to. There have been multiple incidents of the form being directed to the wrong recipient.

- **The Job Request** form (this form is used to provide HR with job posting information). While functional, this form was written from scratch and was several months in development. Although this form ‘works’ it was extremely resource intensive to develop and as such, very few ‘electronic forms’ have been introduced by IT. IT estimates that utilizing our new e-forms software would have reduced the development time for the Job Request form by 75%.
Defining the Problem

To fully understand the cost of paper forms within an organization, we have to look beyond the cost of printing. The 1950’s Hoover Commission reported that printing was only 4.4% of the total cost of business forms. More recently, analysis by Robert Barnett has argued that due to advances in print technology and the rapid rise in labour costs, the printing cost has dropped to 1-2% of the total cost. Even worse, traditional paper-based document systems reinforce inflexible, error-prone information workflows that, despite any investments in process reengineering, sabotage process and quality improvements. This negatively affects both patient and staff satisfaction. Consider the following:

Development and design costs
Resources required to design, proof, approve, review and validate forms.

Printing service expenses
Paper, toner, flash costs, drilling, binding, trimming, packaging, shipping.

Processing costs
These include TIME costs: form completion, copying, faxing, scanning, approving, checking, confirming, filing, separating, sorting, bursting, stuffing, folding, and mailing preprinted documents. Add to that the cost of supplies and data transfer: toner, postage, envelopes, and long distance data charges.

Error correction cost
The standard human error rate is 8%. Error rate on forms can be as high as 80-100%

Cycle time
Describes waiting time and the time to manually move forms through the region. Includes time spent searching for and expediting specific forms. It can also describe lost opportunities; lost quick-payment discounts from vendors.

Specialty Equipment
Includes line printers, dot matrix printers, fax machines, bursters and folders used to ‘process’ preprinted form stock.

Warehousing and inventory costs
Space is a valuable commodity in healthcare facilities. Warehousing costs include the square footage value of the warehouse itself, as well as obsolescence due to changes in process, legislation, clinical practice, department name or standardization. The average department or unit has up to 6 months stock of standard, readily available forms. When revisions are made, many of those forms end up in recycling or shredding bins.

Obsolescence costs
Revisions can transform thousands of dollars worth of pre-printed forms into pure waste. In addition, we often pay someone to haul away and shred this waste.
Records Management & Archiving Costs.
Cost related to training staff to correctly and appropriately classify and store mountains of paper, the cost of file folders, labels, hanging files, filing cabinets and the square footage they require. Consider also that this system does not prevent misfiling. Records management professionals estimate the cost to track down a single misfiled document at $135.00, which doesn’t include the costs of recreating or reproducing hopelessly lost documents.

Security
Locks, cabinets and special rooms all intended to keep sensitive documents safe.

Defining the Solution
It is important to understand that implementing electronic forms is as much a strategic shift in business culture as it is a technological upgrade. People are remarkably attached to paper. Electronic forms allow users to provide data online, preventing time-consuming and costly errors. These forms can then be saved, printed and/or automatically routed, to different and/or multiple recipients simultaneously; for approvals, further processing and even upload into other enterprise applications.

Benefits

Cost savings
There are two types of cost saving. Physical; reduced printing, storage and obsolescence costs of pre-printed stock as well as reductions in photocopying of preprinted forms. Electronic forms will also cut the cost of record storage and paper filing. The impacts would be region-wide, across all departments and all sites. Distribution and Process; Properly designed IEF reduce completion time and data entry, speed up the transfer of information and all but eliminate errors while streamlining document and process approvals. While direct cost reductions may not be immediate, the positive impacts would benefit all departments, especially those who are ‘receiving’ the data and who may realize significant efficiencies in data processing and error correction time. Improved data access and retrieval can drastically reduce the paper-chase between departments by providing authorized users instant access to data and virtually eliminating the search for lost or misfiled documents and reduce the time necessary to research discrepancies.

Data leveraging
Information (data) is a corporate asset but not always treated with the priority we afford more tangible assets. One of the most common complaints we get from our patients is how frequently they are asked to provide the same information to a different care provider. As an organization we spend resources to collect data, validate it, enter it, mine it and management with the expectation that we will then be able to use it for tactical or strategic decision-making. What we discover regularly is that the data doesn’t ‘line up’ and different forms and databases collect information differently. We put a lot into ‘getting’ our data, without getting a lot out of it. Data collection is costly and data management resource intensive. The ultimate data collection goal of any corporation would be ‘collect once, use many.’ (for more details on this concept see Symposium proceedings 2006, Viewing Forms from a Data Perspective, by Jim Bennett of the
Wisconsin Department of Public Instruction). E-forms can greatly assist in the collection, validation and management of corporate data.

More accurate data and reduced completion time
IEF provide a great advantage over paper forms in collecting accurate data. Typical functions include automatic calculations, data validation, and mandatory fields for compliant completion, field masks and auto-population of static data from back-end databases. IEFs reduce errors due to their ability to either detect errors at completion or to block errors entirely using built-in edit checks and pop-up warnings to advise when a mistake is made.

More effective ‘Help’ feature
Electronic forms are complete with interactive prompts to guide the user through the process. On-screen help windows—called up automatically or on demand—provide the form filler the correct information right at the point where it is needed, without cluttering up the form.

Up-to-date design
IEF systems allow you to distribute a new version of a form to all users as soon as it is approved—to provide an instant corporate-wide update by publishing the form to a single location. This ability means staff are always using the correct version of a form with the most up to date business rules.

Improved Security
Electronic forms increase security of operational data and improve disaster recovery readiness for critical business documents. Paper processes have virtually no security and there is no audit trail to track ‘changes.’ Electronic forms, forms portals and digital signatures verify that an authorized person has entered the data, tracks any additions or signatures to the form, and prevents unauthorized access to data.

The Project
Scope & Deliverables

1. Develop criteria for electronic form development
2. Develop process for electronic form development
3. Develop 2-3 electronic forms meeting the above criteria and within the established development process, including process maps and Costing Analysis
**Resources**

**Project Team**

<table>
<thead>
<tr>
<th>Position</th>
<th>Department &amp; Program</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>COO and Sr. Vice President</td>
<td>Corporate Office</td>
<td>Executive Sponsor</td>
</tr>
<tr>
<td>Director</td>
<td>Materiel Management</td>
<td>Management Sponsor</td>
</tr>
<tr>
<td>Regional Coordinator, Forms management</td>
<td>Forms Management &amp; Production</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Systems Consultant III</td>
<td>Information Technology</td>
<td>Technical Support - Programming</td>
</tr>
<tr>
<td>Systems Consultant II</td>
<td>Information Technology</td>
<td>Technical Support – Internal Web</td>
</tr>
<tr>
<td>Forms Analyst II</td>
<td>Forms Management</td>
<td>Form Design</td>
</tr>
<tr>
<td>Systems Consultant II</td>
<td>Information Management/ Forms Management*</td>
<td>E-form Development &amp; Programming</td>
</tr>
<tr>
<td>Forms Analyst I</td>
<td>Forms Management</td>
<td>Process review and mapping</td>
</tr>
</tbody>
</table>

*Materiel Management – Forms Management Program and Information Technology partnered in April 2006 to hire a dedicated resource to support the Intelligent Electronic Forms-Proof of Concept Project. The temporary project position was funded through a combination of STEP student funds and Forms Management budget.

**Software**

In March 2006 with IM& T and VP approval, the Forms Management Program purchased the Electronic Forms development software, Amgraf OneForm Designer Plus. This purchase was financed with a one-time budget surplus due to an open Forms Management position.

**Deliverable #1-Criteria for Electronic Forms Development**

- **Standard process and form.** Either the processes and form are already standard, or the department involved is aggressively working towards standardization.

- **Recent process review.** Department has either just completed an aggressive process review or is willing to complete one. Complete process maps will be a requirement before development activity commences.

- **Processes must be stable.** Electronic form development is resource intensive and it is critical that the processes not be in a state of flux. Old versions of electronic forms must be retained to ensure that ‘old’ data can be displayed precisely as it was originally submitted. Therefore it is important to limit the frequency of revisions. Version control is critical.

- **Project has regional, multi-site or multi-departmental impact** (bang for buck). Later, single department forms may be considered for development, but would be assigned a much lower priority.
- **Existing back-end databases – opportunity to output to enterprise applications.** Much of the value of electronic forms is found in its ability to pull existing data from back-end databases and auto-populate portions of the form, as well as the ability to upload submitted data directly to enterprise applications and reduce re-keying.

**Deliverable #2-Electronic Form Development Process**

- Potential electronic forms may be identified by either the Forms Management Program or the requesting Department
- Forms Management will complete a preliminary evaluation based on the development criteria, to determine appropriateness and priority of project.
- IEForms development team (including representation from affected Departments) will conduct a complete Process Review, Data Elements Analysis and if applicable, error analysis.
- Business process testing completed.
- Initial form design completed (layout only)
- Initial e-form development completed: fielding, masking, logic, extra code, links to existing data tables, output databases developed.
- Form undergoes stringent quality testing.
- Training to end-users, if applicable.
- Implementation
- 6-12 month quality review conducted by department.

**Deliverable #3-Development of E-forms**

Note: process maps were oversized and could not be included in this paper.

**Costing: Sample 1 – 05511 Form Requisition**

Form Requisition #05511 is used across the region by units and departments to order form supplies from Forms Production. It is typically filled out by hand and submitted via fax or interoffice mail. Each requisition has a unique number and can only be used once. When received by Forms Production, each requisition has to be manually entered into Meditech to generate a ‘work order’ for Production that consists of both warehouse items to be picked and/or Print on Demand (POD) items to be printed. Forms Production typically processes about 400 requisitions per month. Errors are a significant problem, as regionalization and lack of standardization has resulted in multiple forms with the same function and/or title. Users regularly order forms that are not catalogued (rogue), have been made obsolete, or are Health Information Materials. Each error requires at least one telephone call to resolve. The cost of process and an error analysis have been included in the analysis.

Reasons for selection

- as process owners, Forms Management was able to effect process change most readily
- clearly defined and familiar process
- clearly defined problems
- high error rate
- increasing data entry time (were considering increasing FTE)
- no mechanism to confirm to users that order was received
- no ability to track orders in system.

**Analysis**

**Process Review**
- The project team and Forms Production team met several times to map the existing process and to develop the new process. No barriers were considered during the review, the process was developed to reflect the best possible practice. The identified problems were reviewed and various solutions offered and considered. Linking the electronic form to the live Forms Management database so that orders could only be placed for ‘active’ forms, thereby eliminating orders for rogue or obsolete forms to reduce error rates. The ability to search the database was also added, to assist users in finding the form product they wanted. Having the form auto-generate a requisition in another linked database reduced data entry. An auto-generated email to the requestor sends a confirmation that their order was received and provides them with their order number for tracking.

**Time/Motion Study**
- A Time/Motion Study was conducted to determine the labour inputs into the process. Several testing scripts were developed representing average orders and the completion times tracked and averaged to provide baseline data.

**Error Analysis**
- An Error Analysis Study was conducted of two representative months. The number and types of errors found on Form Requisition assisted the team in determining which ‘problems’ to solve. Errors are particularly troublesome, since we don’t often include them in standard workload analysis, yet resolving errors is more resource intensive than standard processing. The most common errors were addressed first. Common errors included:

1) Missing data: cost centres, form numbers, contact information
   Solution: Make the intelligent electronic form have mandatory data fields that would prevent the user from submitting it with missing data. We went one step further and linked the cost centre code to the Production database to ensure that only valid cost centre codes can be used, and to reduce data entry by auto populating the ‘ship to’ and ‘contact’ data in the form. Because the form is linked to the Forms Management database, they must provide a form number in order to order a product. There is a link to a catalog where they can ‘search’ for a form if necessary.

2) Attempting to order non-form products or a form not catalogued
   Solution: Because the form is linked to the Forms Management database, they cannot order products not catalogued. *Pop-Up Help* directs them to use the manual process for forms not catalogued and redirects them when they try to
order other products. There is a link to a catalog where they can ‘search’ for a form if necessary.

**Summary of Costing Analysis** (from time motion study and error analysis)

<table>
<thead>
<tr>
<th></th>
<th>Paper form</th>
<th>IEForm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>05511 Form Requisition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft dollar savings per month</td>
<td>1584.20</td>
<td></td>
</tr>
<tr>
<td>Hard dollar savings per month</td>
<td>230.66</td>
<td></td>
</tr>
<tr>
<td>Total efficiency savings per month</td>
<td>1814.86</td>
<td></td>
</tr>
<tr>
<td><strong>Total efficiency savings per year</strong></td>
<td><strong>$21778.32</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Although these costs have been identified as savings, they may not translate to specific budget reductions. Each e-form project will have an independent and specific cost impact and actual bottom-line (hard) savings may not always be realized.*

**Soft Benefits: They Defy Measurement...But They're Still Benefits**

While our decision-making is most often based on the hard costing benefits, it would be shortsighted to only present those benefits. Many non-financial benefits are undeniably tied to an electronic forms initiative.

Electronic forms will also produce benefits in the following areas:

- Meeting regulatory compliance requirements with ease (HIA, FOIPP, CPA cheque standards)
- Improvement communication between users and departments
- Shorten transaction and process cycles
- Increase customer satisfaction
- Greater employee satisfaction and retention
Lessons Learned or Things We Wish Knew When We Started

Things to Consider:

**Prepare customer education**
Many customers don’t understand the difference between ‘electronic form’ and ‘application.’ In fact, make sure you understand it first. Early opportunities for some departments had the project manager scrambling to manage expectations. One customer went way beyond ‘data capture tool’ to ‘incredibly robust pandemic planning application.’ This is an ongoing issue that both the Forms Program and IT are working on resolving, as at this time, there is no agreement on the line between the two.

**Data collection standards and security**
Give consideration to your existing and future data collections needs. Research your organization’s data collection standards, if they exist, or identify the lack of them as a risk in your project plan. How will you collect, manage and leverage the data? How will you ensure that data collected in one form can be used in another? Do you collect last name first, or first name first? Do you use the term ‘surname,’ ‘family name,’ or ‘last name’? Do you have a standard date format? Data collection standards are an essential first step in any e-forms initiative. It’s those standards that will guide future development and ensure accurate data that can be leveraged in multiple ways.

Understand data security requirements and privacy protection legislation. Be clear on your organization’s long-range data administration model and data security strategy to be sure that your planning aligns with that of your Information Management department and is compliant with privacy protection legislation.

**Not everyone is excited about E-forms.**
Don’t expect all your customers to go giddy over your new initiative. Customers that weren’t too excited about your involvement in paper forms development will be even less thrilled about your involvement in e-forms, particularly because e-forms development demands that the forms program get involved in the business process (and by extension, their ‘business’). Be certain to do a thorough process analysis; you don’t want to immortalize a poor process. Further, while some customers will fighting to get in line, others will be fearful of the technology and reluctant to leverage it. Be prepared during customer education to assist them through the change process.

**Set realistic goals and demonstrate early success**
The first few forms you develop will take much longer than you ever imagined. The learning curve is steep and you may find yourself investing energy in understanding your customer’s business processes in greater detail than ever before. If your program has not been involved in the process analysis work in the past, you will notice an even greater impact on your resources and timelines.

It is important to show early success so choose your first few projects carefully. Do select forms with stable, straightforward unidirectional business processes. To build buy-in with your customers and assist them through the change process, it will be invaluable to have some early successes to demonstrate.
Be prepared for simultaneous paper and e-form versions

Have a plan for managing e-forms and paper forms simultaneously. Will they have unique form numbers? Will you use a code to identify the paper form and the e-form? How will you handle multiple versions of e-forms?

Understand your assumptions and state them in your project plan

Make sure you fully understand your software ‘will’ and ‘will not’ do. This is particularly important if you are shopping for e-forms software for the first time.

Understand your enterprise application. We selected software that would interface with a wide variety of database structures and languages. It wasn’t until the project launched that we understood that our enterprise application wouldn’t interface in a common language. Our enterprise database was constructed in a proprietary code and unable to interface with our e-forms software. This isn’t an insurmountable problem, but does create additional work we had not originally anticipated.

Future Opportunities for IEFoms in DTHR

Data administration model/ Data standards

We anticipate that electronic forms and their subsequent data tables will highlight an opportunity for the region to develop a standard data collection standard and standard data administration model. At this time it is estimated that the region supports more than 2000 separate databases, with no standard data collection strategy in place. The value and usefulness of that data is significantly reduced when the region is unable to leverage existing data.

Workflow

The development or purchase of a workflow management module will greatly enhance our ability to automate business processes and leverage our e-forms technology. Workflow will allow us to trigger business processes and partially fill forms based on previously submitted forms. Submitted forms will be able to simultaneously trigger multiple or parallel business processes and radically decreasing data processing time while improving communication and the transfer of data.

Enterprise Wide Application Interface

The development or purchase of an open interface with our enterprise wide application will drastically increase the value of an electronic forms initiative. Limited existing interfaces in Meditech allow for the direct upload of some raw data. For example, an electronic form for Financial Transfer Authorization 00150 would be uploaded directly into the G/L with no human intervention. However, while the processing of expense claims can be improved upon, there is currently no way to directly upload the data into the Accounts Payable module of Meditech.
Conclusion

The Proof of Concept project was a success and senior management approval to launch an e-forms development initiative was granted in October 2006. A new project was launched in late 2006 with Phase I underway. This first phase is focused on purchasing and implementing a Forms Portal for our internal website. Phase II will be the operationalization of the IEForms Program and the recruitment of an E-Forms Developer/Programmer to support the work ongoing. The lessons we learned during this project will go a long way in preparing to launch our e-forms program. Many of the larger gaps and risks were identified and work in other areas has already begun to address them. This project provided an excellent opportunity to trial e-forms on a small scale while learning some valuable lessons about our organization and our customers. These lessons will prove invaluable as we move forward with more aggressive e-forms projects.

There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.

– Niccolo Machiavelli