2005 CIPPI Award Honorable Mention

Best cost/benefit realization as a result of process automation implementation

Druckhaus Berlin-Mitte GmbH (DBM)

Druckhaus Berlin-Mitte GmbH (DBM), Berlin, Germanuy. Submitted by Stefan Reichhart, CEO at Hiflex.

Products incorporated: MAN Roland Druckmaschinen AG press equipped with PECOM system, including MAN Roland 700 (two units, 74x104 cm), MAN Roland 900 (one unit, 100x140 cm) and Hiflex MIS System.

Background: End of 2002 DBM introduced Hiflex Scheduling (JDF Controller) and Hiflex Shop Floor Data Collection (= Production Data Collection, Hiflex PDC). The MAN Roland presses were updated with the PECOM system and in February 2003, JDF connectivity between the Hiflex MIS and the MAN Roland presses was installed.

DBM's JDF implementation was the world's first JDF workflow to work in live production conditions, thus ushering in a new era of JDF connectivity.

DBM's workflow prior to the JDF implementation — Prior to implementation of the JDF workflow, the production data had to be processed four times in order to be passed from the order processing system into the printing press. The customer order was specified and estimated in the Hiflex MIS which also generated the job ticket (first data processing), the job was re-keyed into an internally-developed planning tool and the production hours were entered manually (second data processing). In peak times, DBM used a manual planning board to visualize production load. Therefore paper stripes where manually cut and labeled (third data processing). When the job arrived at the press, the machine operator had to manually key in the relevant job specifications (format, paper thickness etc.) from the job ticket into the control console (fourth data processing).

Consequently, multiple data entry occurred. Moreover, the isolation of the different systems made job planning and scheduling untimely and lacked the flexibility to enhance efficiency and allow adequate reactions to unexpected events.

The prior workflow in detail — After creating an estimate, the customer order was entered in the Hiflex MIS order book by the CSR (customer service representative). He then generated a printout of the job ticket which contains all the relevant production data from the technical estimate and forwarded it to the scheduler. For scheduling, the customer used an internally-developed tool that had no interface to the order processing system; therefore, all job data had to be re-keyed. The required production times for the scheduled capacities were guessed based on the print quantity. The scheduling tool generated a listing of queued jobs without any graphical view.

Communication of customers' approvals between the CSR and the scheduler was particularly problematic. There were two meetings per day (one in the morning at 9:00 a.m. [30 minutes] and one in the afternoons at 3:00 p.m. [20 minutes]) with the scheduler, all CSRs, all heads of departments (altogether 10 people, equating to 7 man-hours per day). Normally the customers' approvals were (if not ad hoc) communicated during these meetings. This procedure delayed the communication of the approval and consequently the earliest possible starting time for production. Since the delivery deadline stayed unchanged, the time frame left for production was shortened. This led to ad hoc production decisions. Fairly frequently live production had to be interrupted in order to start with an urgent job that had already been approved by the customer hours earlier (but not yet communicated to the production schedule).

In peak periods, the jobs were organized on a pegboard. Stripes for each print job were tailored to match the adequate production timeline and were labeled with order name and number, customer name, format, inks and delivery deadline. Modifications at short notice (as pointed out above) made it necessary to manually re-arrange the jobs on the pegboard.

Not only did unnecessary make-readies (caused by ad-hoc production decisions) shorten valuable production time, but the make-ready process itself was slow because the machine settings could not be loaded from an existing database.

Manual time sheets were kept as well as manual logs of consumed material and produced quantities. At the end of each shift, the time sheets were collected and checked by the head of the department, who then forwarded them to the accounting department. This forwarding happened two or three times per day and production data was entered into Hiflex job costing system at least one day in arrears.

As production planning was not synchronized with any shop floor data collection, this workflow lacked flexibility and transparency to run production optimally. Only retrospective analysis of production data was possible and the (short-term) planning horizon was reduced.

In the event of customer inquiries about the job status, the CSR first had to check with the prepress or press department before he could give detailed answers. As the CSR had to make phone calls or take a tour through the company in order to get hold of the "right" person, gathering relevant information was a time- and cost-consuming process.

Objectives: DBM's goal in implementing JDF/JMF connectivity between the Hiflex MIS and the MAN Roland press machine was to greatly improve efficiency in the area of order processing as well as production planning and processing and, thus, make significant time and cost savings. Investments in an integrated workflow solution was made in order to improve process automation, which would improve transparency and flexibility.

In particular, DBM wanted to eliminate the re-keying of job specifications that were already available in the Hiflex MIS, and to streamline the flow of relevant production data from the MIS (through scheduling) to the press.

Last but not least, the project's aim was to optimize communication within the production process; to significantly reduce non-productive time required for production discussions and ad hoc changes to the schedule; as well as to generally reduce make-ready times. They therefore looked for a solution that would provide them with the highest possible degree of transparency and flexibility within the production process. Communication processes should be standardized and also organized in such a way, that relevant information concerning the production plan can be accessed by anybody involved in production.

Druckhaus Berlin Mitte aimed at a return on their investment after 2 years. In the lifecycle of the investment (5 years were calculated) the investment should have paid back twice (= ROI of 100%). The Net Present Value (NPV) was estimated with EUR 180,000.-- (discounted with 8%) which equals an Internal Rate of Return (IRR) of 50%.

Methodology: General Manager of DBM Herbert Preissler states: "When it comes to process automation, JDF was the industry standard we were waiting for. For the integration of our production process, our prime objective was to use the best and most advanced technology in the market to gain more transparency into production status and to increase productivity on press."

DBM was absolutely convinced of the efficiency of JDF-technology. They implemented the world's first JDF workflow to work in live production conditions, thus ushering in a new era of JDF connectivity.

Regarding an ERP system (MIS), Herbert Preissler had thought about SAP as an alternative. But as this software was not developed specifically for the graphic arts industry, they decided to implement the Hiflex MIS which manages all business processes within the printing industry.

With the open-standard, job-ticket format JDF, DBM selected a solution, that reliably streamlines information exchange between the different systems and departments. The MIS enables the integration of administrative and technical workflows, whereas JDF/JMF ensures maximum possible portability between the different platforms.

DBM went for a sustainable solution that allows the seamless future integration of further systems and applications, thus providing the basis to constantly proceed with Computer Integrated Manufacturing (CIM). In this area it was again an important factor that the open standard JDF allows a standardized, cross-vendor communication between the different systems that have implemented JDF, especially the PrintNet PECOM System of MAN Roland.

Implementation Story: The JDF implementation at Druckhaus Berlin-Mitte started in February 2003 and progressed in several steps. Today (April 2005), Druckhaus Berlin-Mitte profits from an integrated workflow between the Hiflex MIS and the MAN Roland presses.

Installation of the Hiflex MIS:
Participants — Druckhaus Berlin-Mitte and Hiflex (Development Department)
Start: November 2002
Installation of Hiflex Scheduling and Hiflex Production Data Collection (Hiflex PDC). Hiflex Scheduling (JDF controller) handles the fully automatic planning for each cost center according to deadlines or priorities. Hiflex PDC is used for decentralized Shop Floor Data Collection.

JDF connectivity to the PECOM system of the MAN Roland presses:

Participants — Druckhaus Berlin-Mitte, Hiflex (Development Department), and MAN Roland (Product Management Department)

Step 1: JDF connectivity between Hiflex MIS and MAN Roland Presses
Start: February 2003
PECOM JDF Prototype (no version number)
Communication method: hot folder system

Implementation of the JDF connectivity between the MIS and the PECOM system of the MAN Roland presses. Automatic 'Job Create' in the PECOM system. The PECOM control systems received job information (e.g. customer name, job number, product designation) and relevant printing parameters (format, paper, length of run, number of plates and inks) via JDF from the Hiflex MIS.

Step 2: Using JDF data for automated technical presetting
Start: March 2004
PECOM v. A006B2
Communication method: hot folder system

The JDF data (as described in Step 1) is used inside the PECOM system to search the internal PECOM database for similar archived jobs in order to re-use technical presettings which are not included in the JDF (e.g. for the air gliders, water, etc.). A list is displayed and the user can select the job from which the settings should be retrieved. The original JDF data remains unmodified.

Step 3: Update of the JDF connectivity between Hiflex MIS and Press
Start: April 2005
PECOM v. A007A1
Communication method: HTTP
Shift of communication method from hot folder system to HTTP.
JMF feedback from the PECOM system is fed into the MIS. Production data such as:

- Progress on the job (in percent)
- Good sheets and waste
- Speed
- Status of the machine (e.g. idle, set up, preparing, washing, production in progress)

This data is automatically transferred into Hiflex Production Data Collection and/or Hiflex Scheduling. Next steps will be the integration of other vendors' printing machines and the finishing operations into the system so that all jobs can be completely controlled via JDF/JMF. Moreover, DBM is planning to integrate a JDF interface between the Hiflex MIS and their prepress PDF-Workflow-System (including automatic imposition).

Resulting Workflow/Process: The diagram of the resulting, integrated workflow illustrates the data exchange between the Hiflex MIS and the production at DBM:

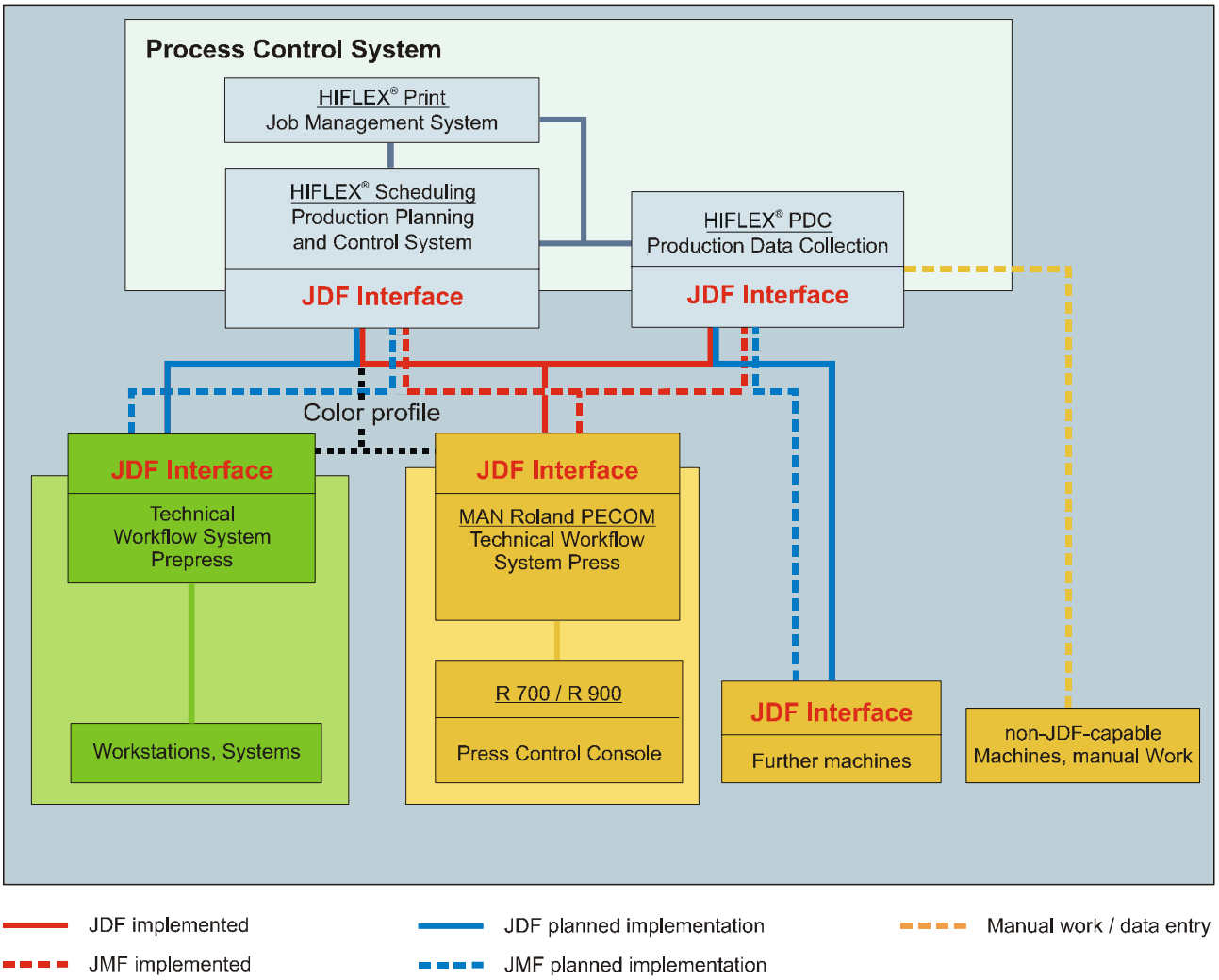

Figure 1: Illustration of the data exchange between the Hiflex MIS and production via JDF/JMF at DBM (Hiflex / Euprima networking model).

DBM's resulting workflow after JDF implementation — The information flow from the administration system (Hiflex MIS) into production (and finally to the press) is now a fully integrated, cross-vendor solution. Production data only has to be entered once and subsequent systems are provided with necessary job specifications. The process of scheduling is improved by enhanced accuracy and a higher degree of flexibility. The scheduling is constantly kept up-to-date by the online feedback from production. Therefore DBM profits from a profound visibility into the production process, which provides them with the prerequisites for an extended planning horizon. At the same time the internal communication process regarding approvals, production meetings and job tracking has been revolutionized.

Resulting workflow in detail — Upon order entry relevant technical job data (e.g. time values for production, format, colors etc.) are automatically exported to the Hiflex Scheduling application (JDF Controller). Precise time values for every sheet and signature are transferred from the technical estimate to the scheduling. Planning has become much more accurate.

The system uses an elaborate sorting algorithm to cope with delivery times and solve possible planning conflicts. On the electronic spread board the jobs are displayed minute-wise. In order to find the optimal production plan the scheduler can define priorities and access technical criteria to achieve convoy planning (e.g. grouping together jobs with identical formats). DBM has dispersed with a full time scheduler. Today the person responsible for scheduling is the head of binding department.

The CSR enters customer approvals immediately after notification into the Hiflex Scheduling application. For this he has access to a sub window of the Scheduling application where all customer approvals are marked out on the planning board (without delay). Apart from the approvals, the CSR also enters further information about shipment or external work which provides a accurate overview of the actions to be done.

Due to the fact that the customer approval status is forwarded to the schedule immediately, the production window between approval and delivery has widened. This results in more prompt and flexible planning and avoids production interruptions caused by ad hoc planning decisions.

Production meetings have been greatly reduced. The production plan itself is no longer the subject of the discussions. Instead, the meetings deal with the communication of job details. The early morning production discussion has been reduced from 30 to 10 minutes. Normally the afternoon meeting is canceled or reduced to five minutes (previously 20 minutes). Today the production meetings involve only half of the prior members of staff. A saving of 7 man-hours per day.

The Hiflex Scheduling application not only manages the planning of the production sequence but also acts as a JDF controller. Just before printing, the scheduler sends job parameters to the PECOM system via JDF. The PECOM system receives all administrative data (order name, order number, production date, delivery date, customer name) and technical data (name of printing sheet, format, press run, paper name, weight, grain, thickness, number and names of colors). Manual entry of job data in PECOM is no longer required. This saves time as well as resources and generates precise and matching data in the PECOM system (MAN Roland) for the job ticket (Hiflex).

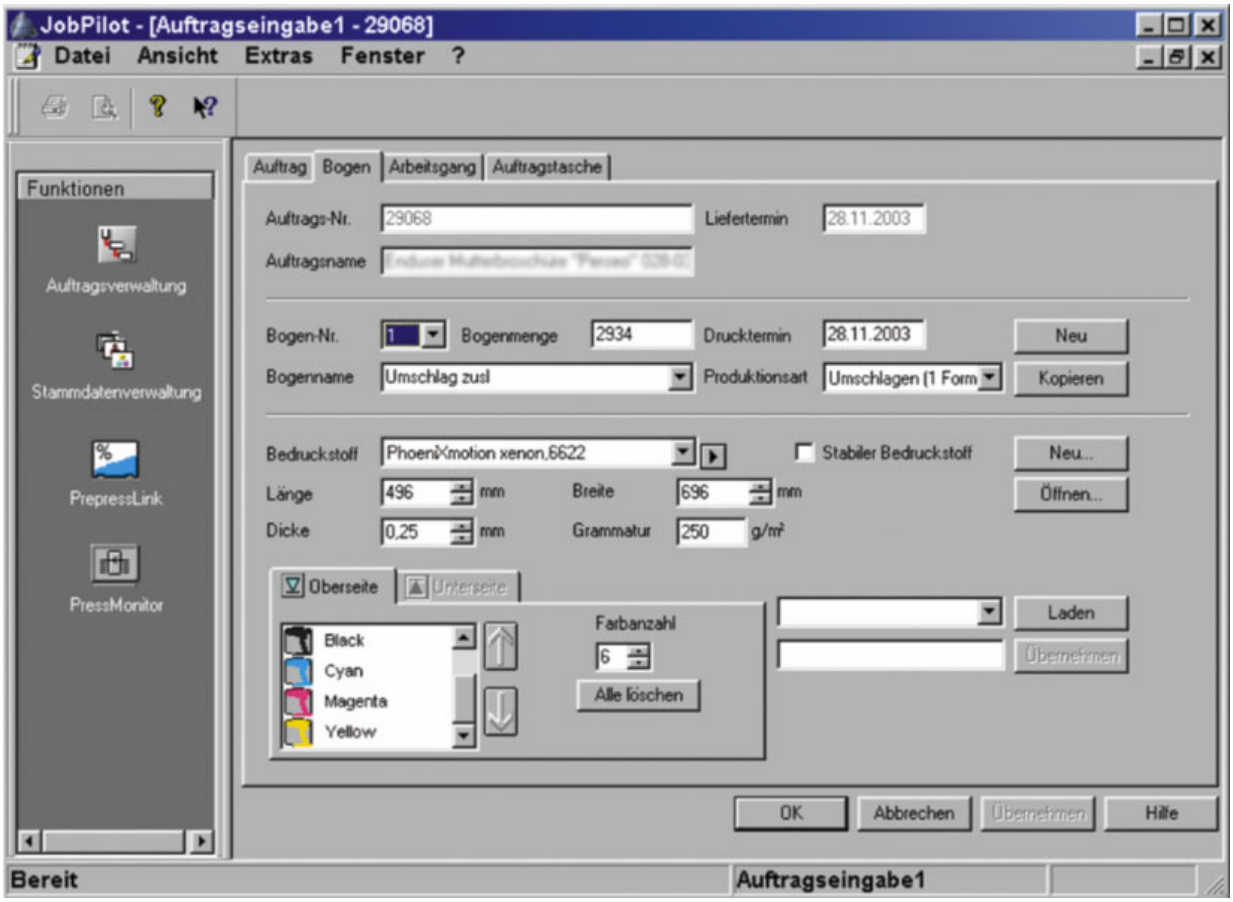

Figure 2: Screenshot from PECOM which shows the printing sheet information, as received from Hiflex Scheduling via JDF.

The JDF-data received by the PECOM system triggers a special PECOM function: automatic technical presetting. The PECOM system takes the received JDF-data and compares it with data in archived jobs stored in a PECOM-integrated database. It then proposes a similar archived job from which to take the technical presets (e.g. settings for the air gliders, ventilators, water). This data is then imported into the JDF-created job without modifying the original JDF data and without any manual intervention by the operator.

Data about production times and working hours are directly entered into the Hiflex Production Data Collection System (Hiflex PDC). Via JMF-feedback, event information from the presses (machine status, speed, produced good sheets, waste and job progress) flow in real-time into the Hiflex PDC and/or the Hiflex Scheduling application. Therefore, the planning system is constantly up-to-date with production.

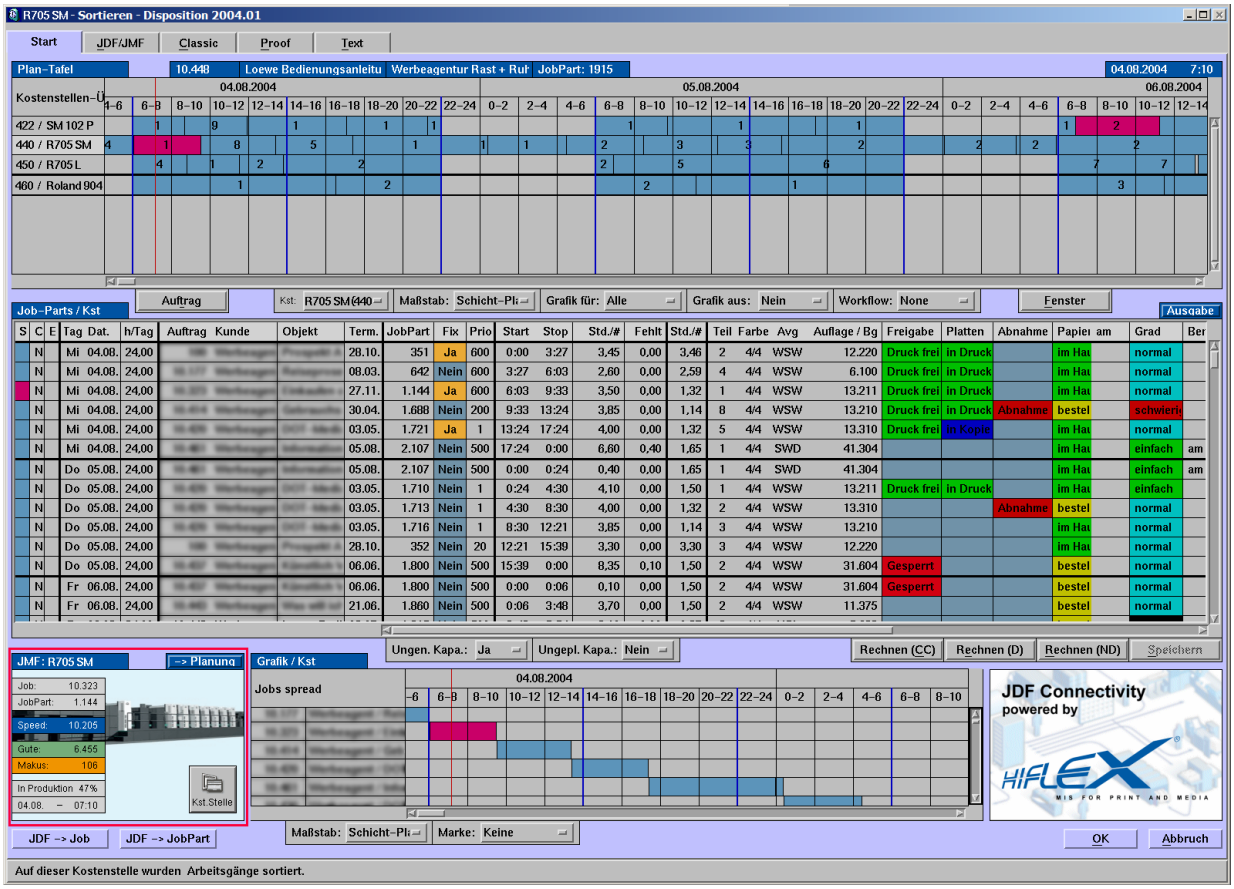

Figure 3: Screenshot from Hiflex Scheduling (digital planning board) which displays the planning of the job sequence and acts as a JDF controller at the same time. In the bottom left-hand corner, machine data is displayed which is fed back via JDF/JMF.

Now that the job status is constantly updated in the Hiflex MIS, the CSR can call-up the job status at any time. This is beneficial when customers call about the job status or modification of running jobs. In the latter case the CSR has to check if the desired modification can still be processed or if the job status is already too advanced. Whenever, or for whatever reason, the CSR wants to check on the status, it can be displayed at the push of a button. He can answer the customer's questions without having to consult other departments, without leaving his office or having to call back once he has found the right person.

Best cost/benefit realization as a result of process automation implementation: The Return On Investment (ROI) of the JDF implementation at Druckhaus Berlin Mitte was 991,9 % within five years (which means that the investment is paid back 10.91 times). The Net Present Value (NPV) is EUR 1,595,626.-- or US$ 2,027,881.-- which equals an Internal Rate of Return (IRR) of 236%.

Since the implementation was made in February 2003 the calculation is not based on ideal assumptions but on empirical data taken from 2002, 2003 and 2004.

The figures calculated for this project (ROI, NPV and IRR) should serve as a realistic example for decision makers who are in the course of evaluating costs and benefits of a possible JDF implementation for their graphic arts companies. When reading these results, two factors have to be taken into consideration:

(1) The prices used in the financial calculation are the list prices. This means that the costs are comparable a similar investment made today. As Druckhaus Berlin Mitte was an early adopter of JDF technology (first ever JDF live installation) and profited from special discounts on software, installation and training, the actual prices paid by Druckhaus Berlin Mitte are lower and thus the ROI is actually higher (because of the lower costs).

(2) Although two periods (2003 and 2004) are already passed, all periods are discounted with a rate of return of 8%. The rate of return is the expected reward that 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.

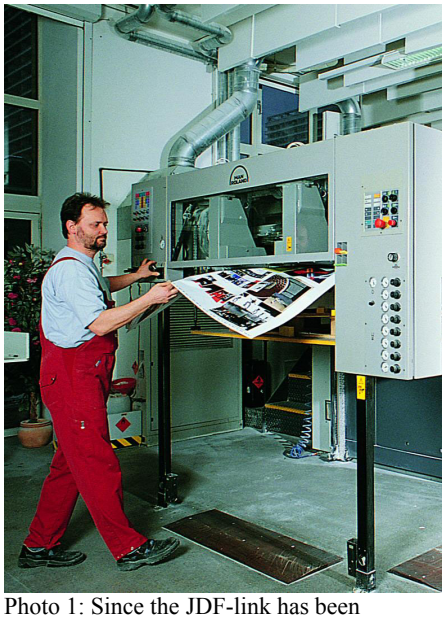

Photo 1: Since the JDF-link has been installed, more sheets per day are produced on the four-color MAN Roland 900

Photo 2: JDF-connected MAN Roland 700

The Benefits:

Increase in sold productivity (C) — The direct effects of the JDF connectivity project was an increase of productive hours (print run hours) in the first period of +3% (2002 compared to 2003) and another +17% in the following period (2003 compared to 2004) summing up to a total of +20% (2002 compared to 2004). The extra productive hours multiplied with the hourly cost rate of the respective machines lead to the increase in added value. The direct costs associated with the increase in added value are subtracted. This figure is also cross-checked with the increase of the net profit before taxes (which was taken from the company's profit and loss statement) which reports the same value. For 2003 and 2004 this is empirical and proven data.
For the periods 2005, 2006 and 2007 the assumption was made that the number of productive hours and the direct costs will stay unchanged (increase compared to 2004 of + 0%).

Reduced production meetings (D) — With process automation via JDF/JMF, DBM succeeded in optimized communication processes within the production process and significantly reduced non-productive time. These cost savings have been achieved by avoiding unnecessary production meetings. The improvements are described below in detail:

- Morning-meetings have been reduced from 30 minutes to 10 minutes. Afternoon-meetings (if they take place at all) have been reduced from 20 minutes to 5 minutes. Detailed discussions on the production plan are no longer required, instead meetings deal with the exchange of "soft-facts" related to the jobs which might lead to a certain fine-tuning in the schedule.
- Production meetings in general need less personnel than before. With the introduction of the digital planning board, the scheduler's function is now carried out by the head of binding department. In case of her absence, the head of the press department is involved. This is possible, because both have been relieved from administrational works since process automation has been implemented.

With an internal hourly cost rate for a CSR of EUR 50.-- (including all direct and indirect costs) the costs of the production meetings prior to the JDF implementation equate to EUR 91,667.-- per year (10 people x (30 minutes + 20 minutes) x 220 days x EUR 50.--) while the costs after the implementation are EUR 13,750.-- per year (5 people x (10 minutes + 5 minutes) x 220 days x EUR 50.--). A saving is EUR 77,917.-- per year.

Wage bill reduction (E) — Herbert Preissler sums up the benefit of the process automation implementation as follows: "We save time and money thanks to the JDF/JMF connectivity between the Hiflex MIS and our MAN Roland presses. It enhanced transparency and flexibility throughout the entire production process and increased our production by 20 percent. The costs of production meetings were dramatically lowered and moreover, our wage bill was reduced by one and a half people, one in the area of scheduling and a half through savings in re-keying of job data."

Since the person occupied with re-keying of the job data has a lower internal hourly cost rate (EUR 30.--) than the scheduler (EUR 50.--) the saving related to the wage bill reduction (including all direct and indirect costs) is EUR 117,000.-- (220 days x 8 hours x EUR 50.-- + 220 days x 4 hours x EUR 30.--).

The Costs:

One time costs (I) — Hiflex always comes as a company license for all modules on an unlimited number of workstations. Because of this model Druckhaus Berlin Mitte already possessed the license for Hiflex Scheduling, JDF and Production Data Collection. Nevertheless the license costs for the necessary modules were proportionally calculated and taken into account as if an investment would have been necessary. The one time costs listing also includes the PECOM licenses, three client licenses, training, installation, hardware, necessary machine updates, internal startup costs and ancillary IT infrastructure costs.

Recurring costs (J) — The recurring costs comprise the proportional Hiflex recurring fee (for license and maintenance) for the Hiflex modules Scheduling, JDF and Production Data Collection as well as external services and internal IT maintenance.

The Calculation (ROI, NPV, IRR) —

Periods		Investment	2003	2004	2005	2006	2007
1 - DISCOUNT RATE							
A Discount rate (expected Rate of Return)	8%						
B Discount factor		1,000	0,926	0,857	0,794	0,735	0,681
2 - BENEFITS							
C Increased added value							
Increase in sold production							
(Increase of added value minus direct costs)			€ 38.157	€ 307.461	€ 307.461	€ 307.461	€ 307.461
D Reduced costs							
Reduced production meetings			€ 77.917	€ 77.917	€ 77.917	€ 77.917	€ 77.917
E Avoided costs							
Wage bill reduction (1,5 persons)			€ 117.000	€ 117.000	€ 117.000	€ 117.000	€ 117.000
F Annual benefits (**C**+**D**+**E**)			€ 233.074	€ 502.378	€ 502.378	€ 502.378	€ 502.378
G Cumulative benefits			€ 233.074	€ 735.451	€ 1.237.829	€ 1.740.207	€ 2.242.584
H Discounted annual benefits = PV(**F**)			€ 215.809	€ 430.708	€ 398.804	€ 369.263	€ 341.910

3 - COSTS						
I One time costs						
License Hiflex Scheduling, JDF and PDC	€ 10.400					
Training Hiflex 4 days	€ 5.120					
Installation Hiflex 4 days	€ 4.096					
10 Hiflex PDC Terminal Licenses	€ 5.000					
Hardware for 10 Hiflex PDC Terminals	€ 5.000					
1 Hiflex Scheduling Terminal License	€ 500					
Hardware for 1 Hiflex Scheduling PC	€ 1.500					
License Pecom incl. JMF for 3 stations	€ 44.000					
3 Maschine Updates (Software)	€ 9.240					
Training Pecom 8 days	€ 9.600					
Pecom Server (Hardware)	€ 1.200					
Internal Startup-costs (1 month)	€ 9.000					
IT ancillary infrastructure costs	€ 7.500					
J Recurring costs						
Hiflex recurring fee on license and maintenance		€ 5.200	€ 5.200	€ 5.200	€ 5.200	€ 5.200
External Services		€ 2.000	€ 2.000	€ 2.000	€ 2.000	€ 2.000
Internal IT maintenance (100h)		€ 5.000	€ 5.000	€ 5.000	€ 5.000	€ 5.000
K Annual costs **= (I+J)**	€ 112.156	€ 12.200	€ 12.200	€ 12.200	€ 12.200	€ 12.200
L Cumulative costs	€ 112.156	€ 124.356	€ 136.556	€ 148.756	€ 160.956	€ 173.156
M Discounted annual costs = PV(**K**)	€ 112.156	€ 11.296	€ 10.460	€ 9.685	€ 8.967	€ 8.303
NET VALUE						
N Annual net value = **(F-K)**	-€ 112.156	€ 220.874	€ 490.178	€ 490.178	€ 490.178	€ 490.178
O Cumulative total	-€ 112.156	€ 108.718	€ 598.895	€ 1.089.073	€ 1.579.251	€ 2.069.428
P Discounted annual value = PV(**N**)	-€ 112.156	€ 204.513	€ 420.248	€ 389.119	€ 360.295	€ 333.607
ROI per Year = **F/K**	-100,0%	1810,4%	4017,8%	4017,8%	4017,8%	4017,8%
ROI Present Value = SUM(**H**)/SUM(**M**)	991,9%					
NET PRESENT VALUE						
Q Net Present Value (SUM(P))	€ 1.595.626					
INTERNAL RATE OF RETURN						
R IRR (Internal Rate of Return)	236%					

The Net Present Value in US$: 2,027,881.-—

About project financial analysis:

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 DBM’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 DBM'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.

Notes:

1. IRR says nothing about the magnitude of the return. A tiny investment or expenditure may lead to a magnificent IRR. An alternative action with a smaller IRR might still be preferred if it brings in a much larger net cash flow, or DCF.

2. IRR has the most meaning when there is an initial net cash outflow, followed at least one period with a net positive cash inflow. IRR cannot be calculated with outflows only, or inflows only; IRR is thus not applicable to "cost only" analyses (such as the typical cost of ownership analysis).

3. IRR can be quite misleading if there is no large initial cash outflow. For instance, when comparing a "Lease" scenario with a "Buy" scenario for new computing equipment, the "Buy" alternative may show an IRR of, say 30%-70%, whereas the "Lease" approach may have an IRR in the thousands. This is because leasing may not involve much of an initial cash outlay. IRR is more appropriate for comparing alternatives that have roughly similar patterns of inflows and outflows.