Ampersand Printing

Section I. Background — Please provide a description of the subject workflow environment and conditions prior to implementation:

Company Profile

Ampersand is a second generation family-run company and offers full service offset printing. Currently we keep 20 employees busy. Our niche is the production of high-end, high-quality products. We can handle a wide spectrum of products ranging from short-run brochures and booklets to full color variable data products, high-end art prints using 10 micron stochastic screening, annual reports, flyers, catalogs, books and business cards.

Now in its 30th year, we have positioned ourselves as one of the leading print service providers in Southern Ontario, Canada. By empowering highly skilled professionals with state-of-the-art technology, Ampersand strives to exceed client expectations every time.
Biggest improvement in efficiency and customer responsiveness as a result of process automation

We were one of the first Canadian companies to install computer-to-plate (CTP) technology. In 2004 we started with Kodak Prinergy digital workflow and CTP system with Staccato screening.

Our press room features a Komori 2-Color perfecting press, which is used primarily for bookwork, and a Mitsubishi 5-Color, which is used for the balance of work. Moreover, we have recently installed an HP Indigo 5000 digital press.

Our fully equipped bindery is outfitted with Heidelberg machines (Polar Cutter, Stahl folder, Cylinder for matrix scores, micro perforating and die-cutting, Stitchmaster Saddle Stitching system, (equipped with both regular and loop stitching heads), and with high speed laminating equipment, wire-o and plastic coil binding systems, high capacity paper drilling equipment as well as automated clip sealing and shrink wrapping. In September 2006 we installed a new JDF-enabled cutter.

Hiflex MIS is used for order management and production planning and was introduced beginning of November 2005. JDF implementation began in April 2006 (today JDF link between Hiflex MIS and Kodak’s Prinergy workflow system as well as JDF link to the cutting machine; soon to be expanded to the presses and further departments).

In January 2007 we achieved Forest Stewardship Council (FSC) Certification. We felt this certification was absolutely necessary since people are becoming extremely sensitive to the environment and this certification allows our customers to choose an environment-friendly print alternative. FSC requires detailed tracking of the purchasing, production and delivery of the paper used in an FSC Certified print job. Basically FSC can track the final product all the way back to the tree the paper came from.

Moreover, we are planning on moving to larger facility in the very near future.

Workflow Prior to Implementation

Prior to implementing the Hiflex MIS System and the resulting automated workflow, we were using several systems (two Order Management and Production systems). Some of them were highly advanced in some areas but nevertheless they revealed limitations which turned out to be the eventual “Thorn in our side”. As the systems were not connected to each other, the existence of multiple data pools inevitably led to inconsistent data at different stages of production and administration. Moreover, there was no online availability of up-to-date job information. We therefore lacked the transparency and flexibility to run production and customer responsiveness most efficiently.

Time consuming processes required for estimates and quotation

The former systems were paper-intensive systems that lacked integration and required manual rework. This got in the way of the level of customer responsiveness we have always been aiming at.

For repeat orders, an employee would need to search a card index that contained all previous jobs. Once found, the old job docket containing the quotation and costing information would be delivered to the estimating department for review. Once reviewed, the pricing was either approved or updated. Once this was complete, the docket was then delivered to the CSR where the order was finally entered manually into the system.

Re-keying of identical data

Our job tickets were big envelopes printed in-house on our press and filled out by hand. It contained customer data, deadlines, technical specifications and instructions.

The completed job tickets were then brought to the prepress department, where the operator would re-key the data into Prinergy. Inevitably, mistyping occurred on occasions, which resulted in a production job differing from the job specifications on the print-out of the job ticket. This also resulted in operators not being able to find jobs in Prinergy because, for example, the order number was mistyped.
Delayed job status information and restrictions in customer responsiveness

With islands of IT application systems we lacked real time communication of job status. This was disadvantageous for both customer responsiveness and our efficiency in the production processes.

Our customer service was restricted, because CSRs could not give immediate answers to job-related inquiries. They had no access to up-to-date status of the job in prepress (customer approvals, status of plates or proofs, or author’s corrections, though the Prinergy system allows page-level status tracking). Consequently, customers had to wait while the CSRs carried out a time-consuming process to gather job information (further phone-calls / tour through the plant / getting hold of the right person). Moreover, the lack of real time status information about customer approvals and statuses about proofs and plates also rendered scheduling a time-consuming and inflexible process.

Lack of flexibility for last-minute modifications

For scheduling and work in progress tracking we used a second system, which was a “home-grown”, in-house, web-based system. There was no automated production planning according to deadlines and capacities. The system did not automatically display real-time information about customer approvals, available plates, and modifications of the production plan. Therefore, time lines were often too short and we lacked flexibility especially when customers requested last-minute modifications.

Generally, last minute changes – if possible – required a sometimes tedious process of hunting down the ticket and manually changing the necessary information, or a start from scratch if it was a radical change.

Need to “re-active meetings”

Scheduled production meetings were only rarely held. As Production Manager I would make my “rounds” and have many “small meetings” with the Sales and CSR staff, which together took up approximately 4 hours of my day. Many of these meetings with various personnel could be considered “re-active meetings”, in other words, meetings that were often initiated by an issue that had arisen.

Deferred availability of production data

For Shop Floor Data Collection (and a very limited level of estimating) we used a DOS-based program. The data collection capabilities were also quite limited. All labor and material consumption was recorded using hand-filled paper time sheets that were handed to a centralized person who then keyed the information into the old system. Many of these time sheets were filled in at the end of the day based on the operator’s memory of the day’s events. A tremendous amount of time was spent with these activities, not to mention human error (forgotten records).

Generally, we considered ourselves lucky if actual job costs were captured or tracked at all. Furthermore, we had no tool in use that could provide reliable info about the throughput.

When materials were not booked for chargeable reworks, considerable profit was lost. Due to incomplete bookings, job costs were never 100% accurate and the inventory never matched production records. This resulted in a lot of administrative overhead to reconcile the missing materials when inventory checks were carried out. On the average, one staff member was preoccupied with this task for approximately five hours per month.

Delayed SFDC resulted in delayed invoicing processes which would have a negative impact on our liquidity.

In sum, the problems were:

- No coherent data pool for administration and prepress with a lot of re-entering information that already existed elsewhere
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- Lack of functional estimating system (was done manually) and document management solutions
- Repeat orders involved laborious administrative processes
- Extensive paper trails
- An extensive amount of time was spent in defining imposition for the vast array of work produced at Ampersand
- No real-time job status of job in prepress (e.g. are the proofs done or are the plates exposed?), therefore lack of transparency and flexibility
- No immediate answer to customer inquiries possible
- No digital job ticket; laborious processes involved in order to include last-minute changes
- Only limited scheduling possibilities, no digital planning board
- “Re-active” meetings took four hours per day
- Delayed and often only incomplete, manual Shop Floor Data Collection
- Delayed invoicing

Section II. Objectives — Please provide a description of the printer, publisher or prepress service’s goal and motivation, including any quantities criteria upon which the goals were established:

With both foreign market influences as well as our current domestic capacities, anyone in this industry knows that pricing is sharp and our market is extremely competitive. Ampersand’s stance is that “If we are to continue to provide our customers with the level of quality we are currently achieving, as well as remain competitive, we must automate the process, make it as streamlined as possible and minimize errors.” The only way to achieve this goal is through process automation with systems that allow best possible JDF connectivity.

Ampersand is growing rapidly and has observed (first-hand) the financial damages that can result as other companies have “stumbled” while trying to upgrade their infrastructure during rapid growth periods. With this in mind, we decided to begin this evolution at a point where we were still small and agile enough to manage the transition, thus allowing us to have the right systems in place prior to our anticipated growth period. This would allow us to have a functioning system that can handle the workload in place before we reach our anticipated growth levels and efficiency as well as customer responsiveness could suffer.

Our key objectives in an overview:
- Automate processes (especially with regard to Estimation, Order Management, Scheduling, Shop Floor Data Collection) in order to save time and effort.
- Seamless, enterprise-wide integration of our business and production processes (starting with the integration of administration system and prepress)
- Improve transparency throughout production, increase production flexibility, improve efficiency and reduce costs
- Continuation with very high level of quality
- Improve customer responsiveness
- Availability of accurate and timely costing and production information
- Improved billing precision
We aimed to increase turnover by 10% with the same staff and machinery and our ROI target was less than 2 years.

Section III. Methodology — Please provide a description of the process of selecting a solution, including alternatives and deciding factors:

As a team, we, Mike (my father and Ampersand’s founder) and I (Damian; with a background in data-driven web development and printing), began our search with no specific criteria in mind. We did, however, know that we wanted to adopt an “enter once - use many” means of managing information. After researching JDF technology, both the in-house development of a JDF-enabled system as well as commercially developed products were considered. After a two-year evaluation of various MIS systems and one unsuccessful installation of an MIS system, it was ultimately an unforeseen and unpremeditated 30 minute demonstration of Hiflex at Graph Expo in Chicago, IL that made up our minds.

My father and I looked at each other, amazed how Hiflex automatically calculated and so specifically, captured a level of detailed job specifications we simply had not seen within any of the other products on the market. Once captured, we then saw how the system can generate and deliver the JDF data and instruction sets to downstream systems and equipment. The demonstration also illustrated how this information also populates an array of documents that the system can produce. Hiflex was able to achieve this “enter once – use many” methodology of information exchange that Ampersand was looking for. “It just made so much sense”, we thought.

Once we decided to go with Hiflex and to automate our production processes, nothing but JDF was considered as suitable. JDF as an open standard allows for standardized, cross-vendor communication between the different systems. It meets all the requirements of an automated, efficient, and standardized print process for us and encompasses everything from conception through production, delivery, billing and job costing. JDF technology allows us to fulfill customer needs through enhanced visibility into the production processes.

Section IV. Implementation Story — Please provide a description of the implementation effort including timeline, participants, critical path/milestones, obstacles overcome (if any), training and testing:

The implementation of automation technology and JDF-connectivity at Ampersand started in November 2005 and progressed in several steps.

*** 1 / Implementation of Hiflex MIS ***

Start: November 2005
Hiflex MIS Release 2004

Implementation of Hiflex MIS, introduction of Hiflex Estimate and Hiflex Order Book for administrative processing, estimating, job costing, invoicing, and document management.

Installation of Hiflex Scheduling and Hiflex Shop Floor Data Collection (Hiflex SFDC). Hiflex Scheduling (JDF controller) handles the automatic planning for each cost center according to deadlines or priorities. Hiflex SFDC is used for decentralized Shop Floor Data Collection.

*** 2 / Implementation of JDF-Connectivity between Kodak Prinergy Workflow System and Hiflex MIS ***

Start: April 2006
Kodak Prinergy 3.1, Kodak Prinergy Business Link 3.0,
Hiflex MIS Release 2004, Hiflex Scheduling (JDF Controller)
JDF-Specification Version 1.2, Communication method: HTTP
Implementation of the link between the Hiflex MIS and Kodak Prinergy. Implementation of ‘Job Create’ (create a Prinergy job) from MIS to prepress by the push of a button in the Hiflex order book when creating a new order in Hiflex MIS.

Implementation of ‘Job Create’ from prepress to MIS, including the correct assignment to the order number in the MIS.

Hiflex monitors JMF events provided by Kodak Prinergy (approval status and prepress operations) including a thumbnail previews of pages from the prepress system. Activation of automatic cost booking: prepress events and approvals are translated to cost center and material data in Hiflex.

The prepress window in Hiflex MIS displays: plates done, page proofs done, form proofs done, Hiflex also receives from Prinergy info on whether an event is chargeable or non-chargeable including any comments the prepress operator added into Prinergy.

Screenshot from Hiflex Prepress Window. Click on a page loads the thumbnail-preview of the original PDF. Click on the preview opens the PDF in Acrobat.

3 / Update Kodak Prinergy Business Link 3.0 to ICS

Start: February 2007
JDF-Specification Version 1.2, Communication method: HTTP,
Kodak Prinergy (v.3.1) ICS compatible
This was the first ICS compatible system with on-time cost booking world-wide.

Display of page approval events: approved / rejected / clear.

Product parts exchange between Hiflex and Kodak Prinergy: whereas before ICS compatibility only job header was transferred, Kodak now receives also product parts (e.g. cover and content) and sheet data.

Hiflex sends job init data as well as StrippingParams to Prinergy. Preps Template is loaded automatically based on the received StrippingParams.

Using Automated Page Assignment (APA) function in Prinergy the refined pages are automatically placed on the loaded imposition templates.

Additionally, the cutting parameters are extracted from the template in Prinergy into a separate file. This file contains JDF and is exported onto a Hotfolder on the network which automatically generates the Polar cutting program and sends it to the cutter.

Screenshot from “Polar Compucut”: visualization of the press sheet in Compucut before the cutting program has been generated. This is generated from the JDF file

Screenshot from “Polar Compucut”: visualization of the press sheet after the cutting program has been generated.

*** 4 / Plans for the Future ***

The integration of press department is planned for the near future. Additionally, the purchase and integration of a further fully JDF-enabled press will follow within the next 12 months.

Along with the press we will be implementing a fully automated JDF compliant Stahl Folder which will be able to set all roller gaps and buckle plate positions using CIP data.

Upgrade to the latest version of Prinergy Business Link, where the imposition creation will be completely automated (on-the-fly) and not only loading of existing templates as before.
Section V. Resulting Workflow/Processes — A description of the resulting workflow, including any applicable workflow or process diagrams.

Today, estimation, order management, document management, scheduling, and Shop Floor Data Collection are all handled with the help of Hiflex MIS. The system functions as the centralized data-pool and JDF-controller. A seamless integration of business and prepress production processes is realized through JDF/JMF connectivity between the Hiflex MIS and the Kodak Prinergy Workflow System.

Our workflow after the implementation of automation technology highly improved efficiency as it is characterized by enhanced transparency and flexibility. Due to the digital instructions as well as the broadness the information is coming back into the system, administrative processes have become streamlined and errors reduced. Implementation of process automation helped us to realize considerable time and cost savings and significantly improve customer responsiveness.

*** Resulting Workflow in more Detail ***

On order entry in Hiflex, the Hiflex System automatically creates a job in Prinergy and the relevant data is passed via JDF. Redundant manual data entry in prepress is overcome. Any modification of the order is entered in Hiflex and then transferred to Kodak Prinergy where jobs are automatically updated.

Moreover, relevant technical job data (e.g. time values for production, format, colors etc.) is automatically exported to the Hiflex Scheduling application (JDF Controller) on order entry. Today, exposed plates are reported via Kodak-Hiflex JMF link and automatically displayed on the scheduler’s digital planning board. Planning has become faster and much more accurate. Precise time values for every sheet and signature are transferred from the technical estimate to the scheduling. The scheduler can manually change the priority of the jobs on the digital planning board according to both job status and capacity.

Using the current Prinergy System, a significant time gain has been realized by the elimination of the manual tasks that took place prior to our current system. Previously, too much time was spent performing material and time tracking activities. Prepress is one of the most difficult departments to track time since so much of the operators time is spent multi-tasking. What we are experiencing now is our Prinergy System is automatically reporting material consumption, produced page proofs, form proofs, and exposed plates, as well as our prepress operators entering the labor time consumed to perform the task. Hiflex can track both at once, whereas material consumption and cost center times are automatically booked against the job.

Additionally, author and proof reader corrections, as well as explanatory information (whether the correction is chargeable or not) is entered in the Kodak Prinergy Workflow System. These comments are passed in real-time to the Hiflex order book, where they are automatically displayed. Automatic transfer of information concerning house corrections (error costs) as well as chargeable and non-chargeable authors’ corrections makes the tracking of costs for invoicing easier and more reliable.
Biggest improvement in efficiency and customer responsiveness as a result of process automation

The real-time JDF/JMF interface between Prinergy and Hiflex improved customer responsiveness, because the CSR’s job information is always up-to-date and he can immediately answer customers’ questions regarding the job status and (extra) costs.

A further valuable advancement was the ability to completely eliminate the paper job tickets from our workflow. 100% of our job tickets now reside, electronically, within our Hiflex System. This provides all personnel in front of workstation immediate and up-to-dated job ticket information. This has been a life saver as far as change orders. We can update a job ticket with new instructions and have that information immediately distributed throughout the shop.

The printed job envelope no longer contains any technical specifications or instructions. The only information we pull from the electronic job ticket and print on the job bag is the docket number, client name and basic job description (just an identifier). It has been an amazing transformation since going to this method of job ticketing.

If historic information about former orders is needed, the consistent data handling through single entry of data enables reliable database searching. With our improved system, repeat orders are now brought up on screen, costing is checked, the job is electronically initiated and the new job ticket is electronically produced. For us the efficiency gains are ten-fold.

As with our JDF prepress advantages, we have also just begun to realize, and begin to take advantage of the reporting capabilities within the Hiflex System. Once I understood the reporting capabilities and began to create my own reports, I found it difficult to walk away and leave for the night . . . I couldn’t get enough.

Shop Floor Data Collection for Kodak operators in prepress is not necessary anymore. The information flows into Hiflex through JDF/JMF Messaging. This is reliable and accurate information. Prior to this our
employees tended to wait until the end of the day and fill out their time sheets from memory. In effect also our invoicing has proven to be more accurate and much quicker now.

The online JDF/JMF tracking also reduced the time required for my small meetings. All of the various personnel within the company now have immediate access to the live and up-to-date information they need. It is now a “pro-active” approach to managing production.

A further beneficial workflow change concerns prepress-postpress interaction. Our new JDF-enabled guillotine cutter has allowed us to eliminate the manual task of ruling out the press sheet and create the cutting program. Now that this information is immediately available via JDF, we have been able to save 25 minutes on all jobs that utilize this piece of equipment.

Photo showing the cutting program after it has been transferred to the Heidelberg Polar Cutter 137XT
Section VI. Biggest improvement in efficiency and customer responsiveness as a result of process automation — Please provide a quantitative analysis of the hard and soft ROI factors expected and realized, to include breakeven analysis, IRR or NPV determination of hard factors and testimonial evidence from users or customers as to the realization of soft benefits.

*** Benefits ***

In Summary, Ampersand benefits from the following effects of the JDF project:

- Turnover increase of 34.78% in the first period after implementation
- Automatic Job Create in Prinergy
- Automatic load of Preps imposition schemas based on JDF StrippingParams
- Better access to archived jobs / very fast search and response times
- Automatic booking of material consumption
- Prepress progress visual for the CSR
- Up-to-the-minute plate status for the scheduler
- Tracking of authors’ and house corrections
- Seamless and accurate billing process
- Inventory checks of plates no longer show any discrepancies.
- Tight integration of the customer into the prepress workflow
- Automatic processing of received files
- No unnecessary correction cycles / clear job content
- Increase of sold productivity on the presses due to ameliorated transparency and flexibility
- Automatic, accurate creation of cutting program (dramatic reduction in make-ready)

Currently we see the largest potential for efficiency gains in the prepress department. The automation benefits utilized from both Hiflex and Prinergy, paired with the ability to integrate the two systems has placed us light years from where we were prior to our process efficiency enhancements. Moreover, efficiency enhancements we already reached had a positive impact on customer responsiveness.

The truly exciting part is the fact that we have only scratched the surface and are just beginning to realize the true benefits of this level of integrated automation. Within a year we expect to be have made another giant step in automating our processes.

Increase in productivity (C)

Automating our production and communication processes led to a turnover increase of 34.78% in the first period after implementation (turnover in 2005 CAD 2,300,000,-- and in 2006 CAD 3,100,000,--).

Process automation increased transparency and flexibility within the prepress department. This positively influenced the production schedule, and we realized an increase in productive hours (print run hours) on the presses of +5% in the first period (2006 compared to 2005). The extra productive hours multiplied with the hourly cost rate of the respective machines led to an increase in added value. The direct costs are subtracted and the calculated increase in sold productivity is CAD 45,122.89. Since JDF connectivity
Biggest improvement in efficiency and customer responsiveness as a result of process automation

started in April 2006 the effect of increased production output for 2006 is calculated for the relevant period (April-Dec 2006 = increase of 3.75% \( \rightarrow \) CAD 33,842.17).

This is empirical and proven data for 2006. For the periods 2007, 2008, 2009 and 2010 the assumption was made that the increase in productivity and the direct costs will stay unchanged (increase compared to 2006 of + 0%).

**Reduced Costs (D)**

The integration of prepress led to cost reductions in the field of prepress operations:

1. **Automatic job creation in Kodak Prinergy:**

Time savings of 5 minutes per manual job creation in Prinergy are multiplied with the number of prepress jobs per year. In 2006 there were 1500 prepress jobs, but since JDF link started in April only 9/12 of these jobs are accounted for. For the years 2007 till 2010 the assumption was made that the number of jobs will increase by 20% per year (so in 2007 1800 jobs). The job creation runs automatically and the amount of jobs processed is no bottleneck factor, so that the calculated increase of the jobs will not require any additional resources in the future.

2. **Automated Stripping in Kodak Workflow:**

Due to automatic stripping the prepress operator saves 30 minutes per automated jobs:

Working with automatic stripping in prepress started in February 2007. Today we produce 30% of our prepress jobs via automatic stripping / JDF. This number is expected to grow as we refine our processes. For the remaining months in 2007 we calculated that 30% of all prepress jobs will be automatically produced this way (for 2008 50%, for 2009 75% and for 2010 90%). ROI calculation: number of automated jobs x 30 minutes saving x hourly cost rate of prepress operator (CAD 100.--).

3. **Automatic cost booking:**

30 minutes time savings for prepress operators per day in Shop Floor Data Collection.

With an internal hourly cost rate for a prepress operator of CAD 100.-- (including all direct and indirect costs) the cost savings sum up to CAD 12,500.-- per year (since JDF connectivity to Kodak started in April 2006 the actual sum for 2006 is CAD 9,375.-- (CAD 12,500.-- x 9/12).

4. **Online plates inventory:**

5 hours time savings per month for monthly stock-taking of plates due to automatic JDF/JMF bookings. The savings sum up to CAD 6,000.-- per year (for 2006 CAD 4,500.--).

5. **Link to cutter**

25 minutes savings in make-ready per job that utilizes our JDF-enabled guillotine cutter multiplied with an hourly rate of CAD 100.--.

Approximately 70% of the prepress jobs will go through cutting. Often one prepress job consists of more than one specific signature (e.g. cover and text with different geometries). However, this was not taken into account (so calculation is moderate).

Since the cutter was integrated in September 2006 the number of jobs taken into account for 2006 is only 350. In 2007 the number of jobs is calculated with 1260 (70% of 1800 prepress jobs). For the following years the jobs will increase (just as in prepress) by 20% per year. The calculation of the cutting program runs automatically and the amount of jobs processed is no bottleneck factor, so that the calculated increase of the jobs will not require any additional resources in the future.
Avoided costs (E)

1. Wage bill reduction (1 person)

Efficiency gains that are related to our JDF implementation led to wage bill reduction of the costs for one person through enhanced transparency and flexibility. This “person” is the sum of savings realized by several employees: the CSR (who has better tracking possibilities), administration person in the invoicing department (faster and easier invoicing due to reliable and accurate costing), and the Scheduler (better planning possibilities due to a better view of JDF/JMF production statuses).

Savings are 250 days/year x 8 hrs/day x CAD 100.-- hourly cost rate (including all direct and indirect costs) = CAD 200,000.--. As JDF connectivity started in April 2006, the savings for 2006 were calculated CAD 200,000.-- x 9/12 = CAD 150,000.--.

*** Costs ***

One time costs (I)

Hiflex always comes as a company license for all modules on an unlimited number of workstations. However, the license costs for Hiflex Scheduling, JDF and Shop Floor Data Collection were proportionally calculated and training and installation were taken into account. The one time costs listing also includes the Prinergy Business Link license, training, installation, hardware, and internal startup costs. For the integration of the cutter, except for IT ancillary infrastructure costs, no extra expenses had to be made because the machine as such brought the necessary conditions for networking. The setup was done with internal resources and is comprised in the internal startup costs.

Recurring costs (J)

The recurring costs comprise the proportional Hiflex recurring fee (for license and maintenance) for the Hiflex modules Scheduling, JDF and Shop Floor Data Collection as well as internal IT maintenance.

*** Calculation (ROI, NPV, IRR) ***

The Return On Investment (ROI) of the JDF implementation at Ampersand was 1815.8% within five years (which means that the investment is paid back 19.15 times). The Net Present Value (NPV) is CAD 1,527,940.39 which equals an Internal Rate of Return (IRR) of 917.3%.

Since the implementation was carried out in April 2006 the calculation is not based on ideal assumptions but on empirical data taken from 2006.

Although one period (2006) has already passed, all periods are discounted with a rate of return of 6%. The rate of return is the expected reward investors demand for investing in the project rather than carrying out alternative investments. The rate of return is often referred to as the discount, interest, hurdle rate, or company cost of capital. Without this consideration the ROI would be even higher.
Biggest improvement in efficiency and customer responsiveness as a result of process automation

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<th>Periods</th>
<th>Investment</th>
<th>2006</th>
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<td>$398,622.89</td>
<td>$458,022.89</td>
<td>$520,230.89</td>
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</tr>
<tr>
<td>G Cumulative benefits</td>
<td>$221,675.50</td>
<td>$577,548.39</td>
<td>$976,171.29</td>
<td>$1,434,194.18</td>
<td>$1,954,425.07</td>
<td></td>
</tr>
<tr>
<td>H Discounted annual benefits = PV(F)</td>
<td>$209,127.83</td>
<td>$316,725.61</td>
<td>$334,691.47</td>
<td>$362,797.03</td>
<td>$388,746.79</td>
<td></td>
</tr>
<tr>
<td>3 - COSTS</td>
<td></td>
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<tr>
<td>I One time costs</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>License Hiflex Scheduling, JDF and SFDC</td>
<td>$11,250.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Training Hiflex 1 day</td>
<td>$1,750.00</td>
<td></td>
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</tr>
<tr>
<td>Installation Hiflex 4 days</td>
<td>$6,800.00</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>License Prinergy Business Link</td>
<td>$21,600.00</td>
<td></td>
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<tr>
<td>Training Prinergy Business Link</td>
<td>$2,800.00</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Internal Startup-costs (3 weeks)</td>
<td>$12,000.00</td>
<td></td>
<td></td>
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<tr>
<td>IT ancillary infrastructure costs</td>
<td>$1,000.00</td>
<td></td>
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<tr>
<td>J Recurring costs</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hiflex recurring fee on license and maintenance</td>
<td>$900.00</td>
<td></td>
<td></td>
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<tr>
<td>Internal IT maintenance (60 hours)</td>
<td>$6,000.00</td>
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</tr>
<tr>
<td>K Annual costs = (I+J)</td>
<td>$19,800.00</td>
<td>$44,300.00</td>
<td>$6,900.00</td>
<td>$6,900.00</td>
<td>$6,900.00</td>
<td></td>
</tr>
<tr>
<td>L Cumulative costs</td>
<td>$19,800.00</td>
<td>$64,100.00</td>
<td>$71,000.00</td>
<td>$77,900.00</td>
<td>$84,800.00</td>
<td></td>
</tr>
<tr>
<td>M Discounted annual costs = PV(K)</td>
<td>$19,800.00</td>
<td>$41,792.45</td>
<td>$6,140.98</td>
<td>$5,793.37</td>
<td>$5,465.45</td>
<td></td>
</tr>
</tbody>
</table>

NET VALUE

| N Annual net value = (F-K) | -$19,800.00 | $177,375.50 | $348,972.89 | $391,722.89 | $451,122.89 | $513,330.89 |
| O Cumulative total | -$19,800.00 | $157,575.50 | $506,548.39 | $898,271.29 | $1,349,394.18 | $1,862,725.07 |
| P Discounted annual value = PV(N) | -$19,800.00 | $167,335.38 | $310,584.63 | $328,898.09 | $357,331.58 | $383,590.70 |
| ROI per Year = F/K | -100,0% | 400,4% | 5057,6% | 5677,1% | 6538,0% | 7439,6% |
| ROI Present Value = SUM(H)/SUM(M) | 1815,8% |

NET PRESENT VALUE

| Q Net Present Value (SUM(P)) | $1,527,940,39 |

INTERNAL RATE OF RETURN

| R IRR (Internal Rate of Return) | 917,3% |
**Return on Investment**

The term Return on Investment (ROI) is frequently used in different ways. In financial circles, the strict meaning of Return on Investment (ROI) is Return on Invested Capital, a measure of company performance: the company's total capital is divided into the company's income (before interest, taxes, or dividends are subtracted).

Most business people use "ROI" simply to mean the "Return" (incremental gain) from an action, divided by the cost of that action. In this sense, an investment that costs $100 and pays back $150 after a short period of time has a 50% ROI. This is exactly how it is used in the financial analysis of Ampersand’s JDF project.

**Net Cash Flow (can be found in the line 'Annual Net Value' (N))**

Cash flow, like income, focuses on the difference between money coming in and money going out over a time period. (Net Cash Flow = Cash Inflows - Cash Outflows). Cash flow results do not include some items found in the income statement, such as depreciation expense. Depreciation expense, for example, does not represent an actual cash payment during the reporting period, but rather an accounting charge against earnings. As a result, depreciation expense is not a "cash outflow" in the above financial analysis.

**Discounted Cash Flow (DCF) (can be found in the line 'Discounted annual value' (P))**

The DCF is a cash flow summary that has been adjusted to reflect the time value of money. It is an important criterion in evaluating or comparing investments or purchases. All things being equal, the purchase or investment associated with the larger DCF is the better decision. DCF makes use of the Present Value concept, the idea that money you have now should be valued more than an identical amount you would receive in the future. Why? The money you have now could (in principle) be invested now and gain return or interest, between now and the future time (interest rate used in the above financial analysis is 8%, (A)). Money you will not have until some future time cannot be used now. Therefore, the future money's value is Discounted in financial evaluation, to reflect its lesser value. What that future money is worth today is called its "Present Value".

**Net Present Value (can be found in the line 'Net Present Value' (Q))**

The net present value is a form of calculating discounted cash flow. It encompasses the process of calculating the discount of a series of amounts of cash at future dates, and summing them. Therefore the height of the net present value is depending on the length of the period for the project financial analysis. The period which we have chosen for the financial analysis of Ampersand’s JDF project is five years.

**Internal Rate of Return (IRR)**

The IRR for an investment is the discount rate for which the total present value of future cash flows equals the cost of the investment. It is the interest rate that produces a 0 NPV. Another way to think of IRR is this: IRR tells you just how high interest rates would have to go in order to "wipe out" the value of this investment. Like DCF, the IRR is a cash flow summary that has been adjusted to reflect the time value of money. The IRR view of the cash flow stream is essentially an investment view: money will be paid out in order to bring in gains. The higher an investment's IRR, the better the investment's return relative to its cost and the lower the risk.