

# Sales Commissions and Spreadsheets – A Calculated Disaster

## Overview:

A leading media firm calculated and administered sales commissions for its 80+ sales people, by using a separate spreadsheet for each of its sales people. The sales data had to be entered into each spreadsheet based on who made the sale. Manager overrides had to be reentered in the manager's version of the sales commission spreadsheet. Splits had to be entered likewise. Whenever a new sales rep was added to the company, one of the existing spreadsheet was copied over for the new sales person's commission calculation. In addition all these spreadsheets were consolidated with a master spreadsheet to provide management reporting. As can be imagined, this customer had a nightmare of a time trying to calculate their commissions every month. In addition, they were plagued by errors and continuous problem resolution with the sales people about their incorrect payments.

Many scientists have done studies proving the existence of pervasive errors in spreadsheets. The researchers, Brown & Gould (1987) used IBM researchers with 1 to 5 years experience, in their study of spreadsheet quality. The subjects considered the tests provided to them much simpler than the real world spreadsheets they had to deal with. But the results showed that every one of the subjects made at least one error in their spreadsheets. More than 44% of the spreadsheets had some errors.

Panko & Halverson (1994, 1995 and 1997) used differing numbers of students to work on spreadsheet problems. They found that subjects working alone had a significantly higher number of errors. They found error rates of 81%, 71% and 50% for subjects working alone, in twos and in fours respectively. The authors thought the results were conservative, since they anticipated that in the real world there would be less structure and more complexity. When the subjects were allowed to work away from the lab, the rate of errors shot up.

Spreadsheets are overwhelmingly used in the calculating of sales commissions in most businesses. This is even more acute in small and mid-market businesses who cannot afford to build more robust systems. Given this sort of common use of this technology, it would be wise to understand the ramifications for businesses depending on this technology.

## Disasters

Most companies, who have been affected by problems due to spreadsheet errors, are not keen to make the information public. They fear the negative publicity associated with the issue. There could also be potential legal and financial consequences of making the information public. If the sales commission errors of one sales person become public, it is very likely that all other sales people will be examining their historical records to see if they have been affected by similar problems.

A study of 19 active operational spreadsheets from 10 different firms found that four of the spreadsheets (21%) had serious quantitative errors and 76% had quantitative or qualitative errors. One of the errors had to do with a funds transfer of \$7 MM between divisions. There were also inconsistent currency conversion numbers in different parts of the spreadsheet. At the same time the developers of the spreadsheet believed that their spreadsheet had no errors.

In England, Coopers Lybrand and KPMG offer spreadsheet audit consultancies. England has requirements that certain spreadsheets have to be audited. These consulting firms found significant errors in 45% of the spreadsheets they audited. The threshold for 'significant errors' was high. Coopers & Lybrand considered an error 'significant' only if they made a bottom-line value off by a minimum of 5%.

The controller in a construction company, while preparing a bid, added a row to include overhead of \$254,000. The controller did not check to see that this row was included in the totaling formula. The firm underestimated the cost of the \$3 million project, resulting in a financial loss. This event resulted in legal action. Kruck, S. E. & Sheetz, S.D. (2003)

Here are some additional examples, courtesy of sources referenced:

Fortune 500 firm uses discounted cash flow to evaluate investment proposals. The formula and discount rate were established long ago, were never documented, and were made by a person who had left the company. Although the prime rate rose from 8% to over 20% between 1973 and 1981, the spreadsheet was kept at 8%.

A Dallas Oil and Gas company's spreadsheet error resulted in millions of dollars being lost. Several executives were fired.

At Fidelity, a spreadsheet was used to report distributions for various funds. For the huge Magellan fund, a \$4.32 per share capital gains distributions was forecast in November, and investors were notified. However in December the company announced there would be no distribution. A clerical worker put the wrong sign in front of a \$1.2 billion ledger entry. This "created" a \$2.3 billion gain in place of the real \$0.1 billion loss. This may have affected buyers, some of whom may have sold to avoid the distribution and missed a price rise, others of whom may have waited to buy to avoid the distribution and also missed the price rise.

In a North Carolina election, results of an election were about to be incorrectly posted. Mr. Woodbury, using a calculator, detected an inconsistency. Examination found an incorrect cross-tabulation in the spreadsheet being used to post the results.

Two spreadsheets with 15,000 cells were used to project the market for CAD equipment. Numbers were rounded off to whole dollars. But the inflation multiplier, which should have been 1.06, became 1. Without inflation, the market was underestimated by \$36 million.

## Types of Spreadsheet Errors

Studies show that in most complex activities human beings commit errors in the range of about 5%. Spreadsheets are no exception. Most people think of spreadsheet errors as one of mistyping a number or a formula. But there are many different kinds of errors. Errors can be classified into many groups; here we are listing some key and common errors evidenced in the sales commission process.

### ***Accidental Errors***

These are simple mistakes, typically caused by mistyping a value or pointing to a wrong cell in the spreadsheet. But these are exceedingly common but they also tend to be caught and corrected at a high rate. But some errors go undetected and can cause significant error results. It is also possible that many of these errors are deliberate and sometimes with malicious intent. Typing in the wrong commission rate or split percentage can significantly affect the final commission paid.

### ***Omission Errors***

Sometimes spreadsheet developers omit to enter certain values or formulas. These errors are dangerous because there is a very low rate of discovery. Missing important values or relationships can give spurious results. When entering commission rates for quota based attainment, it is possible to omit certain errors:

Example

Attainment %	Commission %
20% - 50%	2%
51% - 80%	5%
81% - 100%	7%
100% and above	9%

If the cells are specified as above, and the formula does not take into account, that attainment between 0% and 19% should not be paid at all, then it is likely that the attainment in that range is also paid at 2%.

### ***Duplication Errors***

Values can sometimes be established multiple times, without awareness. Over time, it is likely that one of the values will get modified and the other will not. This will cause errors that are hard to decipher since some of the results will be accurate.

Example:

Split percentage is defined two times, once as its own cell and in another place as a hard coded value within some formula.

Sales Credit Value = Sales\_amt x [Cell X]

Sales Commission = Sales\_amt x 45% x 5%

Where in the 2<sup>nd</sup> expression, 45% should have been more appropriately, [Cell X]

## **Alteration Errors:**

When spreadsheets are modified, the user may make changes that do not properly fit with the original intent of the spreadsheet. One of the most common errors is the addition of a row to the spreadsheet but immediately outside the set of rows that are being cumulated.

When a cell or a set of cells are copied from one location to another, the formulas in those cells are also copied. But the formulas change to use the relative cells rather than the original cells. This may not be anticipated by the user and may provide incorrect results.

## **Complexity Errors:**

In Sales Commission especially the problem to be solved is so complex that using spreadsheets to solve them is sometimes a fruitless exercise. Users trying to do this may think they have solved the problem, not knowing the problems they have within the constructed spreadsheet. Imagine a spreadsheet for sales commission having to solve the following steps to accurately pay commissions

Example 1:

- Compare a sequence of sales transactions against quotas and based on attainment decide a different commission rate.
- If one of the transactions crosses a threshold, then pay that single transaction at two different rates based on the amount below and about the threshold.
- Cancellations/adjustments have to calculate commissions at the original rates

Example 2:

- A set of sales transactions have to be processed so that 50% of the commission has to be calculated and paid at the time of invoicing.
- Another 50% of the commission has to be calculated at the time of invoicing but paid at the time the company received payments for the invoice.
- And some of these invoices can be cancelled at any point, so charge backs have to understand the splits and take back commissions appropriately.

There are situations where the above two examples can be combined and additional complexity such as splits between sales reps have to be added.

## **Syntax Errors:**

Not understanding how mathematical expressions and other spreadsheet formulas are interpreted can be a recipe for disaster. Use of parentheses and understanding the precedence of operators is necessary to create proper calculation formulas. With the use of complex formulas such as nested 'If's, it is even more likely that errors are made.

Example:

In this example we are trying to calculate sales commissions for gross profit.

Value	Cell	Amount
Sales Amount	A1	\$100
Cost	B1	\$60
Commission Rate	C1	10
Commission Amt	D1	?

Formula 1: Commission Amt D1 = A1 - B1 \* C1 / 100 = \$94

Formula 2: Commission Amt D1 = (A1 - B1) \* C1 / 100 = \$4

Many erroneous results are not as obvious as these.

## ***Fraud***

One of the most difficult errors to catch is errors of commission. In many companies a single administrator is responsible for the administration of the commission process. The spreadsheets used tend to be very complex and difficult to understand by others. A formal audit process is more unusual in situations where these spreadsheets are used. In the rare instance where fraud is actively committed (e.g. administrator changes commission rates on certain transactions for a friend), it is much harder to identify and fix.

## ***Overconfidence***

One study, Panko and Halverson (2001), had subjects develop a spreadsheet individually. When asked to estimate the probability that their spreadsheet contained an error, individuals reported a mean probability of 18%. The actual percentage of incorrect spreadsheets was 86% for this population.

The likelihood of finding some errors during their operations actually tends to boost the confidence of the individuals rather than reduce it. They tend to think that their skills at spreadsheet entry are very good, because they caught and fixed errors. This of course tends to cause even more errors.

## **Solution for Sales Commissions**

With the federal requirements for more financial controls in various countries, the problem of calculations using spreadsheets is becoming front and center. The Sarbanes-Oxley laws passed in the United States has created very stiff financial control requirements. Sales Commissions in many companies tend to be almost 10% of the total expense structure and consequently can have a major impact on financial reporting. Spreadsheets are not an acceptable method for calculating sales commissions. In addition to being vulnerable to legal liability when the recipients of sales commissions find issues, the company is also open to governmental prosecution.

The solution to these issues is to automate the sales commission process using a software system designed to administer sales commissions. There are various benefits due to the automation.

## ***Transparency***

The mere fact that the process is automated and the data is available in standard databases and visible to other staff in the company, adds a lot of quality to the entire process. Fraud is likely to be reduced as well as other errors such as duplication or loss of information.

## ***Auditability***

Databases are typically designed for good auditability with the ability to date and time stamp all changes. The information is stored and is auditable easily, especially if audit reporting is provided with the system

## ***Integrity***

A single source of data rather than many spreadsheets floating around, enhances the quality and reliability of the data. The data is more likely to be backed up using the standard IT processes of the company.

## ***Integration***

Integration of the data with source systems such as HR, Order Processing and Payroll, makes sure that data entry errors are reduced. Duplication and omission of data is also reduced.

## ***Controls***

Good sales commission systems will provide the facility to close out a set of data after the fiscal period is complete. This allows good control over the information, because the same transaction is not likely to be used create commissions again.

Accruals can also be done by running calculations mid-period.

## **Reliability**

By using the same compensation plan template for multiple payees, the quality of the calculations is enhanced, without the necessity for copying and pasting. By creating relations between payees and managers proper overrides can be automatically given.

Since commissions systems will provide structures such as quota, commission rates, etc, the typical calculation formula errors found in spreadsheets are not likely.

## **Communication**

Sales commission systems come up with good reporting systems. Commissions statements to payees can be produced with all the calculations listed at a very detailed level. This increases confidence and trust among the payees. Any errors are also quickly found and escalated so that it can be fixed right away, rather than some time in the future.

The recommendation for companies would be to replace their sales commission spreadsheets with a reliable sales commission software system. One quick way to find solutions in this area would be search Google or other search engines with the keywords "sales commission software".

## **Author:**

Gopi Mattel, an executive at CellarStone, Inc., a provider of sales commission solutions and services.

[www.qcommission.com](http://www.qcommission.com), [www.cellarstone.com](http://www.cellarstone.com).

[gopi\\_mattel@cellarstone.com](mailto:gopi_mattel@cellarstone.com)

## **References:**

- Brown, P., and J. Gould. "Experimental Study of People Creating Spreadsheets." *ACM Transactions on Office Information Systems* 5.3 (July 1987): 258-272.
- Panko, R. R., 1995, "Finding spreadsheet errors; most spreadsheet models have design flaws that may lead to long-term miscalculations." *Informationweek*, May, pp. 100.
- Panko, R. R., 1996, "Hitting the wall: Errors in developing and debugging a "simple" spreadsheet model." *Proceedings of the Twenty-Ninth Hawaii International Conference on System Sciences*, January, pp. 356-363.
- Panko, R. R., 1999, "Applying Code Inspection to Spreadsheet Testing." *Journal of Management Information Systems*, 159-176.
- Panko, R. R., & Halverson, Jr., R. P., 1994, "Individual and group spreadsheet design: Pattern of errors." *Proceedings of the Twenty-Seventh Hawaii International Conference on System Sciences*, January, pp. 4-10.
- Panko, R. R., & Halverson, Jr., R. P., 1995, "Are three heads better than one? (at reducing errors in spreadsheet development)." working paper.
- Panko, R. R., & Halverson, Jr., R. P., 1997, "Are two heads better than one? (at reducing errors in spreadsheet modeling)." *Office Systems Research Journal*, Spring.
- Panko, R.R. (2005) Sarbanes–Oxley: What about All the Spreadsheets? EUSPRIG.
- Kamalasen Rajalingham, David R. Chadwick & Brian Knight CLASSIFICATION OF SPREADSHEET ERRORS.
- Davies, N. & Ikin, C. (1987). Auditing spreadsheets. *Australian Accountant*, 54-56.
- Kruck, S. E. & Sheetz, S.D. (2003) Spreadsheet Accuracy Theory, *Journal of Information Systems Education*, Vol 12(2).
- Savitz, E.J., "Magellan Loses its Compass," *Barron's* (84:50) December 12, 1994.
- Ditlea, S. "Spreadsheets Can be Hazardous to Your Health," *Personal Computing* (11:1) January 1987, pp. 60-69.
- Woodbury, G. G. "Re: 'Computer Error' in Durham N.C. Election Results," *The Risks Digest* (9:42) <http://catless.ncl.ac.uk/Risks>, November 13, 1989.
- Business Week* "How Personal Computers Can Trip Up Executives," (2861) September 24, 1984, pp. 94-102 passim