Title: NETWORKED PROJECT ESTIMATION SYSTEM

Abstract: A project vendor, such as a print vendor in a commercial printing industry, enters process capabilities, end product capabilities, and available cost data points for products and processes into a project vendor interface, which is stored within system memory. Product and process options are selectable, such as through palette options within a graphic user interface, by one or more client users at one or more networked client computers. Product and process options are limited to the end product and process capabilities which were entered by the vendor. As a client user enters information regarding a project, the estimation system calculates and displays estimated cost and uncertainty values for the entered project information, based upon the stored cost data points for similar products and processes. The client customer may proceed to enter more accurate information regarding the specification of a project. The client may analyze the costs of a project, save the project specification (i.e. take a snapshot), or may send the project specification to the vendor, such as for a formal request for quote. A client user may readily modify stored project specifications, and may compare estimated costs and uncertainties between different project specifications.
NETWORKED PROJECT ESTIMATION SYSTEM

FIELD OF THE INVENTION

The invention relates to the field of project estimation systems. More particularly, the invention relates to a networked project estimation system to enhance the input of project information, and provide automated rough estimates of project costs.

BACKGROUND OF THE INVENTION

Print vendors are often asked by a client customer to prepare an estimate for a project, before getting an approval to proceed on a project. Many print job projects are sufficiently complex, such that specifications initially provided by client customers are rarely complete. Therefore, a single estimate for a project, manually produced by a print vendor in communication with a client customer, often takes several minutes to complete by hand.

A conventional print job specification may submitted to a print vendor from a client customer in many forms, such as in the form of a letter or form supplied by the client, or as a form supplied by the vendor, which is manually filled out by the client.

Print job projects often include several design and production options, which are often chosen during the estimation process by the client customer. Such decisions are often made based upon the overall project budget of the client customer, the cost of the individual project processes, and the production quantity for the project. For example, even for a project in which most details are known, a client customer may ask for multiple estimates for the specified project, based upon multiple quantities (e.g. 1,000 pieces, 5,000 pieces and 10,000 pieces), different process options (e.g. spot colors, print bleed, bindery options), or different supplies used (e.g. print stock, cover stock). Therefore, several estimates are typically requested by a client customer for each project (e.g. more than ten estimates are common), so that a client customer may eventually find a single
project specification and estimated price which meets their design and budgetary requirements.

In addition, client customers often have incomplete project specifications at the time they approach a vendor for an estimate. However, to provide a client customer with a contractual estimate, a vendor requires detailed specifications for the project. The vendor is therefore often required to help client customers refine their specification to the point that a contractual estimate may be prepared. It would be advantageous to provide an automatic method by which details of the specification are fine tuned.

Conventional estimation processes are therefore highly iterative and communication intensive, wherein a client customer repeatedly modifies the specification of the project, based upon the desired design of the project, and the estimated cost of the project provided by the vendor. However, the expenditure of time required by vendor personnel to manually prepare several project estimates is significant, reducing the profit margin for projects produced by the print vendor, and often increasing the cost of printing services provide to client customers. In addition, while print project transactions are typically high in volume, they are usually low in dollar value, such that the vendor labor required to provide multiple estimates for each project becomes a significant cost factor.

As print procurement is a high volume, low cost transaction category, it is ideally suited to the efficiencies of e-commerce. As well, many corporate customers are insisting on e-commerce processes from their printing vendors. Many print vendors are already networked to their client customers, and many more print vendors quickly becoming networked, in response to the increasing expectations of their client customers. Soon, the majority of all print jobs will flow digitally through some network between print vendors and their client customers. Corporate customers are looking for efficiencies and cost savings that are possible only through electronic linkage with their suppliers.

Prior Art Networked Estimation Systems. While some print project estimation systems have been implemented over the
Internet, these systems typically provide only modest enhancements to manually prepared estimation systems.

In a similar manner to conventional estimation systems, current web-based systems typically provide a form-based or spreadsheet-based data entry user interface, wherein a user is required to enter project specification information within rows and columns. Client users are required to scroll through available options, or tab through various fields, to enter required data.

Efficient use of such complex form-based or spreadsheet-based estimation systems requires a high level of proficiency from users. Numerous categories for data entry are presented to the user, even while several categories are irrelevant for a given project.

While automation of form-based estimation processes provides some improvement of manual form-based methods, it still requires a client user to fill in form-based information, and then submit the specification to a vendor to obtain an estimate. Once an estimate is processed by a vendor, the client user typically adjusts the project specification, and submits the specification for another estimate, in a similar manner to a manual form-based processes. In such systems, each specification is still sent to the print vendor for estimation, requiring the detailed review of each iteration of the project specification by vendor personnel.

Current estimation tools are also form-based, and are typically designed for manufacturing cost estimation, as a part of an accounting package. They are moderately difficult to use, require training, and are not used as a customer/job acquisition or retention tool. Currently, there is no user friendly estimation system for typical print processes, such as for four-color printing processes.

Existing form-based or spreadsheet-based order entry systems are typically used to submit project information to multiple vendors, to obtain multiple estimates for the same defined project specification.
Currently, some print vendors have established their own Internet presence, providing basic Web-based order entry for print jobs, through web-based catalogs of goods and services. These web-based order entry systems range from simple e-mail solutions with their corporate customers, to a Web site for ordering printed matter.

Current web-based specification entry tools often generate many unqualified inquiries, further increasing the workload for a print vendor. Therefore, while web-based request forms often generate significant requests for quotes, they typically fail to reduce the labor requirement for a print vendor for each project, and they typically fail to generate additional business for the print vendor.

One current web site wherein clients may order stationery, business cards and other marketing documents is offered by Image-X, of Seattle, Washington. ImageX provides access to their Web site for existing corporate customers, wherein ImageX receives orders through the web site, and produces the printed materials, through a contracted network of print vendors.

Another current web site which offers printing services, by I-Print, of Redwood City, California, allows consumers to design and order business cards, personal stationery and some consumer greeting cards. This system is primarily a web-based “front end” for a single print vendor, providing a authoring and creation tool for a limited number of available products, and lacks comprehensive estimation capabilities, such as detailed estimation and uncertainty estimates over a wide array of available printing projects.

Currently, print vendors do not receive much in the way of customer profile information, and any information they do gather must be done manually. Nor do print vendors have a good idea of what type of future printing needs customers have, unless they engage in market research, which is often costly and provides limited value.

While the disclosed prior art systems and methodologies provide project ordering and estimation systems, they fail to provide a project estimation system in which all client selectable project options are
applicable to the specified project, and are available by the vendor, through a user friendly interface which allows a client to easily enter one or more project specifications, and obtain approximations of project costs and uncertainties.

It would be advantageous to provide a project estimation system having a user-friendly interface, wherein information fields to be entered by a user are limited to the type of end-product and process chosen by the user. It would also be advantageous to present data entry for project specification based upon graphic portrayal of specified end-products and processes, and wherein a client is automatically provided with an approximate cost and uncertainty for the defined project, and can compare project specifications and costs between a plurality of projects. The development of such a project estimation system would constitute a major technological advance. As well, the development of an automated project estimation system which allows other enhanced system features, such as automated estimation based upon data analysis of similar projects, or the capture of marketing information regarding one or more clients, would constitute a further technological advance.

SUMMARY OF THE INVENTION

A project vendor, such as a print vendor in a commercial printing industry, enters available process capabilities, available end product capabilities, and available cost data points into a vendor module, which are stored within system memory. Product and process options are selectable by one or more client users, such as through a client module having a graphic user interface, at one or more networked client computers. Product and process options are limited to the process and end product capabilities which were entered by the vendor, such as through palette options. As a client user enters information regarding a project, the estimation system calculates and displays estimated cost and uncertainty values for the entered project information at the client module, based upon the stored cost data points for similar products and processes. The client customer may proceed to enter more accurate information regarding the specification of a project. The client may save the project specification (i.e. take a
snapshot), or may send the specification to the vendor, such as for a formal request for quote. A client user may readily modify stored project specifications, and may compare estimated costs and uncertainties between different project specifications.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 shows a plurality of conventional project estimation request for quote forms;

Figure 2 shows a form-based estimation system implemented on a computer;

Figure 3 is a block diagram of a networked project estimation system;

Figure 4 is a block diagram showing vendor input of available resources and cost information;

Figure 5 shows one embodiment of a vendor interface for a vendor module;

Figure 6 is a project specification interface within a client module;

Figure 7 is a specification inspector interface window, in which details regarding resources may be entered, reviewed or modified;

Figure 8 shows cost estimation based upon linear regression analysis of input cost data within a system module;

Figure 9 is a project analysis interface for a client module;

Figure 10 is an interactive snapshot cost comparison window for a client module;

Figure 11 is a system architecture block diagram of one embodiment of the networked project estimation system, in which system software modules are located on a remote computer, and wherein both client and vendor users access the system over a network;
Figure 12 is a system architecture block diagram of an alternate embodiment of the networked project estimation system, in which system software modules are located on a remote computer, and wherein multiple client users and multiple vendor users access the system over a network; and

Figure 13 is a system architecture block diagram of a second alternate embodiment of the networked project estimation system, in which system software modules are located on a vendor computer, and wherein client users access the system over a network.

**DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

Figure 1 shows a plurality 10 of conventional project estimation request for quote forms 12a-12n. A variety of alternate project specifications are typically entered on a plurality of forms 12. Each form 12 usually includes pre-printed printer identification 14. Other information fields, which need to be filled out by a client user, often with direct assistance from a vendor, include an estimate identification 16, client information 18, overall project description 20, artwork input 22, intermediate proofs requested 24, supplies 26, supplementary processes 28, and packaging and delivery services 30.

Figure 2 shows a form-based estimation system 40 implemented on a computer 42, wherein information regarding a project is entered in a manner similar to information input on a manual form 12. A user is typically required to scroll through form-based information entry screens 46, and enter project specification information within data entry fields 48, as applicable to the project. While automated data entry improves the capture of some information, the user is still confronted with many fields 48 and data entry screens 46 which may or may not be applicable for a proposed project. There is very little overview of the project, as specified, within the interface 40. When the user finishes filling the electronic forms in as much detail as is known, the electronic form is typically submitted as an electronic file for a formal request for quote. The user is then required to go through the entire
process again, for example to change project parameters slightly, hopefully entering non-changing information similarly, such that submittal of the second project specification yields a comparable cost for a project based upon the desired changed specification. As well, the vendor receives each submitted specification, just as in a conventional form-based system, and is required to prepare an estimate, based upon the electronic request for quote (RFQ).

There is no automated estimate feedback to the user, either for rough “ballpark” project costs, or for uncertainty values attributed to the rough project costs, during the specification process. As well, there is no interactivity between the defined processes and the specified endproduct.

Figure 3 is a block diagram of a basic embodiment of a networked project estimation system 50a. A vendor user inputs available resources 56 into a vendor module 52 at a vendor computer 54. Available resources 56 include available products 58 which are available to client customers, typically using available processes 60. While materials or supplies 62 may also be entered as available stock by a vendor user, materials and supplies 62 are also commonly ordered or supplied by a client customer. For a networked project estimation system 50a implemented within the printing industry, a print vendor enters end product capabilities 58 (e.g. such as brochures, stationery, business cards, and posters), printing process capabilities 60 (e.g. such as pre-press, printing, bindery, and delivery operations), and available printing supplies 62 (e.g. such as standard or special order paper stocks and inks). The entered product and process capabilities entered by the vendor are related to the available machinery, personnel, and expertise of the vendor.

**Vendor Module.** Figure 4 is a block diagram showing vendor input of available resources 56, including a defined superset 57 of available products 58a-58m, a defined superset 59 of available processes 60a-60n, and a defined superset 61 of available supplies 62a-62o for a basic project estimation system 50. As well, a vendor user may input available cost information data 64a-64p.
Available resources 54 which are entered (i.e. activated) by the vendor user through the vendor module 52 are stored to memory 66 within the system module 68. While the system module 68 is shown as an external module to the vendor computer 54 in Figure 3, it may be located within the vendor computer 54 as well.

As shown in Figure 4, the vendor user inputs cost and uncertainty information 64a-64p for projects (e.g. such as actual charged costs for one or more types of prior projects). The entered cost and uncertainty information 64a-64p is stored to system memory 66, whereby the project estimation system 50a estimates the cost and uncertainty of similar projects specified by one or more client users, based upon one or more entered data points 64. In a preferred embodiment of the vendor module 52, client data 64 from a plurality of vendor users is optionally imported into the system module 68, thus providing a large number of data points 64 for different processes 60 and products 58.

Figure 5 shows one embodiment of a vendor interface 84 for a vendor module 52. In embodiments of the project estimation system 50 wherein system software modules 52, 68, 70 are located on a remote networked computer or server, such as across the Internet, the vendor interface 84 is remotely accessible as a web-site to a vendor user from a vendor computer 54, such as through Internet access software. The vendor interface 84 includes a product module 86, a process module 88, a supply and materials module 90, and a cost entry module 92. In alternate embodiments of the vendor module 52, separate interface screens 84 are used for entry of product, process, supply and cost information.

Within the product module 86, a vendor sets and reviews attributes of one or more available product types 58a-58m, such as through a define product control 94, wherein the vendor may input a name (e.g. "Pamphlet") of a product 58 in product entry field 96. In a preferred embodiment of the vendor module 52, a product library 98 is available, whereby the vendor module 52 includes various conventional products 58 for the industry which the vendor module 52 is used (e.g. typical printing industry products), and wherein the
vendor may easily select product categories and attributes from the product library 98, and use the library product 58, either as defined, or as customized by the vendor. Detailed attributes for a selected product 58 may be set, through activation of attributes icon 100. After a product 58 is defined by the vendor user, the product 58 is activated through activation icon 102. A vendor user may also disable or delete a defined product 58, through product deletion icon 104.

The vendor user may also view the defined product palette, through product palette icon 106. Activation of the product palette icon 106 allows the vendor to review their product line (i.e. items available for manufacture to client customers). The defined product palette is similar in form to the product selection palette 154 (FIG. 6) within the client module 70, in that products 58a-58m activated by the vendor user within the vendor module 52 are added to the palette 154 of selectable products within the client module 70.

Within the process module 88, a vendor sets and reviews attributes of one or more available process types 60a-60n, such as through a define process control 108, wherein the vendor may input a name (e.g. tri-fold) of a process 60 in process entry field 110. In a preferred embodiment of the vendor module 52, a process library 112 is available, whereby the vendor module 52 includes various conventional processes 60 for the industry which the vendor module 52 is used (e.g. typical printing industry processes), and wherein the vendor may easily select process categories and attributes from the process library 112, and use the library process 60, either as defined, or as customized by the vendor. Attributes for a selected process 60 may be set, through activation of attributes icon 114. After a process 60 is defined by the vendor user, the process 60 is activated through activation icon 116, and stored to memory 66. A vendor user may also disable or delete a defined process 60, through process deletion icon 118.

The user may also view the defined process palette, through process palette icon 120. Activation of the process palette icon 120 allows the vendor to review their available processes 60a-60n (i.e.
processes 60 available to client customers). The defined process palette is similar in form to the process selection palette 163 within the client module 70, in that processes 60a-60n activated by the vendor user within the vendor module 52 are added to the palette of selectable processes within the client module 70.

Within the supplies module 90, a vendor sets and reviews attributes of one or more available supplies 62a-62o, such as through a define supply control 122, wherein the vendor may input an identifier (e.g. cover stock) of a supply 62 in supply entry field 124. In a preferred embodiment of the vendor module 52, a supply library 126 is available, whereby the vendor module 52 includes various supplies 62 for the industry which the vendor module 52 is used (e.g. typical printing industry inks and paper), and wherein the vendor may easily select supply categories and attributes from the supply library 126, and use the library supply 62, either as defined (such as by manufacturer and item number), or as customized by the vendor (such as for accepting paper stock from a client for a project). Attributes for a selected supply 62 may be set, through activation of supply attributes icon 128. After a supply 62 is defined by the vendor user, the supply 62 is activated through supply activation icon 130, and stored to memory 66. A vendor user may also disable or delete a defined supply 62 (such as for discontinued or for unavailable paper stock), through supply deletion icon 132.

The user may also view the defined supply palette, through supply palette icon 134. Activation of the supply palette icon 134 allows the vendor to review their available supplies 62a-62o (i.e. supplies 62 available to client customers). The defined supply palette is similar in form to the supply selection palette 165 within the client module 70, in that supplies 62a-62o activated by the vendor user within the vendor module 52 are added to the palette 165 of selectable supplies 62 within the client module 70. For industries wherein supplies 62 are often supplied by clients, or are readily ordered and delivered for a particular project, the supply selection palette within the client module 70 is not necessarily limited to current supply stock 60.
Within the cost data entry module 92, the vendor user inputs cost and uncertainty information 64a-64p for projects, which are stored to memory 66, wherein the project estimation system 50a estimates the cost of similar projects specified by one or more client users. A vendor typically enters either a product cost 136 or a process cost 138, and then enters piece quantity 140 and total project cost 142. In a preferred embodiment, the vendor also inputs a time value 144 (such as by entering the date of the project, thus reflecting a relative historical cost). When the vendor completes the entry of cost information 64, the cost data 64 is stored into memory 66 through activation of store cost icon 146. The vendor user may also delete stored cost information 64, though activation of cost deletion icon 146.

**System Module Architecture.** The system module 68 (FIG. 3) includes a database engine 69, in which business and validation rules (i.e. valid products, processes, supplies and costs) are stored and retrieved. The database engine 69 is matched to the development environment for the software modules 52, 68, 70, as well as to the network 74. It is preferred that system software chosen for the development of vendor modules 52 and client modules 70 provide drag-and-drop capability for the estimating engine, along with draggable process connections between workarea objects within the client user module 70.

For a project estimation system 50 embodiment using Java™/Swing architecture, a JDBC bridge is typically used, which provides efficient communication between modules and the system database 69. For a system embodiment using DRUMBEAT 2000™, a product of Elemental Software Inc., either JAVASCRIPT™ or VBSCRIPT™ are typically used, which provide efficient communication with the system ODBC database 69, typically through the use of ASP pages. Present embodiments of the networked project estimation system 50 use a system architecture based on Java JDK 1.2 Swing objects and DRUMBEAT 2000™.

**Network Architecture.** A preferred embodiment of the networked project estimation system 50 is typically implemented across the Internet 74, forming a web-based tool for estimating print jobs. A
client module 70, typically accessible through web browser software at a client computer 72, is linked to the project estimation system 50a through a two-way communication connection across the network 74. The system module 68 may be located at any location across the network 74, such as at a remote computer location (FIGS. 11,13), in communication with one or more vendor computers 54. In alternate embodiments, the system module 68, as well as the vendor module 52, are located at the vendor computer 54 (FIG. 12).

Client Module. The client module 70 allows client users to input one or more specifications 80 for a project, based upon the available products 58, processes 60, and materials 62, which were defined by the vendor user through the vendor module 52, and stored to system memory 66. The client module 70 communicates with the database 69 to validate client user input, and restricts specification options presented to the client user, depending on the resource and product objects selected by the vendor through the vendor module 52.

At the client computer 72, a client user invokes the estimation system 50, by activating the client estimation module 70 at the client computer 72, such as across the Internet 74, through a website controlled by the vendor module 52. The client estimation module 70 typically provides an introduction screen, wherein the client user enters identification information 78 (FIG. 3), such that only qualified client users are allowed to access the estimation system 50.

Basic embodiments of the client module 70 allow unrestricted access from any client user connected to the network 74. For example, a general web-based estimation system 50 may be offered to homeowners, wherein homeowners can receive approximate estimates 174 for home repair and restoration (e.g., adding a bathroom, installing a new kitchen, building a brick patio). Such an estimation system is valuable for many homeowners, wherein relative costs for different home improvement projects can be viewed, as well as a comparison between “shopping-out” construction and “doing-it-themselves”. In such a general system, the relative costs for local building materials and labor are typically used, such that
homeowners would gain a relatively accurate estimate and cost uncertainty value for a project in their location.

In other applications, preferred embodiments of the client module 70 limit access to client users. For example, in the printing industry, print vendors may restrict networked access through web-based client modules 70 to their estimation system 50, for current client customers located within their region of operation, or to existing and potential customers within their region who have submitted business information (e.g. such as general business information, credit information, and the types and quantities of printed products they are interested in).

Access limitation to a client module 70 is typically accomplished through password protection, such that only qualified client users are allowed to receive estimates for projects. In another embodiment, new client users, upon entering the web-site of a vendor and inputting information in a registration process, are given access to the client module 70. Such input information may be used by the vendor to identify and qualify prospective client customers, or to gain marketing information regarding one or more client customers, or demographic information for a plurality of clients throughout one or more regions.

When access to the client module 70 is allowed, a client user typically enters a project specification interface 150, as shown in Figure 6. The project specification interface 150 provides a work area 152, a product palette 154, a process palette 163, and a materials palette 165, as well as a project quantity input field 170, and a project estimate window 172, which includes a project cost estimate display 174 and an uncertainty display 176.

Each product palette icon element 158 represents the available products 58a-58n, as defined by the vendor user. For example, in the printing industry, a print vendor may typically produce leaflets, booklets, business cards, and posters. Upon activation of these product categories 58 within the vendor module 52, palette icons 158 representing leaflets, booklets, business cards, and posters are
allowed by the system module 68, and are shown as selectable icons 158 from the product palette 154 within client module 70.

Product options 58 are selectable from a superset 59 of all available product options 58a-58m, as entered or activated by the vendor user. In the interface 150 shown in Figure 6, the product specification interface 150 includes a product icon palette 154, which shows the superset 157 of all available product option icons 158a-158m. Each of the selectable product icons 158 represent a product option 58 from the superset 57 of all available product options 58a-58m. The client user therefore selects one or more available product attributes 58 for a project 80, by activation of corresponding product icons 158.

A client user selects a product icon 158 from the product palette 154 of selectable products 58, such as by double-clicking on an icon 158, or by dragging an icon 158 into the work area 152. As shown in Figure 6, the booklet product icon 158 is highlighted, which indicates that the booklet product icon 158 is chosen by the client user (e.g. a printed and bound booklet 58 with cover stock).

When the user selects a product icon 158, the work area 152 expands to show a graphic product thumbnail preview 164 of the product type 58 selected. The graphic product thumbnail preview 164 emulates a product 58, as defined and limited to the selected product attributes 58 and process attributes 60.

Furthermore, the work area 152 expands to display one or more applicable processes 60 used to manufacture a selected product 58, and preferably displays materials 62 which are required to produce the selected product 58. As before, the processes 60 required to produce the product 58 are limited to the processes 60 available from the vendor, as defined within the vendor module 52.

In a preferred embodiment of the client module shown in Figure 6, the workspace 152 displays the applicable processes 60 in the order of workflow for the project 80, whereby the client user may easily view the required processes 60, in order of the process steps 60 required to produce the chosen product 58. For example, in Figure 6, both...
paper stock 62a and cover stock 62b are shown entering the work area 152 at points 166a and 166b respectively. As well, for a five-color booklet chosen, a four-color process ink can 168a is shown, as well as a spot color ink can 168b for the printing the inner pages, and two spot color ink cans 168c,168d are selected by the client user for printing the cover stock pages. Alternate embodiments of the work area 152 provide more detailed graphic views of applicable processes 60 and materials 62.

Upon initial selection of a product 58 (e.g. a booklet), the client user is required to enter basic information regarding the selected product 58 and required processes 60 (e.g. such as use of cover stock, total number of pages, folding and binding details). Within the graphic work area interface 152, the client user is prompted, such as through blinking ink can icons 168, to enter basic information regarding color. By clicking on the ink can 168, or by dragging selectable ink cans 162 from the supply palette 161, the user specifies ink type and color selection, such as process color (e.g. CMYK) 162, as well as one or more spot colors 162. By clicking on or dragging the process color icon 162, the process color ink can icon 168a appears within the workspace 152. Further specification of color is allowed (as limited by the capabilities of the vendor module 52), such that the user may define one or more additional spot colors 62.

**Inspector Windows.** Double-clicking of process elements 60 or material elements 168 within the workspace 152 (e.g. spot color icon 168b) allows the client user to further define attributes, through the use of inspector windows 180, as shown in Figure 7. For example, for spot color icon 168b, the user may define particular inks, either through selection icons 182 (e.g. for basic process color printing), or through detail submenus 184, such as for standard colors (e.g. PANTONE™ colors, based on the PANTONE MATCHING SYSTEM™ of Pantone, Inc., Moonachie, New Jersey), though submenu 184a, for user-defined colors, though submenu 184b, or for specialty inks (e.g. metallics), though submenu 184c. Detailed submenus may also allow the user to specify user-supplied materials 62, or externally-specified materials, such as through an import submenu 184d.
In the example shown in Figure 6, the user may add a spot color, by selectively placing \textit{(i.e. such as by dragging or double-clicking a supply icon 162)} an ink can 168 within the work area 152, associated with the "print copy" process 60. Similarly, the user may add more spot colors, by placement of more ink cans 168 within the workspace 152 \textit{(e.g. as is shown in Figure 6, for the printing of the booklet cover stock, with two ink cans 168c, 168d)}.

While the inspector window 180 is shown in Figure 7 as a separate interface, inspector windows 180 are directly related to a specified project 80 within the work area 152. In alternate embodiments of the client module 70, inspector windows 180 may be displayed within the work area 152.

**Estimated Cost Display.** The current estimated approximate cost 174 for a project, along with an approximation of error factor 176 for the estimate 174, appear within the workarea 152. In some embodiments of the client module 70, the estimated cost 174 and uncertainty 176 are updated automatically while the client user enters project information. In other embodiments, an estimate update control 173 is included, which allows a client user to view updated estimation information 174,176 as desired.

While the estimated cost 174 displayed within the client module 70 is typically non-binding, it provides valuable feedback to the client user during the process of entering a specification 80. As well, the error factor \textit{(i.e. uncertainty) 176 typically increases or decreases}, depending on the complexity of job specification 80, and depending on the detail of the project specification 80 which the client enters into the client module 70. For example, for a simple, single color business card project printed on commonly available paper stock, the uncertainty 176 for an estimated cost 174 may be small. However, for a complex, eighty page annual report, with die-cut and gate-fold processes 60, the uncertainty 176 may be large, since there are many specific processes 60 and materials 62. As well, if few details regarding a complex project 80 are known to the client user, or
entered into the client module 70, the uncertainty will typically be quite large.

As a client customer enters information regarding a planned project 80, the estimation system 50 calculates and displays the estimated cost 174 and uncertainty values 176 for the entered project information, based upon the stored cost data points for similar products 58 and processes 60.

Since the estimated cost 174 and uncertainty 176 typically become more accurate as a project is specified in more detail, client users are inherently encouraged to enter as much detail as is known. For example, for a project specification 80 having incomplete information, the estimated cost 174 might be $5,231, with a large displayed uncertainty 176 of plus or minus thirty percent. The estimated cost 174 contains a large level of uncertainty 176, since few specification details are known. As the client user specifies information in greater detail (e.g. such as by entering paper stock information, selecting 4-color printing, and defining no page bleeds), the estimated price 174 becomes more accurate (e.g. $5,250), while the uncertainty 176 decreases significantly (e.g. plus or minus ten percent).

**System Calculation of Estimated Cost and Uncertainty.**

While some embodiments of the cost estimation system 50 calculate estimated cost based upon detailed calculations, such as through task analysis, labor and machine rates, as input by a vendor user through vendor module 52, a preferred embodiment of the estimation system 50 produces approximate “ballpark” project estimates 174 with a minimum amount of processing time, through the use of data analysis of actual projects produced by a vendor user.

As discussed above, the vendor user inputs vendor cost data 64a-64n through the vendor module 52. The system module 68 stores the input vendor cost data 64a-64n, and categorizes cost data 64a-64n for different products 58, processes 60, and materials 62. Some materials 62 and processes 60 have a large impact on the actual cost of a project. For such influential resources 56, the project estimation
system 50 uses stored data 64, such as input by the vendor user, for projects using similar influential materials 62 and processes 60.

For relevant cost data 64 which relates to similar project specifications 80, materials 62, and processes 60, the system module 68 produces an estimated cost graph 190, using data reduction and error analysis (e.g. such as using linear or non-linear regression analysis) of the input cost data 64, as shown in Figure 8. Figure 8 shows a linear approximation for five cost data points 64a-64e used for business card projects. In Figure 8, actual project data 61a-64e for business card printing projects is input by a vendor user. The system module 68 plots the actual project data 64a-64e, based on project cost 194 as a function of project quantity 196.

Based upon the entered points 64a-64e, the system module 68 provides a projected cost value line 192, such as by using linear regression analysis. For a straight linear projected cost value line 192, therefore, the y-intercept 198 indicates an approximation of fixed setup cost for a business card project 80, and the calculated slope 200 allows the estimated cost 174 to be approximated for any entered quantity.

As more cost data information 64a-64n is input by the vendor user for different projects 80, characterized by available products 58, processes 60, and supplies 62, the approximation 190 of estimated cost 174 for prospective projects 80 typically becomes more accurate. Therefore, in preferred embodiments, the system module 80 receives new cost data 64 from the vendor module 52, as projects are accepted and/or completed, yielding more accurate cost estimations 174.

Non-Contractual Estimations. In most embodiments of the project estimation system, the initial automated estimates 174 which the client user obtains through the client module 70 are intended to be non-contractual "ballpark" estimates. While some embodiments of the project estimation system 50 may provide contractually binding agreements between a client user and a vendor, the system 50 is typically used for non-contractually binding agreements, whereby a
client user quickly receives an approximate estimate for a proposed project, often based on somewhat incomplete project specifications 80, and in which the estimate includes an uncertainty 176 (often due primarily to incomplete specifications).

As the automated estimate is not typically binding to either the client user or to the vendor, the client is likely to enter as much detailed information as is known, and quickly obtain an automated estimate. Early in the development stages of a project, long before parts of the project are specified (e.g. paper type or bindery details may not be known yet), the user may still attain value in a rough estimate 174, (e.g. a client may quickly determine if a potential project may be completed on an allowed budget).

Client Analysis Interface. The client module 70 also preferably provides an analysis interface 210, as shown in Figure 9. Activation of an analysis icon 181 (FIG. 6) from within the project specification interface 152 allows the client user to access the analysis interface 210. While the analysis interface 210 is directly related to the project specification 80 entered into the project specification interface 152, the analysis interface 210 provides a client user with detailed project cost analysis, based upon variables such as the quantity of pieces ordered.

The analysis interface 210 includes a cost analysis graph 212, which allows a client user to view both total project cost 174, as well as piece cost 214, based upon the quantity of pieces ordered. The cost analysis graph 212 includes a project graph 216 of total project cost 174, and a unit graph 218 of unit cost 214. As with other estimated approximated costs 174 and uncertainties 176, the project cost graph 216 and unit cost graph 218 are typically based upon cost data 64 entered by the vendor user, which is analyzed to predict approximated project costs of similar projects 80, and normalized to reflect differences in the costs of supplies 62.

The analysis interface 210 includes a quantity slider 220, having a quantity control 222, whereby a client user may vary the projected quantity of specified product 58, and view projected changes in
estimated approximate total cost 174, as well as projected changes in unit cost 214. The quantity control 222 may be varied across the quantity slider 220, from a minimum quantity order 224 (e.g. reflecting set up costs) to a maximum quantity order 226 (e.g. such as 100 percent of the specified quantity 170). As the client user varies the quantity control 222, a quantity indicator 228 on the cost analysis graph 212 slides to correspond to the chosen order size.

**Project Overview, Comparison, and Submittal.** From within the client module 70, such as within the product specification interface 152 or within the project analysis interface 210, and typically after a client user has entered known details regarding a project specification 80, the client customer is presented with a number of project review options. For example, a client may save a project specification 80, estimated cost 174 and uncertainty 176, by selection of the snapshot icon 177.

The client module 70 preferably stores the results of one or more snapshots 177, contract estimate requests and user demographic information within the database 69. Stored snapshots 177 are commonly used for several reasons, such as for submittal to a vendor for formal request for quote, for budgetary reporting purposes by the client user, or as a comparison to one or more stored snapshots 177 from alternate project specifications 80.

A client may print out an itemized summary of the entered project specification 80, by selection of the print icon 179. From within the print summary interface, the client user may compare the specified project 80 with one or more similar projects 80, such as to determine which project specification best meets design and budgetary goals.

Figure 10 shows a comparison display screen 242 within a snapshot comparison interface 240. The selected project comparison chart 244 displays cost graphs 216a, 216b for different printed quantities of leaflets 53. A first snapshot 177a reflects a first project specification 80a, having two-color printing, using a premium paper stock 62. A second snapshot 177b reflects a second modified project specification 80b, having a similar specification 80, with process-color
printing on a basic paper stock 62. A client user may easily view and compare the project costs of different snapshots 177a,177b. In the example shown, the client user may easily see that while the setup cost 198b for four color printing is higher than the setup cost 198a for two color printing, the use of premium paper stock 62 in the two-color job 177a results in a high project cost for large project quantities. Based on budgetary and distribution requirements for the project, the client user may quickly determine which paper and color printing options are acceptable (e.g. within a given budget, one project snapshot 177 may yield an acceptable quantity of leaflets).

In this example, a client user may quickly specify a first project specification 80a, using two-color process printing and premium paper stock 62, and save a first snapshot 177a based on the first project specification 80. The client user may then modify the specification 80a (e.g. by selecting process color and affordable paper stock), save the modified specification as a second project specification 80b, and save a second snapshot 177b. The client user may then quickly compare relative costs between the two snapshots 177a,177b, by linking them through comparison display screen 242, or by printing comparison chart 250.

The project estimation system 50 inherently provides accurate comparisons between projects having different specified options, since relevant specifications of print projects are typically duplicated between snapshots 177 of alternate projects 80. As well, differences in product 58, process 60, or material 62 options are preferably highlighted in snapshot windows 246a,246b for the client customer, such that the client customer can conveniently view, as well as report to others, comparisons of project costs 174a,174b and uncertainties 176a, 176b between alternate project specifications 80. The client user may also return to the specification entry interface 152 for either project 80, through modify specification icons 252a or 252b, wherein the client user may modify product 58, process 60, or material 62 options.

Submittal of Project Specifications. While the client module 70 preferably provides automated ballpark estimates 174 and
uncertainties 176 for specified projects 80, in most embodiments of
the project estimation system 50, the project vendor still provides a
formal, contractual estimate for work to be performed. The client
module 70 includes a specification submittal icon 178, as shown in
Figure 6 and Figure 9, whereby a client user, upon entering the
project specification 80, may submit the project specification 80 to the
vendor module 52, such as for formal review and request for quote.

When the client user activates the submittal icon 178, the project
specification 80 as well as client information 78, is sent and stored to
the system module 68, wherein a vendor user is notified of the
submitted specification 80, and has access to the submitted
specification 80 through the vendor module 52.

In prior art estimation systems, wherein customer information and
project histories are manually entered by personnel, ongoing
customer information is typically based upon the recollection of a staff
member for a print vendor. Client prospecting and client sales
analysis is therefore often inconsistent and incomplete. The individual
project acquisition preferences for a client customer, such as the type
of projects estimated on or completed, are rarely recorded in a
retrievable manner.

However, in the networked project estimation system 50, since the
project specification 80, as well as client information 78, is sent to the
vendor module 52 when submitted by the client user, the vendor
receives accurate and updated customer information automatically.

When submitted client information 78 and a project specification are
received at the vendor module 52, the print vendor then typically
transfers the project specification data 80, along with updated client
information 78, from the networked project estimation system 50 to a
separate vendor estimation system. The project specification 80 is
therefore preferably sent to the vendor module 80 in a data format
(e.g. such as a tab-delimited file), which is compatible with (i.e.
matched to) an external vendor estimation system, such that the print
vendor is not required to reenter project specifications.
Since the client user has already entered specifications for the project 80 into the client module 70, reflecting the product 58 and process 60 capabilities of the vendor, the vendor receives accurate information for review, and can prepare a formal, contractual estimate for work to be performed, with a minimum of repetitive inquiries as to the customer's project specification 80.

The vendor user, upon receipt of an adequately detailed specification 80, typically prepares a formal contractual project estimate (i.e. a formal project quote), and submits the quote to the client user, for approval to proceed with the specified project 80. In alternate embodiments of the project estimation system, the vendor module 52 incorporates client data analysis, internal project cost, project profitability, and formal quotation preparation capabilities.

As well, since the client user has the capability to automatically “weed out” the specification for the project 80, by viewing and comparing “ballpark” estimated costs 174 of alternate project specifications 80, the submitted specification 80 is likely to reflect a valid project which meets the design and budgetary needs of the client user. The client user has already been able to review an approximation of cost for alternate project specifications 80, and typically has chosen a desirable specification 80 with which to submit to the vendor for a contractual estimate.

Therefore, the vendor can efficiently produce a formal, contractual estimate, based upon a reasonably accurate project specification 80, which the client user is more likely to approve.

While the client information 78 and project information 80 is used by the vendor user to prepare a formal quotation, the information is also preferably used for sales and marketing purposes, as well as providing feedback on tool usage.

In a preferred embodiment of the project estimation system 50, the print vendor may generate user profile reports from the database 69, based upon client information 78 associated with one or more project specifications 80. User profile reports may include information
regarding customer preferences, such as the types of inquiries made, the number of times visiting the site, or length of stay on the site.

**Alternate System Architecture.** Figure 11 is a system architecture block diagram 260 of one embodiment of the networked project estimation system 50b, in which system software modules, including the vendor module 52, the system module 68, and the client module 70 are located on a remote computer 262 having a remote network connection 263, and wherein both client and vendor users access the system over a network 74.

Client customers are not required to integrate, deploy and maintain specialized software to obtain estimates for projects. Client users simply access the project estimation system 50 through conventional desktop computers 72a-72n having a browser application 262 and an network connection 266, such as through a conventional Internet service provider. From within a browser application 264, a client user may access the client module interface 150 as a web page connection to the remote client module.

Similarly, a vendor user accesses the project estimation system 50 through a conventional desktop vendor computer 54 having a browser application 264 and a vendor network connection 268, such as through a conventional Internet service provider. From within a browser application 264, a vendor user may access the vendor module interface 84 as a web page connection to the remote vendor module 52.

The use of remote application software 52,68,70 allows timely updating of application software and features, such as through a system application development module 270. As well, the remote application hardware 262 is installed and tested at a controlled remote location. Since many vendors and clients typically use different hardware platforms and operating systems, deployment of the project estimation system 50 at a controlled remote location 262 provides consistent, reliable service to each of the networked locations.
Remote system functionality is provided through a Web-based, multi-tier system, with a workflow engine, a "Dynamic PostScript" editor, and an optimization engine. As most system processing occurs at the remote server 262, there are minimal client and vendor hardware and software requirements.

The system is comprised of customized sets of Web pages, which are served to the requester (i.e. the vendor user or client users) based on the user resource locator (URL) provided. Each client user typically has a URL, which provides access to stored project specifications 80 and snapshots 177 within the client module 70. In a similar manner, the vendor user has as a URL, which allows the vendor user to navigate and control the vendor module 52.

The contents of the Web pages presented in each URL are elements extracted from the database 69. This allows for the dynamic creation of each web page, depending on the information being requested.

Figure 12 is a system architecture block diagram 272 of an alternate embodiment of the networked project estimation system 50c having a plurality of client computers 72a-72n, as well as a plurality of vendor computers 54a-54p, in which system software modules, including the vendor module 52, the system module 68, and the client module 70 are located on a remote computer 262 having a remote network connection 263, and wherein both client and vendor users access the system over a network 74.

Figure 13 is a system architecture block diagram of a second alternate embodiment of the networked project estimation system 50d, in which dedicated system software modules, including the vendor module 52, the system module 68, and the client module 70, are located on a vendor computer 54, and wherein client users access the client module 70 over a network 74.

The project estimation system 50 can also be integrated as a module to an expanded workflow system, whereby several facets of projects can be implemented, reviewed and controlled between client
customers and print vendors. The project estimation system can alternately be linked to other users who are typically involved in a project. For example, a preferred project estimation system 50 used in the printing industry may provide networked application links to graphic artists associated with either a client customer or to a print vendor, as well as to print vendor suppliers (i.e. the customer's supplier and the print vendor's supplier).

**Enhanced System Security.** Preferred embodiments of the networked project estimation system 50 provide security, by restricting access to the available URLs. This is based on a login, password and a verification of the originating IP address, and by the use of access control lists and realms. Preferred security features, such as Secure Socket Layer (SSL) and X.509 certificates, are optionally available as needed, for client customers or print vendors which require it.

**System Advantages.** The project estimation system 50 empowers client users to easily access the estimation system through a client module 70 (such as through a web-based Internet interface), enter a project specification 80 through a graphic user interface having a format which simulates the materials 62 and processes 60 required for the selected product 58, based upon the product 58 and process 60 capabilities of the vendor, automatically obtain a rough estimate and uncertainty for the entered project specification, compare alternate project specifications, and if desired, submit one or more entered project specifications to the vendor for a formal request for quote.

For the majority of print applications, such as for most corporate documents, the networked project estimation system 50 offers tremendous productivity enhancements. The majority of digital, reprints and templated projects, as well as many specialty projects, are all easily estimated through the networked project estimation system 50.

The project estimation system provides significant savings to print vendors, and provides compelling services to client customers. The project estimation system decreases the print vendor's pre-press
production costs, and provides savings in sales expenses and production control.

As the project estimation system 50 efficiently provides one or more estimates for a project for a client user, based upon a vendor’s capabilities and cost structure, the client user quickly obtains valuable information, such as for budgetary purposes, without requiring direct contact with a print vendor during the pre-sales process. The user interface tool is easy enough to use, so that potential customers are encouraged to enter a specification for a potential project at an early stage in the design and production process, typically before the client would submit a specification for a formal quotation from other print vendors.

For a project estimation system 50 configured across the Internet, a client user may access a website for a print vendor, any time of day or night, whenever the client user had a new project in mind. The user may obtain a rough estimate for a project quickly, simply by logging into the vendor website, and entering information regarding the specification of the project.

Through a user friendly interface 150,210, the client module 70 assists the client user in the entry of detailed information for a print job specification 80. In contrast to form-based project specification systems, only defined product categories 58, and available processes 60 which are applicable for a selected product 80, are shown to a client user. A client user is not confronted with a static list of options which may or may not be applicable to a vendor, or to a product to be manufactured. Instead, the client user, upon choosing a product category from a palette 154 of available products 58, is provided with a visual representation of the selected product 58, as well as a visual representation of the processes 60 and materials 62 required to produce the product 58 (which are also available by the vendor). In industries such as the graphic arts and printing industries, wherein both vendors and clients tend to think visually, rather than analytically, the graphic representation of related products, processes, and materials is extremely valuable.
As more options for a particular project are entered through the client interface, accuracy for the estimated cost 174 for the project improves. As well, as more options for a particular project are entered, the uncertainty 176 for the project improves. Since more complete and accurate project information yields a more accurate estimate 174, client users are compelled to enter the best information they have regarding a project, so they can derive reasonably accurate budgetary figures.

While the networked project estimation system 50 provides significant benefits to client user, the print vendor also yields valuable information, including the extraction of accurate project information 80, the minimization of costs associated with multiple formal estimates for projects, the capture of accurate existing and potential client customer information 70 (customer profiles), and the storage and retrieval of customer preferences, based on one or more projects 80.

Although the networked project estimation system and its methods of use are described herein in connection with client computers networked to a vendor computer, the system and techniques can be implemented between other computers and servers, or any combination thereof, as desired. As well the system and techniques can be readily implemented for numerous other industrial, educational and institutional uses, such as project estimation for residential, commercial, or industrial construction, remodeling, or retrofitting, professional consultation services, product design and development, or the planning and implementation of research projects.

Accordingly, although the invention has been described in detail with reference to a particular preferred embodiment, persons possessing ordinary skill in the art to which this invention pertains will appreciate that various modifications and enhancements may be made without departing from the spirit and scope of the claims that follow.
CLAIMS

1. A process for estimating cost and cost uncertainty values for a project, comprising the steps of:
   storing at least one available product;
   storing at least one available process required to produce at least one of said at least one available product;
   storing a plurality of costs and cost uncertainties of said at least one process capability required to produce one of said at least one product capability, said plurality of estimated costs and said associated cost uncertainties including cost to produce different quantities of said product;
   specifying said project, based upon a selection limited to at least one of said stored at least one available product and a selection limited to at least one of said stored at least one available process required to produce said selected product;
   selecting a quantity of said specified project; and
   estimating cost and cost uncertainty values for said specified project, based upon said selected stored at least one available product capability, said selected at least one available process, said selected quantity of said specified project, and said stored plurality of costs and cost uncertainties.

2. The process of Claim 1, wherein said step of estimating cost and cost uncertainty values for said specified project is data reduction and error analysis of said stored plurality of costs and cost uncertainties.

3. The process of Claim 1, wherein said step of specifying said project includes inputting client information.

4. The process of Claim 3, wherein said step of specifying said project includes sending client information to a vendor computer.

5. The process of Claim 1, wherein said step of specifying said project includes selection of said stored at least one available product is based upon selection of an available product icon within an available product palette.

30

SUBSTITUTE SHEET (RULE 26)
6. The process of Claim 1, wherein said step of specifying said project includes selection of said stored at least one available process is based upon selection of an available process icon within an available process palette.

7. The process of Claim 1, further comprising the step of:
   storing at least one available supply required to produce at least one of said at least one available product;
   wherein said step of specifying said project is also based upon a selection limited to at least one of said stored at least one available supply required to produce said selected product; and
   wherein said step of estimating cost and cost uncertainty values for said specified project is based upon said selected stored at least one available supply.

8. The process of Claim 1, further comprising the step of:
   storing information relating to said specified project at a remote computer.

9. The process of Claim 1, further comprising the step of:
   sending information relating to said specified project to a vendor computer.

10. The process of Claim 1, further comprising the step of:
    comparing information relating to said specified project to another project.

11. A process, comprising the steps of:
    storing at least one available product;
    storing at least one available process required to produce at least one of said at least one available product;
    storing a plurality of costs and cost uncertainties of said at least one process capability required to produce one of said at least one product capability, said plurality of estimated costs and said associated cost uncertainties including cost to produce different quantities of said product;
providing a client interface, wherein a user may enter a specification for a project, based upon a selection limited to at least one of said stored at least one available product and a selection limited to at least one of said stored at least one available process required to produce said selected product, and a selection of a quantity of said specified project;

estimating cost and cost uncertainty values for said specified project when said project is entered at said client interface, based upon said selected stored at least one available product capability, said selected at least one available process, said selected quantity of said specified project, and said stored plurality of costs and cost uncertainties; and

displaying said estimated cost and said cost uncertainty values for said specified project at said client interface.

12. The process of Claim 11, wherein said step of estimating cost and cost uncertainty values for said specified project includes data reduction and error analysis of said stored plurality of costs and cost uncertainties.

13. The process of Claim 11, wherein said step of specifying said project includes inputting client information.

14. The process of Claim 13, wherein said step of specifying said project includes sending client information from said client interface to a vendor computer.

15. The process of Claim 11, wherein said step of specifying said project includes selection of said stored at least one available product is based upon selection of an available product icon within an available product palette within said client interface.

16. The process of Claim 11, wherein said step of specifying said project includes selection of said stored at least one available process is based upon selection of an available process icon within an available process palette.

17. The process of Claim 11, further comprising the step of:
storing at least one available supply required to produce at least one of said at least one available product;

wherein said step of specifying said project is also based upon a selection limited to at least one of said stored at least one available supply required to produce said selected product; and

wherein said step of estimating cost and cost uncertainty values for said specified project is based upon said selected stored at least one available supply.

18. The process of Claim 11, further comprising the step of:

storing information relating to said specified project at a remote computer.

19. The process of Claim 11, further comprising the step of:

sending information relating to said specified project from said client interface to a vendor computer.

20. The process of Claim 11, further comprising the step of:

comparing information relating to said specified project to another project at said client interface.

21. An project estimation system, comprising:

a vendor module having an available product input, at least one available process input, and at least one cost input;

a system module linked to said vendor module, wherein said system module is adapted to receive and store said available product input, said at least one available process input, and said at least one cost input from said vendor module;

a client module having a client interface, wherein said client interface includes a product selection palette and process selection palette, wherein a project may be specified, based limited to said input product and one or more input processes defined in said vendor module;

wherein said system module is adapted to receive said specified project from said client module, select at least one of said at least one of stored cost input relating to said selected product and said selected process, determine an estimated cost for said specified
project based on analysis of said selected cost data, and send said determined estimated cost to said client module;

wherein said client module is also adapted to receive said selected determined estimated cost from said system module, and display said determined estimated cost for said specified project on said client interface.

22. The project estimation system of Claim 21, wherein said determined estimated cost and cost uncertainty values for said specified project include data reduction and error analysis of said selected cost data.

23. The project estimation system of Claim 21, wherein said specified project includes client information.

24. The project estimation system of Claim 21, wherein said vendor module is adapted to receive client information.
Printer Identification

Client Information Input

Project Description Input

Artwork Input

Intermediate Proofs

Supplies (Stock and Ink)

Supplementary Processing (Trim, Emboss, collate, binding, folding)

Package & Delivery

Fig. 1 (PRIOR ART)
Fig. 2

Web-based RFQ form-based Data Entry

Bindery Screen

DIE-CUT Yes
PERFORATE No
BINDING Not Applicable
FOIL STAMP No
EMBOSS Yes
GLUE Not Applicable
FOLD SUBMENU Not Applicable
OTHER DETAILS...

What we're really looking for is...

Screen 4 of 8

Forward

Back

44

46

42

40

48
Fig. 12