ICAEW THOUGHT LEADERSHIP

Twenty principles for good spreadsheet practice

THIRD EDITION

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Preface

Like it or not, spreadsheets are in use everywhere. They have become the lingua franca of business; no matter what your system or requirement, a spreadsheet can connect people like no other business tool.

However, the use of spreadsheets is not without risk, and approximately 90% of spreadsheets contain mistakes. Material errors such as incorrect models, sending out sheets with hidden columns or careless use of formulae, have been well publicised alongside the embarrassment and financial loss that arise as a result.

In addition, there is a serious problem of waste arising from spreadsheets that are created inefficiently or carelessly. 65% of members of the Excel Community are self-taught, and with no formal methodology there is a risk that sub-optimal models and processes become the norm.

This is why ICAEW's Excel Community Advisory Committee came together to develop Twenty principles for good spreadsheet practice that look to reduce spreadsheet risk and inefficiency in all organisations regardless of size or sector.

I would like to thank all the members of the committee for developing these principles, and would encourage readers to act on the recommendations in this report.

Michael Izza
Chief Executive Officer, ICAEW

Why twenty principles?

Many spreadsheets evolve over time without well-structured design or integrity checks, and are poorly documented. Making a relatively simple change can often take a long time, have unexpected consequences and/or result in errors from incorrect calculations or input assumptions, as famously illustrated by debacles such as the collapse of Conviviality.

The purpose of these principles is to help reduce the amount of time wasted, and the number of errors caused, by businesses (including accountancy practices) as a consequence of the way they and their employees use spreadsheets.

There are several points to emphasise. First, no set of principles or standards can guarantee freedom from error. The design, maintenance and operation of spreadsheets are still carried out by humans.

Secondly, this document is not only about 'good spreadsheet design'. The business environment in which spreadsheets are created, maintained and used is at least as important. So the first four principles are ones we believe should be adopted by an organisation before anyone starts to work on any individual spreadsheet-using project. They are intended to create a framework, and to instil attitudes, which encourage best-practice to flourish. These principles are addressed not only to those directly involved in the design and use of spreadsheets but also to those with managerial responsibility, including responsibility for management of risk. They may also be of interest and relevance to those with responsibility for audit.

Third, these are 'principles', not 'standards'. By way of example, Principle 2 requires clarity and consistency in the use of formatting. This could mean using a particular cell colour to denote cells allowing user input. There might be any number of different corporate standards, or publicly available standards, that adhere to this principle. One standard might specify pink as the colour for input cells; another might specify green. Either would satisfy the principle.

Finally, this set of principles is not meant to be comprehensive, nor is it meant to be very detailed. Deliberately it focuses mainly on traditional formula-driven spreadsheet construction, which still accounts for the vast majority of spreadsheet use, rather than on pivot tables, structured references etc. It is a 'top 20' list, with each principle set out simply and concisely, and with some explanation added. It would of course be possible to provide much more detail than this, and to produce a much longer document. These principles are intended to be very widely applicable, and are intended to cover projects of all shapes and sizes and degrees of complexity. As technology, and the ways people use it, evolves, the priorities set out here may need to change, and so the IT Faculty intends to keep these principles under regular review.

The twenty principles explained

The spreadsheet's business environment

1. **Determine what role spreadsheets play in your business, and plan your spreadsheet standards and processes accordingly**
   If you have spreadsheets that play a key or critical role in your organisation, ensure that they are developed and tested, managed and monitored to an appropriate level. Spreadsheets that form part of an organisation's key business processes will need to be managed differently from ad hoc spreadsheets for short-term use by an individual.

2. **Adopt a standard for your organisation and stick to it**
   This might be one that is developed in-house, or adopted from outside and shared with other organisations. A common standard within an organisation facilitates collaboration, aids understanding and saves development time. The standard should include, among other things, consistent conventions on use of cell formatting. For example, you could use Cell Styles to easily apply an organisational standard formatting scheme to your workbook.

3. **Ensure that everyone involved in the creation or use of spreadsheets has an appropriate level of knowledge and competence**
   For anyone designing, developing or maintaining (as distinct from just using) a spreadsheet, this will include: awareness of the range of functions available, clear understanding of such basic concepts as relative and absolute cell references, and an appreciation of the importance of carefully checking the results of functions.

4. **Work collaboratively, share ownership, peer review**
   The extent of collaboration and review needed will depend on the size and complexity of your organisation and of each project.

The twenty principles explained

Designing and building your spreadsheet

5. Before starting, satisfy yourself that a spreadsheet is the appropriate tool for the job

Spreadsheets are not the answer to every problem. A lot of time can be wasted, and errors caused, by using a spreadsheet when some other application would be more appropriate. Very often the more appropriate tool might be a word processor (if it's a table containing text), a database (if large quantities of similar data items need processing) or an existing software package (to undertake well-established processes, such as bookkeeping, for which specialist packages are readily available). Even if a spreadsheet is still the most appropriate tool, it's worth looking for existing templates before starting a new one from scratch.

6. Identify your audience. If a spreadsheet is intended to be understood and used by others, the design should facilitate this

If the only audience envisaged is yourself, you could perhaps justify less explanation and help. However, good documentation is helpful if you come back to a spreadsheet sometime after you've originally created it. Additionally, many spreadsheets often turn out to have a much wider audience than originally intended. Ensure that adequate instructions, validation and help are included to promote ease of use and avoid input errors. Even if parts of a spreadsheet are 'locked', keep calculations visible.

7. Include an 'About' or 'Welcome' sheet to document the spreadsheet

This should give such basic information as author, purpose, version number, and description of general approach. Also include explanations of colour codes and other formatting conventions, any sources of input data (with, where appropriate, hyperlinks to the original data), and any macros and what they do. The more complex the workbook, or the more it needs to be shared, the greater the requirement for good documentation. Conversely, a simple spreadsheet to be used only by the person who designs it might be less rigorously documented.

8. Design for longevity

Design spreadsheets to adapt to any reasonably foreseeable future changes in values (tax rates, etc) or volume (eg, items in a data set) of data used in calculations. However, the need for adaptability should be balanced against following the Agile principle of 'The simplest thing that could possibly work'.

For example, construct formulas so that inserting new values – either by inserting new rows or by adding to the bottom of the existing data – will not require any amendments to the formulas. This could be done with functions that use ranges including blank space for new data, or by using Excel's Table feature.

9. Focus on the required outputs

Work backwards: be clear about the purpose of the spreadsheet, what outputs achieve that purpose and therefore what inputs and logic are required to derive the outputs.

10. Separate and clearly identify inputs, workings and outputs

A properly structured spreadsheet will be easier to understand and to maintain. If pivot tables are used, it may be possible to relax this principle, but clarity remains crucial. Design to ensure that any input should be entered only once.

11. Be consistent in structure

Use the same columns for the same things in each workbook, especially when working with time series. A consistent convention within a workbook reduces the risk of error where one sheet refers to another. For example, a common convention is that time flows horizontally from left to right (and a specific column is always 'Year 1') and calculations flow vertically from top to bottom. Such a structure will help to avoid circular references.

12. Be consistent in the use of formulae

On any worksheet use the smallest practicable number of different formulae. Where it is necessary to use different formulae, ensure that groups of cells using the different formulae are clearly separated.

One common approach used to minimise the number of different formulas in use is to make use of cell anchoring, using $ signs to indicate parts of references that should not change upon a copy and paste. This allows a block of formulas to be built from a single function and both reduces the chance of error and also makes review more efficient.

13. Keep formulae as short and simple as practicable

Shorter formulae are easier to build (and therefore less likely to contain errors) and easier to understand and to review. Stage a calculation through multiple cells rather than build a long, complex formula.

14. Never embed in a formula anything that might change or need to be changed

Instead, put such values into separate cells and reference them. This ensures that values enter the spreadsheet only once, and if change is needed would happen in just one place. It also allows for all formulae cells to be locked without denying access to input values.

15. Perform a calculation once and then refer back to that calculation

Do not calculate the same value in multiple places (except perhaps for cross checking purposes). This reduces risk of error, and is more efficient, since fewer calculations are being performed.

16. Avoid using advanced features where simpler features could achieve the same result

In particular, avoid using programming code unless necessary – in which case ensure that it is clearly documented within the code itself, as well as in a documentation worksheet. Similarly, avoid circular references, and control and document any exceptions. Do not change the software's key default settings (for example, do not turn off automatic recalculation) unless essential, in which case include a prominent message to warn users.

The twenty principles explained

Spreadsheet risks and controls

17. Have a system of backup and version control, which should be applied consistently within an organisation

The appropriate levels of backup and version control will depend on the organisation and the nature of the work, but there should always be, at the very least, a reliable means of preserving, identifying and restoring earlier versions of a workbook.

18. Rigorously test the workbook

The level of testing required will depend on the size, complexity and criticality of the workbook, with riskier workbooks needing a greater degree of independent testing.

Self-review is limited in how many errors can be identified. To truly improve the chances of catching mistakes in a spreadsheet, a system of peer review is recommended. Testing could include adjusting inputs to see if the change in outputs matches expectation, testing extreme values to see how the spreadsheet operates, and double-checking the results of key calculations.

19. Build in checks, controls and alerts from the outset and during the course of spreadsheet design

These checks might include, for example, tests to ensure that a balance sheet balances, assets do not depreciate below zero, and so on. One approach would be to build in a set of audit tests to check validity and use flags to signal compliance or non-compliance. Use a master flag to summarise all the individual flags and place it prominently (on the output sheet, or even throughout the workbook eg, on sheet headers) so that users are bound to see it.

20. Protect parts of the workbook that are not supposed to be changed by users

The level of protection will vary according to the nature of the spreadsheet and the kind of use/users it will have. It might include locking whole worksheets, all cells containing formulae, or everything except designated input cells.

ACKNOWLEDGMENTS

Twenty principles for good spreadsheet practice is the result of debate among members of the IT Faculty's Excel Community Advisory Committee, who saw the document through a number of drafts over several months, and then took on board comments from the wider ICAEW membership and the public.

RECOGNITION SCHEME

ICAEW operates a scheme to recognise modelling standards, training courses, and spreadsheet pro forma that comply with the 20 Principles and demonstrate best practice. Recognised products are entitled to display an 'ICAEW 20 Principles Compliant' badge.

For the latest list of recognised bodies, or to find out more about applying for the recognition scheme, please visit icaew.com/excel20principles

The twenty principles in brief

THE SPREADSHEET'S BUSINESS ENVIRONMENT

1. Determine what role spreadsheets play in your business, and plan your spreadsheet standards and processes accordingly.
2. Adopt a standard for your organisation and stick to it.
3. Ensure that everyone involved in the creation or use of spreadsheets has an appropriate level of knowledge and competence.
4. Work collaboratively, share ownership, peer review.

DESIGNING AND BUILDING YOUR SPREADSHEET

5. Before starting, satisfy yourself that a spreadsheet is the appropriate tool for the job.
6. Identify the audience. If a spreadsheet is intended to be understood and used by others, the design should facilitate this.
7. Include an 'About' or 'Welcome' sheet to document the spreadsheet.
8. Design for longevity.
9. Focus on the required outputs.
10. Separate and clearly identify inputs, workings and outputs.
11. Be consistent in structure.
12. Be consistent in the use of formulae.
13. Keep formulae as short and simple as practicable.
14. Never embed in a formula anything that might change or need to be changed.
15. Perform a calculation once and then refer back to that calculation.
16. Avoid using advanced features where simpler features could achieve the same result.

SPREADSHEET RISKS AND CONTROLS

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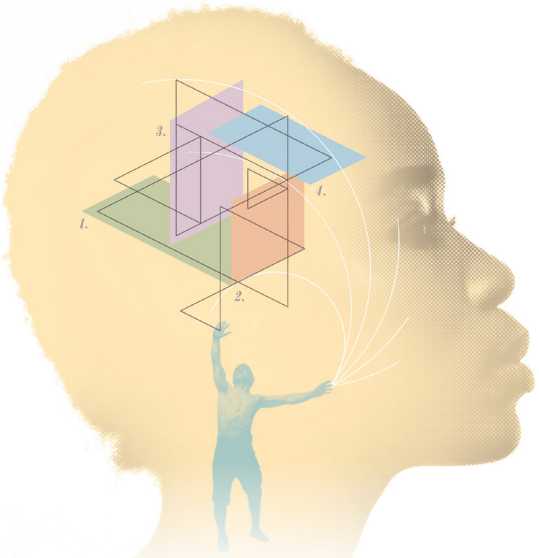
ICAEW is required by its Royal Charter to advance the theory and practice of accountancy in all its aspects and we do this through papers published in our ICAEW Thought Leadership series. Some papers are more practical in nature and aimed at helping members do their work, others consider how law and standards might develop for the future professional.

Twenty principles for good spreadsheet practice

SHARING BEST PRACTICE

A high-level set of guidelines for spreadsheet users of all levels. Developed with input from many top experts, the Twenty Principles are well tested as the essential tenets for reducing spreadsheet risk.

icaew.com/excel20principles



Spreadsheet competency framework

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Excel is one of the most popular end-user tools in the accountant's portfolio. Spreadsheets enable us to quickly and flexibly perform analysis that otherwise would be difficult or time-consuming; however, there is a tendency to place undue trust in them. ICAEW's Excel Community provides a 'one-stop shop' for accountants who want to use Excel better and understand and minimise spreadsheet risk.

For more information about the Excel Community, please visit icaew.com/excel

For more information about the IT Faculty, please visit icaew.com/itfac

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