IDENTIFICATION AND MEASUREMENT OF ONLINE COLLABORATION AND PROJECT MANAGEMENT TECHNOLOGY VALUE

A General Contractor’s Perspective: Kitchell Corporation

1. INTRODUCTION
This case study focuses on identification and measurement of the value of online collaboration and project management (OCPM) technology from a general contractor’s perspective. The case covers tangible and intangible benefits/values at both the project and the organizational level. The following subsections give a brief description of the company and outline the need, selection, cost, and implementation of the OCPM tool. A project of Kitchell Contractors, St. Joseph’s Barrow Neurological Institute Tower, has been selected as a model for the OCPM tool value calculations.

1.1. Kitchell Contractors
Kitchell Corporation,¹ a $600 million privately held firm headquartered in Phoenix, Arizona, provides a wide range of services from general contracting to construction management and development. Kitchell Contractors (Kitchell) is the corporation’s largest branch; it is a construction management and general contracting company serving the private sector. Kitchell has specialty divisions such as health care, custom homes, Native American, and master-planned communities in Arizona and Nevada. The company also has a subsidiary offering of medical equipment and occupancy planning.

1.2. Catholic Healthcare West and St. Joseph’s Barrow Neurological Institute Tower Project
Catholic Healthcare West² (CHW) is one of Kitchell’s clients. CHW, headquartered in San Francisco, is a system of 40 hospitals and medical centers in California, Arizona, and Nevada. Founded in 1986, CHW is the eighth largest hospital system in the nation and the largest not-for-profit hospital provider in California. St. Joseph's Hospital and Medical Center³ (St. Joseph’s) is one of CHW’s hospitals in Phoenix, Arizona, with 535 beds, serving the community since 1895. St. Joseph’s new Barrow Neurological Institute (BNI) Tower is one of three new ongoing construction projects of CHW.

Construction on the BNI Tower, a $91 million expansion project, started in January 2004. Kitchell was awarded the construction management and general contracting guaranteed maximum price (GMP) contract. Perkins & Will’s Los Angeles office is responsible for the design services. All parties are contracted by the owner and subcontractors are contracted by Kitchell. With Kitchell and the architect, CHW used corporate agreement forms to utilize an

¹ http://www.kitchell.com/
² http://www.chwhealth.org/
³ http://www.ichosestjoes.com/

Doctor of Design Candidate Burcin Becerik prepared this case study under supervision of Professor Spiro N. Pollalis as part of “Identification and Measurement of Online Collaboration and Project Management Systems’ Value” study for research purposes and as the basis for class discussion than to illustrate either effective or ineffective handling of an administrative situation. The author would like to thank Ed Costanza, Julie Ernzen, Karl F. Zook and Melonie Walsh of Kitchell Corporation, Nicholas J. Dalba of CHW and Russell Triplet of Perkins+Will for their assistance in developing this case.

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OCPM tool. As of May 2005, the project was under construction and completion expected by February 2006. Although the BNI Tower is one project from a capital funding perspective, the project is divided into four contracts: BNI Tower proper, pharmacy, lobby remodel, and medical mall. CHW is managing the project in multiple phases, with individual owner/contractor agreements for each contract, and different subcontractors on each phase. The new 7-story tower is mostly for neurological patients including operating, surgery, and magnetic resonance imaging rooms as well as patient rooms. The construction of the lobby will start shortly and the pharmacy is under construction as of April 2005.
1.3. The Need for an OCPM Solution
To manage its construction operations, Kitchell standardized on OCPM solutions from Meridian Systems®, utilizing both the client/server-based Prolog® for the past 5 years and web-based ProjectTalk® for the past 4 years. The ultimate goal was to facilitate and improve the communication between team members in all of Kitchell’s large-scale projects. Kitchell wanted to have all project documentation in one central place to: (1) help projects move smoothly without miscommunications or delays; and (2) enforce the teamwork among the participants.

1.4. OCPM Technology Selection
Kitchell evaluated several products before investing in an OCPM system. The company selected its OCPM tool based on the solution features and flexibility; cost wasn’t the main driver in the selection process. The tool gave Kitchell an opportunity to create reports easily and customize them according to owners’ needs. CHW’s Corporate Real Estate (CRE) office® is the design and construction corporate division that oversees all CHW projects greater than $5M. Based on feedback from Kitchell and other contractors, CHW standardized on the same OCPM application for all major projects, and required its use in the St. Joseph’s BNI Tower project. CHW selected this OCPM system because of Meridian’s long history in the market, as well as the flexibility the tool provides to customize reports and forms. CHW has decided to utilize the web-based solution because they didn’t want to invest in the hardware and/or the personnel to host it themselves.

1.5. The Cost
Pricing for the OCPM solution is based on memberships. Organizations can choose to subscribe on a monthly basis or prepay for an annual agreement. When Kitchell decided to use the product, they didn’t set up any kind of corporate-wide agreement with the vendor. Kitchell utilizes the actual amount memberships needed per year based on the actual amount of work secured. This gives them flexibility based on work volume, or when they do not dictate the project management method used on a particular project.

For the hosted OCPM solution, four membership levels are available: 1) project management, 2) scheduling, 3) collaboration, and 4) basic. The project management membership level includes all the collaboration membership services plus financial control, purchasing, project setup, and administrative features. Collaboration-level membership includes the ability to create and manage your own project portfolio, use of the personal action item manager, and collaboration, document control, reports, and field administration features. The memberships Kitchell holds and their cost are shown below.

40 web-based OCPM memberships:
- 31 are at the project management level: 4 are monthly memberships and 27 are annual memberships
- 2 are at the collaboration level: both are annual memberships
- 7 are sponsored (non-Kitchell employees) at the collaboration level: 1 is a monthly membership and 6 are annual memberships

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4 www.meridiansystems.com
7 http://realestate.chw.edu/
Kitchell also has 48 basic (free) users registered on the web-based OCPM solution.

The list price for Collaboration memberships is $60/month, or $576/year (which includes a 20% prepaid discount). The list price for project management memberships is $160/month and $1,536/year (which includes a 20% prepaid discount). Kitchell also obtained 60 user licenses of the client/server-based OCPM tool at a price of $2,500 each; these licenses are used internally. The 40 licenses of the web-based solution are paid for by Kitchell clients (e.g., CHW covers the cost of the OCPM solution for the St. Joseph’s BNI Tower).

1.6. Implementation
All Kitchell projects over a certain dollar value threshold – about $100,000 – use either web-based or client/server-based OCPM solutions. The decision of which type to use depends on the client, as they have to pay for the system if they choose to use the web-based system. If the client agrees to use the collaboration tool, Kitchell and the rest of the team utilize the web-based solution; otherwise, the client server-based solution is used for project management functionalities. One-third of Kitchell’s projects using the tool are managed by the web-based system, the rest on the client/server-based solution.

The intention is eventually to utilize the tool for all Kitchell projects. The St. Joseph’s BNI Tower project was one of the first projects to utilize the tool around 4 years ago. Kitchell trains its own staff and also provides training to project teams upon request. Kitchell charges for training depending on how much it requires; e.g., if it requires traveling and involves a large group like 30-40 people, then Kitchell charges for the training. The users’ access levels are determined by the client (in this case CHW). Kitchell has access to all project information as they are the OCPM tool leader. Architect and design consultants, project and program managers, project sponsor, inspector of record, and CRE personnel have limited access determined by CHW. Subcontractors and suppliers don’t have access to the tool. If they have a question they pass it to Kitchell and Kitchell enters the question into the system. Access levels are indicated below.

- General contractor: all aspects
- Architect and design consultants: meeting notes, RFI response, submittals, drawing logs
- Project and program managers: change management and meeting notes
- Project sponsor: report viewing
- Inspector of record: creation of inspection reports, review status of RFIs, submittals, drawings
- CRE personnel: review of project status and database administration

1.7. The Use of the OCPM Solution in the St. Joseph’s BNI Tower
Kitchell has around 100 active and 25 closed projects in their databases. There are a total of 450 internal and external users in both OCPM solutions. The frequently used modules are cost modules for creating owner contracts, potential change orders, change order requests, owner change orders, RFIs, meeting minutes, issues, drawings and specifications, submittals, transmittal and correspondence log, field administration for recording work journal entries, daily details, events, notices to comply and safety notices, testing and inspection reports for general and detailed inspection information, scheduling required tests, and creating quality assurance checklists.
Different projects use different modules; overall, however, the most-used modules are the RFI and meeting minutes modules. Kitchell leaves the level of use to the project managers and team members. Their long-term goal is utilizing all the modules in every project and mandating the use of the tool by making it a requirement in the contract. One challenge Kitchell faces is resistance to using the system as many parties also have their own systems and see it as a duplication of work. At the end of a project, Kitchell usually archives all project information and gives a copy to the owner.

Although the OCPM tool was not utilized during the design phase of St. Joseph’s BNI Tower project, Kitchell believes it is important to do so at the beginning of projects. Ed Costanza, applications administrator at Kitchell, comments, “It’s advantageous to use the software in the design phase, and we try to accomplish this on our projects.”

For the St. Joseph’s project, the primary users of the OCPM software were the architecture/engineering firm and the general contractor. The architect’s team mostly uses it for RFIs, drawings, and specifications. Kitchell as the general contractor uses almost all modules except purchasing. In addition, the owner receives hard-copy reports generated through the application. Nicholas Dalba, the hospital’s director of facilities development, uses the meeting minutes. He says, “If there is a question, I receive it via email. But I can also go to the OCPM site and check what is posted on it for curiosity. It is a great tool for the owner to monitor the overall project.”

2. BENEFIT/VALUE ANALYSIS

In order to measure benefits, we need to understand the business of the investors and what they are seeking from their investment. There are three main questions: (1) Who are the investors and
what values would they like to get out of their OCPM technology investments (potential benefits)? (2) What did they actually get from their investment in terms of benefits/values (realized benefits)? (3) What would they lose if they didn’t implement these systems (lost opportunities)?

For our purposes the benefit/value analysis is based on three factors: effectiveness, efficiency, and performance. When considering the implementation of a new system it is essential to understand whether you seek efficiency, effectiveness, or overall business performance benefits, or some combination of these factors.

- **Effectiveness (quasi-tangible benefits)** is the ratio of achieved outputs to planned outputs (doing the right things). This is the ability of a program, project, or work task to produce a specific desired effect or result that can be measured. Effectiveness is performing the right tasks correctly, consistent with organizational values, goals and objectives.

- **Efficiency (tangible benefits)** is defined as the rate at which inputs are converted to outputs (doing things right). Efficiency is financially measurable and is represented by money. We will discuss and quantify the benefits in the efficiency area in the following section in the light of the DIA Center addition project.

- **Performance (intangible benefits)** is not directly measurable in quantifiable terms but is judged qualitatively on the impact of a successful implementation in influencing long-term business performance and market share.

The scope and context of the Kitchell case study focused on effectiveness and efficiency in light of CHW’s St. Joseph’s BNI Tower project example.

**-Effectiveness-**

**2.1. Potential Benefits**

CHW expected to benefit from the OCPM tool early on in the project based on their ability to check project status in real time. If user concerns arose, they could be addressed immediately and questions answered quickly using the RFI module. For Kitchell, using the OCPM tool would allow them to address their biggest concern on the St. Joseph’s BNI project of maintaining the schedule. Because this project was a GMP contract, it involved liquidated damages of $5,000 per day. Therefore, key expectations were (1) to keep the project schedule under control, (2) enable smooth and effective project communication, and (3) address problems and/or issues in a timely manner.

**2.2. Realized Benefits**

**2.2.1. Central place for project information (Effectiveness):**

When using an OCPM tool on a construction project, all project participants can manage their own information. However, this information becomes more valuable because it resides in a single database. The OCPM tool eliminates the disconnected silos of project data, enabling all team members to see the latest versions of the files and fostering better teamwork. The tool also provides the flexibility to execute a project globally when users are in different locations and time zones. Karl Zook, senior project engineer of Kitchell, comments, “There is no question
about who owns what, and once everybody is on the same page there are no surprises.” Mark Bittner, one of the area directors of CHW, adds, “It is beneficial for all parties to have access to the same documentation via the logs for submittal processing, RFI processing, change management processing, and meeting minutes.”

2.2.2. Increased project speed (Effectiveness):
It is important for the owner to have the building completed on time as the hospital will generate revenue as soon as it opens. The project team agrees that with the utilization of the OCPM tool there is less paper to handle and they spend less time executing construction work processes such as RFIs or change orders. One can print out different logs or submittal packages and organize this information in many different ways. The team believes that they gain efficiencies; these may or may not be reflected in the schedule directly. Ed Costanza explains the effect of the OCPM tool on the overall project schedule this way, "It definitely enables our people to perform other tasks due to increased efficiency."

2.2.3. Better monitoring and control (Effectiveness):
The tool automatically tracks everything related to the project. The single database model allows team members to create reports and easily search to find the documents they need. In addition, the tool increases team member awareness through instant notifications and provides easy access to information for consultants. There are no claims so far in the BNI Tower project, but if any were to develop, Kitchell has all the documentation available to substantiate their position. This level of audit ability is very important on a project like the BNI Tower, which has $5,000 liquidated damages per day. Ed Costanza says, “We definitely have more documentation electronically than hard copies. We can build a catalog of documents in short order to argue a claim if needed.” The tool also gives power to the owner. Karl Zook comments, “The owner can look at the system and can tell if somebody is underperforming. It enables open communication and it is very beneficial to all parties.”

2.3. In the Absence of the OCPM Solution
Those interviewed commented that without an OCPM system, (1) there would be an increased level of frustration, (2) productivity would decrease, (3) both team work and collaboration would suffer, and (4) the turnaround time for RFIs, submittals, or change orders would be a lot longer. Julie Ernzen, project engineer of BNI tower project, comments, “If I didn't have the system in place, I would have 10 times more paperwork. I would spend more time sending documents back and forth. The tool gives us an opportunity to work in a more structured way.” Ed Costanza answers the question from the Kitchell point of view: "If we didn't have a system like this, we would be less efficient and efficiency is critical when you're dealing with liquidated damages contracts. For us, this is the best system."

2.4. Quasi-tangible Benefits’ Ranking
Besides interviews, an electronic survey of quasi-tangible benefits was designed and distributed via email to all interviewees to measure the improvement in a more consistent and less subjective way. The aim of the survey was to uncover as much information as possible and to quantify quasi-tangible benefits of OCPM technology investments. Each respondent received the identical set of benefits, phrased in exactly the same way in order to reduce errors resulting from the recording of responses, and the respondents were free to rank the benefits according to their
The survey covered several benefits that were stated during the interviews. The responders were asked to rank the benefits 1 through 5 (where 5 is ‘very high’, 4 is ‘high’, 3 is ‘neutral’, 2 is ‘low’ and 1 is ‘very low’). Benefits and values ranked by Kitchell case interviewees can be seen in the table below.

<table>
<thead>
<tr>
<th>Benefits/Values</th>
<th>A*</th>
<th>B*</th>
<th>C*</th>
<th>D*</th>
<th>Ave.</th>
<th>StnDev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled having complete audit trail</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Enabled faster reporting and feedback</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Improved data availability</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Improved information management</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Improved process automation (RFIs/change orders, automatic updating of master budget, etc.)</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Improved quality of the output</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Provided accurate and timely information to give valid/accurate decisions</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Enabled better project/program control</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Enhanced working within virtual teams</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Reduced rework/data reentry</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>3.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Enabled better resource allocation; more effective assembly of project teams</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Enabled fewer information bottlenecks</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Reduced errors and omissions</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Reduced personnel costs due to improved efficiency</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Improved idea sharing among team members/within organization</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2.0</td>
<td>1.2</td>
</tr>
<tr>
<td>Reduced delivery lead times</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabled better forecasting and control</td>
<td>5</td>
<td>4</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabled advance purchase of materials</td>
<td>X</td>
<td>2</td>
<td>2</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved project relationships with strategic partners</td>
<td>2</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabled quicker response to project status and budget</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimized project/business risks</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved timely capture of design/construction decisions</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved information version control</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabled better inventory management</td>
<td>X</td>
<td>X</td>
<td>2</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabled more effective identification and assessment of new suppliers</td>
<td>X</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enabled faster launch to market due to faster</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The names of the respondents are hidden for confidentiality reasons. However, the respondents are managers of Kitchell and CHW and the users of the OCPM solution in the St. Joseph’s BNI Tower project. “X” stands for when the question is not relevant or the responder doesn’t know the answer.
2.5. Request for Information (RFI)
An RFI is one of many documents generated during the construction period. It occurs when a contractor, subcontractor, or supplier finds an unclear element or dimension in construction drawings, a conflict between specifications and drawings, or any question regarding anything on the construction site. The handling of RFIs has a very big impact on the project schedule because RFIs that haven’t been answered on time might cause delays in construction work.

Questions asked have traditionally been sent by fax or in paper form to the construction/project manager or architect, depending on the procurement method. These questions are then passed to the responding parties. The party issuing the RFI - usually the general contractor or a subcontractor - has to wait for the answer, which might take a long time depending on the responding party. After receiving the answer, the construction manager or architect passes to the inquiring party the question file and attached answer information, with the name of the answering party, time, and date they have received it. Usually RFI documents are bound in three-ring binders, which also occupy space. The responsible party has to look at all documents (specifications, drawings, etc.) and answer the question. While some of the questions might be simple to answer, others might take longer. In response to an RFI, the drawing or specification could be changed, modified, or cause a change order, which needs the owner’s approval.

In the St. Joseph’s BNI Tower project, when subcontractors have a question regarding the construction site, it is referred to Kitchell in order to generate an RFI using the OCPM tool. When the description is entered and the date is created, the tool calculates the date required based on the duration set for RFI review. The author company and author of the RFI are automatically filled in with the user information. The tool automatically posts the RFI in the database, and the person from the architect’s office to whom the RFI is referred immediately receives a notification regarding this RFI. This RFI form can be used to track contract document changes including drawings, and any cost and schedule impacts associated with each request for information.

By using this electronic RFI module, specific RFIs can be pulled up on screen without using the search button. Individual drawings listed in the drawing and specification logs can be linked to the RFI using the function in the notes tab. Comments can also be entered in the RFI under the notes tab. Each RFI has the option to show the cost, schedule, and drawing impact under the impact tab. In this project, the team asks for answers within a period of time; if it is critical, they mark it as such and set it up for rapid turnaround such as 2 days. The architect returns the RFI with an answer through the OCPM tool using the same methods. As of May 2005, there have been 983 RFIs asked in the project, of which 181 are still open.

2.5.1. Realized benefits of electronic RFIs:
The BNI Tower project team agrees that the RFI module is a great advantage because the RFIs can electronically transferred and stored in a shared database. In a paper-based process, RFIs...
need to be transmitted by fax, eventually ending up on somebody’s desk or mailbox. With the OCPM tool, all team members receive RFI much more rapidly and can be made aware of the issue simultaneously. In addition, there is always a record of whether the corresponding person has received it and opened it. Russell Triplett of Perkins+Will, BNI tower project the designer, comments, “When the contractor sends a question, we get an email saying there is a new RFI. I can direct it to other people if necessary or I can copy the email to them. It is a great tool for tracking everything.”

Reduction in turnaround time:
The RFI turnaround time on the BNI Tower project can be seen in figure 5. Out of 802 closed RFIs, 415 were answered within a week. The average turnaround time of RFIs based on a 7-day work week is 9.2 days. A total of 397 RFIs were answered before their due dates, as determined by the party who asked the question.

![Figure 4. RFI log](Image)

Decrease in time spent on issuing an RFI:
According to the team, the tool definitely decreases the time spent on issuing an RFI. Depending on the issue, the designers agree that they can send the answer back to the contractor literally in a minute.

Reduction in numbers:
The team agrees that there is no reduction in the number of RFIs in this project. Although the number of RFIs might seem high, Russell Triplett, the designer, thinks that for a $100 million hospital project this is a normal number. Complex structures like hospitals usually have more RFIs.
Figure 5. RFI turnaround in days in BNI Tower project

Figure 6. RFI overdue in BNI Tower project

Figure 7. Average turnaround time and overdue based on 7-day and 5-day work week. Based on 781 RFIs; RFIs not answered (181) and those with over 39 days turnaround time (only 21) are eliminated.
2.6. Change Orders in the BNI Tower Project

A change order is the formal document that is used to modify the original contractual agreement and becomes part of the project’s documents. Changes in a construction project can have numerous causes: design changes, design errors and omissions, etc. Change orders are responsible for a series of impacts as they disrupt work schedules and can create cost overruns. Changes can be initiated by all parties in the construction process. All changes, however, must be approved by the owner before being implemented.

As of May 2005 there have been 465 potential change orders on the BNI Tower project. When they are approved they will be turned into actual change orders. 164 of these potential change orders refer to an RFI in the project. Change orders are not so important for the cost of this project because of the GMP contract.

Figure 8. Status of potential Change Orders

Figure 9. Reasons for potential Change Orders

Figure 10. Funding of potential COs
2.7. Other Utilized Modules

Document and cost control modules are being used very extensively in this project. Ease of transferring documents, drawings, and specifications was definitely among the most important benefits of the OCPM tool, as the architects were located in Los Angeles and the construction team was in Phoenix. Drawings are not sent in their original format due to liability issues. Architects are worried that they have their electronic stamp on the drawings and they don’t want anybody to copy it and use that stamp inappropriately. In addition, they don’t want subcontractors to work on architectural drawings to prepare their specifications. The reason is that, if the vendor doesn’t do the field measurements and utilize the appropriate installation, there might be claims for inappropriate fabrication. Instead, the team posts drawings as PDF documents.

In all, we know there are 4,284 documents (we assume half are 1 page, the other half 2 pages)

Total number of pages = 2,142 + (2,142 x 2) = 6,426

Assume 50% of the documents do not need to be printed
6,426 x 50% = 3,213 pages
Assume at least 3 parties would print the same document if the OCPM tool wasn’t implemented
3,213 x 3 = 9,639 pages of document
Assume cost of printing is $0.1 per page
$0.1 x 9,639 = $964 per project
Assume 3/4 of the documents don’t need to be mailed due to efficient electronic transfer and mailing costs of $1 per document
$1 x ¾ X 4284 = $3213 per project

TOTAL SAVINGS:
3,213 + 964 = $4,177 per project ~ $42,000 for 10 projects

3. FUTURE OPPORTUNITIES
Kitchell cannot imagine giving up its OCPM tool as it is now a critical part of their business operations and work culture. Ed Costanza says, “If we were to stop using the tool for whatever reason, we would have to use another tool. Speed is critical and with the type and size of our projects there is no other way.” In the future, the company is aiming to integrate its OCPM tool with its accounting system and also engage more users. Another plan of Kitchell is having portable devices on their site to address the issues directly.

4. BENEFIT/ VALUE SUMMARY
Tangible, quasi-tangible and intangible benefits of the Kitchell case are summarized in the table below. Savings from the electronic document exchange are the base for the tangible benefits. The BNI Tower project is used as an example and the results are projected to 10 Kitchell projects. The electronic survey is used to quantify the quasi-tangible benefits (improvements) by ranking. No performance (intangible) benefits are observed in this OCPM implementation. The cost of the system is around $45,500 annually for the web-based system; however the cost is passed to the owner frequently.

<table>
<thead>
<tr>
<th>Types of Benefits</th>
<th>Measured Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangible</td>
<td>$42,000 annually (for 10 projects)</td>
</tr>
<tr>
<td>Quasi-tangible</td>
<td>Survey: 3.5/5 (average of 15 benefits identified out of 27)</td>
</tr>
<tr>
<td>Intangible</td>
<td>Not identified</td>
</tr>
<tr>
<td>Cost of the system</td>
<td>$45,500 annually (web-based system; however the cost is passed to the owner frequently)</td>
</tr>
</tbody>
</table>

INTERVIEWEES
- Ed Costanza, Applications Administrator, Kitchell Corporation, 02/25/2005
- Julie Ernzen, Project Engineer, Kitchell Contractors Healthcare Division, 03/30/2005
- Karl F. Zook, Senior Project Engineer, Kitchell Healthcare Division, 03/29/2005
- Melonie Walsh, Senior Project Engineer, Kitchell Contractors Healthcare Division, 04/01/2005
- Nicholas J. Dalba, Director of Facilities Development, St. Joseph's Hospital and Medical Center, 04/18/2005
- Russell Triplett, Senior Associate, Perkins+Will, 04/01/2005