

A Comparison of Construction Cost Estimating Tools

Spreadsheets – Microsoft Excel[®],
Electronic Cost Books and Calculators – RSMeans CostWorks[™], and
Cost Estimating/Project Management Software - 4Clicks Project Estimator[™]

Efficient Facility Repair, Renovation, and Construction Project Delivery Methods

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AT A GLANCE

Spreadsheets - Excel®

- Easy to use
- Customizable
- Readily available
- Time consuming / Inefficient
- Prone to data input and formula errors
- Printing Issues
- No Reporting Capability

Electronic Cost Books & Calculators - CostWorks™

- Easy to use
- Inexpensive
- Square foot costs
- Cost data Inconsistencies
- Weak for detailed estimating
- Limited functionality

Cost Estimating Software – e4Clicks™

- Productive environment supporting data reuse
- Created by estimators for estimators
- Integrated estimate, contract, & project mgmt.
- Learning curve
- Higher initial cost
- Requires adherence to standards/processes

INTRODUCTION

Accurate, timely, and transparent cost estimating is critical to the success of any renovation, repair, sustainability, or new construction project. While most construction cost estimators continue to rely primarily upon hardcopy documents and electronic spreadsheets such as Microsoft Excel, many are beginning to leverage electronic cost books and associated “calculator” software tools. Both of these approaches have merit and are well suited for certain types of users.

Growing numbers of cost estimators, however, have the need to work with multiple projects and multiple estimates simultaneously, securely share information on active projects, localized cost information, as well as easily locate and reuse historical data. These Owners, Contractors, and AEs are moving to advanced cost estimating and management systems. They are discovering that significantly higher productivity can be gained (50%+). Furthermore, the collaborative aspects of these advanced cost estimating and project management software systems are aligned with integrated project delivery methods and construction sector movement toward Building Information Modelling (BIM).

This paper addresses each of these primary approaches to construction cost estimating and discusses their application. For clarity, products are referenced within each category as follows: (1) Spreadsheets - Microsoft Excel, (2) Electronic Cost Books/Calculator - RSMMeans CostWorks, and (3) Cost Estimating and Project Management Software - e4Clicks Project Estimator.

SPREADSHEETS

Construction estimating involves the estimating of material, labor, equipment, overhead and contingencies. Spreadsheets, most commonly Microsoft Excel, are used by more estimators for this purpose than any other tool. Spreadsheets have significantly improved cost-estimation capabilities and accuracy since the 1980s. Relatively easy to master, spreadsheets provide a means to create and report a construction cost estimate. Cost construction models can also be built within spreadsheets. Productivity improvements result from the ability of Excel to easily handle a lot of the more mundane calculations required.¹

¹ Christofferson, Jay. “Estimating with Microsoft Excel”, Brigham Young University. Nickols, Robert Duane. “Construction Estimating Using Excel” Lexington Technical Institute, University of Kentucky.

One problem with spreadsheets, however, is their inherent vulnerability to errors due to data entry, a problem that only increases along with the complexity of an estimate. Also, as the formulae within the spreadsheets become more numerous and complex, errors became exponentially more frequent and costly.²

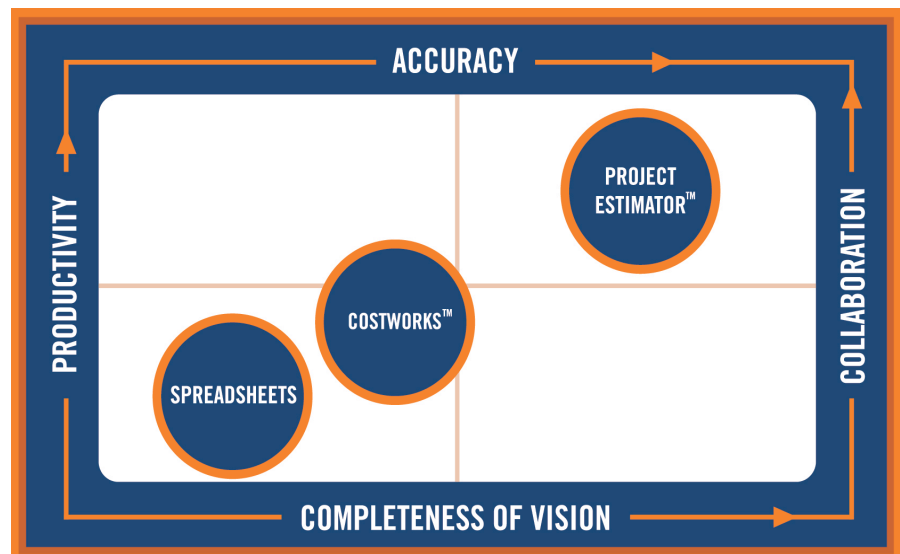
Spreadsheets also do not account for dynamic cost information and associated uncertainties, or even historical information, all of which have proven to be important variables for many construction projects.

Lastly, and in part due to the issues noted above, collaboration using spreadsheets is problematic as are transparency and accurate monitoring/reporting. Having multiple people working on the same spreadsheet is not efficient, or even workable on larger projects. Thus estimates tend to be created and stored in different locations, making information difficult to accurately retrieve and changes extremely costly to execute. As a result old data errors are perpetuated, copied over and over again.

ELECTRONIC COST BOOKS AND CALCULATORS

As it became apparent that more localized and historical data would be critical to improving the accuracy of construction cost estimates and cost models, organizations instituted a formal process for collecting and storing this information. Individual Owners, Contractors, and AEs began to collect this information, as well as third parties. RSMeans Company is North America's leading source for commercial construction cost data, including materials, equipment, labor line

items, productivity factors, as well as assembly and square foot cost information. Localized cost indexes are now also available, and called the City Cost Index (CCI).



Based upon the size and type of construction project, estimators soon found that they could improve their productivity and accuracy even further by using standardized reference cost information; RSMeans, or other reference cost providers; and cost data architectures; Construction Specifications Institute (CSI) Masterformat, Uniformat; in combination with spreadsheets. However, manually entering in tens, hundreds, or even thousands of cost line items from hardcopy cost books remained tedious and prone to data input error, as well as errors of omission.

² Caulkins, Jonathan P., et al. "Do Spreadsheet Errors Lead to Bad Decisions" Carnegie Mellon University.

Integration electronic cost book information directly with a cost calculator was the next logical step. An example of this approach is RSMean's CostWorks product. CostWorks can best be described as an electronic version of RSMean's Cost Books, thus line items can easily be copied and pasted into spreadsheets. CostWorks also incorporates some limited cost calculation tools, thus it moved even closer to the needs of construction cost estimators. Many of inherent data input errors associated with spreadsheet appeared to be mitigated. Other issues, such as collaboration, data reuse, document management, integration and maintenance of alternative cost data sources and reporting, and the integration of robust construction delivery workflows remained largely unsolved.

COLLABORATIVE COST ESTIMATING SOFTWARE SOLUTIONS

Spreadsheets have proven value for single, "static", estimates of a certain project size, as well as for a media to gather and transfer data sets. Similarly, the integration of electronic cost books with spreadsheets and electronic cost calculators (such as CostWorks) are equally valuable for individuals performing a small number of relatively straight forward construction, repair, or renovation estimates, say three (3) to five (5) per year. However, both spreadsheets and electronic cost calculator do not meet the need for collaboration, transparency, document management, and maximized productivity, or provide a capacity to adhere to and report upon specific construction delivery methods and/or contracts, for example Job Order Contracting (JOC), Integrated Project Delivery (IPD), Simplified Acquisition of Base Engineering Requirements (SABER), and Indefinite Delivery Indefinite Quantity (IDIQ), etc. Collaborative cost estimating and project management solutions also support today's need for Adaptive Project Delivery (APD)[™]. APD enables owners, contactors, and AEs to modify and constantly improve upon construction project delivery process to meet their individual and changing requirements.

As noted previously most estimators still rely upon spreadsheets, while tens of thousands have migrated to the use electronic cost books and associate calculators. However, as project and formulae within the spreadsheets became more complex, data input and formula errors and cell-reference errors, became commonplace resulting in costly errors and major business losses.

More sophisticated, dedicated cost estimating and integrated project management software systems are now available. These cost estimating software systems enable hard-coded and customizable schemas and custom databases or unit price books (UPBs) and collaboration capabilities.

Integrated cost estimating, project management, contract management, and document management software systems have become very popular over the past decade, and are exemplified by 4Clicks Project Estimator[™]. These advanced software programs provide the benefits of spreadsheets, electronic cost data books and cost calculators, however, they also offer several other core features required to integrate cost estimating with the user's business processes.

For example, 4Clicks Project Estimator allows users to create estimates and manage multiple types of projects and contract methods: JOC, SABER, IPD, Single Award Task Order Contracting (SATOC), Multiple Award Task Order Contract (MATOC), Multiple Award Construction Contract (MACC), Indefinite Delivery/Indefinite Quantity (IDIQ), Performance Oriented Construction Activities (POCA), and Basic Ordering Agreement (BOA). Users can select from enhanced RSMean's electronic cost data, including an exclusive 400,000 line item database with full descriptions and modifiers as well as graphics, diagrams, and specifications, and/or custom/internal cost information or other standard/custom unit price cost books.

Productivity, visualization, and collaboration tools such as visual estimating/quantity take-off (QTO) and secure document management; are also core components of cost estimating and project management software. Visual estimating saves time, delivers higher accuracy, and improves collaboration. eTakeoff™, included within e4Clicks Project Estimator stands head and shoulders above other visual estimating solutions, enabling estimators to quickly and accurately visualize requirements and trace electronic drawings to determine quantities for line items within estimates. Drawing can be shared in various formats include Adobe Systems Portable Document Format (PDF). The eTakeoff/e4Clicks integration enables users to quickly transfer to e4Clicks Project Estimator.

| SPREADSHEETS Excel® | ELECTRONIC CALCULATORS CostWorks™ | COST ESTIMATING SOFTWARE e4Clicks™ | |
|--|---|--|--|
| <p>Build estimates one at a time from scratch</p> <p>Common interface, customizable, low perceived cost</p> <p>Formula errors, formulae that no longer function as intended</p> <p>Projects under or overestimated</p> | <p>Electronic access to RSMeans Cost Books*</p> <p>Spreadsheet-like look and feel</p> <p>Limited estimating capabilities/features</p> <p>City Cost Index Support</p> <p>* Approximately 80,000 line items</p> | <p>Support Collaboration among Owners, Contractors, and Sub-contractors</p> <p>Handle multi-step/complex processes</p> <p>Multi-contract, multi-award management</p> <p>Reuse and share estimates</p> <p>Automatic variance/comparison reporting – estimates, projects, contracts</p> <p>Integrated Document Management-Project Management-Visual estimating/ QTO</p> <p>Run reports on projects</p> | <p>Standardize estimates, processes, and documents</p> <p>Track milestones</p> <p>Easily modify for current/localized pricing situations- City Cost Index (CCI) direct</p> <p>Integration</p> <p>Re-price estimates from year to year in seconds</p> <p>Exclusive, enhanced 400,000 line item RSMeans Cost Database</p> <p>Easily support multiple cost databases/unit price books (UPBs)</p> <p>Full line item descriptions, pictures, and graphics</p> |

THE EVOLUTION OF CONSTRUCTION COST ESTIMATING AND PROJECT MANAGEMENT

Visual estimating allows you to:

- Estimate and pre-bid processes without paper plans.
- Create measurements by tracing upon electronic drawings.
- View plans with powerful zooming and scrolling capabilities.
- Display measurements in an infinite variety of colors and patterns to identify the type of construction or the materials used.
- Total measurements from multiple plan sheets.

From a deployment perspective cost estimating software solutions address the creation of custom parameters, multiple “knowledge bases”, and easily support client-server, network, or stand-alone system environments.

While these powerful tools may take a bit more time to master, these yield superior productivity, accuracy, transparency, collaboration, and information reuse. They are best suited for anyone using RSM means cost data for renovation, repair, and sustainability projects as well as estimators managing tens to hundreds of projects per year.

CONCLUSION

Over the past forty plus years, there have been many initiatives to improve cost estimating to facilitate the delivery of construction projects on time and on budget. Owners, contractors, and AEs now have multiple methods to select from based upon their needs.

Spreadsheets were a major improvement in the 1980s, followed by formal processes for collecting and harnessing historical information to more accurately project and control costs. Over the past decade, a powerful new capability has been added, collaborative cost estimating and project management software.

The evolution of transparent and collaborative cost estimating and project management software mitigates the unproductive aspects of creating estimates one at a time from scratch, and working “in a vacuum”. Additional benefits include the reduction of data input and formulae errors, as well as costly ‘errors of omission’, common with ‘ad hoc’ spreadsheet-centric approaches.

What’s next...?

The application of cloud computing to cost estimating and project delivery and management software and the subsequent integration with Building Information Modelling. The ability to produce accurate cost estimates and control costs throughout a building’s life-cycle. Another breed of cost estimating and project management software, Adaptive Project Delivery (APD) will also evolve. But all this is for another story.

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