GrCi White Paper

Estimating and Job Costing
Digital Printed Matter

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Introduction

The $50 billion General Commercial printing industry[1] specializes in manufacturing custom-produced printing to meet the business needs of clients. Commercial products include: brochures, flyers, posters, small books, direct marketing, corporate collateral, and similar materials used for advertising products and services.

Throughout the 1980s and 1990s, color commercial printing increased in both volume and quality. During this period, sheetfed offset lithography was the dominant printing method for short-run commercial color products, capable of producing beautiful, high-quality work.

In the 1990s, commercial printing expanded as increased affluence empowered consumerism. Commercial advertising grew in direct proportion to consumer prosperity achieved in the 1990s. The economic expansion during the dot-com boom in the late 1990s was particularly profitable for commercial printers.

Today, the commercial printing segment is greatly influenced by economic conditions as well as increased competition for advertising dollars from other media, including television and the World Wide Web. In recent years, commercial print volume has been stagnant or in decline, with only a few products seeing sales increases. Today, there is stiff competition among printers for the limited dollars spent on commercial printing.

In commercial printing, each project is custom-produced, often with unique challenges. Unlike most manufacturing, the commercial printer encounters new specifications each day, which are usually customer-driven, and often poorly documented and communicated. Printers understand the capabilities of their processes, but also recognize that each project requires individual attention. Individual job specifications impact workflow, complexity, running speeds, waste allocation, and time required to produce the final printed product. For this reason, commercial printers usually plan and estimate the cost of job production before commencing on a project.

In years past, commercial printing was highly craft-based. The skill of the craftsmen helped to differentiate one company from another and warranted price distinctions. In some cases, the most skilled printers produced better work and commanded better pricing; at other

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[1] Davis, R. H. (2005). "A Macro View of Print Markets". *Economic and Print Market Flash Report – July 22, 2005.* Alexandria, VA: Printing Industries of America/Graphic Arts Technical Foundation.

times, larger printing companies could afford specialized equipment that could produce work profitably at a lower cost than their direct competitors.

The typical job began with a *cost estimate*, where sales management would then mark-up the estimate to include a profit, and the price quotation would be forwarded to the customer. The price was usually directly calculated from the cost as a percentage above the estimate.

Today, commercial lithographers have difficulty differentiating themselves from one another, primarily due to the elimination of craft positions and increased reliance on automation. Simultaneously, the comparatively low financial barriers to entering the commercial printing business have allowed new print service providers to enter the marketplace, many of whom are able to price their services aggressively due to low debt or strong capitalization. Technology democratization diminishes quality differences, as many commercial printers produce high-quality work today. To compound this phenomenon, some print buyers are willing to sacrifice quality demands in favor of time compression.

Pricing thus comes under pressure. Price becomes the single most dominant differentiator between print providers.

Profit margins are down as companies compete on similar quality. Combined with little growth in the market, commercial lithography is under pressure. In some segments, print is a commodity, distinguished only by price. For companies choosing to compete as a cost differentiator, the focus is on economies of scale, waste elimination, and overall cost reduction.

Purpose of the study

The purpose of this study is to document and analyze current cost estimating and job costing practices for commercial digital printing. The study will evaluate the relationship of traditional estimating and costing methods to methods cited in the survey. The survey findings will be used to suggest directions that might be taken to improve or develop reliable systems for estimating and job costing commercial digital printing. A portion of this study was originally presented at the 2007 IS&T/SPIE Electronic Imaging Conference.

This study answers the questions: 1) What methods are currently being used to estimate digital printing? 2) What is the relationship between estimating and pricing digital printing? 3) To what extent, if at all, do digital printers use full absorption, all-inclusive BHRs for

estimating – and if they do not, what methods are used to assign costs to various operations? 4) To what extent do digital printers collect and analyze job costs upon completion of each job?

Current Pricing Practices

As a mature industry, today's print marketplace has clearly-defined price ceilings. There is slight pricing latitude, but higher prices must be intensely justified to customers. For this reason, it is vital that pricing be based on actively researched competitive information. A well-defined pricing strategy, combined with aggressive cost reduction plans, is critical for supporting reasonable profit margins in commercial printing.

Growth for traditional commercial color printing has been stagnant and margins have generally been poor in recent years. In 2005, the average lithographer made just 2.5 percent return on sales[2]. This number is projected to be 3 percent for 2006. Price premiums, when justified, help to increase profit margins on individual jobs and lead to greater profitability as a whole. Value-added services – services beyond core printing products that provide unique significance to the customer – are generally perceived as the means for increasing price, market share, and profit margins. Successful commercial printers intimately know their customer's business, are properly equipped to offer unique solutions for their customer's problems, and focus on services and products that provide distinct, substantial, and well-documented value to their customers – a challenging feat in a competitive market.

Cost Estimating

Commercial printers have been cost estimating for many years. Estimating costs prior to producing a job provides multiple benefits. Primarily, a cost estimate can be the basis for pricing decisions. When a client requests a price quotation, a customized cost estimate is prepared using the specifications provided. This information is forwarded to sales management who analyzes the anticipated production costs against competitive pricing information to derive a price quotation. In ideal scenarios, the cost estimate and price

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[2] PIA/GATF. 2005, 2005-2006 *PIA/GATF Ratios.* Sewickley, PA: Printing Industries of America, Inc./Graphic Arts Technical Foundation.

quotation have a wide margin for profit. However, in competitive markets, pricing may be determined independently from the cost estimate.

It could be argued that cost estimating is no longer necessary for pricing. Since pricing is substantially market-driven, then why is it necessary to estimate? Why not simply use a price matrix or competitive pricing? Any managerial accounting system will accurately track revenues and expenses. Yearly profit and loss statements can be developed without a job estimating system. Even if cost estimating is never performed, accurate projections and reports can be generated related to expenses and revenues.

The response to that argument is that knowing anticipated costs prior to negotiating price is extremely helpful. It provides key information to the printing sales representative to know the break-even point on production – the price point at which there is both zero profit and zero loss. Further, this detail provides useful information about production processes or operations that are particularly profitable or especially costly to the business. Cost estimating empowers the sales staff with knowledge about where they can be aggressive and where they need to hold the line on price.

For low-margin work, cost estimating takes on an increasingly important role. In most situations, companies should not price work below their costs. However, without a cost estimate, that break-even point is not known until *after* production. Further, it is quite useful to know that the marketplace simply will not support the cost associated with performing certain processes. For example, if the market rate for perfect binding is extremely competitive, it may make sense to outsource these functions to low-cost trade binders instead of trying to keep the operations in-house. The cost estimate helps to expose those cost-prohibitive operations.

What about digital printing? Is cost estimating still relevant when dealing with digital printing? Why not simply *price* estimate, using simplified formulas with built-in profit to calculate price? In some cases, the customer can price the work directly by consulting a pricing matrix. For printing that is highly uniform, price estimating makes sense. Digital printing often produces standard sizes, on standard paper, with standard inks and toners. When simple, low-complexity work is produced, pricing tables make sense, whether

published or private. When complicated, valued-added processes are involved, however, cost estimating is helpful in managing the pricing and production functions.[3]

What are these complicating factors that necessitate an estimate? When simply running standard paper through a print engine – print-on-demand (POD) or short-run color printing – the cost is fairly uniform and can be easily predicted. However, when variable data, digital asset management, digital coatings, variable finishing, or other non-standard processes are involved, the complexity and unpredictability of the job increases. A customized cost estimate is necessary.

How is cost estimating performed?

The Estimating Process

Cost estimating follows a well-defined workflow. The process begins with the *Request for Estimate,* provided to the estimator by a sales representative or the customer directly. When completed thoroughly, the request for estimate form contains the specifications to accurately estimate the cost of production. An alternate to a request for estimate form is a Web portal, where the customer or sales representative completes the necessary fields for the estimate. Most Web portals are integrated with estimating software, facilitating easy transfer of specifications directly to the software. The Web has also ushered the era of the *unknown customer*. Today, it is common to estimate jobs for businesses where no established relationship previously exists.

After the estimator receives the request for estimate, he or she begins the estimating process. To estimate correctly, the job's production must be accurately planned. Production planning involves mapping the production steps and materials needed to complete a project. The estimator breaks down the production planning by cost center. A *cost center* is an area of production, such as digital prepress, which has defined costs associated with it including equipment, labor, supplies, and facilities. One or more operations may be performed in a cost center. For example, digital prepress may include operations such as preflighting, image manipulation, color correction, imposition or proofing, and might have an hourly cost rate of $85 per hour.

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[3] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-2). Bellingham, WA: SPIE International.

Estimating involves two steps: *planning production* and *assigning times and costs* to the plan. Since cost centers often have different hourly cost rates, this must be done independently for each cost center used in the production plan. The most commonly used estimating formula is:

Cost Center estimate = (production time × BHR) + Consumables + Buyouts[4]

After all costs have been calculated and summarized, the completed estimate is forwarded to sales management who analyzes it for price determination. A price quotation is generated and provided to the customer. Once a price has been agreed upon, an order is initiated, credit is checked, and the order is entered or transferred to a production planning module.

Production Standards (Throughput)

Cost estimating relies on intimate knowledge of production. With study, a detailed table is generated reflecting "averages" of production for all variables. For example, it would be simplistic to say all folding can be produced at a rate of 12,000 sheets per hour. However, for a given type of fold and under the proper set of conditions, that rate can be achieved. When paper X can be produced with fold Z at a rate of 12,000 per hour, a production rate has been established.

Average production rates, defined for multiple conditions (type of paper, weight of paper, etc.) and multiple types of folds (single, right angle, gate-fold, etc.), are called production standards. It is the standard rate of production or throughput achievable under similar conditions on a consistent basis. Each operation requires well-developed production standards.

Production standards are the rate at which production can be achieved in a cost center. They are averages and should reflect reality or at least average out to reflect reality. They are usually displayed in table (or spreadsheet) form and contain units in relation to time. For example, folding may be reflected in *pieces-per-hour*. Other tables may be reflected in

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[4] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-2). Bellingham, WA: SPIE International.

minutes-per-piece, sheets-per-hour, characters-per-hour, minutes-per-image, or some similar ratio. Production standards are the foundation for calculating the time required to complete an operation. All production standards need to be reviewed periodically to ensure they reflect actual production.

For particularly challenging estimates, where production requires unusual or especially difficult operations, the smart estimator will consult with production experts during the planning stage. In unique circumstances, the estimator may even seek cost information from production.

Budgeted Hourly Rates (BHR)

After time has been calculated for one or more areas of production, costs are applied. Budgeted hourly rates (BHRs), or more precisely *all-inclusive* budgeted hourly rates, are used to apply costs to the estimate[5]. The basis of all-inclusive budgeted hourly rates is to prorate all business costs over each cost center so that production rates recover both direct costs and a portion of indirect or overhead costs. The BHR is a *full absorption* cost accounting method, meaning that indirect business costs are absorbed through production rates.

The BHR for each cost center includes direct labor, equipment, supplies, and the space and utilities for the operation. It also includes a portion of the indirect costs such as indirect labor and all general and administrative (G & A) overhead of the business. Though not a perfect science, the premise is that all costs of the business are recovered at the end of the year through the various production cost centers. All business expenses are charged against production cost centers.

There are several challenges in developing accurate BHRs. First, the method used to allocate G & A expenses will impact the BHR and may make the operation cost-prohibitive. Should one prorate G & A expenses based on square footage of the cost center? How about as a percentage of the overall expense? Or should the G & A expenses randomly be applied to each cost center. If over or under-inflated, a cost-center's BHR will not be market-competitive.

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[5] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-2). Bellingham, WA: SPIE International.

The second challenge lies in calculating the number of hours over which to prorate capital equipment costs, as well as indirect and G & A expenses. In order to accurately prorate fixed costs, it is necessary to estimate the number of annual billable hours for each cost center. Since no operation is 100 percent productive, it is not as simple as calculating 40 hours x 52 weeks x 2 shifts; the efficiency of the operation must be accounted for accurately. Most conventional printers operate between 70 percent and 85 percent productivity, but this varies for each company and operation.

Digital printers may operate at lower productivity. This is especially true for on-demand businesses, who must always have capacity available to sell. These printers cannot schedule at maximum capacity.

A third challenge relates to the way BHRs are used. The BHR is assumed to reflect actual cost of production for a given cost center. However, in overtime situations or when production efficiencies improve, direct costs are a more accurate depiction of true cost. In these situations, new hourly rates would need to be calculated to reflect the increase in annual billable hours. While constantly readjusting BHRs is impractical, smart printers acknowledge the impact increasing billable hours has on the bottom-line and may focus on improving efficiencies or provide incentives to get additional work from customers. Conversely, when equipment goes under-utilized, it has detrimental effects on the hourly rate, driving up the BHR in order to recover overhead costs over fewer billable hours.

BHRs treat all operating expenses as variable when in reality, many are fixed. While layoffs do occur in printing, we have relatively fixed labor expenses, excluding overtime. Further, with traditional printing equipment, capital expenses do not change based on volume of usage.

Budgeted Hourly Rates rely on converting *yearly fixed costs* – costs independent of production volume – into *variable hourly costs* – costs which increase in direct proportion with production volume. Naturally, this is challenging. To convert fixed costs to variable costs, one must accurately predict annual billable hours for each cost center and then divide the annual fixed cost by annual billable hours. This assumes the printer knows the productivity ratio of billable to available hours.

Some costs are more accurately classified as semi-variable, such as labor. If presses are close to capacity, the printer will likely pay employees for 40 hours and schedule

maintenance or other duties during any downtown – a fixed cost. However, when production is very slow, employees are laid-off, a variable cost. To complicate matters, benefits are mostly fixed for these employees. However, wages are variable or nearly variable.

Consumables

In commercial lithography, there are consumables used in the manufacturing process; most commonly paper, ink, and plates. The quantity and cost of these materials are estimated, including waste generated during production. Other consumables such as fountain solution and press chemistry are generally included in the BHR as opposed to trying to charge to individual jobs.

Operations consuming materials generate waste. When a process is stable, it is easy to predict waste and build consumable usage into the estimate. In conventional lithography, waste is usually calculated as a percentage of the run length and added to the estimate. Process control is critical in stabilizing a process and making waste predictable. With poor process control in manufacturing, it is difficult to predict consumable usage leading to the purchase of incorrect quantities of paper and ink.

One of the most important jobs of the estimator is to correctly estimate the quantity of paper needed. This difficult job involves predicting how much paper will be wasted on press and in the bindery. It is usually done by developing waste matrices for both makeready and running spoilage for all operations using paper. Difficulty factors are included in the matrices to incorporate complexity into the equation.

Outsourcing

Commercial printers rarely do everything. Difficult or unusual operations are often outsourced to specialists. Trade finishers (cutting, folding, binding, embossing, die cutting, foil stamping), premedia companies (photography, prepress, plates), data suppliers (lists, data processing), and hand finishing companies (hand assembly) are all examples of businesses who offer specialized services to printers. Outsourced services, also known as "buyouts", are an important component of print production costs and must be accurately reflected in the estimate.

Activity Based Costing

The use of BHRs is the most common method for estimating conventional printing. Opponents of BHRs generally look to Activity Based Costing (ABC) or a derivation of ABC to provide better cost reporting. Activity Based Costing focuses on tracking costs of all activities, not just production operations. During the estimating process, both production activities and all support activities are recognized and included in the calculations.

In ABC, administrative activities have an associated rate and are charged to the customer. The estimating activity has a rate, the customer service representative has a rate, and the samples department has a rate. These costs, along with production costs, are added up to complete the estimate. Proponents of ABC insist that it gives a more accurate depiction of true costs. Rather than prorating all G & A costs and applying them to production activities exclusively, any G & A expenses that involve activity performed for customers are charged directly to those customers. Unlike full-absorption methods, ABC does not try to recover support expenses exclusively through production rates.

David Dodd and Bill Lavelle, in their book *Activity Based Costing for Printers,*[6] argue that BHRs provide inaccurate information for pricing decisions. Their primary argument focuses on the fact that all-inclusive hourly rates (BHRs), while successful in recovering G & A costs over time, artificially inflate operational costs and often lead to poor sales decisions. Sales management foregoes certain jobs, assuming they will lose money. In fact, with accurate manufacturing cost information, sales priced above factory costs are positive. If a business is not at full-capacity, pricing above manufacturing costs will contribute to overhead costs and ultimately profitability, even though full-absorption costs are not recouped.

When all is said and done, all G & A costs must be recovered to end the year "in the black." Pricing based on factory costs alone will not provide sufficient income to cover overhead expenses. However, Dodd's and Lavelle's argument is accurate; *in under-capacity situations, increasing volume with work priced above manufacturing costs, even though below full-absorption cost, will indeed improve profitability.* Capacity then, becomes a key element in price determination and may justify aggressive pricing.

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[6] Dodd, G. G & Lavelle, W. K. (2003) *Activity-Based Costing for Printers: An Implementation Guide.* Nashville: Point Balance Publishing.

Dodd's and Lavelle's second argument is that ABC gives a more accurate assessment of true costs. With ABC, every activity, whether production or administrative, has a cost associated to it. In ABC, a customer service representative (CSR) is not a G & A expense. Rather, the CSR's time is accounted directly to specific jobs. With ABC, customers with greater service needs are accurately reflected with higher costs. Their jobs are accurately estimated with higher CSR costs, as well. ABC does, in fact, provide a more accurate picture of true cost.

With complex Variable Data programs, a dedicated project manager may be needed to coordinate a small number of jobs. ABC provides a better depiction of true costs in this scenario and may well be better suited for companies doing this type of work.

A third reason to adapt ABC as an estimating and costing model relates to *managing* administrative costs. Most printers do not know if their estimating department is efficient or not. Traditional cost accounting methods do not report the metrics necessary to determine if you have met a benchmark. To effectively manage administrative costs, it is necessary to track and report support costs.

Arguments against ABC

Those opposed to ABC generally focus on three points. First, they look to the fact that customers are not willing to pay for certain business activities such as estimating. These costs are more easily buried in G & A expenses, rather than trying to track and expense them to individual customers. Typically, support costs are hidden from the customer because they do not appear as line items on the final invoice.

ABC opponents also argue that while factory expenses are important to know, it is a poor practice to regularly take work without adequate recovery of overhead costs. In under-capacity, tight-market conditions, it may be necessary, but as a general practice it undermines profitability. Further, most methods for developing all-inclusive hourly rates include manufacturing BHRs. Manufacturing BHRs reflect direct manufacturing costs only. Therefore, it is quite simple for the conventional estimator to report manufacturing costs only, achieving the same information derived by ABC.

The third argument against ABC focuses on the complexity of calculating costs with ABC. Since all direct activities must be estimated, not just production activities, there is

more work involved in establishing an ABC estimating system and completing the estimate. Most commercial MIS or accounting systems are not easily adaptable to an Activity Based Costing system.

Job Costing

Cost estimating is performed prior to printing a job. In commercial lithography, it is completed prior to the price quotation. Job costing, on the other hand, is the function of tracking and applying actual costs to a job *after* production. Its purpose is two-fold: compare actual cost to estimated cost; and ensure all change-orders are applied and correctly billed to the customer. Job costing usually requires all customer changes to be initiated in written form, ensuring a paper trail for billing purposes.

Commercial printers may link job costing to their payroll system. This requires employees to accurately track their time against a job in order to get paid. Consumables must also be tracked to give accurate results. Most commercial printers put some emphasis on their job costing efforts, largely because change-orders can go unbilled unless an effort is made to track all costs associated with each job. Job costing also reveals trends that can help identify ongoing production problems.

One very important benefit of accurate job costing is continuous improvement. The estimating process needs feedback in order to ensure the most accurate outcomes, which means that production standards must be continually monitored. Improved production efficiencies, if not reflected in the estimate, will result in fewer print contracts awarded than possible. Alternatively, an optimistic estimate that doesn't reflect actual production may secure a job, but result in lost revenues when production takes longer than expected.

When the estimating manager gets repeated feedback from the job cost report that a particular process is outperforming or underperforming expectations, he or she can refine the production standards and consumables used. This refinement is an ongoing process, and when diligently preformed, results in a very accurate estimating system.

Estimating Digital Printing

There are typically three costs associated with acquiring a digital print engine:
   1. Capital equipment expense (cost of the press/printer)

2. Service agreement (monthly or yearly maintenance contract)

3. Click charge (licensing agreement or royalty)

The click charge, popularized by Xerox in the copier business, involves a fee per impression paid by the printer to the press manufacturer. The click charge may or may not include consumables and is normally discounted in tiers as volume increases. Sometimes, the lease contract includes a certain number of "clicks" per month, whether or not they are used.

Beyond these three costs, multiple other expenses may be necessary to incorporate an entire digital workflow for digital printing. These may include networking expenses, digital prepress equipment and VDP software, building modifications, training, and other expenses.

Digital Press Consumables

Estimating digital printing exhibits similarities and differences to estimating conventional lithography. Unless paper and toner/ink are included in the click charge, they must be estimated in the same manner as conventional printing. Paper quantity is calculated, with set-up and running waste included for all operations. Cut-sheet paper is usually wrapped in reams (500 sheets) and typically priced per 1000 sheets ($/M-sheets) or per 100 pounds ($/CWT). Paper weight, brightness, and finish are all important considerations in selecting paper for digital printing. Roll-fed paper may be calculated based on linear feet or weight. Non-paper substrates are estimated in a like manner.

Paper and toner/ink waste does occur in digital printing, though not on every job. Therefore, it is necessary to determine the frequency of paper jams, waste that occurs during machine start-up, and waste that occurs from defective quality on a daily or weekly basis. These and other forms of waste must be documented and prorated into the cost estimating system so that their costs are recovered through billable work.

Ink or toner usage, if not included in the click-charge, is calculated based on coverage of the sheet, and then multiplied by run quantity. Usually, coverage is calculated as a percentage of the total available square inches. A table of ink or toner mileage is referenced to calculate the total ink or toner usage. An ink/toner mileage table shows the number of square inches of coverage per pound or cartridge of ink or toner. Ink or toner waste must be predicted and incorporated into the estimate as well. The use of other consumables included in the digital

printing process such as blankets, photo imaging plates and wearable parts and supplies may also need to be estimated or incorporated in the BHR.

Digital Press Labor and Other Costs

Toner-based digital printing (an electrostatic process) usually includes a click-charge – a licensing fee charged for each impression. As such, this cost is essential to estimating. However, it is certainly not the only cost. In nearly all cases, there are one or more operators whose salary and benefits must also be recovered. It is possible to create an all-inclusive BHR, calculate press time using production standards, and then add the click charge into the cost data. While this would certainly yield an accurate cost estimate, an alternate method is to develop an inclusive per-click charge, which is sometimes expressed as an all-inclusive per sheet or per piece charge.

Estimating full-absorption costs solely on a per click basis creates some challenges. Fixed G & A expenses must be converted to variable costs and prorated per impression. This requires an accurate depiction of annual volume – something that may be difficult to predict in some environments. A common practice is to calculate *factory click charges,* avoiding the inclusion of G & A costs. A factory click charge includes the manufacturer's click charge, depreciated equipment expense, service contract expenses, any direct labor wages, and consumables. Fixed costs such as the equipment expense and the service contract are converted to a *per impression cost,* relying upon accurate volume predictions. Most G & A costs are not recovered in this cost structure. Sufficient mark-up is required to generate a contribution to overhead, in addition to profit.

Digital Front-end & Variable Data Printing Costs

Of all production functions, digital front-end workflow is one of the more complex to estimate. For static print, the prepress work is similar to commercial lithography in that it may require estimating costs for graphic design, text entry and proofreading, image capture, image manipulation and color correction, page layout, imposition, proofing, output, and preflighting.

Variable Data Printing (VDP), however, creates an additional set of challenges and costs for which the estimator must account. The discreet production steps that need estimating for

VDP may include: renting lists; database and digital asset management; data cleansing, verification, and processing; building templates and data rules; RIPping; and response management. Some or all of these steps may be handled by the digital print provider.

Data is the foundation of variable data printing. The digital printing company may be asked to secure data from a list broker. As such, the estimator must know multiple list suppliers and have the knowledge to intelligently discuss the needs of the client. Lists are typically rented on a *per name* or *cost per thousand* basis. As an example, the list may include names of homeowners in a given region at a cost of $60/M. The more refined or specialized the list, the more expensive it is. Companies must understand the value and necessity of quality data for a VDP project to be successful. Some work with Customer Relationship Management (CRM) applications to generate robust databases that are used to build a quality VDP program.

Care must be taken to ensure that the right data is selected, as this is one of the most critical aspects of VDP. Selection of a low-cost, non-performing list could mean a failed VDP campaign and a lost client. For this reason, the cost of a range of lists may be estimated, with the final pricing determined at the time of order. The client must sign off on the list selection in advance of producing the project.

The management of databases and digital assets is another critical component of variable data printing. If a clean list is provided, there may be little database management required. However, some customers may ask the printer to manage their database or to store digital assets used in printing campaigns. Digital asset management (DAM) involves storing digital images for easy search and retrieval. The estimator should understand DAM production and must include the costs to build the DAM structure, manage the database, and include costs for search, retrieval, and use in collateral pieces.

Images used for VDP, whether stored as part of a DAM system or not, may require sizing, color management, cropping or other manipulation to provide optimum results. Determining such needs in advance of a VDP job or program can be difficult unless sample files are provided. Clients should be advised of the specifications required for such images and notified that charges may be levied above the estimate if such manipulation is required.

Data cleansing, verification, and processing involves cleaning up a database and preparing it for use in VDP. The most common data cleansing function for VDP is

merge/purge. Merge/purge cleans up a database by merging or purging duplicate entries. It is very common for lists to contain two entries for the same individual, usually with slightly different name or address spellings. Data processing may also involve CASS certifying names for mailing. CASS (Coding Accuracy Support System) certification is a USPS requirement to received discounted postage. The certification process entails converting data entries into USPS approved format, and verification that each address falls within the known range of addresses for a particular street. Like all production processes, the estimator must understand the operation and assign times and data processing costs to a production plan. The estimator develops and uses production standards to estimate data processing.

Page building for static print runs is similar to the page layout process for conventional offset printing, but complex VDP work requires that dynamic fields must be placed into the page. Templates and data rules (if/then statements) may be very complex and quite time consuming to create, if not in a library. From an estimating standpoint, page building may incorporate different tools and different hourly rates. With a challenging VDP project, multiple hours may be involved in designing the variable data layout. The estimator may need to consult production experts to accurately estimate the time of production.

With VDP, processing data at the RIP (raster image processor) is an ongoing process, not a one-time event as in conventional printing. Each page must go through a RIPping process to compile the variable data and image the page. Complex or poorly-constructed VDP projects may take longer to process than is needed for the printing of each page, causing a delay in the delivery of output data to the print engine. Because of this potential, RIP processing for VDP jobs may use a different BHR from conventional prepress work. This cost center may require multiple, specialized servers and advanced networking, thus raising the hourly rate for VDP RIPping. Alternatives include a higher press hourly rate or simply applying a complexity factor for VDP work.

The success of a VDP campaign is measured by response rates. *Response management* incorporates the tracking of responses generated by a VDP campaign. Marketers, retailers, and others who buy VDP are interested in tracking and verifying the success of one-to-one print campaigns. While this is outside the purview of most digital printing companies, this value-added service may be provided by the digital printer in an effort to demonstrate ROI to

the customer. In such situations, the estimator must develop and use an accurate estimating system to account for the time and computer servers to accurately manage this function.

Variable Finishing

Digital presses may be used to produce products that are folded and bound. As such, estimating for digital printing may entail estimating the cost of cutting, folding, and binding. Finishing production for variable printing is achieved in one of three ways: 1) off-line, where the equipment is separated from printing and is run on conventional, high-speed finishing equipment; 2) in-line, where the finishing equipment is integrated in-line with the digital press; or 3) near-line, where the physical equipment is separate but integrated in the workflow via network for automatic recognition and set-up.

In-line variable finishing or *finishing-on-demand* (FOD) may involve set-up costs and reduced press speeds. The estimator must investigate set-up times by working directly with production supervisors and equipment manufacturers to develop production standards for variable finishing equipment. Extremely complex projects may involve multiple people to complete the estimate; savvy estimators rely on production experts as resources in the estimating process.

Significant consideration must be given to the careful handling of printed pieces in VDP in all downstream processes. Often, 100% completion is a requirement, assuring that all individuals in a data list are sent their document. Any pieces that are damaged, destroyed or lost must be tracked, reprinted, and then finished before the project or program can be considered complete. The costs of such work must be estimated as a factor of waste within the project and included in the final price to the client. The more processes involved, the higher the potential waste may be.

Estimating Mailing and Hybrid Work

The complexity of mailing rates and postal regulations has lead many printing companies to employ mailing experts. The estimator may work with an internal mailing expert or directly with a USPS direct mail service representative. To take advantage of presorting, automation, or other discounts, the mailpiece must be meticulously prepared. Estimators should work closely with production to determine the necessary steps to prepare the piece for

mailing, as the estimate must account for all preparatory steps and costs associated with placing a piece in the mail stream.

Much variable data printing today, particularly high-volume applications, involves the printing of offset shells with digitally-printed interiors, often called "hybrid" work. In these situations, the estimate must include the cost of both conventional printing as well as digital printing. The work is broken down by cost center and the litho portion is estimated in parallel with the digital portion.

Research Method and Data Collection

This study used Elite and Specialized Interviewing, a technique developed by communication scholar Lewis A. Dexter as a qualitative research method of interviewing people who are highly knowledgeable on the subject of the interview and in a position of importance. The process involves a discussion of the topic during which responses to the questions are drawn out. The interviews resulted in detailed information about estimating of digital printing. Interview questions used during the discussion were developed in advance, but whenever possible, follow-up and related questions were used to discover additional information beyond the developed survey.

The data gathering process consisted of two components. An initial background survey was conducted through email. This was followed-up by 20-40 minute telephone interviews with each company. Thirteen surveys and interviews were conducted during the period February 1 through June 30, 2006. All interviewees were senior-level or estimating-level representatives from commercial digital printing companies.

Participating companies

The companies who have participated in the study are geographically distributed as follows:

- West Coast – 7 companies
- Northeast – 3 companies
- Southeast – 1 company
- Mountain states – 1 company
- Canada – 1 company

The following individuals were also consulted during this study:

- David Cranage – EFI
- Mike Chiricuzio – Blue Moon Solutions / Arizona State University
- Hal Hinderliter – Graphic Communication Institute at Cal Poly
- Harvey Levenson – Cal Poly State University
- Frank Romano – Rochester Institute of Technology

Company Background Survey

Once a candidate agreed to participate in the study, an initial background survey was distributed via email to seek basic information, centered on four themes:

1) Contact information
2) Markets served
3) MIS/Estimating system used
4) Print engines/software used

Contact information

The background survey asked for typical contact information including the representative's name, company address, and contact email and telephone numbers.

Markets served

Three market segments were identified as requiring custom commercial estimates: short-run color, print-on-demand, and variable data printing. Each of these markets is served by *commercial digital printing companies,* who must understand the complexities of each type of work in order to successfully estimate costs.

The background survey asked if the participant's company is involved in transactional printing. Transactional and wide-format printing companies were excluded from the interview stage, since these business segments are beyond the scope of this study.

The survey also asked if the company produced commercial printing by conventional lithography. Conventional lithographers have long been estimating commercial printing. It

was assumed that companies producing lithography already have established estimating practices.

MIS Software, Print Engines, and VDP Software Used

The survey also included questions as to the participant's Management Information System (MIS), the digital presses the company owns, and the VDP applications typically used. These questions helped to determine if the company was a good candidate for the research.

The survey participants used a variety of black-and-white and color print engines. The most common engines were HP Indigo and Xerox equipment. See Figure 1.
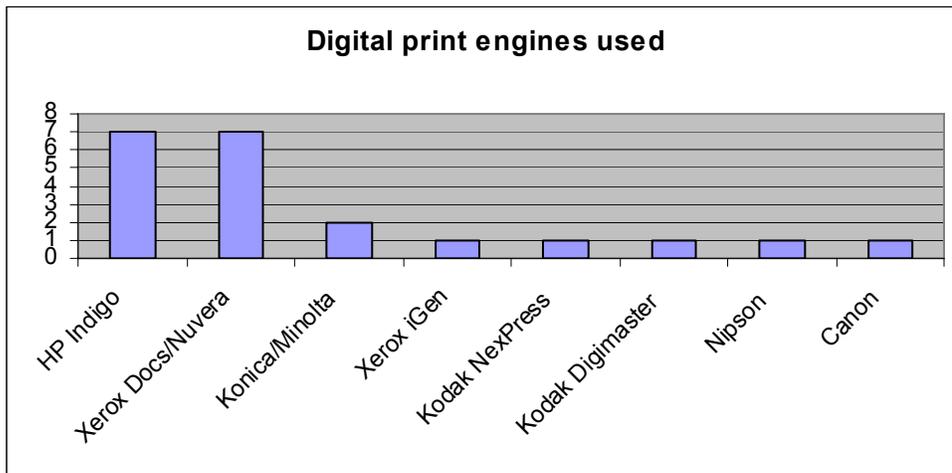
Fig. 1. The different digital print engines used by sample group.

VDP software also varied substantially. Refer to figure 2 to view the VDP software packages used by the participants.

Interview Findings

After the background surveys were returned, a 20-40 minute telephone interview was scheduled with each participant. The interviews followed a structured set of questions but were tailored during the interview in the form of a discussion to discover new information. Follow-up questions were asked as appropriate.
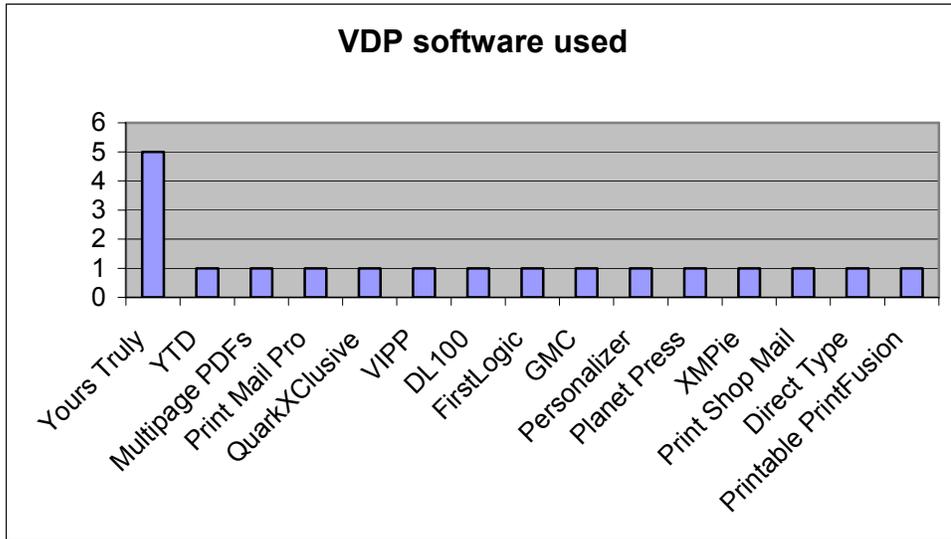
Fig. 2. The different VDP software used by sample group.

Interviews averaged 30 minutes in length. Some were completed sooner and many took longer, depending on the depth of answers and the need for follow-up questions. The interviews focused on the following areas:

1. Pricing matrix
2. Pricing contribution to overhead
3. Cost estimating using BHRs
4. Factory click charge
5. Estimating specific operations
6. MIS/CE systems
7. Job Costing
8. Activity Based Costing

The interview process began with a description of the purpose of the study, research method used, and assurance of confidentiality in reporting the findings. Questions regarding the background of the interviewee were also asked, in order to determine if the participant understood conventional print estimating.

Pricing matrix

The first three questions asked were:

- Do you use a published or private digital printing ***pricing matrix*** (price list)?
- If so, how was it developed?
- Does the matrix include paper costs? Does the matrix include ink or toner costs?

The rationale behind these questions focused on understanding the role of price estimating with digital printing companies. It is a common practice to use price lists, but how are they developed? Are they based purely on competitive market information? Are they developed using a simplified "click-charge +" formula? Or, are they developed using a structured cost estimating process followed by strategic pricing practices?

All participants used some form of a price list with some or all customers.[7] In some cases the lists were public but in most cases, the lists were private and were used for internal pricing only. These lists were used for standardized work only.

Pricing contribution to overhead

The next question asked:

- Do you know with confidence, precisely how much each digital print job contributes to general and administrative overhead?

Few printers, whether digital or conventional, can honestly answer yes to this question. To date, margins for digital printing have been high enough to not worry about cost and contribution to overhead. Many expressed enough profit to not be concerned with contribution on a job by job basis.

More than half of the respondents did not know exactly how each job contributes to General and Administrative overhead. This shows a lack of a comprehensive costing model by 54 percent of the participating companies. Most participants knew that their work was profitable, but not how each job contributes to overhead. See Figure 3.

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[7] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-3). Bellingham, WA: SPIE International.
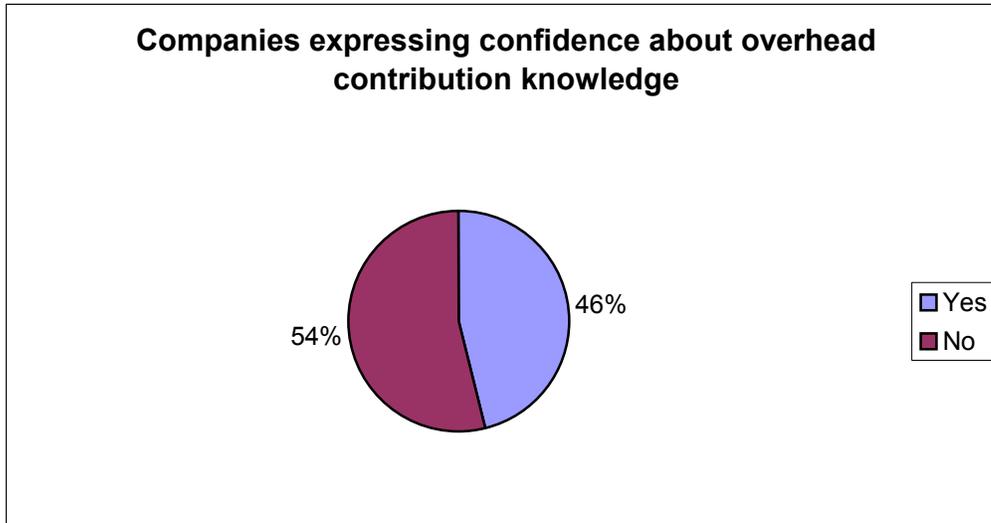
Fig. 3. Companies expressing confidence about overhead contribution knowledge.[8]

Cost Estimating Using Budget Hourly Rates (BHRs)

The next questions were:

- Have you established an hourly cost rate or BHR for your digital press(es)?
- What percentage of your jobs involve a custom estimate?
- Which components are reflected in the estimate (direct labor, indirect labor, utilities, etc.)?

Traditional cost estimating involves developing full-absorption hourly rates for each cost center. These three questions focused on whether conventional cost estimating is used for digital printing. Since several of the participants currently have conventional lithographic presses or had many years experience in the commercial printing industry, rates are mostly developed as full-absorption BHRs, converting all annual business costs into manufacturing rates. When asked if hourly rates have been established for each digital press, two respondents did not have established budgeted hourly rates for all presses. Both of those participants expressed interest in developing rates for their presses.

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[8] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-3). Bellingham, WA: SPIE International.

When asked what percentage of their digital print work required a detailed cost estimate, the responses varied significantly. Some companies produced estimating for nearly all their work while others rarely produced a cost estimate. See figure 4.
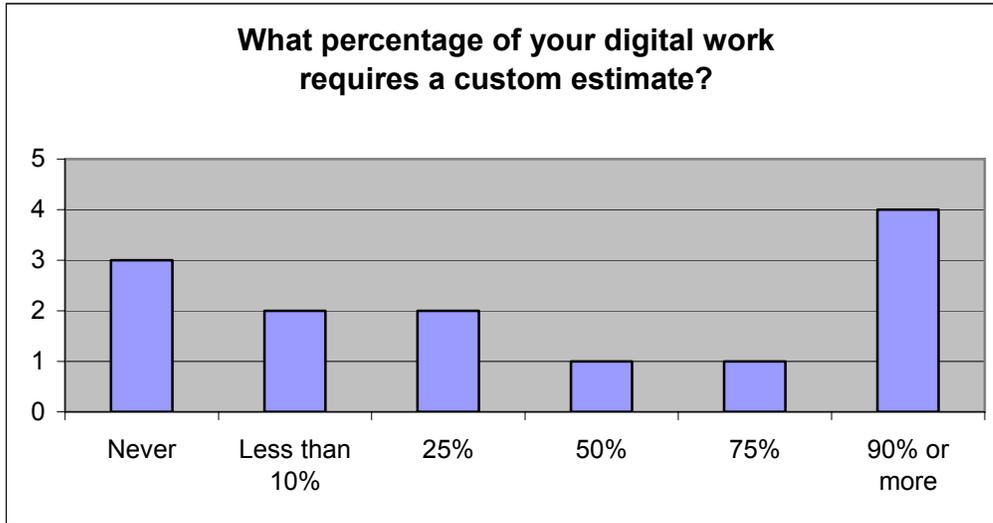

Fig. 4. Percentage of digital printing requiring a custom estimate.[9]

Factory click charge

The concept of a "factory click-charge" was discussed. A per-click cost is calculated that includes not only the press costs (manufacturer's click-charge, service contract, consumables, labor), but also all other direct or indirect expenses, prorated down to a single impression. The factory click charge may or may not include G & A overhead.

Four companies had not calculated factory click charges. The balance had some understanding of absorbed cost per impression, though a few indicate low-precision with this calculation. A couple of companies reverse-engineered their factory click charge using a conventional BHR approach.

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[9] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-4). Bellingham, WA: SPIE International.

Estimating specific operations

The next series of questions focused on the details of cost estimating for commercial digital print, as follows:

- Describe the process you use to estimate the cost of short-run color or print-on-demand digital printing.
- Describe the process you use to estimate the cost of **database management**.
- Describe the process you use to estimate the cost of **digital asset management.**
- Describe the process you use to estimate the cost of **data cleansing, verification, and processing,** including Merge/Purge and mailing certification (CASS).
- Describe the process you use to estimate the cost of **building a VDP page.**
- Describe the process you use to estimate **VDP RIPping.**
- Do you use a **different hourly rate or factory click-charge** for VDP output compared to short-run color digital printing? Do you price the output portion differently?
- Do you offer **response management** services? If so, describe the process you use to estimate this service.
- Do you offer **variable finishing** or **finishing-on-demand?** If so, describe the process you use to estimate variable finishing.
- Do you offer **mailing services**? If so, describe the process you use to estimate mailing.
- What **value-added services** (besides those listed above) do you offer to clients and how do you estimate those?

Estimating Database, Digital Asset Management, and Mailing Functions

Database work, digital asset management, and mailing functions all were approached in varying ways. Only a handful of the study participants performed these functions in-house. When they did, they tended to be handled on a *price* basis only – no structured cost information was calculated. When very complex work needed estimating, some companies consult with their prepress operators to predict time needed to clean a database. Most software applications clean databases (merge/purge, etc.) at 95 percent accuracy. In those

circumstances, where near perfect lists are required, proofreading is necessary, slowing down the process.

Estimating Page Templates, VDP Rules, and VDP RIP Time

Variable Data Printing (VDP) involves unique challenges and costs for which the estimator must account. Due to the complexity of some VDP jobs, there are a number of assumptions made by the estimator. When asked about estimating for specific VDP prepress and data management operations, the responses varied significantly. Many companies handle these operations on a price list basis solely. Rather than estimate time or cost, a per-piece or flat charge is derived.

Other respondents indicated that these operations were outsourced, making cost estimating quite easy. A few indicated that they use a "charge-back" system, where a price range is established and the customer is charged based on the actual complexity and time required to produce the work. One comment, "we quote static jobs, we estimate variable jobs."[10] Throughout the course of these interviews, it became apparent that few really understand their VDP costs completely. Further, since there is such a wide range of complicating factors, the ability to accurately predict production time is challenging.

Price estimating is most commonly used in VDP prepress operations. For example, one company may charge $0.02 per side for VDP RIP processing. When asked if that reflects true costs and whether slow jobs are charged at a different rate than quick jobs, the answer is no. Typically, VDP prepress is price-listed.

Estimating page template production and VDP rule building varied substantially depending on the complexity of the work produced. Nearly sixty percent estimated the time needed for these functions and multiplied by an hourly rate. One company simply charges a flat fee for VDP work, regardless of complexity. Three companies indicated that they do not charge additional fees for VDP prepress over static prepress, likely indicating they only produce low-complexity work. One company simply responded that the customer must provide the VDP files ready for output. See figure 5.

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[10] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-5). Bellingham, WA: SPIE International.
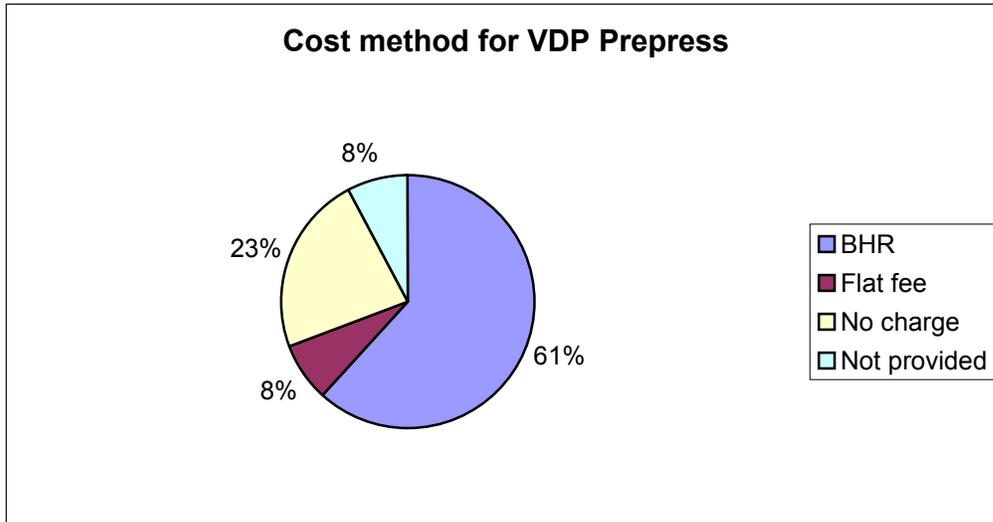
Fig. 5. Cost estimating method for VDP prepress.[11]

When asked if additional RIP costs are calculated for VDP work, there was little consistency here. Just over half of the companies surveyed did not estimate additional RIP costs. One company estimated a flat percentage cost increase. Two companies estimated RIP time and multiplied by an hourly rate. Three companies charged a per piece RIP fee. One company indicated that they will begin to incorporate a retainer or program fee for large VDP campaigns. This retainer fee would be independent of print costs. See figure 6.

Response Management Services, Variable Finishing and Mailing Services

When asked about response management, few companies are engaged in this activity. Only a few companies, who perceive their role more as a marketing firm offering consultative services, participate in response management, which include developing ROI analyses and tracking responses. Most printers do not appear to understand how to enter this value-added service.

Two participants report offering complete response management services, including processing response data, collecting money, and filling orders. One company provides this

[11] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-6). Bellingham, WA: SPIE International.

service to clients on a charge-back basis. The other company charges a set-up fee and a per-unit price for response management services.
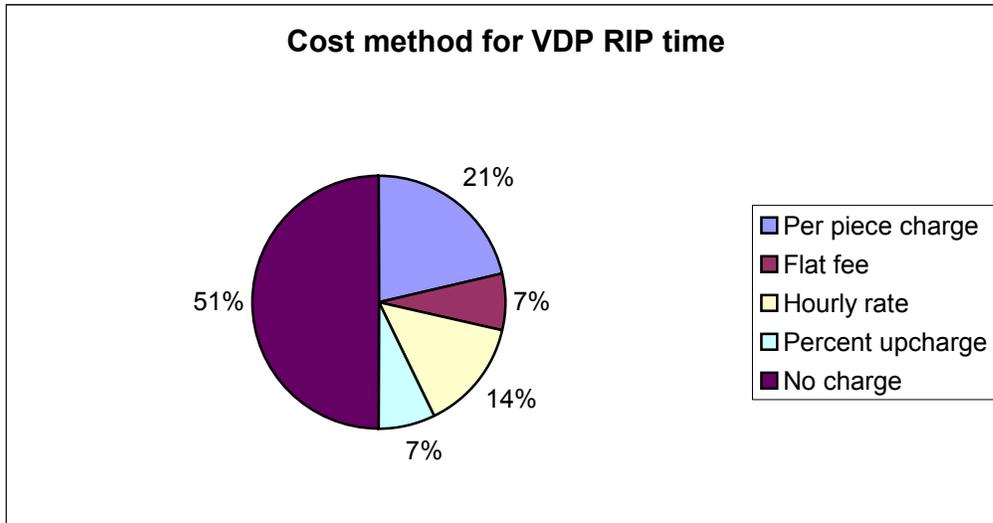

Fig. 6. Cost estimating method for VDP RIP time.[12]

As VDP marketing grows, measuring and demonstrating a project's ROI becomes critical. Businesses will increasingly insist upon this information as a critical component in their decision making process.

None of those surveyed currently offer in-line variable finishing. However, one respondent offers pick-and-pack fulfillment work and another one does offline variable book finishing. Another discussed matched inserting, which is generally price-list based.

Most companies offer mailing services either in-house or by partnering with a mailing facility. When estimating for in-house work, most companies utilize a staff mailing expert to estimate that portion of the job estimate. Postage is usually estimated as a line item.

MIS/Computer Estimating System

The interview next asked about specific MIS applications for digital printing, as follows:

- Do you use a computerized estimating (or MIS) program? If so, which one?

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[12] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-7). Bellingham, WA: SPIE International.

- To what extent is your computerized estimating system (or MIS) integrated with job costing accounting?
- To what extent is your computerized estimating system (or MIS) integrated with scheduling?
- To what extent is your computerized estimating system (or MIS) integrated with your workflow through UP3I, JDF, or CIP3?

Some participants use the same estimating application for both conventional printing and digital printing. However, most claimed that they do not integrate well. Several opt for Excel spreadsheets or simply a printed price list, even when the company owns a well-known MIS system. Some companies have developed their own customized estimating applications for digital printing. No one integrated their estimating system with their workflow, with the exception of those using a Web portal as the comprehensive customer interface.

Of the companies surveyed, there was no clear favorite for Management Information System (MIS) or Computer Estimating package. Several different commercial MIS systems were used by the participants. Those who identified no MIS mostly use an internal spreadsheet for calculating estimates. See figure 7.
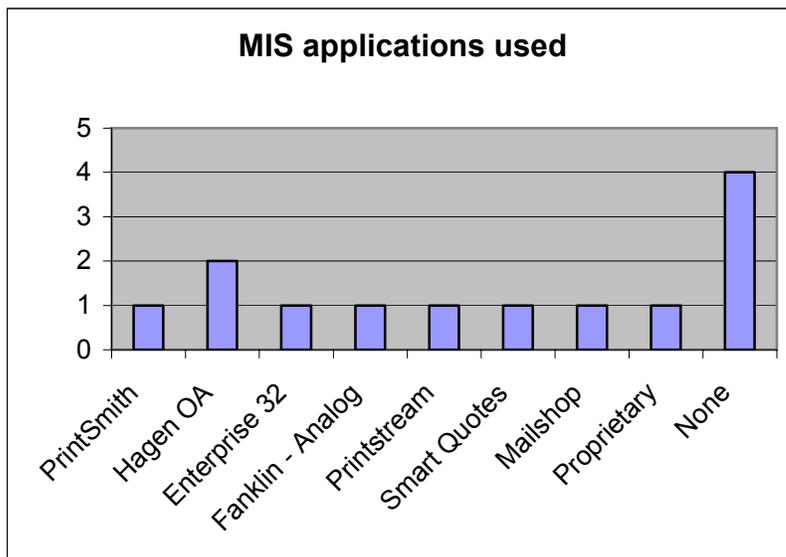

Fig. 7. Different MIS applications used by sample group.

Job Costing

In conventional lithography, it is common to track all individual job costs for the purpose of determining actual job cost (to compare with estimated costs) and to ensure that all change-orders are applied to the correct customer. Only a few companies do this in digital printing, and typically to only a few jobs. The questions related to job costing were:

- Which data do you ***collect and assign to individual jobs*** during or after production?

- Upon completion of a digital printing job, to what extent do you calculate and report (internally) ***job costs*** using actual cost data?

Three companies track actual job costs for every job they produce. Three companies select a sampling of jobs each week or month and look at those to determine trends and to refine their estimating process. More than half of the companies either never track job-level costs or do it only when something goes wrong. The majority of those surveyed do not know if actual job costs are above or below their estimated costs, on a consistent basis. See figure 8.

Frequency of job cost analysis

- 23%
- 39%
- 23%
- 15%

Legend:
- Never
- Only if needed
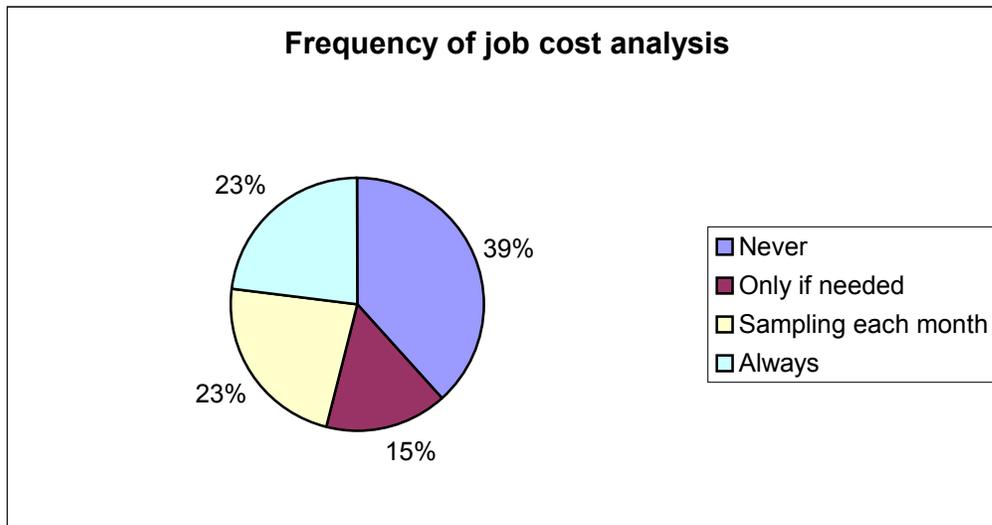- Sampling each month
- Always

Fig. 8. Frequency of job cost analysis performed by sample group.

When asked why digital printers do not job cost, the typical response was focused around two themes: not enough time; and no persuasive reason to. Most digital printers do not

consistently job cost. However, periodically, such as when a job encounters substantial problems, job costing is performed.

With VDP jobs, it is helpful to know the cost per response for a particular campaign. For the printing customer, their cost is the printer's price. However, the print provider may be interested in knowing their cost per response too, so they can make strategic pricing and marketing decisions.

As run length and total job price declines, some companies felt it was not cost effective to track costs at the job level and preferred to use a "cash register" model. For these companies, rather than track the costs of a $75 job, it is preferred to track costs at a daily level. At the end of the day, the costs for the day are compared to the revenues for the day. For these companies, the costs associated with data collection and job costing exceeds the value derived from it.

Job costing is increasingly being automated. With direct machine interfaces, it is possible to not only send parameters to a digital engine but also to collect data automatically from that machine. As this process improves, it will advance the job costing function and reduce the costs associated with it.

Activity Based Costing (ABC)

The last question asked if the participant was familiar with activity-based costing. Activity based costing was a term familiar to only three participants. Most were not familiar with the term and no participant currently uses ABC principles in their business. Interestingly, with highly consultative VDP campaigns, where a large portion of a project manager's time may be assigned to one or two campaigns, ABC increases in relevance. It is possible that more companies will look to this costing model in the future.

Observations and Conclusions

There are a number of interesting observations and conclusions that can be derived from this research study. Notable observations include:

1. *Job cost estimating is not uniformly understood or applied by digital printers.* The understanding and importance of job cost estimating to a company is largely influenced by the background of the executives for that company. Those coming from

a conventional printing background, with relatively low margins, tend to value estimating to a greater extent.

2. *Presently, digital printing companies put most of their focus on marketing strategies* with less emphasis on cost estimating processes. In an effort to expand digital printing opportunities, companies emphasize cost containment and estimating less than the marketing value of VDP and on-demand opportunities.

3. Digital printing companies experience better margins than conventional lithographers so there is *less incentive to focus on cost calculations*. Demonstrating response rates and return on investment is perceived as more valuable than focusing on costs.[13]

4. As the digital print market tightens and prices subsequently drop as a result of increased installations, *cost control and estimating will increase in relevance*. This is particularly true for low complexity work such as short-run color with minimal variation and finishing.

5. *Tiered click-charges,* the practice of lowering manufacturers' click charges when a particular monthly volume is reached, *can make cost estimating challenging*. Some companies enter into a variable click charge, depending on monthly volume, making estimating of costs less predictable.

6. *Digital print engines are estimated at a defined run speed*, unlike offset equipment, where speed is variable based on the complexity and run length of the job.

7. *As ink-jet digital printing penetrates the commercial market, the click-charge model may change*.

8. *Database (list) management, cleansing, verification, and processing are highly price-list based*. Few printers understand true costs of these functions.

9. *The time required to build a page template with VDP rules can vary substantially by job* and their costs can be difficult for the estimator to project.

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[13] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-7). Bellingham, WA: SPIE International.

Three Approaches to Digital Printing

There are three broad approaches to commercial digital printing[14]:

- ▪ ***Traditional print providers***, who supplement their offset presswork with digital printing for short-run color and versioned commercial print.
- ▪ ***"Low-touch" print providers***, who leverage the power of the internet to streamline business transactions with digital storefronts.
- ▪ ***Marketing solutions providers***, who see printing less as a discrete manufacturing process and more as a component of a complete marketing campaign.

A category's approach will influence the need and relevance of an accurate estimating system. Traditional print providers and "low touch" providers need to have accurate job cost estimating systems, as price models for these companies generally gravitate towards low-cost differentiation.

Traditional print providers already know how to cost estimate, since most have been estimating offset work for some time. Conventional MIS estimating applications can easily adapt to short-run color engines. As more digital print engines enter a particular market, margins tighten and the work gets commoditized, increasing the need for cost control and estimating.

"Low touch" providers use a different approach. Their estimating needs involve immediate, computer-generated pricing via a digital storefront. Their pricing model prohibits customized estimating by a human. This work is low-complexity, highly-automated, and suits a pricing matrix well. A variety of online environments are available to store customer assets and facilitate digital transactions.

The third category of digital printing companies, marketing solutions providers, focuses on consultative, complex services that are priced by market value. While costs are important, the greater complexity, and subsequent margins, *may* reduce the relevance for a sound estimating process. When a company makes a lot of money, estimating, tracking, and controlling costs may be perceived as unnecessary or secondary.

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[14] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-8). Bellingham, WA: SPIE International.

Conclusions[15]

Traditional print providers use digital printing for short-run and versioned campaigns. These companies evolve from commercial lithographers and photographers and add digital engines to extend their capabilities into short-run lengths. They typically use an existing sales force and call on conventional printing clients. These companies use established estimating practices adapted from offset estimating.

Those with a conventional lithography background have a greater affinity to cost estimating and tend to use costs as a basis for pricing. Those with a prepress or photography background lean toward price lists. Those with a marketing background understand the value of branding, cost per response, and look to market value as a basis for pricing.

Pricing matrices are used liberally and may influence the commoditization of digital printing in the future, particularly in short-run color markets. The practice of offering substantial discounts on digital print jobs will continue to increase as competition grows.

"Low-touch" print providers leverage the power of the internet to streamline business transactions with digital storefronts. These companies focus on very short-run and print-on-demand projects, reducing costs by limiting human contact with jobs. Often the dollar amount of each job is quite low, necessitating a totally automated workflow. The onus is put on the customer to complete the job information, access online assets or upload a file for output, and initiate the order.

The "low touch" model works well for short-run and very short-run static or versioned printing. Simple VDP work is possible too. "Low touch" companies use pricing matrices and real-time estimating via digital storefront to minimize the costs associated with producing an estimate for short-run digital printing. In many cases, the print transaction requires prepayment via credit card.

Driving costs out of administering a transaction is the key to success in static short-run digital printing. Reducing the "touch points" is critical. The primary way to drive costs out of the process is to automate the entire transaction through a Web portal, including pricing, job delivery, digital job ticket, preflighting, and job queuing/scheduling. For short-run color, job estimating and job costing are only cost-effective in situations when those processes can be

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[15] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-8). Bellingham, WA: SPIE International.

automated. One participant suggests it costs $50 to complete a single estimate. One comment: "Can't stop and touch a job. If you stop to estimate it, you'll lose money."

Some digital press engines track and report costs, though there is some skepticism about how thorough these calculations are. For example, one participant complained that the tracking did not consider sales tax to be a cost and therefore inflated its profit calculations.

Marketing solutions providers see printing less as a discrete manufacturing process and more as a component of a comprehensive marketing campaign. These companies provide significant value by incorporating variable data into widespread marketing programs. Web-to-print applications may be used, though the complexity of work is significantly higher than "low-touch" print providers. Marketing solutions companies focus on complex VDP projects and utilize project management teams to execute a marketing campaign. They function in a consultative role, focusing energy on tracking response and demonstrating ROI. VDP work requires greater quality control and more tracking of materials, generating higher costs throughout the process. These companies tend to use *value-based pricing* models focused on customer benefit rather than *cost estimating*.

There is a big difference in the necessity for cost-based estimating in short-run color and print-on demand where time and expenses are fairly predictable, compared to complex variable data printing, where the intricacy of each job can substantially influence cost variation. Complex VDP work is difficult to estimate. A high-price is often negotiated for very complex work and the printer makes money, though the precise amount is not known in advance.

Choices for Estimating Digital Printing

A functional cost estimating system is only practical for estimating work with common, predictable processes. Most digital printing is relatively simple to estimate. The variable cost of each impression is easy to determine. The run speeds are predictable (quantity ÷ throughput × BHR). Finishing and conventional prepress are also simple. With common processes and predictable production speeds, these operations are estimated in a similar manner to conventional offset.

However, using BHRs may not be the best option for digital printers. Since a large portion of toner-based printing's costs involve variable expenses, i.e. click-charge, it may be

better to estimate using factory click charges instead of hourly rates. Commercial MIS packages are beginning to incorporate a click-charge model for estimating.

The optimum model for estimating digital printing depends on the category or approach of the company. *Traditional print* models will likely continue to estimate using existing MIS tools, creating hourly rates or factory click charges in a manner similar to their offset presses. The key to profitability for traditional printers is to build an estimating system that can be highly responsive to customer demand and can produce estimates at a fairly low cost. This will likely mean a factory click-charge model. The traditional printer needs to transition to a "low touch" model or a marketing solutions model. In the long run, building a business as a short-run color conventional printer will be difficult without a solid differentiation strategy.

"Low-touch" digital printing is focused on fully-automated, low-cost digital workflows using Web interfaces. Web-to-print applications must be capable of generating quick, accurate pricing, usually based on standardized pricing matrices. For this reason, product standardization, with a structured pricing matrix and digital integration, from initial customer contact to machine set-up, are keys to profitability. "Low touch" printers will likely build their "estimating" system on pricing models, not estimating models.

Commercial MIS providers have recognized the need for integrated digital storefronts, price estimating (as contrasted with cost estimating) modules, and direct machine interfaces (DMI) to automate the process of "low touch" transactions.

Marketing solutions providers are in the best position to offer differentiated, value-added solutions, and avoid the commoditization of digital print. Marketing solutions providers offer consultative services in combination with comprehensive marketing campaigns. They recognize that digital print is most valuable in the context of a larger branding or concentrated direct marking program.

Since complex VDP programs require significant project oversight, a means to estimate and track project management activities is needed. Activity Based Costing may be the best approach for this type of work. Estimating using ABC should provide the greatest near-term usefulness, as it provides for tracking and managing support costs, in addition to production costs. Unfortunately, there are few commercial MIS applications that work well using ABC. As VDP workflows become more standardized, streamlined, and predictable, project management needs may decline, making BHR approaches more practical.

Variable Data Prepress Estimating Practices

Clearly, the biggest estimating challenges today relate to managing databases and building templates and VDP rules. Estimating variable data prepress can be very complex. With today's inconsistent VDP workflows, a one-step estimating formula is impractical. Expert operator opinion is necessary in any circumstances to accurately predict time requirements. However, a useful approach to estimating variable data prepress incorporates the following practices:

1. Determine what data is used in the list. Ask the customer to print the field names or header row of their database to give the printer a sense of the data stored in the list. This helps the estimator understand the scope of the project.

2. Determine how large the database is. This will influence the amount of time needed to clean the data. If the customer requires a high-degree of accuracy, factor in some time for manual proofreading of the file.

3. Have the customer provide a sample of the database. For large campaigns, 1 percent of the file is sufficient. Smaller campaigns may need 5-10 percent of the data. This gives the estimator a sense of the quality of the data.

4. Run some trials to determine the rate at which your database or mailing software can do various functions. This will be reflected in the number of fields or records capable of being processes per hour.

5. Examine a print sample to determine the dimensions and complexity of the project.

6. Determine if significant creative and preflighting activities are needed. This is achieved by determining how tight the project parameters are and how knowledgeable the customer is.

7. Determine the scope of the variable information in the job. Decide if custom rules are needed or whether the variable components can be selected from a rules library. This helps the estimator understand how much time is needed for setting up the VDP job.

8. Before presenting a price quotation, clearly document the scope of the campaign and delineate the assumptions the project is based on. Detail will help to prevent "project creep".

9. When possible, output a sample job to determine if the job will choke the RIP.

Inquiring about these items will help the estimator understand the complexity of a VDP job and to accurately predict time necessary to complete it. With investigation, the estimator will become an expert at predicting costs.

Final Thoughts

Understanding and predicting costs can be extremely beneficial for business decisions. Establishing a solid system to estimate those costs can be somewhat challenging though. Estimating often takes a back seat, particularly when profit margins are strong. Unquestionably, cost estimating digital printing will increase in relevance in the years ahead, as margins tighten and cost knowledge increases in value.

Before embarking on a cost estimating system for digital printing, one must consider the ultimate goals.[16] Is automating the estimating process important? Certainly if a company is striving to be "low touch", estimating and job costing must also be "low touch". If the objective to produce ultra precise estimates for cost containment, pricing matrices are not the best solution. Like production workflow, the estimating workflow for one company will not be the same as another. Step one is to determine the objective. With thought, a functional estimating system will help any company make better management and marketing decisions.

About the Author

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[16] Keif, M. G. (2007). **Cost Estimating for Commercial Digital Printing.** In X. Lin & B. A. Yanikoglu (Eds.). *Document Recognition and Retrieval, Proceedings of SPIE, Volume 6500,* (p. 6500M-9). Bellingham, WA: SPIE International.