



Solving The Spreadsheet Paradox

by David Andersen, Ph.D.

While studies indicate that the vast majority of companies today are still using traditional spreadsheets to create and maintain financial reports, experts point out that errors are found in an alarmingly high percentage of them. According to one important study by the British accounting firm Coopers & Lybrand, a staggering 90% of the spreadsheets audited contained errors. Citing the study, an important article noted that if the errors hadn't been detected it could have had devastating effects on the business. The authors, all known experts in the field, rightly insisted that "the occurrence of spreadsheet errors is a major problem for businesses and needs to be addressed urgently."¹ Given the high error rates and urgency of the problem, one might ask why companies are still using spreadsheets for such a critical task rather than Business Intelligence tools designed to reduce the errors? Admittedly, spreadsheets are easy to use and perform convenient calculations on an intuitive grid format. However, using spreadsheets to create and maintain financial statements is probably going well beyond the purpose for which they were originally intended – stretching them, as it were, to the breaking point.

Because of the growing frustration with spreadsheet pitfalls, many companies are intrigued with BI tools and their ability to automate the reporting process and allow for dynamic data analysis. As intrigued as they are however, most companies aren't adopting them because of their high cost, complexity, and importantly they don't have the spreadsheet format and ease of use to which companies are accustomed. BI products, in other words, tend to trade one pain for another. So, the burning question is, how can companies streamline reporting processes *with* the spreadsheet model in tact, but without the inherent limitations of traditional spreadsheets – an apparent paradox to be sure.

We will show using the Rajalingham et al (University of Greenwich) spreadsheet error flow chart that a ground breaking advance known as Multi-dimensional INtelligent Data-store (MIND) technology has reduced the potentially serious spreadsheet errors by a significant 75%. By eliminating the most serious spreadsheet errors, it will be shown that MIND makes a considerable contribution to solving the reporting paradox, keeping in tact the spreadsheet model companies embrace while providing database capabilities usually attributed exclusively to BI products. Said another way, MIND uniquely combines the best of both worlds.

But first, so that we're not offering a solution in search of a problem, we need to explore two important questions: Why are more and more companies now requiring the database power of BI tools, and exactly why is the spreadsheet model proving inadequate? By examining the pros and cons of both BI tools and spreadsheet models, we'll be able to establish the implicit market demand that MIND technology fulfills.

1 Kamalasen Rajalingham, David R. Chadwick & Brian Knight, "Classification of Spreadsheet Errors," p. 1.

Why Businesses Intelligence?

Business Intelligence vendors rightly point out an ever widening gulf between the amount of information companies are able to put into their software system and the ability to extract information for reporting purposes. This is at least partly due to the development architecture most (if not all) software companies adopt to maximize database efficiencies, and understandably so. Ensuring there aren't meaningless data duplications within a database is crucial to any business with large amounts of data, as speed and agility are directly affected. However, the downside is that reporting off the data can be difficult precisely *because* of the lack of data duplication. This is where Business Intelligence tools can be invaluable. For most companies, it's critical to be able to have daily access to key performance indicators in order to make critical business decisions in a timely manner.

As important as this information is, however, most companies today use spreadsheet models to analyze their data. Raymond Panko (University of Hawaii) reports that, according to the finance intelligence firm CODA, 95 percent of U.S. firms use spreadsheets for their financial reporting. He also cites a study performed by CFO.com in which 168 finance executives were interviewed. Of 14 technologies discussed, only two were found to be in wide use – spreadsheets and basic budgeting and planning systems. Every subject said their department used spreadsheets.² Another study found that of 287 companies, 73 percent rely primarily on spreadsheets and manual processes, 16 percent use analytical applications, and 11 percent extract the necessary information out of their accounting modules. “When asked about the most acute problems with their current planning process, more than 60 percent said it 'takes too long'. Nearly 43 percent said 'not enough time to analyze data', and more than a third cited 'lack of ownership by business units'.”³

BI advocates have demonstrated over and over that a company's ability to analyze data and react in a timely manner is greatly reduced because of the onerous work spreadsheet methods require. CFO Warren Green of One Call Medical Inc. sums the spreadsheet problem up concisely:

“I spent more time building and managing the [spreadsheet] model, and making sure none of the links were broken, than I did managing the data and analyzing it to ensure it fit the strategic plan. Aligning the spreadsheets was a nightmare. A simple change like someone adding an account threw the whole template [of operating expenses] out of whack. But the real drawback was my inability to do an analysis of data to make better decisions, to re-forecast or otherwise plan accordingly.”⁴

In the above study, we find that 70 percent of analytical application users still use spreadsheets for various ad hoc analysis, and are generally satisfied with their analytical applications for planning, budgeting, and forecasting. However, importantly the opposite is the case for companies relying on spreadsheets. “Of the 189 survey respondents whose primary planning, budgeting, and forecasting technology is spreadsheets, 20 percent of respondents say their finance staff is 'very satisfied', compared with 33 percent of those whose primary technology is an automated analytical application.”⁵

2 Raymond R. Panko, “What We Know About Spreadsheet Errors,” pp. 2-3.

3 Russ Banham and Sam Knox, “When Do Companies Outgrow Their Spreadsheets?,” p. 1.

4 Russ Banham and Sam Knox, “When Do Companies Outgrow Their Spreadsheets?,” p. 2.

5 Russ Banham and Sam Knox, “When Do Companies Outgrow Their Spreadsheets?,” p. 3.

As Jennifer Caplan at CFO.com points out, BI applications have become quite sophisticated, with many vendors like Cognos and Hyperion making it their primary business. Starting out with basic reporting capabilities, they now offer helpful at-a-glance dashboards of key performance indicators. Many BI applications now even ship with email alerts that function as warning lights as to whether a particular business unit is performing to goal.⁶ As most businesses can probably attest, being alerted to whether inventory turns have increased or customer service levels have fallen can be critical. Imagine having an email automatically dispatched to the appropriate people when something happens within the business that requires immediate attention. That's just the beginning of what BI tools do for companies, and what spreadsheets couldn't dream of doing.

Primarily, BI tools empower companies to automate financial and operational reports in a way not possible in spreadsheets. They supply a connection, either directly or indirectly, to the database and can therefore automatically track data in the system as it's updated. To run a report with updated data is as simple as entering the current date and selecting the run button. The time savings are enormous compared to doing the same tasks in spreadsheets, *if* they can be done at all.

So given the measurable increase in operational efficiencies and the often dramatic reductions in expenses related to reporting, why exactly don't more companies adopt a BI solution? The statistics indicate that companies aren't jumping on the BI band-wagon as one might expect.

For one, Caplan points to the fact that while BI products are proving valuable for getting data and allowing managers to analyze it, they're still implemented on a piece-by-piece bases because most are external applications running on top of the ERP backbone. That, says Caplan, "relegates enterprise wide analysis to little more than a distant possibility." Tom Hoblitzell at Answerthink notes that one-third of his company's customers don't have the cross-functional strategy necessary for a successful BI implementation.⁷

One study asked respondents what barriers *prevent* them from implementing new technologies, to which 74% chose integration with existing systems, while 71% selected cost.⁸ And, such concerns are understandable. Most BI solutions are costly in many ways. First they're expensive on the front end. But second, and perhaps more importantly, they tend to be IT intensive both to implement and maintain (which ends up often being the most costly part of the project).

So after all of that, most companies turn back to the method they started out with, the spreadsheet. They're practically universal, easy to use, and come at a low entry cost.

Reasons Spreadsheets Refuse to Disappear

As indicated above, the statistics betray an interesting, if odd, reality: namely, new technologies with all of their creative capabilities have been largely ignored by businesses. "Spreadsheet hell," writes Don Durfee in CFO.com, "a term often invoked by software companies – and, occasionally, by customers – is not, as of yet, driving many CFO's to make

6 Jennifer Caplan, "Applying a Little Business Intelligence," p. 1.

7 Jennifer Caplan, "Applying a Little Business Intelligence," p. 2.

8 Don Durfee, "Spreadsheet Hell," p. 5.

substantial investments in newer forms of IT.”⁹ Notes Durfee, ironically Sarbanes-Oxley may actually be slowing the pace of adopting new technology. Compliance requires such a major effort that many CFO's simply don't want the disruption of a new software implementation. Strange, because one might expect that today's need for a system that reduces errors and allows for easier reporting would excel adoption of newer technology, not hamper it. Simply put, companies seem to be taking the cautious approach when it comes to new software. Durfee remarks:

“Broadly speaking, finance executives appear to be largely content with the technologies they have today: 72 percent say they have most or everything they need in the way of finance IT. And the much-derided spreadsheet, so often posited as the dinosaur that newer technologies will ultimately make extinct, is not heading for the tar pits anytime soon. Every single company we surveyed uses spreadsheets today, and a mere 9 percent think they will decline in importance in the coming years.”¹⁰

In fact, according to a survey that Durfee reports, 71% of companies asked about how important spreadsheets will be in five years said they'll be as important as they are today. 20% said they'll be even *more* important, while only 9% said they'll be less important. This attitude being the case, companies need to consider what may be at stake as they move forward with the spreadsheet model.

Spreadsheet Errors and Their Impact

As every historical document confirms, it's natural for human beings to commit errors. While that might sound overly obvious, it seems that even the particular types of errors committed have a peculiar pattern that remains constant throughout the centuries. Indeed, some of the most common ancient scribal errors, committed before the printing press when people copied entire works by hand, have a curious parallel to those commonly found in modern spreadsheets. For instance it was quite common when copying a manuscript, that a word was written once when it should have been written twice, or twice when it should have been written once. Omission of words or entire phrases often occurred, as a scribe glanced from the copy back to the original, only to miss an entire phrase because of similar words found in several different places.

Interestingly, recent research into spreadsheet errors and their impact on businesses proves to parallel closely the problems raised within ancient texts. In ancient literature, a slight mistake in the copying process could dramatically alter the original thought of the author, having devastating affects on what was originally written. Research demonstrates exactly the same problem with errors that afflict the majority of spreadsheets, errors that can prove just as devastating to a company's bottom line.

As meticulously documented, spreadsheet errors are more common to the average spreadsheet than not. According to KPMG Management Consulting, at least 5 errors were found in a sobering 95% of financial models reviewed.¹¹ The fact that spreadsheet error rates

⁹ Don Durfee, “Spreadsheet Hell,” p. 1.

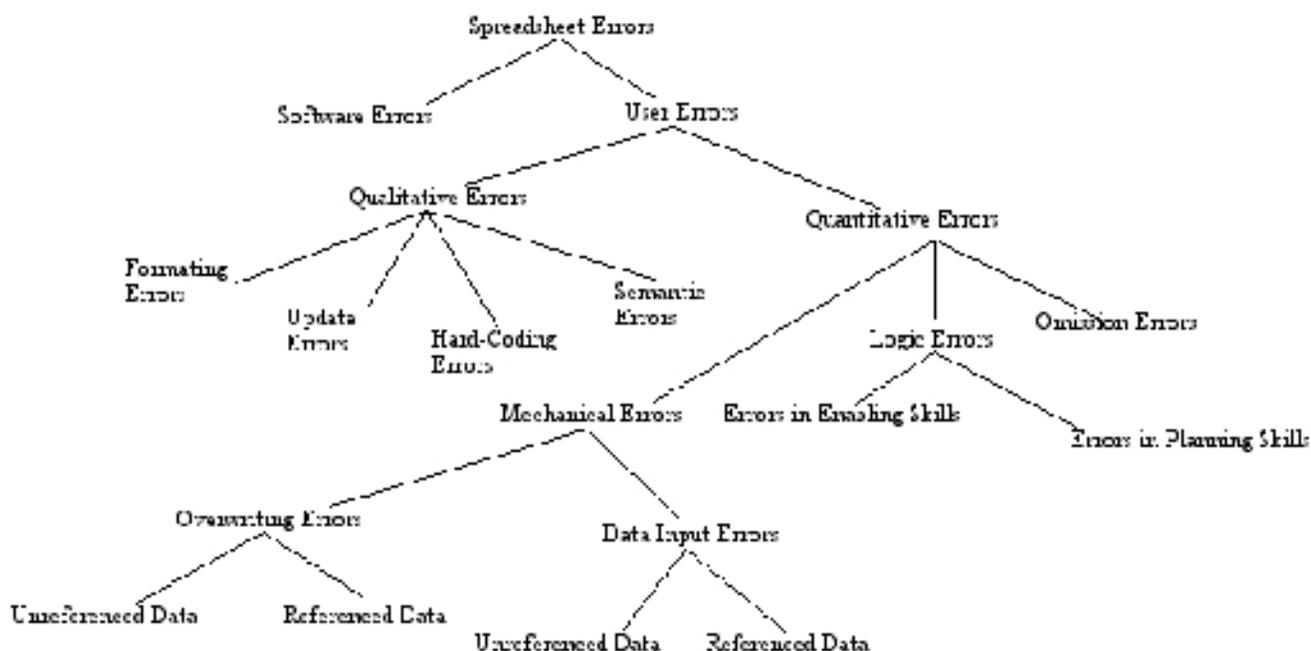
¹⁰ Don Durfee, “Spreadsheet Hell,” p. 2.

¹¹ Kamalasen Rajalingham, David Chadwick, Brian Knight, Dilwyn Edwards, “Quality Control in Spreadsheets: A Software Engineering-Based Approach to Spreadsheet Development,” p. 1.

are high, leading to lost profits and even government investigations, is beyond doubt. And lest we think that they're minor and in no need of urgent attention, studies demonstrate otherwise.

As reported by Panko, one of these studies inspected 19 operational spreadsheets. Common to such studies, this one found that developer confidence (or over-confidence) was disproportionately high to the error rates found in spreadsheets. One error alone involved \$7 million funds transfer between divisions, and another showed inconsistent currency conversion numbers in different parts of the spreadsheet. In yet another study, though the developers used an error reducing methodology, errors were found that would have been over a billion dollars if they hadn't been caught.¹²

So, other than intentional errors (which, of course, present problems of a different sort), what kinds of (unintentional) errors are causing companies so much pain? The Rajalingham et al spreadsheet error flow chart will be instructive here:



Though we'll discuss the particulars in detail later, it's interesting to note that omission and duplication are common. As in ancient scribal inaccuracies, spreadsheet developers often fail to include important data. One reason could be that as developers re-enter data from their accounting system into a spreadsheet, they unintentionally omit data as their eye moves from one document to the other. As many have pointed out, omission errors are especially dangerous because they're extremely difficult to detect and thus have low detection rates. Spreadsheet duplication, as in ancient texts, occurs when a developer accidentally re-creates elements of the spreadsheet, causing redundancy.¹³

Research shows that the majority of spreadsheet errors are formula based, however. Formulae are incorrectly constructed due to their inherent complexities, or even carelessness when entering incorrect cell addresses. "Formulae are the most important elements of the

12 Raymond R. Panko, "What We Know About Spreadsheet Errors," pp. 11-12.

13 Kamalasen Rajalingham, David R. Chadwick & Brian Knight, "Classification of Spreadsheet Errors," p. 5.

spreadsheet model as they are the ones that actually calculate and provide useful results based on raw, user-entered data values.”¹⁴ As these experts rightly highlight, formula construction in spreadsheets is a form of computer programming. They elaborate as follows:

“...companies are being put at risk due to their failure to realise that the process of constructing spreadsheets requires the discipline of traditional programming. Spreadsheet applications are more vulnerable to poor design and to errors than conventional programs.”¹⁵

In fact, in order to combat high error rates, they propose a stage-by-stage component testing of spreadsheets very much like that found in programming environments. Perhaps they're right, because as Panko points out, research shows that people aren't just prone to making errors; perhaps more importantly, they're only moderately good at correcting them.¹⁶

Panko's conclusions are important here:

“All in all, the research done to date in spreadsheet development presents a very disturbing picture. Every study that has attempted to measure errors, without exception, has found them at rates that would be unacceptable in any organization. These error rates, furthermore, are completely consistent with error rates found in other human activities.”¹⁷

Incredibly, as serious as spreadsheet errors have proven to be, Panko reports that companies appear to be in a state of denial. He continues by stating:

“They do not regularly implement even fairly simple controls to reduce errors, much less such bitter pills as comprehensive code inspection. One corporate officer probably summarized the situation by saying that he agreed with the error rate numbers but felt that comprehensive code inspection is simply impractical. In other words, he was saying that the company should continue to base critical decisions on bad numbers.”¹⁸

At very least, the facts present a bleak picture of the corporate reporting world. BI tools present a significant barrier due to the high cost of software, implementation, and overall IT resources; while spreadsheets present serious problems of their own due to high error rates and the impracticality of implementing regular code inspection. And in fact, from a business perspective, detailed code inspection *is* impractical. Code inspection is fine, even necessary, for programming houses with experts at the wheel, but most companies can't follow that model. Yet, while spreadsheet developers may feel confident - probably over-confident - in their abilities, most aren't professional developers. Given the fact, then, that spreadsheet development is very similar to programming, companies are facing a major problem. Spreadsheets are the easiest, most cost effective way of getting reports written, but they also require a deceptively high level of technical attention most companies can't afford to give.

14 Kamalasan Rajalingham, David Chadwick, Brian Knight, Dilwyn Edwards, “Quality Control in Spreadsheets: A Software Engineering-Based Approach to Spreadsheet Development,” p. 3.

15 Kamalasan Rajalingham, David Chadwick, Brian Knight, Dilwyn Edwards, “Quality Control in Spreadsheets: A Software Engineering-Based Approach to Spreadsheet Development,” p. 7.

16 Raymond R. Panko, “What We Know About Spreadsheet Errors,” p. 7.

17 Raymond R. Panko, “What We Know About Spreadsheet Errors,” p. 20.

18 Raymond R. Panko, “What We Know About Spreadsheet Errors,” p. 20.

So, ironically, we're back to the age-old dilemma entire generations faced with ancient literature. Hand copying literature before the printing press wasn't going away any more than spreadsheets are in the corporate world. The printing press solved many of the most common errors in duplicating literature, but is there any hope of something equivalent for spreadsheets? The critical question facing modern companies is how to continue using spreadsheet functionality while, paradoxically, eliminating many or most of the potentially serious errors - errors that can literally bring a company to its knees. It's to that important subject we now turn.

Solving the Reporting Paradox

Almost instantaneously, the printing press solved the most serious problems associated with copying books by hand. Omission, duplication, and many other errors were virtually non-existent after the emergence of the Gutenberg press in the 15th century. We have something analogous to these errors within modern spreadsheets, so the question arises as to whether there is a solution to spreadsheets similar to what the printing press was to manuscript transmission?

Many BI solutions have flooded the market with the goal of being that solution, some more successful than others. A common denominator of most of them (if not all), however, is that they bring an alien format to the user that isn't very intuitive. Part of the problem has been that the corporate world is intimately familiar with spreadsheets, and having to switch from that easy format to a more complex system has been difficult. What companies seem to saying with their habitual use of spreadsheets is that they want a reporting system providing spreadsheet flexibility, but a system not fraught with the downsides of spreadsheets. As our examination indicates, what companies want is a sort of paradox: spreadsheet functionality without spreadsheet limitations.

One recent advance by CompuSoft Development attempts to offer such a resolution to the paradox. Multi-dimensional INtelligent Data-store technology (MIND) is a highly advanced programming breakthrough that is proving highly successful in dealing with potential errors. Essentially, what it provides is an unprecedented melding of database capabilities with the flexibility and ease of use of a standard spreadsheet. More technically, in addition to a cell's traditional ability to contain labels, numbers, and formulae, MIND empowers a cell with an all-important capability it inherently lacks: the ability intelligently to *retrieve actual data*.

For users, this means that instead of tracking numbers by manually entering/re-entering data and constructing complex spreadsheet formulae, MIND allows them to have data *automatically* populated in a particular cell. Behaving in this respect like a database, the cell tracks the data automatically, no matter what changes occur in the model. Though MIND provides the cell abilities only a true database can provide, users simultaneously retain that spreadsheet look, feel, and functionality with which they're intimately familiar.

So, precisely which errors in Rajalingham's flow chart does MIND eliminate? It might be helpful to provide some quick definitions of his list of errors. For our present purposes, we'll focus on User Errors which are divided under two main headings, Qualitative and Quantitative.¹⁹

¹⁹ For a further discussion of the errors with examples, see Rajalingham et al, "Classification of Spreadsheet Errors," pp. 3ff.

Qualitative Errors are errors that don't immediately produce incorrect numeric values, but degrade the quality of the model. The model becomes more prone to misinterpretation and more difficult to update and maintain. Four errors fall under this category:

Formatting Errors: Occur when the developer fails to specify what is being put in a cell.

Update Errors: Produced because of the use of data which hasn't been updated. This can lead to unreliable decisions or interpretation of the situation.

Hard-coding Errors: Defined as maintainability flaws that make it difficult for the spreadsheet to be updated or modified. Hard-coding of a formula makes a spreadsheet much less flexible.

Semantic Errors: Occur due to a distortion of or ambiguity in the meaning of data, leading to incorrect decisions, choices or assumptions. They can take the form of design flaws in the layout of the model or incorrect headings, and can thus be difficult to detect.

Quantitative Errors are numerical errors leading to incorrect bottom-line values, thus forming the bulk of the more serious ones. Numerous errors fall under this category, but can be summarized as follows:

Mechanical Errors: General data input errors. They're relatively simple mistakes, such as pointing to the wrong cell, mistyping a number, or overwriting the data with incorrect values. However, while they're simple they can be disastrous along with the others in this category.

Logic Errors: An implementation error occurring when a formula is incorrectly constructed due to a lack of understanding of the features and functions of the spreadsheet software in use. As a result, the formula produces a wrong value. Two distinct problems surface here, as the spreadsheet planner may not understand the proper use of formulae, and then the users simply duplicate incorrect formulae as they expand the spreadsheet. As researchers all agree, logic errors form the bulk of spreadsheet errors, and are difficult to detect and correct.

Omission Errors: Things accidentally left out of the model by the developer. They're especially dangerous because they have low detection rates.

MIND virtually eliminates the more serious errors users commit. As noted, the bulk of potentially serious errors occur when developers use formulae to populate cells, or logic errors. Because MIND retrieves actual data most of the formulae users write are eliminated from the start. How? An example will serve to illustrate the point.

When developing financial statements, it's very common for accountants to use formulae to reference numbers on another sheet. For instance, Sheet 1 may contain a Trial Balance from which they need to reference cell B5 for an Income Statement in Sheet 3. A simple enough formula, they simply enter =Sheet1.B5 (or something similar depending on the software package). However as commonly happens, the cells in Sheet 1 change because account numbers have been added, thereby rendering the numbers in Sheet 3 (and any other sheets referencing that cell) invalid.

The problem here isn't just that the numbers have changed (which is bad enough), but that the error is very difficult to detect. Difficult of course because the formula is still reporting a number, but is now incorrect. Because spreadsheets don't track actual account numbers, there are no built-in mechanisms for flagging these kinds of changes. The results can obviously be disastrous. Multiply this instance by fifty or one hundred across multiple sheets, and you have an extremely volatile situation considering accurate reporting of financial numbers is so important to a company's stability.

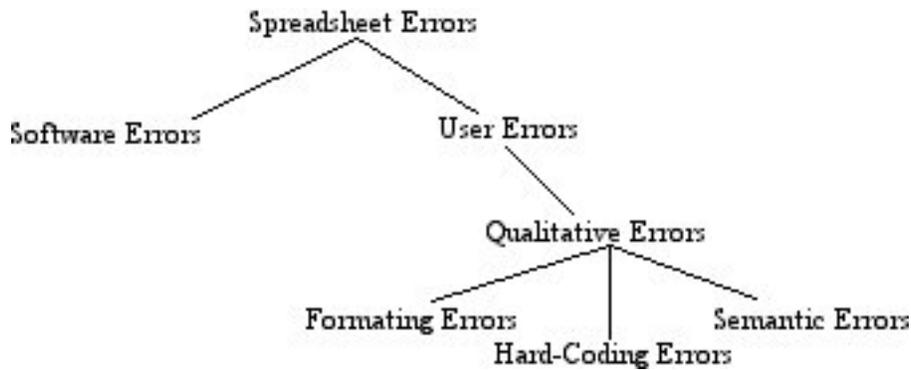
With a MIND infused cell, accountants have direct access to their chart of accounts in each and every cell and can simply click on the appropriate account number(s), which then automatically populates the cell no matter what happens to the rest of the report. In fact, by entering a range of accounts, they can add account numbers as often as needed confident that the numbers are being accurately pulled in automatically; in other words, MIND does all of the heavy calculations in the background *without* any user formulae input. Thus the age-old problem of invalidating the results of the spreadsheet model by adding or deleting account numbers becomes completely obsolete.

Importantly, MIND has literally redefined the *nature* of a spreadsheet cell by eliminating the need for a formula to populate cells with number values, numbers so often easily invalidated. This fact alone represents a major technological breakthrough with immediate application for virtually every business utilizing spreadsheet models.

Mechanical errors are also virtually eliminated with MIND. Much of the time, accountants will re-key data from their ERP/accounting system back into a spreadsheet - overwriting or omitting data in many instances - in order to have reporting flexibility. The problem, however, is much the same as it was centuries ago, that re-keying data opens the door for all sorts of input and omission errors. And research demonstrates that to be exactly the case in a high percentage of spreadsheet models. Again, because MIND empowers the cell to retrieve data directly from the actual database, these errors are a thing of the past. There's absolutely no need to re-key information or overwrite data because the MIND infused spreadsheet retrieves data directly, and automatically re-calculates the numbers based on up-to-date account numbers. Needless to say, omission of important data is eliminated as a matter of course.

Finally to Qualitative Errors. Because MIND retains the openness and flexibility of a true spreadsheet, (characteristics that seem essential to the majority of businesses) it eliminates one of the qualitative errors. For the exact reasons mentioned above, reports with MIND technology are automatically updated with current information, thereby completely eliminating update errors.

To visualize MIND's dramatic reduction of potentially serious errors, we can reconstruct the Rajalingham spreadsheet error flow chart as follows:



As can be seen, MIND eliminates Rajalingham's categories of Mechanical, Logic, and Omission Errors, along with their respective subcategories. It also eliminates Update Errors, but the same possibility of Formatting, Hard-coding, and Semantic Errors remain because MIND retains the flexibility of a spreadsheet model: in fact, it remains in these respects an actual spreadsheet. However, while it doesn't remove the possibility of these particular errors, it takes great strides in purging the more serious errors from the spreadsheet model affecting bottom lines – at least 75% percent of them.

Sharon Swander, a Corporate Controller in Austin Texas, reports that MIND capabilities have had dramatic affects on her productivity. Before implementing a product with MIND technology called Synoptix, it could literally take her a full day to complete company level financial statements in a traditional spreadsheet. Like many accountants, she was having to either re-key or import financial numbers into a spreadsheet, and then manipulate it from there to meet corporate requirements. “Maintaining complex financial statements was a nightmare, because if I needed to add an account number or just update the balances for a journal entry, it created significant extra work having to adjust the cells and re-check formulae so that our numbers didn't end up wrong.”

Swander points out that the inordinate amount of time it was taking to create and maintain financial reports was hampering management's ability to make critical business decisions in a timely manner. After implementing Synoptix, Swander was able to dramatically reduce the time it takes to create and maintain reports.

“Reports that used to take me up to a day to create the way corporate wanted to view them can now be completed within a matter of minutes. As far as report maintenance goes, there's absolutely no comparison to traditional spreadsheets. Now, maintaining reports can be done in a few minutes, and if I need to add account numbers I simply point and click and Synoptix does the rest. Not only this, but I don't have to waist time doing research for other departments any more because, with Synoptix' security features, managers can access the information they need on their own. The time savings overall have been phenomenal.”

Dana Smith, Financial Manager in Gold Beach Oregon, reports similar results. Smith says that owners and management were frustrated it took so long to get meaningful information to identify problems. By the time information was finally available, it was often too late to do anything about it. “We would run reports from our financial system using the report writer window. This information was then re-entered into Microsoft Excel worksheets that were linked to a very large number of customized worksheets used for Financial Statements and Executive Summary presentation,” explains Smith.

“The total time taken to pull data, manipulate data and create custom driver reports was taking from 10 to 40 hours a week between three people. The total time taken to run financial reports and re-enter to worksheets was taking about 20 to 40 hours each month.” After installing Synoptix, Smith says that creating a maintaining reports became easy. Freeman can now pull data for a wide variety of key performance indicators with ease they simply couldn't achieve with traditional spreadsheets. “I don't even want to think about going back to the way this was done before Synoptix... Synoptix has made my job so much easier.” The bottom line, according to Smith, is that Freeman now has key financial data readily available, giving them actionable information with which to make timely important business decisions.

In the end, with a MIND infused spreadsheet cell users have the best of two very different worlds, without the traditional drawbacks of either. Business Intelligence tools have done a fairly good job of allowing users to automate reports and analyze data, but they've tended to be complex compared to the simple spreadsheet format most companies prefer. Spreadsheets on the other hand, while offering that user friendly look and feel, require an inordinate amount of work to maintain and are open to far too many potential errors. MIND technology has successfully bred the power of a database with the spreadsheet format, enabling users for the first time to create and maintain reports with the ease of spreadsheets, but also with database functionality at the heart of each and every cell.

Conclusion

It's clear from research on the subject that companies want the automation capabilities Business Intelligence products offer, as well as the ability to analyze data quickly. Yet it's equally clear they aren't making moves in mass toward BI solutions for various reasons, not least of which are software/implementation costs, product complexity, and lack of the spreadsheet format. In the end, the clear majority of businesses are still using spreadsheet models, with all their advantages and disadvantages. Low cost of entry, ease of use, and flexibility of the model lead the reasons for universal spreadsheet appeal.

However, as has become painfully clear in recent years, spreadsheet adoption comes at a high price. The cost associated with the high error rates found in the majority of spreadsheets runs into the thousands of dollars per year in wasted man-hours or even government investigations, with larger companies spending much more. Traditional spreadsheets require technical expertise more akin to programming than most users realize, despite their relative confidence in the models they create. Furthermore, curbing the problems with tight spreadsheet controls doesn't seem to make sense to companies, as the cost of maintaining a strict system with checks and balances seems to nullify the reasons for adopting spreadsheets in the first place.

While not completely taking the human element out of the reporting process any more than the printing press has for the copying process, MIND technology offers an important advance in spreadsheet error reduction. Companies are able to maintain the flexibility with formatting they seem to appreciate, but are relieved of 75% of the potentially serious errors afflicting the majority of spreadsheets. They have, in other words, the very best of the BI and spreadsheet worlds - they have a solution to the spreadsheet paradox. Having at their fingertips the ease and flexibility of the spreadsheet model as well as the power only a database can provide, companies can create and maintain reports in a fraction of the time it takes with a traditional spreadsheet. So while MIND may not impact the world to the degree Gutenberg's press did,

it does forge uncharted territory in spreadsheet technology allowing companies to create reports as easily as a spreadsheet, but without the inherent limitations of traditional spreadsheets.